The New Encyclopædia Britannica

Volume 4

MICROPÆDIA

Ready Reference

FOUNDED 1768
15 TH EDITION

Encyclopædia Britannica, Inc.
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Additional advice is given by committees of members drawn from the faculties of the Australian National University, the universities of British Columbia (Can.), Cambridge (Eng.), Copenhagen (Den.), Edinburgh (Scot.), Florence (Italy), Leiden (Neth.), London (Eng.), Marburg (Ger.), Montreal (Can.), Oxford (Eng.), the Ruhr (Ger.), Sussex (Eng.), Toronto (Can.), Victoria (Can.), and Waterloo (Can.); the Complutensian University of Madrid (Spain); the Max Planck Institute for Biophysical Chemistry (Ger.); the New University of Lisbon (Port.); the School of Higher Studies in Social Sciences (Fr.); Simon Fraser University (Can.); and York University (Can.).

First Edition	1768–1771
Second Edition	1777–1784
Third Edition	1788–1797
Supplement	1801
Fourth Edition	1801–1809
Fifth Edition	1815
Sixth Edition	1820–1823
Supplement	1815–1824
Seventh Edition	1830–1842
Eighth Edition	1852–1860
Ninth Edition	1875–1889
Tenth Edition	1902–1903

Eleventh Edition
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Twelfth Edition
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Thirteenth Edition
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Fourteenth Edition
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Fifteenth Edition
© 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991
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Printed in U.S.A.

Library of Congress Catalog Card Number: 89-81675
International Standard Book Number: 0-85229-529-4

How to use the MICROPAEDIA

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

Alphabetization

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

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

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

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

Entry arrangement

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

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

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

Cross-references

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

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

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

Abbreviations

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

Territorial boundaries

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

delusion, false belief or persistent error of perception continued in spite of logical absurdity or contradictory evidence; symptomatic of such mental disorders as paranoia, schizophrenia, and psychotic depression and of such physiological conditions as senile psychosis, general paresis, and delirium. Delusions vary in intensity, extent, and coherence and to some extent represent pathological exaggeration of normal tendencies to rationalization, wishful thinking, and the like. Probably the most common are delusions of persecution and grandeur (*see* paranoia); others include delusions of disease (hypochondriasis; *q.v.*), sin, guilt, and erotic delusions (*e.g.,* that one is loved by some famous person).

Delvaux, Paul (b. Sept. 23, 1897, Antheit, Liège, Belg.—leading Belgian Surrealist painter, whose canvases portray transfixed humans in mysterious time and place.

Impressed by the Spaniard Salvador Dalí, the Italian Giorgio De Chirico, and later his fellow Belgian René Magritte, he joined their Surrealist ranks in 1935. When touring Italy before World War II, he was influenced by the classic architecture (as De Chirico had been) and by the early-16th-century Mannerist paintings, which took liberties with form and space.

Delvaux
Publi-Press

A representative Delvaux painting is "The Echo" (1943), in which three somnambulistic nudes walk in tandem past dead temples, as if walking through time. In "Entombment" (1951), skeletons bury fellow skeletons. Major Delvaux exhibitions have been held in North and South America and Africa as well as at many places in Europe; important awards have come to him from Italy and Belgium. From 1950 to 1962 he was a professor of painting in Brussels.

Consult the INDEX *first*

Delvigne, Henri-Gustave (b. 1799, Hamburg—d. Oct. 18, 1876, Toulon, Fr.), French army officer and inventor who designed innovative rifles and helped introduce the cylindrical bullet.

Delvigne joined the French Army as a youth and attained the rank of captain of the royal guard. In 1826 he introduced the Delvigne rifle, the powder chamber of which was narrower than the barrel. When the rifle ball was dropped down the barrel against the chamber, a few blows of the ramrod expanded the ball to fit the rifled grooves snugly. Although this system had several drawbacks, it performed well in Algeria and was used extensively.

Delvigne began experimenting with elongated bullets as early as 1830. He designed a cylindro-conical bullet with a hollow base that would expand to fit the rifling grooves when fired. Although he did little to further develop the bullet, the basic idea was adopted by the French inventor Claude-Étienne Minié in the widely used Minié ball.

Delvigne designed a chambered breech rifle that was adopted by France in 1842. His experiments and developments were essential to later advances in firearms. He also introduced new grenade designs.

Delyn, district, Clwyd County, northeastern Wales. It was created in 1974 and covers an area of 99 sq mi (257 sq km) on the north coast of Wales. The district extends westward from the west bank of the Dee Estuary into the Clwydian Hills and borders the districts of Rhuddlan and Glyndwr to the west and Alyn and Deeside to the south and southeast. Across the Dee estuary to the east lie the English districts of Wirral and Ellesmere Port. An obelisk erected by Nehemiah Griffith in 1736 to commemorate the spot where the Saxons and Picts were defeated in AD 430 is located just west of the town of Mold in southern Delyn. Richard II formally surrendered to Henry Bolingbroke at Flint Castle in 1399, after having been persuaded to leave the safety of Conwy Castle by the treacherous Earl of Northumberland. (Bolingbroke was crowned Henry IV in the same year.)

The Greenfield Valley at Holywell was one of the birthplaces of the Industrial Revolution, and Delyn remains a heavily industrialized region, although emphasis has shifted from the traditional ironworks and docks to the smaller scale and more diverse industries in engineering, chemicals, and synthetic textiles. Mold, the administrative seat of both Delyn district and Clywd County, is also the market centre for the limited agricultural crops grown in southern Delyn and in western Alyn and Deeside districts. Flint is an important centre for the rayon industry and the production of chemicals. Tourist attractions in the district include St. Winefride's Well at the parish church in Holywell and the extensive bird havens that have been developed along parts of the shore of the Dee Estuary. Daniel Owen, considered by many to be the father of the Welsh novel, was born in Mold in 1836. A railroad, parallelled by a highway farther inland, extends along the banks of the Dee Estuary. Pop. (1982 est.) 65,600.

dema deity, any of several mythical ancestral beings of the Marind-Anim of southern New Guinea, the centre of a body of mythology called the *dema* deity complex. The decisive act in *dema* myths is the slaying of a *dema* (ancestral) deity by the ancestral tribe. This act brings about the transition from the ancestral world to the human one. In many ancient myths, the creation of man occurs after the creation of the cosmos. Man and those attributes that are most decisively human—sexuality, the cultivation of food, and death—are viewed as a decisive break with the previous mode of existence, which was characterized by asexual reproduction, the spontaneous production of food, and immortality.

The rupture between the divine world and the ensuing human world may be brought about by theft of a divine property (*e.g.,* the stealing of fire or grain by a culture hero), which, if viewed as an evil act, regards the human condition as punishment (the Fall complex). In other traditions, man is defined as a clever thief, and the human condition and culture is perceived as the seizing of an opportunity (the Prometheus or trickster complex; *see* trickster tale). Another view is that the rupture between the divine-ancestral and the human worlds is associated with the slaying of an ancestor or an ancestral deity by the ancestors. The term for this structure is the *dema* deity complex.

The most widely quoted example of the *dema* deity complex is the version of the Ceramese myth of Hainuwele, by the Danish anthropologist Adolf E. Jensen. According to this myth, a *dema* man named Amenta found a coconut speared on a boar's tusk and in a dream was instructed to plant it. In six days a palm had sprung from the nut and flowered. Amenta cut his finger, and his blood dripped on the blossom. Nine days later a girl grew asexually from the blossom, and in three more days she became sexually mature. Amenta named her Hainuwele, which means Coconut Branch. During a major religious festival Hainuwele stood in the midst of the dance grounds and excreted valuable objects. After nine days of this activity, the *dema* men dug a hole in the middle of the dance ground, threw Hainuwele in, and danced the ground firm on top of her. Amenta dug up her corpse, dismembered it, and planted the pieces. These pieces gave birth to plant species previously unknown, especially tubers, which have since been the Ceramese's chief food. Another *dema* goddess forced the *dema* men to go through a labyrinth. Some became ordinary mortals; others changed into animals and spirits.

Since its initial discovery in New Guinea, the *dema* complex has been found to be characteristic of the culture of many other tuber cultivators. The basic motif of death and dismemberment appears to reflect the fact that a tuber must be cut up and the pieces buried in order to propagate the species.

Demades (b. *c.* 380 BC—d. 319), Athenian orator and diplomat who rose from humble origins to a leading place in politics through his vigorous speeches and shrewd ability to fathom popular opinion. Demades opposed Demosthenes' attempt to arouse the Athenians against Philip II of Macedonia, but he fought against the Macedonians at the Battle of Chaeronea (338) and was taken prisoner. On his release he helped negotiate peace between Macedonia and Athens. The admiration of Philip's successor, Alexander the Great, for Demades caused the conqueror to treat Athens leniently after its rebellion in 335. In 324 Demades proposed divine honours for Alexander, but during the winter of 324–323 he was found guilty of accepting bribes against Alexander from Harpalus, Alexander's treasurer. He was heavily fined and lost his citi-

zenship but was reinstated in 322 so that he could negotiate a peace with Antipater (regent in Macedonia) concluding the Lamian War (Athens versus Macedonia, 323–322). Before setting out he persuaded the citizens to pass the death sentence upon Demosthenes and his followers. His embassy resulted in a peace disadvantageous to the Athenians. In 319 he was again sent to the Macedonian court, but either Antipater or his son Cassander, learning that Demades had intrigued with the regent Perdiccas, put him to death. None of Demades' speeches survive.

demand (economics): *see* supply and demand.

demand curve, in economics, a graphic representation of the relationship between product price and the quantity of the product demanded. It is drawn with price on the vertical axis of the graph and quantity demanded on the horizontal axis. With few exceptions, the demand curve is delineated as sloping downward from left to right because price and quantity demanded are inversely related (*i.e.*, the lower the price of a product, the higher the demand or number of sales). This relationship is contingent on certain *ceteris paribus* (other things equal) conditions remaining constant. Such conditions include the number of consumers in the market, consumer tastes or preferences, prices of substitute goods, consumer price expectations, and personal income. A change in one or more of these conditions causes a change in demand, which is reflected by a shift in the location of the demand curve. A shift to the left indicates a decrease in demand, while a movement to the right an increase. *Compare* supply curve.

Demaratus (fl. late 6th–early 5th century BC), king of Sparta, together with Cleomenes

Demaratus, bronze bust; in the Museo Archeologico Nazionale, Naples
Brogi—Art Resource/EB Inc.

I, who frustrated Cleomenes' designs on both Athens and Aegina. He was consequently dethroned by Cleomenes on a false charge of illegitimacy, upon which he fled to Persia and was given some small cities in northwestern Asia Minor, which his descendants held in Xenophon's time. The historian Herodotus told several stories of Demaratus' advice and warnings to Xerxes, whom he accompanied on his expedition to Greece in 480.

Demavend, Mount, Persian QOLLEH-YE DAMĀVAND, extinct volcanic peak of the Elburz Mountains, Iran, about 42 miles (68 km) northeast of Tehrān. Estimates of its height vary from about 18,400 feet (5,600 m) to more than 19,000 feet (5,800 m), and it dominates the surrounding ranges by 3,000 to 8,000 feet (900 to 2,450 m). Its steep, snowcapped cone is formed of lava flows and ash and is crowned

Mount Demavend, Iran
Marilyn Silverstone—Magnum

by a small crater with sulfuric deposits. Below the crater are two small glaciers; there are also fumaroles (holes for escaping fumes and gases), hot springs, and mineral deposits of travertine. Mount Demavend is mentioned in several Persian legends, one of which gives it as the resting place of Noah's ark.

deme, Greek DĒMOS, in ancient Greece, country district or village, as distinct from a polis, or city-state. *Dēmos* also meant the common people (like the Latin *plebs*). In Cleisthenes' democratic reform at Athens (508/507 BC), the demes of Attica (the area around Athens) were given status in local and state administration. Males 18 years of age were registered in their local demes, thereby acquiring civic status and rights.

The demes of Attica were local corporations with police powers and their own property, cults, and officials. Members met to decide deme matters and kept property records for purposes of taxation. The *bouletai* (members of the Athenian Boule, or Council of 500) were selected from each deme in proportion to its size. Because the demes were natural districts in origin, their size varied considerably. There were about 150 demes in the 5th century BC and more than 170 later. A typical deme had three *bouletai,* but the largest had as many as 22.

The term deme continued to designate local subdivisions in Hellenistic and Roman times and was applied to circus factions at Constantinople in the 5th and 6th centuries AD.

dementia, chronic, usually progressive deterioration of intellectual functions, usually owing to pathological changes in the brain. Dementia is most commonly seen in the elderly and usually begins with the loss of short-term memory; other initial manifestations can include confusion, irritability, and personality disturbance. Dementia was formerly distinguished from senility, which was considered to affect those over age 65; the term "presenile dementia," or Alzheimer's disease, was reserved for younger patients. However, it is now recognized that the same symptoms occur in all victims of dementia regardless of age.

The largest number of those with dementia have the irreversible, degenerative brain disease known as Alzheimer's disease (*q.v.*). These individuals first lose recent memory and higher intellectual functions such as judgment and abstract reasoning, then develop more severe memory losses leading to spatial and temporal disorientation. They may become emotionally unstable and deteriorate physically as well as mentally, ultimately losing even the ability to speak coherently. Dementia is also present in another degenerative brain disease, Pick's disease (*q.v.*).

The most significant other cause of dementia is cerebral arteriosclerosis, which accounts for 20 percent of all cases. Dementia is often a feature in cases of Huntington's chorea, and the syndrome is prominent in cases of paresis (*q.v.*) and some types of encephalitis. Treatable dementias occur in hypothyroidism, other metabolic diseases, and some malignant tumours. Treatment of the underlying disease in these cases may arrest the progress of dementia but usually does not reverse it. About 10–20 percent of all cases of dementia result from such treatable diseases.

dementia paralytica (disease): *see* paresis.

Demerara River, river in eastern Guyana that rises in the forests of central Guyana and flows northward without important tributaries for 215 miles (346 km) to the Atlantic Ocean at Georgetown. Its narrow estuary and rapid flow keep clear a direct channel of 16–20 feet (5–6 m) to the ocean. Oceangoing steamers ascend 65 miles (105 km) to Linden for bauxite; smaller ships reach Malali, 25 miles (40 km) farther upstream; beyond lie numerous rapids. Its name is that of the old Dutch colony of Demerara, which joined with Essequibo and Berbice in 1831 to become British Guiana (from 1966 the independent republic of Guyana).

demesne, in English feudal law, that portion of a manor not granted to freehold tenants but either retained by the lord for his own use and occupation or occupied by his villeins or leasehold tenants. When villein tenure developed into the more secure copyhold and leaseholders became protected against premature eviction, the "lord's demesne" came to be restricted and usually denoted the lord's house and the park and surrounding lands.

Demesne of the crown, or royal demesne, was that part of the crown lands not granted to feudal tenants but managed by crown stewards until it was later surrendered to Parliament in return for an annual sum. Ancient demesne was land vested in the crown in 1066, the tenants of such land having a number of privileges, such as freedom from tolls. *See also* copyhold; freehold.

Demeter, in Greek religion, daughter of the deities Cronus and Rhea, sister and consort of Zeus (the king of the gods), and goddess of agriculture. Her name means either "grain mother" or "mother earth."

Demeter is rarely mentioned by Homer, nor is she included among the Olympian gods, but the roots of her legend are probably ancient. The legend centred on the story of her daughter Persephone (*q.v.*), who was carried off by Hades, the god of the underworld. Demeter went in search of Persephone and, during her journey, revealed her secret rites to the people of Eleusis, who had hospitably received her (*see* Eleusinian Mysteries). Her distress at her daughter's disappearance was said to have diverted her attention from the harvest and

Demeter of Cnidus, sculpture, mid-4th century BC; in the British Museum
By courtesy of the trustees of the British Museum

caused a famine. In addition to Zeus, Demeter had a consort, Iasion (a Cretan), to whom she bore Plutus (Wealth; *i.e.,* abundant produce of the soil).

Demeter appeared most commonly as a grain goddess. The name Ioulo (from *ioulos,* "grain sheaf") has been regarded as identifying her with the sheaf and as proving that the cult of Demeter originated in the worship of the grain mother. The influence of Demeter, however, was not limited to grain but extended to vegetation generally and to all the fruits of the earth, except the bean. In that wider sense Demeter was akin to Gaea (Earth), with whom she had several epithets in common, and was sometimes identified with Rhea–Cybele.

Another important aspect of Demeter was that of a divinity of the underworld; as such she was *chthonia* (earth goddess) at Sparta, and especially at Hermione in Argolis, where, at the festival Chthonia, a cow was sacrificed by four old women. The epithets Erinys (Avenger) and Melaina (the Black One) as applied to Demeter were localized in Arcadia and stress the darker side of her character.

Demeter also appeared as a goddess of health, birth, and marriage. A certain number of political and ethnic titles were assigned to her, the most important being Amphiktyonis, as patron goddess of the Amphictyonic League, subsequently well known in connection with the temple at Delphi.

Among the agrarian festivals held in honour of Demeter were the following: (1) Haloa apparently derived from *halōs* ("threshing floor"), begun at Athens and finished at Eleusis, where there was a threshing floor of Triptolemus, her first priest and inventor of agriculture; it was held in the month Poseideon (December). (2) Chloia, the festival of the corn beginning to sprout, held at Eleusis in the early spring (Anthesterion) in honour of Demeter Chloë (the Green), the goddess of growing vegetation. This festival is to be distinguished from the later sacrifice of a ram to the same goddess on the sixth of the month Thargelion, probably intended as an act of propitiation. (3) Proerosia, at which prayers were offered for an abundant harvest, before the land was plowed for sowing. It was also called Proarktouria, an indication that it was held before the rising of Arcturus. The festival took place, probably sometime in September, at Eleusis. (4) Thalysia, a thanksgiving festival held in autumn after the harvest in the island of Cos. (5) The Thesmophoria, a women's festival meant to improve the fruitfulness of the seed corn. (6) The Skirophoria held in midsummer, a companion festival.

The attributes of Demeter were chiefly connected with her character as goddess of agriculture and vegetation—ears of corn, the mystic basket filled with flowers, corn, and fruit of all kinds. The pig was her favourite animal, and as a chthonian deity she was accompanied by a snake. In Greek art Demeter resembled Hera, but she was more matronly and of milder expression; her form was broader and fuller. She was sometimes riding in a chariot drawn by horses or dragons, sometimes walking, or sometimes seated upon a throne, alone or with her daughter. The Italians identified Demeter with their own Ceres (*q.v.*).

Demetrios I (Orthodox patriarch): *see* Dimitrios I.

Demetrius, name of rulers grouped below by country or patriarchate and indicated by the symbol •.

Foreign-language equivalents:
Greek ..... Dimitrios
Russian ..... Dmitry, or Dmitrii

BACTRIA

• **Demetrius** (fl. 2nd century BC), king of Bactria who was the son and successor of Euthydemus. The historical evidence for Demetrius' reign is slight and open to varying interpretations. According to some scholars, he ruled

Demetrius, coin, 2nd century BC
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

from about 190 to about 167, when he was killed by Eucratides, who then became king. Earlier, Demetrius had made such extensive conquests in northern India that for a brief time he virtually reestablished there the great Mauryan Empire that had collapsed about 184. Other scholars, however, contend that it was a younger Demetrius (likewise a Bactrian king but not directly related to the son of Euthydemus) who made conquests in India, of a less extensive kind, and lost his kingdom to Eucratides after reigning from about 180 to 165. The fact that one of these two men was the first to strike coins with a bilingual inscription in Greek and Prakrit suggests that he pursued a policy of treating the Indian peoples and the Bactrian Greeks as equals.

MACEDONIA

• **Demetrius I** POLIORCETES (b. 336 BC, Macedonia—d. 283, Cilicia), king of Macedonia 294–288.

He was the son of Alexander the Great's general Antigonus I Monophthalmus, in whose campaigns he commanded with distinction and whose empire, based in Asia, he attempted to rebuild. Unsuccessful against Ptolemy I Soter, satrap of Egypt, and against the Nabataeans, he liberated Athens from the Macedonian Cassander in 307 BC and in 306 decisively defeated Ptolemy at Salamis (Cyprus). From his unsuccessful siege of Rhodes (305) he won the title Poliorcetes (the Besieger). Recalled by his father from Greece, he fought in the Battle of Ipsus, in which his father was killed and lost much of his empire (301). Demetrius kept a foothold in Greece and in 294 reoccupied Athens and established himself as king of Macedonia, but in 288 he was driven out by his rivals Lysimachus and Pyrrhus. He finally surrendered to Seleucus I Nicator in Cilicia (285) and died there (283). He is the subject of one of Plutarch's *Lives.*

• **Demetrius II** (b. *c.* 276 BC—d. 229), king of Macedonia from 239 BC.

He gained distinction as a boy by defeating and dethroning Alexander of Epirus, thus saving Macedonia (*c.* 263). On his accession he was faced by an Aetolian and Achaean coalition, later joined by an Epirote League. Thus threatened, he was drawn northward by a Dardanian invasion, and after a defeat there he died. His failure seriously weakened both kingdom and monarchy.

PATRIARCHATE

• **Demetrius I:** *see* Dimitrios I.

SYRIA

• **Demetrius I** SOTER (Preserver) (b. *c.* 187 BC—d. 150), king of Syria from 162 to 150 BC. He was one of the line of rulers of the Seleucid dynasty, founded in 312 by a Macedonian successor of Alexander the Great.

The son of King Seleucus IV Philopator (ruled 187 to 175), Demetrius was sent to Rome as a hostage during his father's reign. While he was away, Syria came under the rule of his uncle, Antiochus IV Ephiphanes (died 164), and then of his cousin, Antiochus V. Aided by the Greek statesman and historian Polybius, Demetrius escaped from Rome in 162 and returned to Syria to claim the throne. Having defeated the rebel general Timarchus, he was recognized as king by the Roman Senate. In 160 he crushed a Jewish rebellion in Palestine. Demetrius died while fighting

Demetrius I, coin, 2nd century BC; in the British Museum
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

the pretender Alexander Balas, who was supported by Rome, Egypt, and Pergamum.

• **Demetrius II** NICATOR (Victor) (b. 161 BC—d. 125), king of Syria from 145 to 139 and from 129 to 125 BC.

The son of King Demetrius I Soter, he went into exile when his father was killed fighting the usurper Alexander Balas in 150. Returning to Syria (147) with an army of Cretan mercenaries, he deposed Balas in 145 and installed

Demetrius II, coin, 2nd century BC; in the British Museum
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

himself on the throne. In 140 he drove back a Parthian invasion but was defeated and captured by the Parthians in 139. Released from captivity in 129, he returned to Syria, but, during his second reign, controlled only part of the kingdom. He was assassinated about four years later.

VLADIMIR

• **Demetrius (II) Donskoy:** *see* Dmitry (II) Donskoy.

Demetrius CHALCONDYLES (b. 1424, Athens—d. 1511, Milan), Renaissance teacher of Greek and of Platonic philosophy.

In 1447 he went to Italy, where Cardinal Bessarion became his patron. In 1463 he was made professor at Padua, and in 1479 he was summoned by Lorenzo de' Medici to Florence, but in 1492 he moved to Milan. He was associated with Marsilio Ficino, Politian, and Teodoro Gaza in the revival of letters in the Western world. One of his pupils at Florence was the German scholar Johann Reuchlin. Demetrius Chalcondyles published the first

printed editions of Homer (1488), of Isocrates (1493), and of the *Suda* lexicon (1499); and a Greek grammar (*Erotemata*) in question-and-answer form.

Demetrius OF PHALERON, also called DEMETRIUS PHALEREUS (b. *c.* 350 BC, Phaleron, near Athens [Greece]), Athenian orator, statesman, and philosopher who was appointed governor of Athens by the Macedonian general Cassander (317 BC). He favoured the upper classes and gave effect to the ideas of such earlier political theorists as Aristotle. When the old democracy was restored in 307, Demetrius escaped to Thebes and later to Egypt, where he became prominent at the court of Ptolemy, enjoying a high reputation as an orator.

Demetrius, PSEUDO-: *see* Dmitry, False.

Demetrius Cydones: *see* Cydones, Demetrius.

Demetrius Triclinius: *see* Triclinius, Demetrius.

"De," "la," and similar components of a name, when followed by a space, are alphabetized as separate words (e.g., *De Forest, Lee*). *When they are joined to the following part of a name, the combination is treated as a single word* (e.g., *DeForest, John William*).

Demidov FAMILY, Russian family that acquired great wealth in the 18th century, largely through iron production and mining, and became benefactors and patrons of the arts and sciences.

Nikita Demidovich Antufyev (1656–1725), a blacksmith from Tula who took the surname Demidov in 1702, began to accumulate his family's fortune by manufacturing weapons and, after receiving land grants from Peter I the Great (ruled 1682–1725), by constructing and operating an iron foundry at Tula. Peter made Demidov, a former serf, a nobleman.

Akinfy Demidov (1678–1745), Nikita's son, increased his inherited wealth by expanding his holdings and establishing gold, silver, and copper mines, mainly in the Ural Mountains. Largely as a result of Nikita's and Akinfy's efforts, the Demidov family, by the end of the 18th century, controlled vast estates and enterprises and produced about 40 percent of the country's output of cast iron.

Subsequently, other members of the family engaged in philanthropic activities. Akinfy's nephew Pavel Grigoryevich Demidov (1738–1821) traveled extensively and became a benefactor of Russian education. His nephew Count Nikolay Nikitich Demidov (1773–1828) directed the family's mining business and also contributed liberally to scientific education, mainly in Moscow. Nikolay's elder son, Pavel Nikolayevich Demidov (1798–1840), founded an annual prize for Russian literature, to be awarded by the Academy of Sciences. Nikolay's younger son, Anatoly Nikolayevich Demidov (1812–70), also a traveler and patron of the arts, lived for many years in Italy, purchased the Tuscan title prince of San Donato, and married (1840) Princess Mathilde, Jérôme Bonaparte's daughter and Napoleon I's niece.

deMille, Agnes (George) (b. 1909, New York, N.Y., U.S.), American dancer and choreographer who further developed the narrative aspect of dance and made innovative use of American themes, folk dances, and gestures in her choreography of musical plays and ballets.

Her father was the playwright William deMille and her uncle was the film director Cecil B. deMille. From 1929 to 1940 she toured the United States and Europe, giving concerts

Agnes deMille and Yurek Lazowski performing in *Three Virgins and a Devil,* 1955
Fred Fehl

of her own humorous character sketches in mime-dance. She created her first major roles in ballet with the Ballet Rambert, performing in works by Antony Tudor, and later studied modern dance.

Rodeo (1942), one of her most important ballets, was created for the Ballet Russe de Monte Carlo. The first ballet to include tap dancing, it continued the use of characteristically American gestures—bronco riding and steer roping movements—begun by Eugene Loring in *Billy the Kid* (1938). Most of deMille's other ballets were choreographed for New York City's Ballet Theatre, which she joined in 1940. Her works for that company include *Fall River Legend* (1948), *The Harvest According* (1952), and *Three Virgins and a Devil* (1941).

DeMille's equally outstanding career as a choreographer of musicals began in 1929 with *The Black Crook.* In 1943 she choreographed the dances for *Oklahoma!;* in that Broadway musical, dance not only added to the dramatic atmosphere but also, for the first time in American theatrical history, was instrumental in advancing the plot. Among the other musicals for which she staged the dances were *One Touch of Venus* (1943), *Carousel* (1945), *Brigadoon* (1947), *Gentlemen Prefer Blondes* (1949), *Paint Your Wagon* (1951), *The Girl in Pink Tights* (1954), and *110 in the Shade* (1963). She also arranged dances for the films *Romeo and Juliet* (1936) and *Oklahoma!* (1955), directed plays, and choreographed television programs.

Her extensive writings include *To a Young Dancer* (1962), *The Book of the Dance* (1963), *Lizzie Borden* (1968), *Russian Journals* (1970), and *America Dances* (1980), as well as several volumes of autobiography.

deMille, Cecil B(lount) (b. Aug. 12, 1881, Ashfield, Mass., U.S.—d. Jan. 21, 1959, Hollywood, Los Angeles, Calif.), American motion-picture producer-director whose use of spectacle attracted vast audiences and made him a dominant figure in Hollywood for almost five decades.

Cecil B. deMille
EB Inc.

He was the son of the playwright Henry Churchill DeMille. After studying at the Pennsylvania Military College and the American Academy of Dramatic Arts, he began his career in the theatre as an actor in 1900. He was soon collaborating with his brother, the playwright William Churchill deMille.

In 1913 deMille joined Jesse Lasky, Samuel Goldwyn, and Arthur Freed in forming the Jesse Lasky Feature Play Company, which subsequently became Paramount Pictures. DeMille's own first film was a western, *The Squaw Man* (released 1914), one of the first full-length feature films produced in Hollywood. His ability to give the public what it wanted soon made him a "name" director in the days when directors were virtually unknown. From 1919 to 1923 deMille made comedies that reflected the postwar freedom from moral restraint, but, when a reaction set in, he began to produce films dealing with biblical subjects and featuring spectacular crowd scenes and sets. Among these were *The Ten Commandments* (1923) and *The King of Kings* (1927), which, it is estimated, was seen by 800,000,000 persons.

DeMille was known for his strong and assertive personality: he was the first director to use a megaphone on the set and the first to install a loudspeaker system for issuing orders. He was also noted for his right-wing political views and his strenuous opposition to labour unions. In later decades deMille concentrated upon large productions, culminating in *Samson and Delilah* (1949), *The Greatest Show on Earth* (which won the Academy Award for the best picture of 1952), and a second version of *The Ten Commandments* (1956), his 70th and last film. His other films include *The Sign of the Cross* (1932) and *Union Pacific* (1939). From 1936 to 1945 deMille appeared on radio in a popular weekly series of adaptations of recent motion pictures.

Although many critics dismissed deMille's films as devoid of artistic merit, he was conspicuously successful in a genre—the epic—that he made distinctively his own.

Deming, W(illiam) Edwards (b. Oct. 14, 1900, Sioux City, Iowa, U.S.), American statistician, educator, and consultant whose advocacy of quality-control methods in industrial production aided Japan's rise to global supremacy in many industries in the late 20th century.

The son of a small-town lawyer, Deming attended the University of Wyoming (B.S., 1921), University of Colorado (M.S., 1924), and Yale University (Ph.D. in mathematical physics, 1928). He then taught physics at several universities, worked as a mathematical physicist at the United States Department of Agriculture (1927–39), and was a statistical adviser for the U.S. Census Bureau (1939–45). From 1946 he was a professor of statistics at New York University's graduate school of business administration, and he was also a research consultant for private business.

Deming became interested in the use of statistical analysis to achieve better quality control in industry in the 1930s, and in 1950 he was invited to Japan to teach that nation's executives and engineers about the new methods. Deming's ideas were eagerly adopted by Japanese companies, whose commitment to quality control helped Japanese products to dominate the market in many parts of the world. Japan's Deming Award, which is given to major corporations who win a rigorous quality-control competition, is named after Deming.

In the 1980s Deming's ideas were taken up by American corporations as they sought to compete more effectively against foreign manufacturers. Deming's quality-control methods centred on systematically tallying product defects, analyzing their causes, correcting the latter, and then recording the corrections' effects on subsequent product quality.

Demirel, Süleyman (b. Oct. 6, 1924, İslâmköy, Tur.), politician and civil engineer who served six times as prime minister of Turkey.

Born into a peasant family, Demirel graduated in 1948 from the Technical University of Istanbul as an engineer. Throughout the 1950s he supervised hydroelectric dams and water works for the government of Prime Minister Adnan Menderes. He entered politics in 1961 and was elected to the National Assembly that same year as a member of the Justice Party (JP), which was an offshoot of Menderes' Democrat Party. He became the Justice Party's leader in 1964, in 1965 he became deputy prime minister in a coalition government, and in general elections on Oct. 10, 1965, the Justice Party won an absolute majority, thus enabling Demirel to become on October 27 the youngest prime minister in his country's history. As prime minister he improved Turkey's ties with its NATO allies and the United States and instituted development programs for his basic constituency, the Turkish peasantry.

Demirel was reelected in elections in 1969, but his moderate policies faced growing opposition. Although he was supportive of the traditional values and culture of Turkey, Demirel attempted to accelerate economic progress by lifting various regulatory controls on private enterprise, thus angering left-wing elements. His pro-Western foreign policies exacerbated rising nationalist feelings in Turkey. His government's policies were attacked from both the left and the right, and, upon his refusal to allow the military to assume a policy-making role in efforts to combat rampant terrorism, Turkey's military commanders forced him to resign in March 1971. In March 1975 a coalition of the JP and smaller right-wing parties in a Nationalist Front once more restored Demirel to the prime ministry.

Demirel pursued a policy of economic growth, in spite of civil violence and terrorism from extremist factions, inflation, and a trade deficit. But the electoral coalitions that now enabled him to maintain power were inherently weak, unstable, and governmentally ineffective. His fourth ministry fell in June 1977, but he achieved a fifth prime ministry from July to December 1977 and a sixth from November 1979 to September 1980. As the country continued to be torn apart by extremist violence, the military overthrew his government on Sept. 12, 1980. Demirel, along with other formerly important politicians, was banned from participating in politics under Turkey's new constitution adopted after the military coup.

demiurge, Greek DĒMIOURGOS ("artisan," or "craftsman"), in Plato's *Timaeus,* the creator of the world; later, in the 2nd and 3rd centuries AD among various Gnostic sects, a jealous and inferior god who indeed created the world with all its imperfections and who was ignorantly worshiped by unknowing (non-Gnostic) ordinary Christians, in contradistinction to the supreme God whom the Gnostics alone knew and worshiped.

democracy, literally, rule by the people (from the Greek *dēmos,* "people," and *kratos,* "rule"). The term has several different senses in contemporary usage: (1) a form of government in which the right to make political decisions is exercised directly by the whole body of citizens, acting under procedures of majority rule, usually known as direct democracy; (2) a form of government in which the citizens exercise the same right not in person but through representatives chosen by and responsible to them, known as representative democracy; (3) a form of government, usually a representative democracy, in which the powers of the majority are exercised within a framework of constitutional restraints designed to guarantee all citizens the enjoyment of certain individual or collective rights, such as freedom of speech and religion, known as liberal, or constitutional, democracy.

Democracy had its beginnings in certain of the city-states of ancient Greece in which the whole citizen body formed the legislature, a system made possible by the fact that a city-state's population rarely exceeded 10,000 persons and that women and slaves enjoyed no political rights. Citizens were eligible for a large variety of executive and judicial offices, some of which were filled by elections, others being assigned by lot. There was no separation of powers, and all officials were fully responsible to the popular assembly, which was qualified to act in executive and judicial as well as legislative matters.

Greek democracy was a brief historical episode that had little direct influence on the practice of modern states; from the fall of the Greek city-state to the rise of modern constitutionalism, there was a gap of 2,000 years in the practice of democracy.

Modern democratic ideas were shaped to a large extent by ideas and institutions of medieval Europe, notably the concept of divine, natural, and customary law as a restraint on the exercise of power. Democratic practices also grew out of European kings' practice of seeking approval of their policies, including the right to levy taxes, by consulting the different "estates," or group interests, in the realm. Gatherings of representatives of these interests were the origin of modern parliaments and legislative assemblies. Contributing to their emergence were profound intellectual and social developments, notably the emergence of concepts of natural rights and political equality during the Enlightenment and the American and French revolutions.

Representative parliaments, freely elected under universal franchise, became in the 19th and 20th centuries the central institutions of democratic governments. In the West, democracy also implied competition for office, freedom of speech and the press, and the rule of law.

The Communist definition of democracy in the 20th century was quite different. The "peoples' republics" of the Soviet bloc evaded Western criteria and "elected" officials without competition from a single authorized party slate. Their apologists argued that collective ownership of the means of production is sufficient to ensure that the will of the people will be carried out.

Democratic Centralist, in the history of the Soviet Union, member of an opposition group within the Communist Party that objected to the growing centralization of power in party and government organs.

The group developed during 1919–20 as the central government and party organs, responding to practical needs created by the Russian Civil War, tightened their control over local soviets and party units. Led by Timofey V. Sapronov, Vladimir M. Smirnov, and Valerian V. Osinsky (Obolensky), the group was composed largely of intellectuals, many of whom had opposed the centralization of state control over industry in 1918. At various party and government conferences in 1919, the Democratic Centralists protested the tendencies of the Communist Party's leaders to dictate policy and appoint local officials, and they urged more intraparty freedom. Although the seventh Congress of Soviets supported those aims (December 1919), few practical adjustments were made in the distribution of power. The Democratic Centralists continued their protest through 1920; but at the 10th Party Congress (March 1921) opposition groups were condemned, and the Democratic Centralists, satisfied by the passage of resolutions supporting organizational reforms, became temporarily inactive.

They revived their protests, however, as the party failed to implement its resolutions. In 1923 they joined other opposition elements to criticize the central party leadership (Declaration of the Forty-Six, presented to the Politburo Oct. 15, 1923), and in 1926–27 they sided with the opposition against Stalin's increasing domination of the party. But Stalin defeated the opposition; at the 15th Party Congress (December 1927), 18 Democratic Centralists were expelled from the party. During the purges of the 1930s most of the Democratic Centralists were arrested and either sent to labour camps or executed.

Democratic Party (Japan): *see* Minseitō.

Democratic Party, liberal political party in the Republic of South Africa that was established in 1989 by the merger of the Progressive Federal Party (*q.v.*) with two smaller liberal parties, the National Democratic Movement and the Independent Party. The Democratic Party supported full voting and other civil rights for South Africa's black majority and called for an end to human-rights abuses by the government. It won 33 seats in general elections to the South African Parliament in 1989.

Democratic Party, in the United States, one of the two major political parties. Its traditional symbol is the donkey; and its theme song, since the 1930s, has been "Happy Days Are Here Again."

The party can be traced to 1792, when a national group of voters began supporting Thomas Jefferson with the name Republicans, or Jeffersonian Republicans (*see* Republican Party), to emphasize antimonarchical sentiments. The party, or faction, was known by various designations until, during the presidency of Andrew Jackson in the 1830s, the party adopted its present name.

Jefferson had established the party on the principle of popular government, but its early presidents—Jefferson, James Madison, James Monroe, and John Quincy Adams—were aristocrats by birth, breeding, and education; not until 1829, when Jackson became president, did a "man of the people" enter the White House.

Between 1837, when Jackson retired, and 1860 four Democratic presidents—Martin Van Buren, James K. Polk, Franklin Pierce, and James Buchanan—were elected. The Democrats won every presidential election except those of 1840 and 1848. But during the 1840s and '50s the party began to undergo serious internal strains over the issue of slavery and its extension to the Western territories. Southern Democrats, led by Jefferson Davis, insisted on the protection of slavery in all the territories, a demand buttressed by the Supreme Court's Dred Scott decision of 1857. Northern Democrats, led by Stephen A. Douglas, advocated the doctrine of popular sovereignty, under which the settlers in a territory could vote to ban slavery from their midst. The party split over the slavery issue in 1860 at its presidential convention in Charleston, S.C. The Northern Democrats nominated Douglas as their presidential candidate, and the Southern Democrats adopted a proslavery stance and nominated John C. Breckinridge as their presidential candidate. This North–South split proved disastrous to the Democrats; the newly formed, antislavery Republican Party won its first national victory under Abraham Lincoln in 1860, receiving a majority of votes in the electoral college because of the split.

From 1860 to 1900 the Democratic Party held the presidency for only eight years, during the two terms of Grover Cleveland (1885–89, 1893–97). In the postwar decades white Southerners associated the Republican Party with both the prosecution of the Civil War and with Radical Reconstruction; these voters subsequently remained firmly Democratic until the mid-20th century. The Democratic

Party at this time was basically conservative and agrarian-oriented; its members were anti-big business in attitude, opposed to protective tariffs, and in favour of cheap-money policies. In 1896 the party once more split disastrously over the free-silver and Populist program of its presidential candidate, William Jennings Bryan, who lost that year's election. Through their support of economic radicalism under Bryan's leadership, the Democrats once again after 1896 became a minority party in the nation.

But the need for government to regulate America's increasingly industrialized and corporatized economy began to result in the early 20th century in a gradual renascence of the Democratic Party. The Democrats returned to power in 1912 with Woodrow Wilson, mainly because the Republican vote was divided between William Howard Taft and the Progressive Party candidate, Theodore Roosevelt. Under the slogan of the New Freedom, Wilson obtained legislation for a broader federal regulation of banking and industry, among other reforms. Wilson was reelected in 1916, but his idealistic stance ultimately proved less attractive to the public than the Republicans' frank embrace of big business amid the spectacular prosperity of the 1920s. The Democrats lost the presidential elections of 1920, 1924, and 1928.

The Great Depression, however, and the Republicans' evident inability or unwillingness to take governmental action against its grievous consequences swept the Democratic Party back into power in 1932 under the candidacy of Franklin D. Roosevelt. Roosevelt's vigorous New Deal policies and his inspired political skills brought small farmers into coalition with other groups that were to become firmly Democratic: Northern urban voting blocs, organized labour, blacks and other minorities, liberals, intellectuals, and reformers. This coalition enabled the Democratic Party to retain the presidency until 1952, turned it into the majority party in the country, and gave it control, of at least one and usually both houses of Congress throughout the rest of the 20th century.

Roosevelt was reelected in 1936, 1940, and 1944 and upon his death was succeeded by Harry S. Truman. Truman was narrowly elected in 1948 despite the defections of many segregationist Southern Democrats under J. Strom Thurmond and of many liberals under Henry Wallace.

The Democrats lost the presidency in 1952 and did not regain it until John F. Kennedy's election in 1960. The party's role in championing civil-rights and desegregation legislation under Kennedy and his successor, Lyndon B. Johnson, lost it the traditional allegiance of many of its former Southern supporters. Johnson was elected president by a landslide in 1964. But widespread popular support for Johnson's liberal Great Society legislative program was largely negated by bitter opposition to American participation in the Vietnam War, and the divided Democrats lost the 1968 presidential election to the Republicans. The Democrats' strife-ridden convention of 1968 subsequently led to a reformation of the party's rules and selection procedures under the leadership of its 1972 presidential candidate, George S. McGovern, who lost by a landslide. The Democrats recovered the presidency in 1976 under the candidacy of Jimmy Carter. Four years later Carter was defeated for reelection by the conservative Republican Ronald W. Reagan in an election that also marked the party's loss of its long-term control of the Senate. In 1984 the Democratic presidential candidate, Walter F. Mondale, along with Geraldine A. Ferraro, the first woman chosen by a major party as a nominee for vice president, lost by an overwhelming margin to Reagan. Many of the liberal reforms championed by the Democrats during the 1960s and '70s had meanwhile passed into law, while others had failed or been largely abandoned by the electorate. By the 1980s the long-lived New Deal coalition had partially dissolved, and the Democrats seemed both uncertain of their legislative goals and in danger of losing their position as the nation's clear majority party.

Democratic-Republican Party, in U.S. history, offshoot of the Republican Party (*q.v.;* 1801–25), or Jeffersonian Republicans, and the forerunner of the modern Democratic Party.

Democratic Socialist Party (Italy): *see* Italian Democratic Socialist Party.

Democratic Socialist Party, Japanese MINSHATŌ, Japanese political party formed in 1960 by moderate Socialists who had broken away from the Japanese Socialist Party the year before because of its alleged Marxist dogmatism and its definition of itself as a "class" party. The main base of the Democratic Socialist Party is the Dōmei Kaigi, the second largest labour-union confederation in Japan; and it favours a moderate evolution of socialism, with at first the improvement of workers' welfare and the nationalization of only a few key industries. It disfavours any left coalition that would include the Communists.

Democrazia Cristiana (Italian political party): *see* Christian Democracy.

Democritus (b. *c.* 460 BC—d. *c.* 370), Greek philosopher important in the development of the atomic theory of the universe.

Knowledge of Democritus' life is largely limited to untrustworthy tradition: it seems that he was a wealthy citizen of Abdera, in Thrace; that he traveled widely in the East; and that he lived to a great age. According to Diogenes Laërtius, his works, covering almost the whole range of human knowledge, numbered 73; only a few hundred fragments have survived, mostly from his treatises on ethics.

Democritus' physical and cosmological doctrines were an elaborated and systematized version of those of his teacher, Leucippus. Democritus agreed with the Eleatic philosophers' assertion that reality, or Being, is an eternal and undifferentiated whole, but he denied its oneness and immobility. To account for the world's changing physical phenomena, he asserted that space, or the Void, had an equal right with Being to be considered existent. Democritus conceived of the Void as a vacuum, an infinite space in which moved an infinite number of atoms that made up Being (*i.e.,* the physical world). These atoms are eternal and invisible; absolutely small, so small that their size cannot be diminished (hence the name *atomon,* or "indivisible"); absolutely full and incompressible, as they are without pores and entirely fill the space they occupy; and homogeneous, differing only in shape, arrangement, position, and magnitude. But while atoms thus differ in quantity, differences of quality are only apparent, due to the impressions caused on our senses by different configurations and combinations of atoms. A thing is hot or cold, sweet or bitter, or hard or soft only by convention; the only things that exist in reality are the atoms and the void. Thus, the atoms of water and iron are the same, but those of water, being smooth and round and therefore unable to hook onto one another, roll over and over like small globes, whereas those of iron, being rough, jagged, and uneven, cling together and form a solid body. Because all phenomena are composed of the same eternal atoms, it may be said that nothing comes into being or perishes in the absolute sense of the words, although the compounds made out of the atoms are liable to increase and decrease, explaining a thing's appearance and disappearance, or "birth" and "death."

Just as the atoms are uncaused and eternal, so too, according to Democritus, is motion: instead of a moving principle (the Love and Strife of Empedocles; the *nous,* or intelligence, of Anaxagoras), Democritus posited the fixed and "necessary" laws of a purely mechanical system, in which there was no room for an intelligent cause working with a view to an end. Democritus explained the origin of the universe as follows. The original motion of the atoms was in all directions; it was a sort of "vibration"; hence there resulted collisions and, in particular, a whirling movement, whereby similar atoms were brought together and united to form larger bodies and worlds. This happened not as the result of any purpose or design but rather merely as the result of "necessity"; *i.e.,* it is the normal manifestation of the nature of the atoms themselves. Atoms and void being infinite in number and extent, and motion having always existed, there must always have been an infinite number of worlds, all consisting of similar atoms in various stages of growth and decay.

Democritus also devoted considerable attention to perception and knowledge. He asserted that sensations are changes produced in the soul by atoms emitted from other objects which impinge on it; the atoms of the soul can be affected only by the contact of other atoms. But sensations such as sweet and bitter are not as such inherent in the emitted atoms, for they result from effects caused merely by the size and shape of the atoms; *e.g.,* sweet taste is due to round and not excessively small atoms. It is in Democritus' thought that we find a first real attempt to explain colour, which again is not an objective quality as such: it is due, he thinks, to the "position" rather than to the shape of the constituent atoms of compounds. The sensation of white, for instance, is caused by atoms that are smooth and flat so as to cast no shadow; the sensation of black is caused by rough, uneven atoms.

In theology Democritus attributed popular belief in the gods to a desire to explain extraordinary phenomena (thunder, lightning, earthquakes) by reference to superhuman agency. His ethical system, founded on a practical, rather than a theoretical, basis, posited an ultimate good ("cheerfulness") that was "a state in which the soul lives peacefully and tranquilly, undisturbed by fear or superstition or any other feeling."

Articles are alphabetized word by word, not letter by letter

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demography, study of the structure of human populations (their distributions by age, sex, marital status, etc.) and their dynamic aspects (births, deaths, migratory movements, etc.). Contemporary demographic concerns include the "population explosion," the interplay between population and development, the birth control movement, urban congestion, illegal immigration, and labour force statistics. For a discussion of the objects of demographic study, *see* population (in human biology and physical anthropology).

The beginning of demography as a science may be found in the work of the Englishman John Graunt, who in 1662 published *Natural and Political Observations . . . Made upon the Bills of Mortality,* "Bills of Mortality" being weekly records of deaths and baptisms going back to the end of the 16th century, which furnished Graunt with his raw material. In search of statistical regularities Graunt made an estimate of the male–female ratios at birth and death–birth ratios in London and rural communities. His most famous contribution was his construction of the first mortality table; by analyzing birth and death rates he

was able to estimate roughly the number of men currently of military age, the number of women of childbearing age, the total number of families, and even the population of London. Another precursor of the modern science was German pastor Johann Süssmilch, who in 1741 published the first edition of his *Die Göttliche Ordnung* ("The Divine Order"), which analyzed the populations of 1,056 parishes in Brandenburg and various cities and provinces of Prussia. He constructed several mortality tables, including the first one for the whole population of Prussia (1765).

In 18th-century Europe an interest arose in the study of mortality statistics, resulting from the development of life insurance and from the growing attention given to public health; to this period belongs the work of Willem Kersseboom in Holland (1740), Antoine Deparcieux in France (1746), Daniel Bernoulli in Switzerland (1760), and Pehr Wargentin in Sweden (1766), all mathematicians or astronomers. In the 19th century demographic statistics developed rapidly. The establishment of a civil registry of demographic events (births, deaths, marriages) was, in effect, an extension of the old church registries.

Censuses of the population also developed during the 19th century; decennial censuses began in the United States in 1790 and in England in 1801, quinquennial censuses in France in 1801. Demographic research was still concentrated on mortality, notably in the mathematical works of Benjamin Gompertz (1825), William Makeham (1860), Wilhelm Lexis (1875), and Karl Pearson (1897). Interest in fertility developed much later, for it seemed to be a more fundamentally stable phenomenon and one which did not call for collective action. This lack of interest in the study of fertility is remarkable on the part of scientists living in the century of Thomas Malthus, whose thesis that reproduction tended to outrun the means of subsistence was enormously influential. When it became apparent that a considerable decline of fertility had taken place in the industrialized countries during the second half of the 19th century, however, demographers began to make studies of fertility and reproduction.

The phenomenon of differential fertility, with its implications about selection and more particularly about the evolution of intelligence, evoked widespread interest as shown in Charles Darwin's theories and in the works of Francis Galton. Wilhelm Lexis (1875), G.F.R. Böckh (1884), and Robert Kuczynski worked out measurements of population reproduction, while Alfred Lotka, starting in 1907, founded mathematical demography.

As fertility continued to decline, the period between the two world wars saw the development of studies on this subject. At the same time, demography took on a broader, interdisciplinary character, as can be seen in the fundamental work of Frank Lorimer and Frederick Osborn, *Dynamics of Population.* After 1920 international demographic conferences multiplied, and in 1928 the International Union for the Scientific Study of Population was founded.

In the second half of the 20th century the field of demography greatly expanded, reflecting the increased importance of population problems in both the developing and the developed countries. This has been marked by the creation of numerous specialized research institutes, the publishing of several dozen periodicals devoted exclusively to demographic research, and the great importance assigned to demographic questions by international organizations, particularly the United Nations.

The basis for most demographic research continues to lie in population censuses and the registration of vital statistics. A population census is a gigantic and costly operation, because it involves collecting a considerable amount of information from all the inhabitants of a country in a brief period of time. No census is ever completely accurate, because omissions and double counts are inevitable; thus it is estimated that in the 1960 census of the population of the United States there was a 3 percent omission and a 1.3 percent double count, giving a net underestimate of 1.7 percent. Moreover, if the questions are too numerous, it is not possible to obtain replies of a high quality except by making exceptional efforts, which add to the expense; to avoid this, some questions are asked of only a fraction of the population.

Birth, death, and marriage statistics are based on certificates drawn up by local authorities and turned in to the regional or national government. In countries with a long tradition of registering these events, such statistics have considerable accuracy. Elsewhere they do not.

Demographic studies pursued in depth require extensive data from each individual, some of it of a qualitative nature (opinions, miscellaneous situations, intentions). The inquiry is concentrated on a limited number of persons (a few thousand), chosen in a representative manner by some sampling technique; they may be questioned not only about the situation at a given moment but about their history.

demoiselle (fish): *see* damselfish.

Demolder, Eugène (b. Dec. 16, 1862, Brussels—d. Oct. 8, 1919, Essonnes, Fr.), Belgian novelist and storywriter, writing in French, who was a member of the Jeune Belgique (Young Belgium) literary renaissance of the late 19th century.

He was trained to be a lawyer, and his memoirs, *Sous la robe* ("Under the Robe"), provide a record of the professional and cultural life of a class that was in the forefront of Belgian literary reform. Demolder's novels are noted for their evocation of atmosphere and may be regarded more as a sequence of tableaux than as coherent narratives.

In early works, such as *La Légende d'Yperdamme* (1891), he transposed stories from the Gospels into Flemish medieval settings whose scenes have been compared with the paintings of Bruegel. In *La Route d'emeraude* (1899; "The Emerald Road") Demolder provided rich graphic descriptions in his story of the life of a would-be painter in the Low Countries in the 17th century. Demolder's other important novel, *Le Jardinier de la Pompadour* (1904; "Madame de Pompadour's Gardener"), is set in France; in this evocation of an elegant period, Demolder's style and subject are in perfect harmony. His *L'Espagne en auto* (1906; "Spain by Auto") is one of the earliest narratives of automobile travel.

demon, also spelled DAEMON, in religions worldwide, any of numerous malevolent spiritual beings, powers, or principles that mediate between the transcendent and temporal realms.

A brief treatment of demons follows. For full treatment, *see* MACROPAEDIA: Doctrines and Dogmas, Religious.

In ancient Greece a demon (Greek *daimon*) was a supernatural power, and the term was used almost interchangeably by Homer with *theos,* for a god. The distinction was that *theos* emphasized the personality of the god, and demon his activity. Hence, demon was regularly applied to sudden or unexpected supernatural interventions not due to any particular deity. It became commonly the power determining a person's fate, and a man could have a personal demon. As early as Hesiod, the dead of the Golden Age became demons; and later philosophical speculation envisaged these as lower than the gods (possibly mortal) but as superior to humanity.The Christians, therefore, attributed the actions of the pagan gods to demons identified as fallen angels.

In Zoroastrianism, a religion founded by the 6th-century-BC Persian prophet Zoroaster, the hierarchy of demons (daevas) is headed by Angra Mainyu (later called Ahriman), the Evil, or Destructive, Spirit. The demons are in constant battle with Ahura Mazdā (later called Ormazd), the Good Lord.

The hierarchy of demons in Judaism, which is rooted in ancient Near Eastern and Zoroastrian demonology after the postexilic period (after 538 BC), is quite varied. The prince of the forces of evil (Hebrew *shedim,* meaning "demons" and applied to foreign gods, or *seʿirim,* meaning "hairy demons"), who often were believed to inhabit desert wastes, ruins, and graves and to inflict men with various physical, psychological, and spiritual disorders, was called by different names: Satan (the Antagonist), Belial (the spirit of perversion, darkness, and destruction), Mastema (Enmity, or Opposition), and other names. Though the Old Testament refers to Satan as the prosecutor of God's celestial court (Zech. 3; Job 1–2), a hierarchy of demons under Satan or other princes of evil was developed in inter-testamental literature and later Judaism.

The hierarchy of demons in Christianity is based on various sources: Jewish, Zoroastrian, Gnostic (a syncretistic religious dualistic-belief system in which matter is viewed as evil, the spirit good, and salvation as being attainable through esoteric knowledge, or gnosis), and the indigenous religions that succumbed to Christian missionizing. In the New Testament, Jesus speaks of Beelzebul as the chief of demons and equates him with Satan. In the Middle Ages and the Reformation period, various hierarchies of demons were developed, such as that associated with the seven deadly sins: Lucifer (pride), Mammon (avarice), Asmodeus (lechery), Satan (anger), Beelzebub (gluttony), Leviathan (envy), and Belphegor (sloth).

The Islāmic hierarchy of demons is headed by Iblīs (the devil), who also is called *Shayṭān* (Satan) or *ʿaduw Allāh* (Enemy of God). Based to a great extent on Jewish and Christian demonology, Iblīs became the leader of a host of *jinn,* spiritual beings that generally bode evil for men.

In Hinduism, the *asura*s (the Zoroastrian *ahura*s) are the demons who oppose the *deva*s (the gods). Among the various classes of *asura*s are *nāga*s (serpent demons), Ahi (the demon of drought), and Kaṃsa (an archdemon). Demons that afflict men include the *rākṣasa*s, grotesque beings who haunt cemeteries, impel men to perform foolish acts, and attack *sadhu*s (saintly men), and *piśaca*s, beings who haunt places where violent deaths have occurred.

Buddhists often view their demons as forces that inhibit man from achieving Nirvāṇa (bliss or the extinction of desire); an important example is Māra, an arch tempter, who, with his daughters, Rati (Desire), Rāga (Pleasure), and Tanhā (Restlessness), attempted to dissuade Siddhārtha Gautama, the Buddha, from achieving his enlightenment. As Mahāyāna (Greater Vehicle) Buddhism spread to Tibet, China, and Japan, many of the demons of the folk religions of these areas (*e.g.,* the Chinese *kuei-shen;* the Japanese *oni*) were incorporated into Buddhist beliefs.

Demonesi Insulae (Turkey): *see* Kızıl Adalar.

Demophoon, in Greek mythology, the son of Celeus, king of Eleusis. The goddess Demeter, wandering in search of her daughter Persephone, became Demophoon's nurse. As an act of kindness to those who had sheltered her, she attempted to immortalize him by burning out his mortal parts but was surprised in the act by his mother, who thought that she was harming the boy. Incensed, Demeter quickly withdrew the child from the fire, thus leaving

him susceptible to death. In another version the surprise resulted in Demophoon's death in the flames. Shortly thereafter Demeter departed from Eleusis.

Demopolis, city, Marengo County, western Alabama, U.S., at the confluence of the Tombigbee and Black Warrior rivers, which form a navigable waterway. Founded in 1817 by Napoleonic exiles who unsuccessfully tried to raise olives and grapes, it was named Demopolis (Greek: "city of the people") and was chartered in 1819. A cotton-plantation society flourished (1830–60), and many fine Greek Revival mansions were built, including Gaineswood and Bluff Hall. Later, beef cattle, dairying, soy beans, and lumbering replaced dependence on cotton. Manufacturing industries (chiefly lingerie, paperboard and pulp, and chemicals) also developed, with shipping provided by the Demopolis Inland State Docks (1956). Recreational activities focus on nearby Lake Demopolis, with a 400-mi (640-km) shoreline, formed by the dam on the Tombigbee. Pop. (1980) 7,678.

dēmos (in ancient Greece): *see* deme.

Demosthenes (d. 413 BC), Athenian general who proved to be an imaginative strategist during the Peloponnesian War (Athens versus Sparta, 431–404).

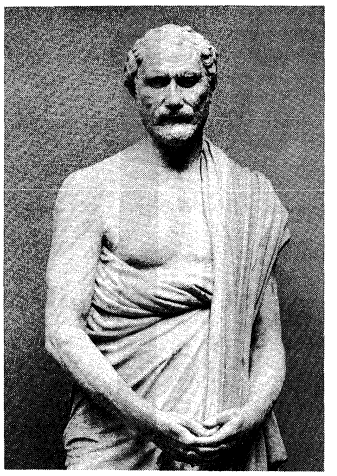
In 426 he unsuccessfully besieged the Corinthian colony of Leukas and was severely defeated in an attempted invasion of Aetolia. Demosthenes redeemed these failures by successfully defending Naupactus, the Athenian naval base in the Gulf of Corinth, against a Spartan land attack and by winning two decisive victories over the Spartans, at Olpae near Argos and at Idomene in the hills to the north of Argos. In 425 he was authorized to use the fleet for operations around the Peloponnese. He fortified the promontory of Pylos in Messenia and, while the rest of the flotilla sailed on to Sicily, remained with five ships at the harbour of the peninsula at Pylos. There he managed to resist Spartan attacks. The Spartans occupied the neighbouring peninsula of Sphacteria but were besieged after their ships were driven off by the returning Athenian fleet. The politician Cleon joined Demosthenes in defeating and capturing the stranded foe.

In 424 Demosthenes made an abortive attack on Megara and launched an unsuccessful invasion of Boeotia. In 413 he was sent to reinforce the general Nicias during the Athenian siege of Syracuse. Failing in a night attack on the high ground overlooking the city, Demosthenes advised immediate retreat but was overruled by Nicias. When the retreat finally began, the division under Demosthenes fell behind and was forced to surrender. Demosthenes was put to death by his captors.

Consult the INDEX *first*

Demosthenes (b. 384 BC, Athens—d. Oct. 12, 322, Calauria, Argolis), Athenian statesman, recognized as the greatest of ancient Greek orators, who roused Athens to oppose Philip of Macedon and, later, his son Alexander the Great. His speeches provide valuable information on the political, social, and economic life of 4th-century Athens.

Heritage and youth. Demosthenes, a contemporary of Plato and Aristotle, was the son of a wealthy sword maker. His father died when he was seven, leaving a large inheritance, but the boy's unscrupulous guardians took advantage of their position, and when he came of age Demosthenes received very little of his estate. His strong desire to sue his guardian, Aphobus, in the courts, coupled



Demosthenes, marble statue, detail of a Roman copy of a Greek original of c. 280 BC; in the Ny Carlsberg Glyptotek, Copenhagen

By courtesy of the Ny Carlsberg Glyptotek, Copenhagen

with a delicate physique that prevented him from receiving the customary Greek gymnastic education, led him to train himself as an orator. He also studied legal rhetoric. In his *Parallel Lives* Plutarch, the Greek historian and biographer, relates that Demosthenes built an underground study where he exercised his voice, shaving one half of his head so that he could not go out in public. Plutarch adds that Demosthenes had a speech defect, "an inarticulate and stammering pronunciation" that he overcame by speaking with pebbles in his mouth and by reciting verses when running or out of breath. He also practiced speaking before a large mirror.

Despite this self-improvement program, his first youthful speaking efforts in the public Assembly met with disaster; he was laughed at by his audiences. His lawsuits against Aphobus and two other guardians in 363 were more successful; they produced little money, but he learned much about speaking strategy and methods of argument. Three of his speeches against Aphobus and two against the sculptor Antenor have survived.

Demosthenes as speech writer. At the age of 20 the young Demosthenes found himself without his fortune, without a trade or profession, and with seemingly little prospect for success in any field. But his rhetorical skill had been noticed. In 4th-century democratic Athens every citizen who wished to prosecute a lawsuit or to defend himself against accusation had to do the speaking himself. Not every citizen, of course, possessed sufficient skill to write his own speeches—a fact that gave rise to the practice of employing a speech writer (logographer) to prepare a speech for such occasions. Demosthenes' skill in his speeches against Aphobus was recognized by wealthier men in need of a logographer; he soon acquired wealthy and powerful clients willing to pay well for his services. Thus began a lifelong career that he continued even during his most intense involvement in the political struggle against Philip of Macedon, much as a modern lawyer might retain a private practice while engaged in public affairs.

Demosthenes was already 30 when, in 354, he made his first major speech before the Assembly. The speech, "On the Navy Boards," was a marked success. The Assembly or Ecclesia (Ekklēsia), a legislative body composed of all adult male Athenian citizens, had convened to consider a rumoured threat against Athens by the King of Persia. Demosthenes' tightly reasoned oration helped persuade the Athenians to build up their naval strength quietly to show the Persians that, though Athens would not launch an attack, it was ready to fight. He pointed out that, while Athens would have no allies if it attacked first, every other Greek city-state would join Athens if the Persians were the first to attack. Here, for the first time, Demosthenes sounded a theme that was to run through his whole public career—the policy that Athens could best keep its democratic freedom by remaining independent of all other cities while, on the other hand, being ready to make temporary alliances whenever danger threatened. In the same speech, revealing his penchant for careful fiscal planning, he proposed an elaborate revision of the method used to tax the wealthy to raise money for ships.

Leader of the democratic faction. From this point on (354), Demosthenes' career is virtually the history of Athenian foreign policy. It was not very long before his oratorical skill made him, in effect, the leader of what today might be called the democratic party. Some interests, especially the wealthy, would have preferred an oligarchy instead of a democracy; many merchants would have preferred peace at almost any price. While they agreed that the Macedonians were barbarians, most Athenian citizens distrusted other Greek city-states such as Thebes and Sparta. The Athenian Assembly was a loosely organized, often tumultuous body of up to 6,000 male citizens; it was capable of shouting down a speaker it did not like or of routing him with laughter. Any citizen could speak, but the criteria were so high that only the best orators survived for long. In this turbulent arena Demosthenes stood out. Contemporaries refer to him as "a water drinker"; that is, a severe and perhaps forbidding personality. Although name-calling was common practice in the Assembly, Demosthenes' wit was exceptionally caustic; when defending himself in his speech "On the Crown" against the attacks of his lifelong rival, Aeschines, he did not scruple to call him "sly beast," "idle babbler," "court hack," and "polluted." Demosthenes was not merely better at abuse than most; he also realized the advantage of making an audience lose respect for his opponent.

He was an assiduous student of Greek history, using detailed historical parallels in almost all his public speeches, and reportedly copied out Thucydides' *History of the Peloponnesian War* eight times in order to improve his command of language and to absorb its history. He constantly asked the Athenians to recall their own history, to remember their past belief in democracy, and to remind themselves how much they hated tyrants. His love of democracy gives his speeches a humanistic breadth that makes them interesting even today. Demosthenes was also extremely industrious. Plutarch says that it was his habit to sit down at night and go over the conversations and speeches he had heard during the day, experimenting with various replies or speeches that could have been made. He excelled whenever he could prepare his speeches carefully in advance, but the nature of Athenian political life must often have forced him to reply to an opponent on the spur of the moment. Unfortunately, because all of the surviving speeches are carefully edited texts, it cannot be established how often Demosthenes spoke extemporaneously.

His famous speech in 354 "On the Navy Boards" was addressed to the threat from the East. Meanwhile, in Macedonia, to the north, the young king Philip, almost the same age as Demosthenes, was gradually annexing Greek cities south of his borders. In 356 Philip had captured an Athenian possession in Thrace, after hoodwinking the Athenians with promises to protect the city, and in 354 he took another Athenian possession. By 353 both Sparta and Arcadia were asking Athens for military assistance against Philip. When he continued

to move south, employing bribery and threat as well as military force, the Athenians sent a small force to close off the pass at Thermopylae. Although Philip turned aside to the coast of Thrace, avoiding a direct confrontation with Athens, his intentions were clear. Yet many Athenians continued to believe that Philip's threat was transitory.

The Philippics. Early in 351 Demosthenes delivered a speech against Philip, the so-called "First Philippic," that established him as the leader of the opposition to Macedonian imperial ambitions. For the next 29 years Demosthenes never wavered; as Plutarch says, "The object which he chose for himself in the commonwealth was noble and just, the defense of the Grecians against Philip." In the "First Philippic" he reminded the Athenians that they had once defeated the Spartans, who were as strong as Philip, and sarcastically pointed out that Philip would never have conquered their territories if he had been as timid as the Athenians seemed to be. He concluded by challenging his countrymen to take their affairs in their own hands rather than let Philip win by default.

This goading speech nonetheless failed to rouse the Athenians. Philip advanced into Chalcidice, threatening the city of Olynthus, which appealed to Athens. In 349 Demosthenes delivered three stirring speeches (the "Olynthiacs") to elicit aid for Olynthus, but the city fell the following year without significant help from Athens. Finally, Philip and the Athenians agreed in April 346 to the Peace of Philocrates; Demosthenes, partly to gain time to prepare for the long struggle he saw ahead, agreed to the peace and went as one of the ambassadors to negotiate the treaty with Philip. During the negotiations, Philip, recognizing Demosthenes' eloquence as a threat to his plans, ignored him and addressed his fellow ambassador Aeschines instead. The two men returned from the embassy bitter foes, Demosthenes denouncing Aeschines and Aeschines assuring everyone of Philip's good intentions.

In his oration "On the Peace" late in 346 Demosthenes, though condemning the terms of the treaty of Philocrates, argued that it had to be honoured. Meanwhile, Philip continued his tactic of setting the Greek city-states, such as Thebes and Sparta, against each other. Demosthenes was one of several ambassadors sent out on a futile tour of the Peloponnesus to enlist support against Philip. In retaliation Philip protested to Athens about certain statements made by these ambassadors. Demosthenes' "Second Philippic," in 344, retorted that he would never have agreed to the Peace of Philocrates if he had known that Philip would not honour his word; moreover, he asserted, Aeschines and others had lulled the Athenians into a false sense of security. The issue came to a public trial in the autumn of 343, when Demosthenes, in his speech "The False Legation," accused Aeschines of rendering false reports, giving bad counsel, disobeying instructions, and being susceptible to bribery. The court, however, acquitted Aeschines.

The tangled pattern of threat and counterthreat continued into 341, until an Athenian general incurred Philip's wrath for operating too near one of his towns in the Chersonese. Philip demanded his recall, but Demosthenes replied in a speech, "On the Chersonese," that the motive behind the Macedonian's "scheming and contriving" was to weaken the Athenians' will to oppose Philip's conquests. "Philip is at war with us," he declared, "and has broken the peace." Shortly afterward, Demosthenes delivered his "Third Philippic," perhaps the most successful single speech in his long campaign against Philip. As a result, Demosthenes became controller of the navy and could thus carry out the naval reforms he had proposed in 354. In addition, a grand alliance was formed against Philip, including Byzantium and former enemies of Athens, such as Thebes. Indecisive warfare followed, with Athens strong at sea but Philip nearly irresistible on land. The Macedonian army was well organized under a single brilliant commander who used cavalry in coordination with highly disciplined infantry, while the Greek alliance depended upon what was essentially a group of citizens' militia.

Disaster came in 338, when Philip defeated the allies in a climactic battle at Chaeronea in north central Greece. According to Plutarch, Demosthenes was in the battle but fled after dropping his arms. Whether or not he disgraced himself in this way, it was Demosthenes whom the people chose to deliver the funeral oration over the bodies of those slain in the battle. After the peace concluded by the Athenian orator and diplomat Demades, Philip acted with restraint; and, though the pro-Macedonian faction was naturally greatly strengthened by his victory, he refrained from occupying Athens. Demosthenes came under several forms of subtle legislative attack by Aeschines and others.

In 336 Greece was stunned by the news that Philip had been assassinated. When his son Alexander succeeded him, many Greeks believed that freedom was about to be restored. But within a year Alexander proved that he was an even more implacable foe than his father—for, when the city of Thebes rebelled against him in 335, he destroyed it. A string of victories emboldened Alexander to demand that Athens surrender Demosthenes and seven other orators who had opposed his father and himself; only a special embassy to Alexander succeeded in having that order rescinded. Shortly thereafter, Alexander began his invasion of Asia that took him as far as India and left Athens free of direct military threat from him.

In 330, nevertheless, judging that the pro-Alexandrian faction was still strong in Athens, Aeschines pressed his charges of impropriety against Ctesiphon—first made six years earlier—for proposing that Demosthenes be awarded a gold crown for his services to the state. The real target was, of course, Demosthenes, for Aeschines accused Ctesiphon of making a false statement when he praised the orator's patriotism and public service. The resulting oratorical confrontation between Aeschines and Demosthenes aroused interest throughout Greece, because not only Demosthenes but also Athenian policy of the past 20 years was on trial. A jury of 500 citizens was the minimum required in such cases, but a large crowd of other Athenians and even foreigners flocked to the debate.

Delivery of "On the Crown." The oration "On the Crown," Demosthenes' reply to Aeschines' charges of vacillating in his policy, accepting bribes, and displaying cowardice in battle, is universally acknowledged as a masterpiece of rhetorical art. It covers the entire two decades of Greek involvement with Philip and Alexander, contrasting Demosthenes' policies in every case with what he terms the treachery of Aeschines as an agent of the Macedonians. As always, his command of historical detail is impressive. Over and over again he asks his audience what needed to be done in a crisis and who did it. Addressing Aeschines directly, he says, "Your policies supported our enemy, mine, our country's." His scathing epithets picture Aeschines as a contemptible turncoat, a hireling of Philip. The jury's verdict was resoundingly clear—Aeschines failed to receive even one-fifth of the votes and was thus obliged to go into exile. Demosthenes and his policies had received a massive vote of popular approval.

Imprisonment and exile. Six years later, however, he was convicted of a grave crime and forced to flee from prison and himself go into exile. He was accused of taking 20 talents deposited in Athens by Harpalus, a refugee from Alexander. Demosthenes was found guilty, fined 50 talents, and imprisoned. The circumstances of the case are still unclear. Demosthenes may well have intended to use the money for civic purposes, and it is perhaps significant that the court fined him only two and one-half times the amount involved instead of the 10 times usually levied in such cases. His escape from prison made it impossible for him to return to Athens to raise money for the fine. The onetime leader of the Athenians was now a refugee from his own people.

Another dramatic reversal occurred the very next year, however, when Alexander died. The power of the Macedonians seemed finally broken; a new alliance was concluded against them. The Athenians recalled Demosthenes from exile and provided money to pay his fine. But at the approach of Antipater, Alexander's successor, Demosthenes and other orators again fled the city. His former friend Demades then persuaded the Athenians to sentence Demosthenes to death. While fleeing Antipater's soldiers, he killed himself by taking poison. Following his long service to the state, which nonetheless ended in abandonment by the fickle Athenian citizenry, Demosthenes' death can be viewed as a symbol of the decline of Athenian democracy.

Influence and reputation. After his death, according to Plutarch, the Athenians erected a brass statue to his memory. In the following century the scholars at the library in Alexandria carefully edited the manuscripts of his famous speeches. The Roman orator and politician Cicero was so impressed with his speech "On the Crown" that he translated it into Latin and wrote a prologue for it. When Cicero delivered a series of speeches in 44 BC opposing Antony, in circumstances not unlike those in which Demosthenes opposed Philip, Cicero's speeches were called Philippics too. Roman schoolboys studied Demosthenes' speeches as part of their own oratorical training. During the Middle Ages and Renaissance his name was a synonym for eloquence; Queen Elizabeth I was so impressed with Demosthenes that she studied the Greek texts of his speeches with the scholar Roger Ascham. Some 19th-century scholars regarded the Macedonian conquest of the bickering city-states of Greece as a natural political evolution and thus condemned Demosthenes as an opponent of progress. A curious revival of interest in Demosthenes occurred in Europe during World War I: French writers such as the statesman Georges Clemenceau admired him for his resistance to the Macedonian invaders of Greece; some German writers, on the other hand, praised him for his skill in mobilizing political power. Modern scholars such as Werner Jaeger present a more dispassionate view by pointing to the highly complex political issues Demosthenes handled with his oratorical skill. Whatever the interpretations of his personality and work, he has in every age been regarded as one of the world's greatest orator-statesmen. (J.J.M.)

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Demotic Greek language, also called ROMAIC, Greek DEMOTIKI, or ROMAIKI, the mod-

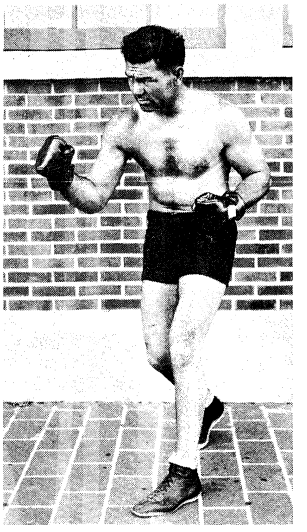
ern vernacular of Greece. In modern times it has been the standard spoken language and, by the 20th century, had become almost the sole language of Greek creative literature. In January 1976, by government order, it became the official language of the state, replacing Katharevusa Greek (*q.v.*) as the language for governmental and legal documents, in the courts and Parliament, in the schools, and in newspapers and other publications. (Katharevusa continued to be used in some legal documents and other technical writings in which there was a large body of established literature.)

Although the vocabulary, phonology, and grammar of ancient Greek remain the basis of Demotic Greek, they have been considerably modified and simplified. Foreign words and constructions that have penetrated the language in large numbers reflect the influence of various foreign powers that held sway in postclassical Greece or that exerted influence there, from the foundation of the eastern Roman Empire (AD 325) through the Crusades to the Venetian and Turkish conquests. The Turkish domination, in particular, destroyed Greek literary continuity and development; and, after Greece regained its independence in the early 19th century, many nationalists despised the language of the people as degenerate; they tried to develop an artificial language, Katharevusa, as an approximation of the old classical norms. It was a deliberate archaization. When a military dictatorship arose in 1967, the new conservatism extended to language, and Katharevusa was strictly imposed in the schools. But after the restoration of political democracy in 1974, linguistic democracy followed suit, and Demotic—literally, the "popular" language—was given official sanction.

demotic script, Egyptian hieroglyphic writing of cursive form, in use in handwritten texts from the early 7th century BC until the 5th century AD. Demotic script derived from the earlier pictographic hieroglyphic inscriptions and the cursive hieratic script (*q.v.*), and it began to replace hieratic writing during the reign of Psamtik I (664–610 BC). By the 5th century BC, demotic script had come into use everywhere in Egypt for business and literary purposes, although hieratic remained in use for religious texts. The demotic script began to be displaced by Greek during the Ptolemaic period (304–30 BC), but hieratic graffiti left by the priests of Isis at Philae date as late as AD 452.

Dempsey, Jack, byname of WILLIAM HARRISON DEMPSEY, also called MANASSA MAULER (b. June 24, 1895, Manassa, Colo., U.S.—d. May 31, 1983, New York City), American world heavyweight boxing champion, regarded by many as the apotheosis of the professional fighter. He held the title from July 4, 1919, when he knocked out Jess Willard in three rounds in Toledo, Ohio, until Sept. 23, 1926, when he lost a 10-round decision to Gene Tunney in Philadelphia. By far the most popular boxer of his time, Dempsey attracted the first five "million-dollar gates" (attendance receipts) in boxing history.

Dempsey started boxing in 1914 under the name of Kid Blackie. In 1918 and early 1919 he compiled an impressive number of knockouts, most of them in the first round, to earn a fight with Willard. The 37-year-old champion proved to be no match for young Dempsey, who attacked ferociously from the starting bell and knocked Willard to the floor seven times in the first round. Even more primitive in its intensity was Dempsey's title defense against Argentine heavyweight Luis Angel Firpo in New York City on Sept. 14, 1923. After being knocked out of the ring in the first round,



Dempsey
UPI—EB Inc.

Dempsey battered Firpo into defeat in the second.

During the next three years Dempsey fought only exhibition matches, and, at the age of 31, he found that he had aged too much to deal with the carefully trained Tunney in their first fight. On Sept. 22, 1927, in Chicago, they met again in the famous "Battle of the Long Count," in which Dempsey forfeited his chance for a seventh-round knockout by standing over the fallen Tunney rather than going to a neutral corner of the ring. Tunney recovered to win another 10-round decision.

In the 1930s Dempsey appeared in many exhibitions but was never again a serious contender for the championship. In 1940 he had three knockout victories over unknown opponents before retiring to referee boxing and wrestling matches. In World War II he served as a lieutenant commander in the Coast Guard. From 1914 to 1940 he had 84 bouts, winning 62, 51 by knockouts. He eventually became a successful restaurateur in New York City. His autobiography was published in 1977.

Dempster, Arthur Jeffrey (b. Aug. 14, 1886, Toronto—d. March 11, 1950, Stuart, Fla., U.S.), American physicist who built the first mass spectrometer, a device used to separate and measure the quantities of different charged particles, such as atomic nuclei or molecular fragments. It is useful in analyzing chemical composition and in determining the relative abundance of the different isotopes (type of nuclei) of an element.

Dempster
The University of Chicago Archives

Dempster discovered numerous nuclides, including uranium-235, which is used in atomic bombs. He built his first mass spectrometer in 1918 and in 1936, with Kenneth T. Bainbridge of the U.S. and J.H.E. Mattauch of Austria, developed a double-focusing type of mass spectrograph, a device used to measure the mass of atomic nuclei. Thereafter he devoted his time almost exclusively to the development of mass spectrometry techniques.

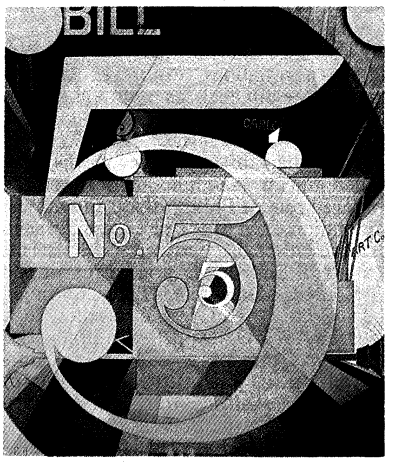
Demre (Turkey): *see* Myra.

demurrer, in law, process whereby a party admits as true certain facts alleged by the opposition but asserts that they are not sufficient grounds for relief. A ruling on a demurrer can result in the quick disposition of a case resting on the point of law challenged in the demurrer.

In criminal law a demurrer is usually based upon some defect in the indictment or the claim that the facts presented do not constitute a felony or serious crime. In civil cases demurrers are also often based upon some error or omission. A general demurrer attacks the general substance of an indictment or plea; a special demurrer attacks its structure or form or one specific part of it.

Demuth, Charles (b. Nov. 8, 1883, Lancaster, Pa., U.S.—d. Oct. 23, 1935, Lancaster), painter who was a major influence in channeling modern European movements into American art and who was also a leading exponent of Precisionism (*q.v.*).

His early training was under Thomas Anshutz and W.M. Chase at the Pennsylvania Academy of the Fine Arts. Between 1907 and 1913 Demuth made several trips to Europe to study, and while in Paris he was attracted by the work of Marcel Duchamp and the Cubists, influences that lasted throughout his career. After returning to the United States, he illustrated works of several of his favourite



"I Saw the Figure 5 in Gold," oil on composition board by Charles Demuth, 1928; in the Metropolitan Museum of Art, New York City
By courtesy of the Metropolitan Museum of Art, New York City, The Alfred Stieglitz Collection, 1949

authors, among them Henry James, Émile Zola, and Edgar Allan Poe. These illustrations, however, were not intended for publication. Moving gradually away from illustrative art, he next executed a series of watercolours of flowers, circuses, and café scenes that placed him in the first rank of watercolourists of his period. Late in his career, Demuth began to paint advertisements and billboards into such cityscapes as his "Buildings, Lancaster" (1930; Whitney Museum of American Art, New York City), in which bold, commercial lettering is complemented by the severely hard-edged abstraction of buildings. Among Demuth's best-known works are his poster portraits such as the tribute to the poet William Carlos Williams, "I Saw the Figure 5 in Gold."

Den Bosch (The Netherlands): *see* 's Hertogenbosch.

Denali National Park and Preserve, park and preserve in central Alaska, U.S., established in 1980 from the former Mount McKinley National Park (1917) and Denali National

Monument (1978). Denali ("The Great One") is the ancient Athapascan Indian name for Mount McKinley, the highest mountain in North America at 20,320 feet (6,194 m). Highlights of the park include the large glaciers of the Alaska Range and abundant wildlife. The total area is 7,930,000 acres (3,210,000 hectares).

denaturation, in biology, process modifying the molecular structure of a protein. Denaturation involves the breaking of many of the weak linkages, or bonds (*e.g.,* hydrogen bonds), within a protein molecule that are responsible for the highly ordered structure of the protein in its natural (native) state. Denatured proteins have a looser, more random structure; most are insoluble. Denaturation can be brought about in various ways—*e.g.,* by heating, by treatment with alkali, acid, urea, or detergents, and by vigorous shaking.

The original structure of some proteins can be regenerated upon removal of the denaturing agent and restoration of conditions favouring the native state. Proteins subject to this process, called renaturation, include serum albumin from blood, hemoglobin (the oxygen-carrying pigment of red blood cells), and the enzyme ribonuclease. The denaturation of many proteins, such as egg white, is irreversible. A common consequence of denaturation is loss of biological activity (*e.g.,* loss of the catalytic ability of an enzyme).

Denbigh, Welsh DINBYCH, market town, Glyndŵr district, Clwyd county, Wales. After the conquest of Wales under Edward I, Henry de Lacy, 3rd Earl of Lincoln, founded a borough there in 1283 and built a castle, which withstood attack in 1402 by the rebel Owen Glendower, though the town itself was razed. In the 17th century the castle was besieged and later dismantled in connection with the English Civil Wars (1642–51). In the 15th and 16th centuries Denbigh was one of the most important towns in Wales. Denbigh is now mainly a market town with some modern industry. Pop. (1981) 7,783.

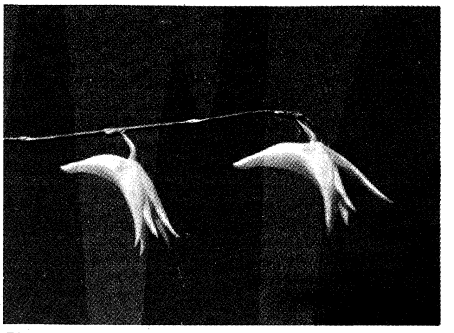
Denbighshire, Welsh SIR DINBYCH, historic county and region of northern Wales, bounded on the north by the Irish Sea. The River Conwy (Conway) forms most of the western boundary of the region. The northeastern reaches are roughly defined by the Clwydian Range. Broadly speaking, the region is coextensive with the ancient boundaries of Gwynedd-is-Conwy and Powys Fadog.

The high ground of Denbighshire is dotted with tumuli. Finds of gold and socketed axes dating from the later Bronze Age indicate that the upper Dee valley and the Vale of Clwyd had become important lines of movement by that time. Native hill fortresses such as Dinorben, and Roman statues of later times, show the importance of the north Wales coastal route. Inscribed stones at Gwytherin and Pentrefoelas date from Roman times. Eliseg's Pillar, near Llangollen, tells of the struggle at Chester between the Britons and Aethelfrith's invading Northumbrians (*c.* 614). In the southeast is a section of Offa's Dyke. Among the ancient monuments of Denbighshire are the burial chamber at Capel Garmon and the beautiful, ruined Cistercian Valle Crucis Abbey (founded *c.* 1200), near Llangollen.

The county was formed by an act of Henry VIII out of the lordships of Denbigh, Ruthin, Rhos, and Rhyfoniog, which were roughly the midland between the rivers Conwy and Clwyd, and the lordships of Bromfield, Yale, and Chirkland.

Dendera (Egypt): *see* Dandarah.

Dendrobium, genus of as many as 1,500 species of orchids that grow on other plants and are native to tropical and subtropical Asia, many Pacific islands, and Australia. Some species have small, pale flowers; others



Pigeon orchid (*Dendrobium crumenatum*)
Ivan Polunin—EB Inc.

have large, showy ones. The flowers may be borne singly, in groups, or on arching spikes. The lateral sepals of all *Dendrobium* flowers are joined at the base, forming a small sac. The pseudobulbs (swollen stems) are bulblike or reedlike and range in height from 5 cm to about 4.5 m (2 inches to 15 feet).

The pigeon orchid (*Dendrobium crumenatum*), a white-flowered species; the bull orchid (*D. taurinum*), a Philippine species with twisted, hornlike petals; and the cucumber orchid (*D. cucumerinum*), an Australian species with cucumber-like leaves, are popular members of the genus.

dendrochronology, or TREE-RING DATING, the scientific discipline concerned with dating and interpreting past events, particularly paleoclimates and climatic trends, based on the analysis of tree rings. Samples are obtained by means of an increment borer, a simple metal tube of small diameter that can be driven into a tree to get a core extending from bark to centre. This core is split in the laboratory, and the rings are counted and measured.

Dendrocolaptidae, songbird family, order Passeriformes, consisting of a number of brownish birds of the forest or brushland and found from Mexico through South America. Representative members are the scythebill and the woodcreeper (*qq.v.*).

dendrogram: *see* phylogenetic tree.

Deneb (Arabic: "Tail" [of the Swan, Cygnus]), also called ALPHA CYGNI, one of the brightest stars, with an apparent magnitude of 1.26. This star is, at about 1,400 light-years' distance, one of the most remote (thus one of the brightest intrinsically) of the 20 apparently brightest stars. It lies in the northern constellation Cygnus.

Deng Xiaoping, Wade–Giles romanization TENG HSIAO-P'ING (b. Aug. 22, 1904, Szechwan Province, China), Chinese communist leader who was the most powerful figure in the People's Republic of China during the late 1970s and 1980s. He abandoned many orthodox communist doctrines and attempted to incorporate elements of the free-enterprise system into the Chinese economy.

After study in France (1921–24), where he became active in the communist movement, and in the Soviet Union (1925–26), Deng returned to China and became a leading political and military organizer in the Kiangsi Soviet, an autonomous communist enclave in southwestern China that had been established by Mao Zedong. Deng participated in the Long March (1934–35) of the Chinese communists to a new base in northwestern China and was a political officer in the communists' Eighth Route Army throughout its resistance to the Japanese occupation of China during World War II. In 1952, after the communist takeover of China, he became a vice-premier. In 1954 he became secretary-general of the Chinese Communist Party (CCP) and in 1955 a member of the ruling Politburo.

From the mid-1950s Deng was a major policymaker in both foreign and domestic affairs. He became closely allied with such pragmatist leaders as Liu Shaoqi, who stressed the use of material incentives and the formation of skilled technical and managerial elites in China's quest for economic development. Deng thus came into increasing conflict with Mao Zedong, who stressed egalitarian policies and revolutionary enthusiasm as the key to economic growth, in opposition to Deng's emphasis on individual self-interest.

Deng was attacked during the Cultural Revolution of the late 1960s by radical supporters of Mao, and he was stripped of his high party and government posts sometime in the years 1967–69, after which he disappeared from public view. In 1973, however, Deng was reinstated under the sponsorship of Premier Zhou Enlai and made deputy premier, and in 1975 he became vice-chairman of the party's Central Committee, a member of its Politburo, and chief of the general staff. As effective head of the government during the months preceding the death of Zhou Enlai, he was widely considered the likely successor to Zhou. However, upon Zhou's death in January 1976, the (Maoist) Gang of Four managed to purge Deng from the leadership once again. It was not until Mao's death in September 1976 and the consequent fall from power of the Gang of Four that Deng was rehabilitated, this time with the assent of Mao's chosen successor to the leadership of China, Hua Guofeng.

By July 1977 Deng had returned to his high posts. He struggled with Hua for control of the party and government. Deng's superior political skills and broad base of support soon led Hua to surrender the premiership and the chairmanship to protégés of Deng in 1980–81. Zhao Ziyang became premier of the government, and Hu Yaobang became general secretary of the CCP; both men looked to Deng for guidance. From this point on, Deng proceeded to carry out his own policies for the economic development of China. Operating through consensus, compromise, and persuasion, Deng engineered important reforms in virtually all aspects of China's political and economic life. He instituted decentralized economic management and rational and flexible long-term planning to achieve efficient and controlled economic growth. China's peasant farmers were given individual control over and responsibility for their production and profits, a policy that resulted in greatly increased agricultural production within a few years of its initiation in 1981. Deng stressed individual responsibility in the making of economic decisions, material incentives as the reward for industry and initiative, and the formation of cadres of skilled, well-educated technicians and managers to spearhead China's development. He freed many industrial enterprises from the control and supervision of the central government and gave factory managers the authority to determine production levels and to pursue profits for their enterprises. In foreign affairs, Deng strengthened China's trade and cultural ties with the West and opened up Chinese enterprises to foreign investment.

Deng eschewed the most conspicuous leadership posts in the party and government. But he was a member of the powerful Standing Committee of the Politburo, and he retained control of the armed forces by virtue of his being chairman of the CCP's Central Military Commission. He was also a vice-chairman of the CCP. Owing both to his posts and to the weight and authority of his voice within the party, he remained China's chief policymaker throughout the 1980s.

In 1987 Deng stepped down from the CCP's Central Committee, thereby relinquishing his seat on the Politburo and its dominant Standing Committee. By so doing he compelled similar retirements by many aged party lead-

ers who had remained opposed or resistant to his reforms. Hu Yaobang was forced to resign his position as general secretary in 1987. Deng resigned his chairmanship of the Military Commission on Nov. 9, 1989, but, though lacking any formal post in the communist leadership, he retained ultimate authority in the party.

He faced a critical test of his leadership in April-June 1989, when student demonstrators in Tiananmen Square in Peking began to demand a more democratic government and to spread the message from Peking to other cities. Deng's support of a military suppression and the continuing trials and, sometimes, executions of student leaders and sympathizers forced many Western analysts to reexamine their notions about the future of China.

dengue, also called BREAKBONE FEVER, or DANDY FEVER, acute, infectious, mosquito-borne hemorrhagic fever that temporarily is completely incapacitating but is rarely fatal. Besides fever, the disease, caused by a virus, is characterized by an extreme pain in and stiffness of the joints (hence the name "breakbone fever"). It may occur in any country where the carrier mosquitoes breed.

The carrier incriminated throughout most endemic areas is the yellow-fever mosquito, *Aedes aegypti.* The Asian tiger mosquito, *A. albopictus,* is another prominent carrier of the disease. A mosquito becomes infected only if it bites an infected individual (humans and perhaps also certain species of monkey) during the first three days of the victim's illness. It then requires 8 to 11 days to incubate the virus before the disease can be transmitted to another individual. Thereafter, the mosquito remains infected for life. The virus is injected into the skin of the victim in minute droplets of saliva. The spread of dengue is especially unpredictable because there are four serotypes of dengue virus. Infection with one type—though it confers lifetime immunity from reinfection with that type of dengue—does not prevent an individual from being infected by the other three types.

Diagnosis is made on clinical findings; namely, sudden onset, moderately high fever, excruciating joint pains, intense pain behind the eyes, a second rise in temperature after brief remission, and particularly the type of rash and decided reduction in neutrophilic white blood cells. There is no specific therapy; therefore attention is focused on relieving the symptoms. Temporary preventive measures must be taken to segregate suspected as well as diagnosed cases during their first three days of illness and, by screens and repellents, to keep mosquitoes from biting more people.

The potentially fatal fever is prevalent in parts of Asia, and in the late 20th century it spread to areas of South and Central America and to Cuba, Puerto Rico, and other nearby islands. Fundamental in the control of the disease is the destruction of mosquitoes and their breeding places.

Dengyō Daishi: *see* Saichō.

Denham, Dixon (b. Jan. 1, 1786, London, Eng.—d. May 8, 1828, Freetown, Sierra Leone), English soldier who became one of the early explorers of western Africa.

After serving in the Napoleonic Wars, Denham volunteered in 1821 to join Dr. Walter Oudney and Lieutenant Hugh Clapperton on an official expedition across the Sahara to Bornu, in the Lake Chad basin. After enduring danger and privation, they arrived at Kuka, the capital of Bornu, on Feb. 17, 1823. In December 1823, while Clapperton and Oudney set out on a journey westward, Denham explored the shores of Lake Chad and the lower courses of the Waubé, Chari, and Logone

Dixon Denham, detail from an oil painting by T. Phillips, 1826; in the National Portrait Gallery, London

By courtesy of the National Potrait Gallery, London

rivers. Returning to England in 1825, Denham became a celebrity. He was promoted to lieutenant colonel and appointed superintendent of liberated slaves in West Africa in 1827. The next year he was made governor of Sierra Leone, where he died of fever.

Denham, Sir James Steuart, 4TH BARONET, original name (until 1773) JAMES STEUART (b. Oct. 21, 1712, Edinburgh, Scot.—d. Nov. 26, 1780, Edinburgh), Scottish economist whose exposition of mercantilist views showed a sophistication ahead of his time.

Denham was the son of Sir James Steuart, a former lord advocate of Scotland. He was educated at the University of Edinburgh (1724–25). In the course of continental travels following his qualification as a lawyer (1735), he became embroiled in the Jacobite cause. Denham's involvement in the 1745 rebellion of the Stuart pretender to the throne forced him to remain in exile until 1763, when he finally returned to Edinburgh. He then retired to Coltness. In 1773 his father obtained the estates of his uncle, Sir Archibald Denham, on the condition that he and his father adopt Denham as a surname. In 1780 he succeeded his father in two baronetcies.

His chief work, *Inquiry into the Principles of Political Economy* (1767), is probably the first systematic treatise on economics in English. As an exponent of mercantilist economics, Denham accorded government a key role in the economic development of society, particularly in the management of population and employment. Government intervention was also desirable, in his view, to bring about market equilibrium. Consistent with his mercantilist views, Denham believed that an industrializing country would experience loss of international markets because of rising wages; thus, he believed that reliance upon internal markets was important. His theory of the role of money in economic growth remains of interest to contemporary economists.

Denham, Sir John (b. 1615, Dublin, Ire.—d. March 10, 1669, London, Eng.), poet who

Sir John Denham, engraving

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

established as a new English genre the leisurely meditative poem describing a particular landscape.

Educated at the University of Oxford, Denham was admitted to the bar, but he was already actively writing. He had translated six books of the *Aeneid,* parts of which were later printed; but he made his reputation with *The Sophy,* a blank-verse historical tragedy acted in 1641, and with *Cooper's Hill,* a poem published in 1642. During the English Civil Wars, he was engaged at home and abroad in the cause of Charles II. Made a knight of the Bath and elected to the Royal Society after the Restoration in 1660, he also served as a member of Parliament. He was buried in Westminster Abbey.

Denham's poetry is essentially didactic. His strength is considered to lie in his thought, particularly his neatly turned expressions of ethical and moral truisms. Restoration and 18th-century critics praised him, together with Edmund Waller, for the development of the closed heroic couplet (a couplet rhyming *aa* and containing a complete idea, not dependent upon the preceding or following couplet). Denham greatly increased the popularity of that style with *Cooper's Hill,* a new type of descriptive landscape verse that was imitated by English poets for the next 100 years.

denial of Not-Being (philosophy): *see* Not-Being, denial of.

Denikin, Anton Ivanovich (b. Dec. 16 [Dec. 4, Old Style], 1872, near Warsaw, Pol., Russian Empire—d. Aug. 8, 1947, Ann Arbor, Mich., U.S.), general who led the anti-Bolshevik ("White") forces on the southern front during the Russian Civil War (1918–20).

A professional in the Imperial Russian Army, Denikin served in the Russo-Japanese War (1904–05) and in World War I (1914–16). After the February Revolution of 1917, which overthrew the Romanov dynasty, he became chief of staff to the provisional government's commander in chief, Mikhail V. Alekseyev, but was quickly disillusioned by that government's inability to maintain discipline in the army. He was dismissed from his post in July for political reasons.

Placed in command of the western front, Denikin came into close contact with General Lavr G. Kornilov, then the Russian supreme military commander, and in August 1917 the two were arrested for conspiring to overthrow the provisional government and establish a military dictatorship. A month after the Bolsheviks' October (Old Style) coup d'état, however, they escaped from prison and fled southward to the Don region, where Kornilov assumed command of the White Army recently formed by Alekseyev. Kornilov was killed in April 1918, and Denikin became commander of the White forces in southern Russia. By the beginning of 1919 he controlled the northern Caucasus; in May he launched a major offensive, advancing through the Ukraine toward Moscow. In October, however, the Red Army defeated him at Oryol (250 miles [402 km] from Moscow) and forced him to retreat with his disintegrating army to Novorossiysk; the remainder of his army was then evacuated to the Crimea (March 1920). In April Denikin turned over his command to General Pyotr N. Wrangel and settled in France, where he wrote his memoirs, *Ocherki russkoy smuty,* 5 vol. (1923–27; "History of the Civil Strife in Russia"). He immigrated to the United States in 1945.

Deniliquin, chief town of the fertile southern Riverina region, south-central New South Wales, Australia, on the Edwards River (a branch of the Murray), 30 miles (50 km) from the Victoria border. Established in 1845 by Benjamin Boyd as a personal holding, it was made a town in 1848 under the name Sandhills. Two years later it was officially gazetted

as Deniliquin, a corruption of the Aboriginal term *denilocoon,* meaning "wrestlers' ground." It became a busy crossing point for livestock and was declared a municipality in 1868. It is now the commercial and administrative centre for the Berriquin, Denimein, and Wakool irrigation districts. The region is well known as merino sheep stud country and also supports beef cattle, fat lambs, rice, fruits, tobacco, and grains. The town's products include butter, cheese, cordials, processed seed, brick and plaster, fabricated iron and steel, and timber. Deniliquin lies at the junction of the Riverina and Cobb highways; it is also the terminus of a rail line from Echuca and is connected by air to Sydney (374 miles [602 km] northeast) and Melbourne. Pop. (1986) 7,566.

denim, durable twill-woven fabric used principally for work and leisure clothing. The name is said to have originated in the French *serge de Nîmes.* Denim is yarn-dyed and mill-finished and is usually all-cotton, although considerable quantities are of a cotton-synthetic fibre mixture. Denim is mainly indigo or blue but is also produced in other colours and in stripes and various patterns. Traditionally used for ranch, farm, work, and sea-going attire, denim has become an important children's-wear item and is used for casual wear by both sexes of all ages. *See also* jeans.

Denis, SAINT, Denis also spelled DENYS, Latin DIONYSIUS (b. Rome?—d. 258?, Paris; feast day: Western church, October 9; Eastern church, October 3), first bishop of Paris and patron saint of France.

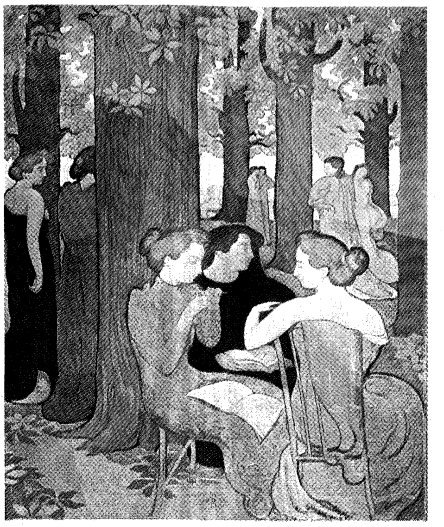
According to St. Gregory of Tours's 6th-century *Historia Francorum,* Denis was one of seven bishops sent to Gaul to convert the people in the reign of the Roman emperor Decius. Little is known of his life except that he became bishop of Paris and was later martyred during the persecution of Christians by the Roman emperor Valerian. In 626 his relics were moved to the Benedictine abbey at St. Denis, near Paris. In the 8th century a passage in Gregory's work was misinterpreted as stating that Denis had been sent to France by Pope St. Clement I of Rome (*c.* 90). According to a spurious tale recorded by the 9th-century Hilduin, abbot of St. Denis, after decapitation Denis's corpse, led by an angel, walked from Montmartre to the abbey church of St. Denis. He has thus been represented in art.

Denis THE LITTLE: *see* Dionysius Exiguus.

Denis, Maurice (b. Nov. 25, 1870, Granville, Fr.—d. Nov. 13, 1943, Paris), French painter, one of the leading artists and theoreticians of the Symbolist movement.

Denis studied at the Académie Julian (1888) under Jules Lefebvre and at the École des Beaux-Arts. Reacting against the naturalistic tendencies of Impressionism, Denis fell under the influence of the work of Paul Gauguin, whose style was also much-admired by Denis's fellow students Paul Sérusier, Édouard Vuillard, Pierre Bonnard, and Ker Xavier Roussel. With these friends, Denis joined in the Symbolist movement and its later offshoot, the group of painters collectively called the Nabis (*q.v.*). The quasi-mystical attitude of the Nabis was perfectly suited to Denis's highly religious nature. In 1890 Denis expressed the underlying principle of much modern painting in the following often-quoted words: "It should be remembered that a picture—before being a warhorse, a nude, or an anecdote of some sort—is essentially a flat surface covered with colours assembled in a certain order."

Later, however, after visiting Italy, Denis became greatly influenced by the works of the great Italian fresco painters of the 14th and 15th centuries and began to place emphasis on subject matter, traditional perspective, and modeling, as in "Homage à Cézanne" (1901; Musée National d'Art Moderne, Paris). Denis's monumental mural decorations are to be seen in many French churches as well as on the ceiling of the Champs Élysées Theatre in Paris. In 1919 he, along with Georges Desvallières, founded the Studios of Sacred Art. His work was one of the chief forces in the revival of religious art in France.

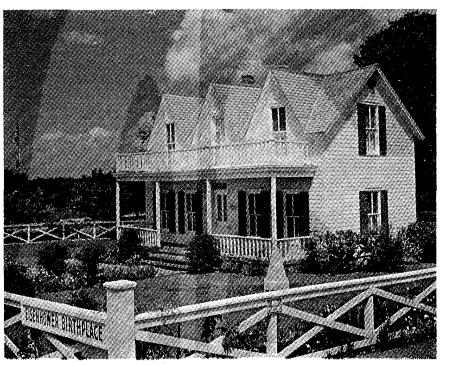


"The Muses," oil painting by Maurice Denis, 1893; in the Musée National d'Art Moderne, Paris

By courtesy of the Musee National d'Art Moderne, Paris; permission S.P.A.D.E.M. 1971, by French Reproduction Rights, Inc.; photograph, Marc Garanger

Denishawn School of Dancing and Related Arts, dance school and company founded in 1915 by Ruth St. Denis and her husband, Ted Shawn. Considered a fountainhead of American modern dance, the Denishawn organization systematically promoted nonballetic dance movement and fostered such leading modern dancers as Martha Graham, Doris Humphrey, and Charles Weidman. Because St. Denis and Shawn believed that all dance techniques were valid and instructive, the school offered classes in Oriental, Spanish, and primitive dance; the fundamentals of ballet; their own innovative techniques; and, later, the modern-dance techniques that had been developed in Europe by Rudolf Laban and Émile Jaques-Dalcroze. Branches of the school were established in New York City and other American cities. The company's repertoire, choreographed by St. Denis and Shawn, ranged from unadorned solos to opulent productions with Japanese, Hindu, Middle Eastern, or American Indian themes. The Denishawn dancers frequently toured the United States and performed in the Orient (1925–26). The organization disbanded in 1931 after St. Denis and Shawn separated.

Denison, city, Grayson county, north-central Texas, U.S. Denison is situated near Sherman and Lake Texoma (impounded on the Red River by Denison Dam) near the Oklahoma border, 73 miles (117 km) north of Dallas. Originally a stop on the Southern Overland Mail Route, it was organized by the Missouri-Kansas-Texas Railroad in 1872 as a division point and named for George Denison, a railroad director. Its economy is basically agricultural, augmented by light industry (chiefly clothing, aluminum, and plastic products), transportation, and tourism based on the Lake Texoma resort area, Hagerman National Wildlife Refuge, and Eisenhower State Park. The birthplace (1890) of President Dwight D. Eisenhower is preserved as a state historic site. Inc. 1891. Pop. (1988 est.) city, 24,958; Sherman-Denison MSA, 97,900.



Birthplace of President Dwight D. Eisenhower, Denison, Texas

By courtesy of the Texas Highway Department

denitrifying bacteria, microorganisms whose action results in the conversion of nitrates in soil to free atmospheric nitrogen, thus depleting soil fertility and reducing agricultural productivity. *Thiobacillus denitrificans, Micrococcus denitrificans,* and some species of *Serratia, Pseudomonas,* and *Achromobacter* are implicated as denitrifiers. *Pseudomonas aeruginosa* can, under anaerobic conditions (as in swampy or water-logged soils), reduce the amount of fixed nitrogen (as fertilizer) by up to 50 percent. Without denitrification, however, the Earth's supply of nitrogen would eventually accumulate in the oceans, since nitrates are highly soluble and are continuously leached from the soil into nearby bodies of water. *See also* nitrogen cycle.

Consult the INDEX *first*

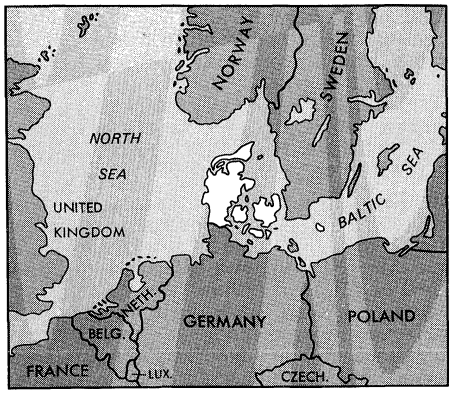
Denizli, city, southwestern Turkey. It lies near the Çürüksu River, which is a tributary of the Menderes River. Set among the gardens at the foot of Mount Gökbel (7,572 feet [2,308 m]), Denizli inherited the economic position of ancient Laodicea ad Lycum, 4 miles (6 km) away, when that town was deserted during wars between the Byzantines and the Seljuq Turks in the 12th century. By the 14th century, as Lâdik (Lādīq), Denizli had emerged as an important Turkish town noted for its woven and embroidered products and its luxuriant gardens. It was ravaged by earthquakes in the 18th and 19th centuries. Denizli is linked by a branch line to the Dinar-İzmir railway.

In the surrounding agricultural area the cultivation of cotton, cereals, figs, and tobacco, along with livestock raising, are the principal activities. North of Denizli is Pamukkale, ancient Hierapolis, a resort around which limestone deposits from the hot springs have formed beautiful cascades and basins. Pop. (1985) city, 169,130.

Denmark, officially KINGDOM OF DENMARK, Danish KONGERIGET DANMARK, Faeroese KONGARÍKIDH DANMARK, Greenlandic DANMARKIP NÂLAGAUVFIA, a small country occupying a peninsula extending northward from the centre of continental western Europe, and covering an area of 16,638 square miles (43,093 square km), excluding Greenland and the Faeroe Islands, which are self-governing dependencies within the Danish realm. The capital is Copenhagen.

Denmark extends for about 210 miles (335 km) from north to south and for about 180 miles (290 km) from east to west, when the eastern island of Bornholm is included. The country is a physical, cultural, and commercial bridge between Scandinavia and central Europe. Denmark's only landward neighbour is Germany, which lies to the south and with which it shares a border of only 42 miles (68 km). Denmark's 4,500-mile (7,300-kilometre)

coastline (including the country's 406 islands) extends along the North Sea on the west, the Skagerrak (strait) on the north, and the Kattegat (strait), The Sound, and the Baltic Sea on the east. The population in 1990 was estimated to be 5,141,000.



Denmark

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

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. The mainland of Denmark occupies the Jutland Peninsula; it is a lowland area, averaging less than 100 feet (30 m) above sea level with its highest point only 568 feet (173 m) at Yding Forest Hill in central Jutland. The landscape derives its character from the northern European glaciations: a scenic moraine runs from Nissum Fjord on the western coast of Jutland eastward toward Viborg, turns southward, and continues the length of the country. The moraine demarcates the western Jutland region of sands and gravels from the fertile loam plains of eastern Jutland. The two largest islands, Zealand (Sjælland, containing Copenhagen) and Funen (Fyn), together constitute more than one-fourth of the country's total land area.

Denmark's largest river, the Gudenå, is 98 miles (158 km) long from its source in east-central Jutland to its mouth on the Randers Fjord on the eastern coast. Lake Arre, with an area of 16 square miles (41 square km), is the largest of the country's many lakes.

The climate of Denmark is generally temperate and moist, with local annual rainfall ranging between 32 and 16 inches (800 and 400 mm). The mean annual variation in temperature is from about 32° F (0° C) in February to 61° F (16° C) in July.

Denmark's share of the North Sea's rich oil and natural-gas fields is smaller than that of the United Kingdom and Norway but is enough to supply about one-half of the country's domestic needs. Denmark has almost no mineral reserves other than its large limestone deposits.

The people. The modern population of Denmark is the result of a racial mixture that occurred in the Neolithic Period (New Stone Age). Nordic characteristics of blond hair and blue eyes predominate. There is an area of German settlement in southern Jutland. Other ethnic minorities include Turks, Yugoslavs, Iranians, and Pakistanis, most of whom arrive as "guest workers."

The Danish language is a subdivision of the Germanic group and is closely related to Norwegian. The established religion, to which nearly all the population belong, is Evangelical Lutheran.

Denmark's population has been declining since 1981, primarily because of its aging population profile (deaths exceeding births). Life expectancy at birth in the late 20th century was relatively high at 72 years for men and 78 years for women. Metropolitan Copenhagen has more than one-fourth of the country's total population and, like Denmark's other major population centres of Århus and Ålborg on Jutland and Odense on Funen, is growing only slightly.

The economy. Despite rather poor natural resources, the Danish population enjoys a standard of living equaled by only a few other countries in the world. Denmark has a mixed economy based on services, manufacturing, and financial services. The gross national product (GNP) is growing more rapidly than the population and is comparable to those of other Western industrialized countries.

Nearly two-thirds of Denmark's land is arable and extensively fertilized. Danish farming is intensive; most farms are medium-sized and family-owned. Barley is the principal crop; wheat, rapeseed, sugar beets, and potatoes are other major crops. Pastures occupy about one-twentieth of the land area, and livestock consists mainly of pigs, with lesser numbers of beef and dairy cattle. Chickens and ducks are also important. Forests, including both natural deciduous and cultivated spruce and fir, occupy more than one-tenth of the land area. The division of Denmark into numerous islands has given it an exceptionally long coastline. The configuration of much of this coast into fjords provides natural harbours that encourage the fishing, shipping, and associated industries. Denmark's fishing (mostly marine) industry generally ranks among the top 15 worldwide in total catch.

Denmark's extractive industry is based on granite and kaolin. Crude petroleum, petroleum products, and coal constitute approximately one-tenth of Denmark's imports.

Denmark's manufacturing is well-developed and diversified, employing nearly one worker in five. The most important products are non-electrical machinery and apparatus, food other than meat, industrial chemicals and other chemical products, metal products, and processed meat. Electricity is almost exclusively produced by coal-fired power plants.

Tourism is important, bringing in many tourists annually, most of whom are attracted to Copenhagen and its neighbouring coastal resorts.

Denmark's post-World War II industrialization program has raised the demand for raw materials and energy fuels, nearly all of which have to be imported. Discovery of oil deposits in the North Sea in 1970, however, brought some relief from the cost of energy imports. Coupled with a wide-ranging social-welfare program developed by the government, trade and budgetary deficits have become a common feature of the nation's economy. More than one-fourth of the labour force is employed in social services. Unions in Denmark are legal and completely free to organize and engage in union activity; they also administer the unemployment-insurance program for the government.

The Danish State Railways own and operate more than four-fifths of Denmark's railways. The country has an extensive road and highway system, and all of the roads are paved. There are about 260 miles (420 km) of inland waterways. Ferries operated by Danish State Railways link the Danish islands and Jutland and also serve Germany, Sweden, the United Kingdom, and Norway. Denmark's many good harbours provide favourable conditions for its 15 major shipping companies. The international airport is at Kastrup, about 6 miles (10 km) southeast of Copenhagen.

Exports are primarily machinery and transport equipment, including industrial machinery, electronic equipment, and ships and boats. The principal imports are consumer goods, machinery and capital equipment, chemicals and related products, machinery parts, and fuels and lubricants. The principal trading partners are Germany, the United Kingdom, and Sweden.

Government and social conditions. Denmark is a constitutional monarchy whose crown retains only ceremonial power; its most significant duty is to appoint the prime minister and the members of the cabinet, who, however, are accountable to the Folketing, Denmark's unicameral legislature. The 179 members of the Folketing (including two from the Faeroe Islands and two from Greenland) are elected by proportional representation. Under the 1953 constitution, the prime minister may dismiss the legislative body at any time and call for new elections. Denmark has a multiparty system, and no party usually wins more than a plurality. The Social Democratic Party (mainly representing workers and public servants) has been the country's dominant political organization; however, in the 1980s a coalition of nonsocialist parties (Conservative People's Party and the Liberal Party) gained power. The judicial system is headed by the Supreme Court.

The country has one of the world's oldest and most extensive social-welfare systems; it covers all citizens and provides benefits for old age, disability, maternity, death, and sickness. Its effectiveness together with a high standard of living have helped create excellent health conditions in Denmark.

Education in Denmark is compulsory for children between the ages of 7 and 16. Most schools are publicly operated and free. There are five universities, including the University of Copenhagen (founded 1479).

The news media in Denmark are free of censorship. Radio and television are operated by Danmarks Radio, an independent public institution supported by license fees on radio- and television-receiver owners.

Denmark has produced its share of internationally renowned writers, dancers, and visual artists. Among its great writers were Norwegian-born Ludvig Holberg, Hans Christian Andersen, and the philosopher-theologian Søren Kierkegaard. The Nobel Prize for Literature was awarded to the Danish novelists Henrik Pontoppidan in 1917 and Johannes V. Jensen in 1944. The Royal Danish Ballet became internationally famous through the 19th-century choreographic contributions of Auguste Bournonville. The Royal Danish Academy of Fine Arts, established in 1754, produced the sculptor Bertel Thorvaldsen and in modern times the architect Arne Jacobsen.

History. Archaeological remains have shown evidence of human activity in Denmark as far back as 100,000 years ago. During the Stone Age (10,000 to 1500 BC), the population of Denmark progressed from an existence as hunters and fishers to a more settled life-style as agriculturists. About 2800 BC a single-grave culture emerged in the south and spread throughout Denmark. By about AD 400 political power was increasingly consolidated and trading connections with the Romans had been established. The first runic inscription in Denmark appeared about AD 200; this writing system may have developed through contact with the Latin alphabet.

The northward extension of Charlemagne's Frankish empire in the late 8th century brought Denmark into close contact with the rest of Europe. The Frankish conquests were halted in the early years of the 9th century, and a treaty signed in 811 made the Eider River the frontier between Denmark and its neighbours to the south. The period of Viking expansion into the region began in the 7th century, and Christianity arrived in Denmark in the 10th century. Under King Canute, an Anglo-Danish empire came into being that included parts of Sweden and lasted until his death in 1035.

The medieval period of Danish history was marked by competition between the Danish

nobility and would-be kings that resulted in the enforcement (in 1282) of the previously conceived annual *hof* (parliament). During the 14th and 15th centuries Danish trade was hampered by the predominance of the German-dominated Hanseatic League. A union with Norway and Sweden came into existence in 1397, largely through royal-family intermarriage, and lasted until 1523, though there were intermittent periods of disunion and warfare between Denmark and Sweden beginning in 1448.

During the 16th century civil war erupted in Denmark, bringing about the establishment of Lutheranism and the strengthening of the nobility. Denmark pursued a series of debilitating wars in the 17th century in an attempt to assert its hegemony over the Baltic. Mostly unsuccessful, the wars resulted in the Peace of Copenhagen (1660), which established the frontiers of Norway, Sweden, and Denmark at their present locations.

Economic hardships followed these costly wars, but some economic advances were made in the 18th century through expanded trade in colonial markets. The Napoleonic wars of the early 1800s again drained the treasury, and in 1814 Denmark had to cede Norway to Sweden. In 1864–66 Denmark lost Schleswig-Holstein to the Prussians.

Denmark went through three constitutions between 1849 and 1915, regained northern Schleswig by plebiscite in 1920, and was occupied by Nazi Germany in 1940–45.

In 1945 Denmark recognized the independence of Iceland and in 1948 granted home rule to the Faeroe Islands, which had been part of Denmark since 1380. Greenland was officially incorporated into Denmark in 1953 and granted home rule in 1979. Denmark was one of the founding members of NATO (1949) and became a member of the European Economic Community (EEC) in 1973.

Denmark, Evangelical Lutheran People's Church of: *see* Evangelical Lutheran People's Church of Denmark.

Denmark Strait, channel partially within the Arctic Circle, lying between Greenland (west) and Iceland (east). About 180 miles (290 km) wide at its narrowest point, the strait extends southward for 300 miles (483 km) from the Greenland Sea to the open waters of the North Atlantic Ocean. The cold East Greenland Current flows southward along the west side of the strait and carries icebergs, which originate in the Arctic Ocean and on the Greenland ice cap; a branch of the warmer Irminger Current flows northward near the Iceland coast.

Denmark's Aquarium, Danish DANMARKS AKVARIUM, largest aquarium in Denmark, located in Charlottenlund, outside of Copenhagen. It is noted for its collection of unusual fishes. Included among the more than 3,000 specimens of nearly 200 species of marine and freshwater fishes are lungfish, blind cave fish, mudskippers, and the primitive paddlefish from the United States. The aquarium also has some impressive marine-invertebrate exhibits, such as those of sea anemones and octopuses.

Denmark's Aquarium was opened in 1939. It was expanded in 1974 to accommodate a set of landscape aquariums. The aquarium conducts research programs in fish physiology and parasitism that are supported by the Royal Danish Academy of Sciences.

Denner, Johann Christoph (b. Aug. 13, 1655, Leipzig [Germany]—d. April 20, 1707, Nürnberg, Bavaria), German maker of musical instruments and inventor of the clarinet.

Denner's father, Heinrich, made horns and animal calls; from him Christoph learned instrument building, at the same time becoming an excellent performer. His energy was mainly devoted to improving already existing woodwind instruments, and his well-tuned recorders, flutes, oboes, and bassoons were highly regarded all over Europe. His invention of the clarinet occurred around 1690–1700, although single-reed instruments already had a long history and wide currency, especially in folk music. One of these, the chalumeau (a term also used for a double-reed instrument), was known to Denner; apparently his attempts to refine the chalumeau led to his invention of the clarinet. Denner's two sons continued the family tradition of instrument building.

Dennie, Joseph (b. Aug. 30, 1768, Boston, Mass. [United States]—d. Jan. 7, 1812, Philadelphia, Pa.), essayist and editor who was perhaps the chief literary figure in the United States in the first decade of the 19th century.

Dennie graduated from Harvard College in 1790 and spent three years as a law clerk before being admitted to the bar in 1794. His practice failed to flourish, however, and in the meantime he had turned to writing. He and Royall Tyler formed a literary partnership under the pseudonyms Colon and Spondee, and together they began contributing satirical prose and poetry to local newspapers. Between 1792 and 1802 Dennie wrote his periodical "Farrago" essays. For the *Farmer's Weekly Museum,* a well-known newspaper of Walpole, N.H., he wrote the series of graceful, moralizing "Lay Preacher" essays that established his literary reputation. He served as editor of the *Farmer's Weekly* from 1796 to 1798.

The strong pro-Federalist bias of Dennie's editorship and of his "Lay Preacher" essays secured him an appointment as personal secretary to Secretary of State Timothy Pickering in 1799. He thus moved to Philadelphia, but his job ended when Pickering was dismissed by President John Adams in 1800. Undaunted, Dennie, with Asbury Dickins, began in 1801 a politico-literary periodical called *The Port Folio,* which became the most distinguished literary weekly of its time in America. He contributed his own "Lay Preacher" essays and commissioned original manuscripts from Thomas Campbell, Leigh Hunt, and Thomas Moore, among other prominent writers and poets. As the founder of the Tuesday Club, Dennie was the centre of the aristocratic literary circle in Philadelphia and was for a time the leading literary arbiter in the country. He derided native American rusticity and crudity and opposed all democratic innovations while praising English literature, manners, and sophistication. He also advocated sound critical standards and encouraged talented younger writers, one of whom was Washington Irving.

Dennis, town ("township"), Barnstable county, southeastern Massachusetts, U.S., extending across Cape Cod. It includes the villages of Dennis Port, East Dennis, South Dennis, and West Dennis. Settled in 1639, it was a part of Yarmouth until 1793, when it was incorporated and named for the Reverend Josiah Dennis, pastor of the first meetinghouse. Clipper ships were once built in Shiverick Shipyard (East Dennis). Tourism and cranberry cultivation are economically important. Many New York stage productions are tried out at the Cape Playhouse, a restored colonial meetinghouse and one of the best-known summer-stock theatres in the eastern United States. Historic sites include the Josiah Dennis Manse (1736) and Jericho House (1801). Pop. (1988 est.) 13,994.

Dennis, Eugene, original name FRANCIS XAVIER WALDRON, JR. (b. Aug. 10, 1905, Seattle, Wash., U.S.—d. Jan. 31, 1961, New York, N.Y.), American Communist Party leader and labour organizer. He was general secretary of the Communist Party of the United States of America (CPUSA) from 1945 to 1957 and national chairman during 1959–61.

Having worked at various trades in Seattle, Dennis joined the Industrial Workers of the World and in 1926 the Communist Party. Later he went to California to organize workers, for which he was arrested numerous times. Jumping bail after a conviction in 1930, he spent several years in the Soviet Union and other countries. Returning to the United States in 1935, he began to rise in the hierarchy of the Communist Party. In 1949 he and 10 other Communist leaders were convicted of conspiring to advocate the violent overthrow of the government, for which Dennis served three years and nine months in prison. During his leadership of the Communist Party, Dennis supported the party's continued alignment with and subservience to the Soviet Union, although he partially repudiated Stalinism after Khrushchev's rise to power in the mid-1950s.

Dennis, John (b. 1657, London, Eng.—d. Jan. 6, 1734, London), English critic and dramatist whose insistence upon the importance of passion in poetry led to a long quarrel with Alexander Pope.

Educated at Harrow School and the University of Cambridge, Dennis traveled on the European continent before settling in London, where he met leading literary figures. At first he wrote odes and plays, but, although a prolific dramatist, he was never very successful.

The most important of Dennis' critical works are *The Usefulness of the Stage* (1698), *The Advancement and Reformation of Modern Poetry* (1701), *The Grounds of Criticism in Poetry* (1704), and *An Essay on the Genius and Writings of Shakespear* (1712). His basic contention was that literature, and especially drama, is comparable to religion in that its effect is to move men's minds by means of the emotions. What Dennis looked for primarily in a work of art was passion and elevation rather than decorum and polish. His idol among English poets was John Milton. This bias may explain Dennis' antipathy toward Pope and probably accounts for the hostility between them. Pope, who thought Dennis' work bombastic, included an adverse allusion to Dennis in his "Essay on Criticism." Dennis replied with *Reflections Critical and Satyrical* (1711), which mixed criticism of the *Reflections* with a vicious personal attack upon Pope as "a hunch-back'd toad" whose deformed body mirrored a deformed mind. Despite a temporary reconciliation, the quarrel continued sporadically until Dennis' death. Dennis also defended the drama against the English bishop Jeremy Collier's condemnation of it in 1698. Dennis argued that plays discouraged disaffection by spreading pleasure and providing exercise for the passions.

Dennis, Nigel (Forbes) (b. Jan. 16, 1912, Bletchingley, Surrey, Eng.—d. July 19, 1989, London), English novelist, playwright, journalist, and critic, best known for his satirical novel *Cards of Identity* (1955). It depicted the ease with which a group of tricksters could compel people to assume false identities because their real ones were so nebulous.

Dennis spent his early childhood in Rhodesia (now Zimbabwe) and was educated, in part, at the Odenwald School in Germany. He went to the United States in 1934, working for the National Board of Review of Motion Pictures in New York City (1935–36) and then as associate editor and book reviewer for *The New Republic.* He was employed as a staff book reviewer at *Time* magazine (1940–58). He was dramatic critic for *Encounter* magazine (1960–63) and returned as joint editor (1967–70). His book reviews also appeared regularly in the *Sunday Telegraph.*

Dennis' first novel, *Boys and Girls Come Out to Play,* appeared in 1949. *A House in Order* (1966) retained some of the same preoccupations with contemporary man's lack of an authentic existence, as did *Cards of Identity. The Making of Moo,* a satirical play on

religion, was performed in 1957 and was published, together with the stage version of *Cards of Identity,* as *Two Plays and a Preface* (1958). His knowledge of journalism sharpened the satire of *August for the People* (1961), a much-praised play about the power of the press.

Dennison, Aaron Lufkin (b. March 6, 1812, Freeport, District of Maine, Massachusetts, U.S.—d. Jan. 9, 1895, Birmingham, Warwickshire, Eng.), watch manufacturer who was among the first to adapt the concept of interchangeable parts to the production of pocket watches. He is generally credited with being the father of American watchmaking.

Apprenticed at the age of 18 to a watchmaker in Brunswick, Maine, he learned the prevailing manual methods of watchmaking. Later he went to Boston, set up his own business, and then studied the mass-production techniques being employed in making firearms at the Springfield arsenal. Surmounting the technical difficulties of machine production of small parts, Dennison in 1850 set up a factory and began to supply the market with the first inexpensive factory-made watches. His shop, forced into bankruptcy in the financial panic of 1857, was reorganized by new backers in 1859, becoming the American Waltham Watch Company. Dennison's introduction of machinery into the manufacture of paper boxes and other paper products resulted in the founding of the Dennison Manufacturing Company.

Denon, Dominique Vivant, Baron (b. Jan. 4, 1747, Chalon-sur-Saône, Fr.—d. April 27, 1825, Paris), French artist, archaeologist, and museum official who played an important role in the development of the Louvre collection.

Denon studied law in Paris but turned to the theatre, writing a successful comedy at 23. He drew and painted and was commissioned by Louis XV to arrange a cabinet of carved gems. Between 1772 and 1787 he carried out diplomatic missions to Russia, Naples, and Switzerland; in Naples he etched portraits and collected works of art. In 1787 he became a member of the Académie de Peinture.

During the French Revolution he returned to Paris, where he was protected by his friend, the painter Jacques-Louis David. In 1798 he accompanied Napoleon Bonaparte on the latter's expedition to Egypt and there made numerous sketches of the ancient monuments, sometimes under the very fire of the enemy. The results were published in his *Voyage dans la basse et la haute Égypte* (1802; "Travels in Lower and Upper Egypt"). In 1804 Napoleon made Denon director general of museums, a post he retained until 1815. In this capacity he accompanied the Emperor on his expeditions to Austria, Spain, and Poland and advised him in his choice of works of art to pillage from the various conquered countries. Most of these works ultimately reached the Louvre.

After Denon had become acquainted with the work of Aloys Senefelder, the inventor of lithography, he was one of the first artists to introduce lithography into France. His first extant lithograph is dated September 1809. His unfinished but admirably illustrated history of art was published posthumously in four volumes in 1829 under the title *Monuments des arts du dessin chez les peuples tant anciens que modernes* ("Monuments of the Arts of Design Among Peoples As Much Ancient As Modern").

Denpasar, city, capital of Bali *propinsi* (province), south central Bali, Indonesia, 40 miles (70 km) south of Singaraja. The largest city on the island of Bali, it is also the capital of the Badung *kabupaten* (regency). Denpasar was the site of a suicidal battle of the rajas of Badung against the Dutch Militia in 1906. A large open square in the centre of the city, named Puputan Square, commemorates the event. The population is mostly Balinese who speak a dialect of Indonesian written in Pallava script and practice a form of Islām strongly influenced by Hindu customs. In addition, there are Arab and Indian merchants who deal mainly in textiles; Chinese operate most local businesses, and there are some Christians. The city's mechanized industries include food processing, papermaking and printing, and the manufacture and repair of machinery. Handicrafts include sandstone carving, weaving, coconut and bone carving, plaiting, basket weaving, and the production of coir and of gold and silver jewelry.

A network of roads links Denpasar with Singaraja and other cities on the island. Denpasar also has an international airport. A branch of the National Archaeological Research Centre; the Bali Museum, built by the Dutch government in 1932 and containing specimens of Balinese art from prehistoric times to the early 20th century; and Universitas Udayana (founded 1962) are located at Denpasar. Sites of interest include the Puri (temple) Pemecutan, St. Joseph Church, Meredith Memorial Library, Pasar (market) Dadung, Kokar (Conservatory of Performing Arts), Academy of Indonesian Dances, and Abiankohas Art Centre. Pop. (1980) 261,263.

densitometer, device that measures the density, or the degree of darkening, of a photographic film or plate by recording photometrically its transparency (fraction of incident light transmitted). In visual methods, two beams of equal intensity are used. One is directed through the plate, while the intensity of the other is adjusted by an optical wedge, by an iris diaphragm, or by moving the source, until the two beams have equal intensity, judged by the eye or by a photoelectric cell. With proper calibration, the density can be read directly. Other methods employ photoelectric cells to measure the intensity of the same beam with and without film or plate inserted in the path, the difference in intensity being a measure of density.

The same techniques can be used to measure the density of semitransparent materials other than photographic plates—for example, sunglasses.

density, mass of a unit volume of a material substance, expressed as kilograms per cubic metre in MKS or SI units; the densities of common solids, liquids, and gases are listed in textbooks and handbooks. Density offers a convenient means of obtaining the mass of a body from its volume or vice versa; the mass is equal to the volume multiplied by the density, while the volume is equal to the mass divided by the density. The weight of a body, which is usually of more practical interest than its mass, can be obtained by multiplying the mass by the acceleration of gravity. Tables that list the weight per unit volume of substances are also available; this quantity has various titles, such as weight density, specific weight, or unit weight. *See also* specific gravity. The expression particle density refers to the number of particles per unit volume, not to the density of a single particle.

density current, any current in either a liquid or a gas that is kept in motion by the force of gravity acting on small differences in density. A density difference can exist between two fluids or between different parts of the same fluid because of a difference in temperature, salinity, or concentration of suspended sediment.

Density currents in nature are exemplified by those currents that flow along the bottom of oceans or lakes. Such subaqueous currents occur because the water entering an ocean or a lake is colder, saltier, or contains more suspended sediment and, thus, is denser than the surrounding waters. As a consequence, it sinks and flows along the bottom under the effect of gravity. The difference in density, moreover, slows down the mixing of the subaqueous current with the overlying waters, enabling it to maintain itself for a relatively long distance.

Density currents are of considerable practical importance. For example, the deposition of sediment from turbidity currents—*i.e.*, density currents in which the density difference is caused by suspended sediment—in lakes may result in a rapid decrease of reservoir capacity. Equally significant, the industrial discharge of large amounts of polluted or heated water may generate density currents that have adverse effects on neighbouring human or animal communities.

Because of such considerations, many experimental studies on the properties of density currents have been undertaken. Small turbidity currents have been investigated in the laboratory and have been observed directly in lakes. Indirect evidence strongly suggests that large-scale turbidity currents occur in ocean basins. Many researchers believe that a current of this type is caused by the slumping of sediments that have accumulated at the head of a submarine canyon. Slumping of large masses of sediment produces a very dense sediment–water mixture that eventually flows down the canyon to spread out across the seafloor and deposit a layer of sand in the deep water. Repeated deposition results in the formation of submarine fans, structures that closely resemble the alluvial fans that occur at the mouth of many river canyons. Sedimentary rocks that are thought to have originated from ancient turbidity currents are called turbidites and are common in the geological record.

Densmore, Frances (b. May 21, 1867, Red Wing, Minn., U.S.—d. June 5, 1957, Red Wing), ethnologist, foremost American authority of her time on the songs and music of American Indian tribes, and widely published author on Indian culture and life-styles.

After studying at the Oberlin Conservatory of Music, Densmore conducted research in Indian music for the Bureau of American Ethnology in 1907. She subsequently worked with both the Bureau and the Smithsonian Institution and conducted a survey of Gulf Coast Indians for the National Research Council. In her published work she provided a new conception of the Indian, giving detailed analyses of the music and the circumstances under which songs were created and sung. She received the 1940–41 award of the National Association for American Composers and Conductors for her contributions to American musicology and conducted studies for a number of American museums and other organizations, including the Library of Congress. In 1941–43 she was consultant to the National Archives and established the Smithsonian–Densmore Collection of sound recordings of American Indian music.

Densuşianu, Ovid (b. Dec. 29, 1873, Făgăraş, Rom.—d. June 9, 1938, Bucharest), folklorist, philologist, and poet who introduced trends of European modernism into Romanian literature.

Educated at Iaşi and later in Berlin and Paris, Densuşianu was appointed professor of Romance languages at the University of Bucharest. Strongly influenced by western European Symbolism, he opposed the bucolic school of writing then established in Romania and in 1905 founded the opposition review *Viaţa Nouă* ("New Times"), which he published for 20 years. In French he wrote *Histoire de la langue roumaine* (1901–14; "A History of the Romanian Language"); in Romanian, *Dicţionar general al limbii Române* (1909; "A General Dictionary of the Romanian Tongue"), *Flori alese din cântecele poporului* (1920; "An Anthology of the Songs of the People"), the poems *Raze pe lespezi*

(1920; "Sunlight on the Paving Stones"), and *Literatura română modernă* (1920–33; "Modern Romanian Literature"). His poetry is published under the pseudonym Ervin.

Dent, Edward John (b. Aug. 19, 1790, London—d. March 8, 1853, London), English clockmaker noted for his highly accurate clocks and chronometers.

Dent learned the clockmaker's trade from Richard Rippon and, during the period 1815–29, established a reputation as a builder of accurate chronometers. His reputation for precision eventually brought requests from the Admiralty and the East India Company. Dent confirmed his expertise by creating in 1829 a chronometer action that incorporated an improved method of reducing the timing errors caused by fluctuations in temperature. From 1830 until 1840 he was the partner of John Roger Arnold in the manufacture of first-rate clocks and watches. Thereafter, as the proprietor of three clock shops in London, Dent won the esteem of Sir George Airy, the astronomer royal, who recommended him as the maker of a large clock for the tower of the new Royal Exchange. Dent established a workshop in the Savoy to produce this excellent timepiece, which was installed in 1844.

In 1852 Dent won the commission to make the great clock—now called Big Ben—for the Houses of Parliament at Westminster, but he died before completing the project. Upon the death of Rippon, Dent had married his widow, whose sons Frederick and Richard took Dent's name and succeeded to his business. Frederick Rippon Dent finished Big Ben in 1854.

dental auxiliary, person qualified by training and experience to perform dental work under the direction and supervision of a dentist. Some of these auxiliary persons work directly for the dentist in his own office; others work in a separate office or laboratory, where they perform services to the dentist on the basis of work authorizations or prescriptions. There are three principal dental-auxiliary groups: dental hygienists, dental laboratory technicians, and dental assistants.

Dental hygienist. The hygienist, working under the direction of a licensed dentist, cleans and polishes the patient's teeth and gives advice on the care of teeth. Hygienists may also take and develop X-ray pictures of the teeth, mix filling compounds, apply fluorides to the teeth, and otherwise assist the dentist with a patient. In the United States, hygienists are also employed by public school systems to visit schools periodically, where they examine the teeth of the children and refer to a dentist cases in which treatment is indicated. Hygienists employed in hospitals may be called upon to work with bed and ambulatory patients who require limited prophylactic treatment.

Dental laboratory technician. A dental laboratory technician, upon receiving a prescription or work-authorization form from a licensed dentist, fabricates various appliances, such as full and partial dentures, crowns and bridges, and other prosthetic devices that the dentist uses in making restorations for the patient. The technician is not permitted to fit these appliances, nor may he take the impressions from which the dentures and other devices are fabricated.

Dental assistant. About 65 percent of all dental auxiliaries are dental assistants. Their duties vary according to the degree to which the dentist elects to delegate duties that do not require extensive professional knowledge. In general, the assistant is expected to prepare patients for dental treatment; to prepare materials and equipment for use by the dentist, including sterilizing and laying out instruments; to know instrument and equipment nomenclature; and to keep records of appointments, examinations, treatments, and supplies. A growing number of assistants are being trained to assist the dentist at the chair in restorative dentistry, in surgical operations, and in prosthetic dentistry; many also are being trained to perform dental X-ray work.

Dentatus, Manius Curius (d. 270 BC), Roman general, conqueror of the Samnites and victor against Pyrrhus, king of Epirus.

Dentatus was born into a plebeian family that was possibly Sabine in origin. As consul in 290 BC, he gained a decisive victory over the Samnites, thereby ending a war that had lasted 50 years. The same year, he also reduced the Sabine insurgents to submission and granted them *civitas sine suffragio* ("citizenship without the right to vote"). In 284 he defeated the invading Senones. After Pyrrhus had returned from Sicily to Italy (275), Dentatus, once again consul, finally defeated him near Beneventum (now Benevento). Dentatus was consul for the fourth and last time in 274, the year he conquered the Lucanians. During his term as censor, 272, he began to build an aqueduct to carry the waters of the Anio River into the city but died before its completion. Later writers idealized Dentatus as a model of old Roman simplicity and frugality.

denticle, part of a conodont, a small toothlike fossil found in marine rocks representative of a long span of geologic time. Although they resemble cusps, denticles are generally smaller than distinct cusps and vary greatly in shape and structure. Denticles may be spaced closely to each other or separated by gaps of varying size; they may be distinctly formed or partially fused to each other. In shape, denticles may be needlelike, spiny, or saw-toothed. In some conodonts, denticles are completely absent, and the major part of the conodont consists of a single cusp. The form, number, and arrangement of denticles are frequently distinctive and characteristic of particular kinds of conodonts. In some forms, denticles are present as single straight, or almost straight, rows. In others, the denticles may be curved or even split into several branches. The earlier conodont forms that possess denticles generally consist of a main bar that supports the denticle row and the main cusp. In later forms, the main cusp and denticle row are flanked by a platform on either side.

dentine, also spelled DENTIN, in anatomy, the yellowish tissue that makes up the bulk of all teeth. It is harder than bone but softer than enamel and consists mainly of apatite crystals of calcium and phosphate. In humans, other mammals, and the elasmobranch fishes (*e.g.*, sharks, rays), a layer of dentine-producing cells, odontoblasts, line the pulp cavity of the tooth (or, in the case of sharks, the toothlike scale) and send projections into the calcified material of the dentine; these projections are enclosed in tubules. Sensitivity to pain, pressure, and temperature is transmitted via the odontoblastic extensions in the tubules to and from the nerve in the pulp chamber. Secondary dentine, a less well-organized form of tubular dentine, is produced throughout life as a patching material where cavities have begun, where the overlying enamel has been worn away, and within the pulp chamber as part of the aging process.

In nonmammalian vertebrates, enamel is lacking; the tooth crown is covered instead with vitrodentine, a compound related to dentine, which is harder than dentine but somewhat softer than enamel.

A few animals, such as flounder and cod, have vasodentine, in which tubules are lacking, and the dentine is nourished directly by capillaries. Though more efficient nutritionally, this type of dentine is softer and less resistant to disease than tubular dentine. The material composing the toothlike scales of sharks and related fish is also called dentine. *Compare* cementum; enamel.

dentistry, profession concerned with the teeth and their associated structures such as the jaws and gums. It includes the repair or removal of decayed teeth, the straightening of and adjusting for proper occlusion of teeth, and the design, manufacture, and provision of false teeth and other prosthetic devices.

A brief treatment of dentistry follows. For full treatment, *see* MACROPAEDIA: Medicine.

Origins of the treatment of oral disease are found in the ancient civilizations of the Middle and Far East. Until the 18th century dentistry was concerned only with the removal of teeth, and then only because of pain. Originally teeth were pulled by barber-surgeons, but by the 14th century there existed specialist tooth-pullers called dentatores, especially in France, where dentistry was more advanced than elsewhere in the world. In the 19th century the lead was taken by the United States, where most of the specialized equipment for dentistry was developed.

Early dental drills were hand-operated—the dentist twisting the bur between his fingers or turning a handle with one hand while drilling with the other. Later, a treadle-operated model was derived from the sewing machine, and in 1870 the electric drill was invented, though it was some while before the supply of domestic electricity brought it into universal use. It remained until ousted by the air turbine (high-speed) drill, developed in the 1950s. This has speeds around 400,000 rpm, allowing easier tooth repair with less discomfort.

Anesthesia and analgesia were introduced at the end of the 19th century, first by using cocaine or nitrous oxide and later other drugs. Another improvement in the practice of dentistry was the development of X rays, which revealed the condition of the roots of the teeth and any associated decay or infections.

False teeth were fairly common by the 18th century, but they were generally unsatisfactory; the impression of the jaw was made using plaster, which had to be chipped off painfully and pieced together again. The resulting denture was made from wood, ivory, or tortoiseshell, with teeth of ivory or porcelain, but was usually a poor fit and therefore uncomfortable. Improvements came first with the development of wax and then plastics for impression taking and, later, with the introduction of rubber and then plastic as the base on which the false teeth could be set. Also, early dentures had prongs or wires to attach them to the jaws, but they nevertheless were wobbly; almost all modern dentures use the capillary action of water to hold them in place, and this requires that they have a precise fit. The technique of permanently implanting false teeth in the gums became popular in the second half of the 20th century.

The other major developments in dentistry have been (1) oral hygiene and brushing for the prevention of tooth decay and gum disease, (2) the use of fluorides to make teeth resistant to decay, and (3) the development of orthodontics (tooth straightening.)

The first dental school was founded in Baltimore in 1840. Now most countries of the world require dentists to undergo a formal training lasting five to six years, after which they must pass written and practical examinations. Dentistry also requires a high degree of mechanical dexterity because the practice involves using highly sophisticated instruments and materials.

The work of a dentist involves not only filling and extracting teeth but also scaling and polishing the teeth to remove tartar, advising on the care of the teeth and gums, designing and supplying false teeth, restoring damaged teeth, and straightening teeth.

Denton, city, seat (1857) of Denton County, northern Texas, U.S. Denton is situated about 35 miles (56 km) northwest of Dallas–

Fort Worth. Permanently settled in 1857 and named for John B. Denton, a Texas frontiersman and Indian fighter, the city, although located in an industrial and agricultural region, is predominantly a cultural, research, and educational centre, with North Texas State University (1890), Texas Woman's University (established as Girls Industrial College in 1901), and Denton State School (1960) for the mentally retarded. It is the site of the federal government's first regional emergency centre, headquarters for civil defense, disaster, and preparedness operations in a five-state area. Inc. 1866. Pop. (1980) 48,063.

D'Entrecasteaux Channel, inlet of the Tasman Sea, extending northeast for about 35 mi (55 km) between Bruny Island (east) and the southeast coast of mainland Tasmania, Australia, to merge with the Derwent River estuary. It is known locally as The Channel. Its western shore is interrupted by the large indentations of Port Esperance and the Huon River estuary. Sighted in 1642 by the Dutch navigator Abel Tasman, it was surveyed in 1792 by the French admiral Bruni d'Entrecasteaux, who proved it to be a channel rather than a bay. The southern approach to Hobart, the channel is also the centre of the state's scallop industry (May–July), although catches are declining. Its west coast is paralleled by the Channel and Huon highways.

D'Entrecasteaux Islands, islands in Papua New Guinea, lying across Ward Hunt Strait from the eastern tip of New Guinea, Solomon Sea, southwestern Pacific. Administratively they are part of Milne Bay province.

The large islands of Normanby, Fergusson, and Goodenough (*qq.v.*), and the much smaller Sanaroa (Welle) and Dobu are volcanic, precipitous (rising to 5,000–8,000 ft [1,500–2,400 m]), and forested. Perhaps the remnants of a submerged mountain range, they have a combined land area of 1,213 sq mi (3,142 sq km). Visited and named by the French navigator Bruni d'Entrecasteaux during his search for Jean-François de Galaup La Pérouse in 1793, the group was more accurately charted and individually named by Capt. John Moresby of HMS "Basilisk" in 1873. Copra is produced in fertile coastal patches. Pop. (1980 prelim.) 40,742.

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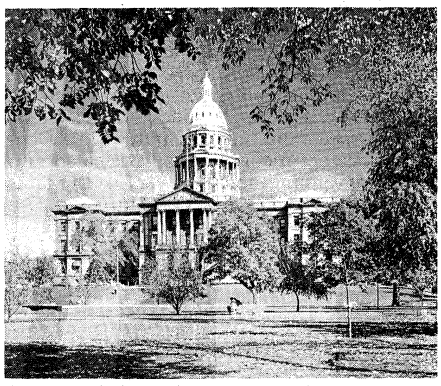
denture, artificial replacement for one or more missing teeth and adjacent gum tissues. A complete denture replaces all of the teeth of the upper or lower jaw. Partial dentures are commonly used to replace a single tooth or two or more adjacent teeth. The partial appliance may be removable or fixed; it usually relies on remaining teeth for support and stability.

Improved stability is sometimes obtained with overdentures, appliances that use remaining teeth and roots for support. An added advantage of overdentures is that the remaining roots help preserve the alveolar bone—the part of the jawbone that holds the teeth—in turn preserving important bone, nerve, and tissue that tend to degenerate in the presence of complete, full-mouth dentures. About 95 percent of all dentures are made from polymethyl methacrylate, an acrylic resin.

Denver, capital of Colorado, U.S., seat (1901) of Denver County, at the western edge of the Great Plains, just east of the Rocky Mountains' Front Range. The city lies at the junction of Cherry Creek and the South Platte River; its altitude (5,280 ft [1,609 m] above sea level), which gives it the nickname "Mile High City," and crisp, dry climate are distinctive characteristics. The site, an early stopping place for Indians, trappers, and traders, was settled in the "Pikes Peak or bust" gold rush of 1859. Early settlements (Placer Camp and Montana) gave way to the rival towns of Auraria and St. Charles. The latter was renamed Denver City for James W. Denver, governor of the territory in 1858. Auraria and Denver consolidated in 1860, and seven years later Denver was designated the permanent capital. The city was devastated by fire in 1863, and a year later a flash flood swept away many buildings, including the city hall. Indian wars on the plains in the 1860s also retarded the community's growth. When the transcontinental railway was built through Wyoming, Denver's citizens organized their own railway to connect with the Union Pacific at Cheyenne; this was completed in 1870, and the Kansas Pacific Railroad reached Denver shortly thereafter. The resulting economic boom increased the population from 4,759 in 1870 to 106,713 in 1890.



State Capitol, Denver, Colo.
David Muench—EB Inc.

During the 1870s and 1880s silver became more important economically than gold. Mining kings were created almost overnight, and an opera house was built. This period of opulence ended in 1893 with the crash of the silver markets. Banks failed, smelters shut down, and silver kings became paupers. New gold discoveries helped prevent a major decline, and farming, cattle and sheep ranching, and commerce began to provide a more stable economy. The Denver branch of the U.S. Mint (opened 1906) produces about 75% of U.S. coinage and is the nation's second biggest gold depository.

Military and related installations established in the area include Fitzsimmons Army Medical Center (1918), Lowry Air Force Base (1938), U.S. Air Force Academy (50 mi south), Rocky Mountain Arsenal, and the Air Force Accounting and Finance Center.

As the largest city between the Missouri River and the Pacific states, Denver serves as a transportation, industrial, and commercial hub. The Denver Union Stockyards form one of the nation's largest livestock markets. Denver has become a major centre for winter sports, with many ski areas in the vicinity, including Winter Park. The city is the seat of the University of Denver (incorporated 1864 as Colorado Seminary), Regis College (1888), Colorado Women's College (1909), Iliff School of Theology (1892), Loretto Heights College (1918), Metropolitan State College (1963), and medical and extension centres of the University of Colorado. The State Capitol (built 1887–95 in Corinthian style) has a 272-ft gold-leafed dome, and the Civic Center adjoins the Capitol grounds. The Denver Mountain Parks, in addition to the 150 parks in the city, extend into the Rocky Mountain foothills and are scattered over a wide scenic area.

Metropolitan growth after World War II created a ring of satellite communities, including Arvada, Aurora, Brighton, Broomfield, Cherry Hills Village, Commerce City, Edgewater, Englewood, Golden, Lakewood, Littleton, Northglenn, Westminster, and Wheat Ridge. Stapleton International Airport is in the northeast corner of the city. Inc. 1861. Pop. (1980) city, 492,365; metropolitan area (SMSA), 1,620,902.

Denver and Rio Grande Western Railroad Company, U.S. railroad chartered in 1870 as the Denver and Rio Grande Railway. It began with a narrow-gauge line extending from Denver to Salt Lake City, and in 1901 acquired the Rio Grande Western Railway. The running time between Denver and Salt Lake City was shortened by eight hours with the opening of the six-mile Moffatt Tunnel through the Rockies in 1934, placing Denver on a transcontinental route for the first time.

The railroad operates in Colorado and Utah, and is one of the few U.S. lines to carry its own passengers. Much of its freight revenues are from bituminous coal and lignite. Other sources include food products, lumber, and motor vehicles.

Denys, SAINT: *see* Denis, Saint.

Deo Van Tri, Lao KHAM UM (b. *c.* 1849, northwestern Vietnam—d. March 1, 1908, Lai Chau), fiercely independent tribal chief of Tai peoples in the Black River region of Tonkin (now northern Vietnam) who created a semiautonomous feudal kingdom and coexisted with the French, who ruled the rest of Vietnam.

Deo Van Tri was the son of Deo Van Seng, chief of the Tais who occupied the Vietnamese lands surrounding the Black River. As the head of a band of Chinese pirates, Deo Van Seng had seized the area in 1869. His son joined with him to repel a Shan invasion at age 16, and, together with the Black Flag pirate bands, he defended the kingdom of Vietnam. For his bravery the Vietnamese court named Deo Van Tri chief and accorded his father a mandarin title. When rival pirate bands threatened his father's principality of Muong Theng, Deo forced their retreat into China's Yunnan Province.

In 1885, with Tonkin at war against France, Deo again served the Vietnamese loyally. He offered refuge to the young rebel king, Ham Nghi, and the regent, Ton That Thuyet. The regent, however, tried unsuccessfully to assassinate Deo in order to insure the secrecy of their whereabouts. Deo escorted him to the frontiers of his fiefdom and thenceforth refused to associate with the Vietnamese resistance effort.

Deo, encouraged by members of his family, came to terms with France in 1888 in order to protect the independence of his people and agreed to serve the French colonial regime. He accompanied the French explorer Auguste Pavie on several journeys and on a mission to China, and he permitted members of his family to travel with Pavie to Paris, where they were enrolled at schools. Continuing his policy of cooperation with France, Deo assisted in operations delimiting the Indochinese frontier with China in 1894.

Deoband school, Arabic DĀR AL-'ULŪM (House of Learning), the leading Muslim theological centre (*madrasah*) of India. It was founded in 1867 by Muḥammad 'Ābid Ḥusayn in the Sahāranpur district of Uttar Pradesh. The theological position of Deoband has always been heavily influenced by the 18th-century Muslim reformer Shāh Walī Allāh and the early-19th-century Indian Wahhābīyah, giving it a very puritanical and orthodox outlook.

The program of studies is highly traditional, stressing jurisprudence (*fiqh*), Qur'ānic exegesis (*tafsīr*), the study of traditions (Ḥadīth), scholastic theology (kalam), and philosophy (*falsafah*). Modern disciplines, which are not relevant to a proper knowledge of Islām and can lead to sinful innovation (*bid'ah*), are ignored, and the modern practice of Islām is studied only in order to purify it of unorthodox accretions. The student is thus prepared mainly for religious leadership of the Muslim community.

Deoband's enrollment of about 1,500 students is culled from all parts of the Muslim world. The madrasah boasts a library of 67,000 printed books and manuscripts in Arabic, Persian, and Urdu. A mosque, lecture halls, and student residences further serve the scholarly community.

Deoghar, also spelled DEOGARH, town, northeastern Bihār state, northeastern India. It is a major rail and road junction and agricultural trade centre. An ancient town, it is famous for its group of 22 temples dedicated to the Hindu god Shiva. Numerous Buddhist ruins are nearby. Deoghar has a hospital, tuberculosis clinic, and leper asylum and houses several colleges (including a teacher-training institute) affiliated with Bhāgalpur University. The Muslim invader Bakhtyār Khaljī made Deoghar his capital in 1201 after the conquest of Bihār. It was constituted a municipality in 1869. Pop. (1981) town, 52,904; metropolitan area, 59,120.

Deogir (India): *see* Daulatābād.

deontological ethics, in philosophy, ethical theories that place special emphasis on the relationship between duty and the morality of human actions. Deontology (Greek *deon,* "duty," and *logos,* "science") consequently focuses on logic and ethics. No attempt is made in such theories to explicate specific moral obligations.

In deontological ethics an action is considered morally good because of some characteristic of the action itself, not because the product of the action is good. Deontological ethics holds that at least some acts are morally obligatory regardless of their consequences for human welfare. Descriptive of such ethics are such expressions as "Duty for duty's sake," "Virtue is its own reward," and "Let justice be done though the heavens fall."

By contrast, teleological ethics holds that the basic standard of morality is precisely the value of what an action brings into being. Deontological theories have been termed formalistic because their central principle lies in the conformity of an action to some rule or law.

The first great philosopher to define deontological principles was Immanuel Kant, the 18th-century German founder of critical philosophy, whose ethics were much-influenced by Christianity as well as by the Rationalism of the Enlightenment. Kant held that nothing is good without qualification except a good will, which is one that wills to act in accord with the moral law and out of respect for that law, rather than out of natural inclinations. He saw the moral law as a categorical imperative—*i.e.,* an unconditional command—and believed that its content could be established by human reason alone. Reason begins with the principle "Act only on that maxim whereby thou canst at the same time will that it should become a universal law." Kant's critics, however, have questioned his view that all duties can be derived from this purely formal principle and have argued that, in his preoccupation with rational consistency, he neglected the concrete content of moral obligation.

This objection was faced in the 20th century by the British philosopher W.D. Ross, who held that numerous "prima facie duties," rather than a single formal principle for deriving them, are themselves immediately self-evident. Ross distinguished these prima facie duties (such as promise keeping, reparation, gratitude, and justice) from actual duties, for "any possible act has many sides to it which are relevant to its rightness or wrongness"; and these facets have to be weighed before "forming a judgment on the totality of its nature" as an actual obligation in the given circumstances.

Deor, also called DEOR'S LAMENT, Old English heroic poem of 42 lines, one of the two surviving Old English poems to have a refrain. (The other is the fragmentary "Wulf and Eadwacer.") It is the complaint of a *scop* (minstrel), Deor, who was replaced at his court by another minstrel and deprived of his lands and his lord's benevolence. In the poem Deor recalls, in irregular stanzas, five examples of the sufferings of various figures from Germanic legend. Each stanza ends with the refrain "That trouble passed; so can this." Though some scholars believe that the lament is merely a conventional pretext for introducing heroic legends, the mood of the poem remains intensely personal.

Deorāi, Battle of (March 22–24, 1659), victory of the Mughal emperor Aurangzeb that confirmed his possession of the throne. It was fought at Deorāi, in northeastern India, between Aurangzeb and his brother and rival prince Dārā Shikōh.

Dārā challenged Aurangzeb, relying on the promised support of Jaswant Singh of Mārwār, but Jaswant then deserted him, and Dārā was left to face Aurangzeb's superior army alone. Defeated after three days' resistance, he was captured and later executed.

Deoria, town, eastern Uttar Pradesh state, northern India, about 32 miles (50 km) southeast of Gorakhpur. On a major rail line to Bihār state, it is an agricultural trade centre. Its principal industry is sugar milling. Major crops grown in the surrounding agricultural area include sugarcane, rice, oilseeds, and pulses; there are also a number of sugar-processing factories. Nearby Kasia (ancient Kuśīnagara), the reputed place of Buddha's death and cremation, is a noted pilgrimage centre. Pop. (1981) town, 55,720.

Deosai Mountains, range in the Himalayan mountain system in the northern part of the Indian subcontinent. The mountains are located in the Pakistani-held sector of the west-central part of the state of Jammu and Kashmir. The range extends for 120 miles (190 km) from the Indus River bend at Bunji to the Suru (Karcha) River, which separates the range from the Zāskār Range. The main body of the Deosai massif (mountainous mass) is composed of sedimentary rock of the Precambrian Era (more than 570,000,000 years old) combined with granite bodies of younger age. Several peaks reach elevations of more than 18,000 feet (5,500 m). The Deosai Basin lies between mountain ranges at an elevation of 13,000 feet (3,962 m); it possesses steep sides and a level floor and appears to be an ancient cirque (deep, steep-walled recess in a mountain, caused by glacial erosion). The terrain of the Deosai Mountains is rugged and almost devoid of human population. Sparse vegetation vies for existence with a few hardy alpine mammals such as the marmot. The Burji Pass is situated southwest of Skārdu, which is one of several villages lying at the foot of the mountains.

deoxyribonucleic acid: *see* DNA.

deoxyribose, also called D-2-DEOXYRIBOSE, five-carbon sugar component of DNA (*q.v.*; deoxyribonucleic acid), where it alternates with phosphate groups to form the "backbone" of the DNA polymer and binds to nitrogenous bases. The presence of deoxyribose instead of ribose is one difference between DNA and RNA (ribonucleic acid). Deoxyribose was synthesized in 1935, but it was not isolated from DNA until 1954.

Depardieu, Gérard (b. Dec. 27, 1948, Châteauroux, Fr.), French motion-picture actor noted for his versatility.

The son of migrant labourers, Depardieu received little formal education and at age 15 went to Paris, where he studied acting. He made his screen debut in the short film *Le Beatnik et le minet* (1965) and began to appear as a bit player in full-length films in the early 1970s. His performance as a young thug in *Les Valseuses* (1973; *Going Places*) brought him his first real notice, and he subsequently appeared in such major films as Bernardo Bertolucci's *1900* (1976), François Truffaut's *Le Dernier Métro* (1980; *The Last Metro*), *Loulou* (1980), *Le Retour de Martin Guerre* (1981; *The Return of Martin Guerre*), Andrzej Wajda's *Danton* (1982), and *Jean de Florette* (1987). Depardieu played a wide variety of roles, from peasants to the French Revolutionary leader Georges Danton. He was notable for projecting a screen image of masculine strength that was nevertheless imbued with gentleness and sensitivity. He became noted for acting in as many as six films a year, and by the late 1980s he had become the most popular actor in France and had achieved an international reputation.

département, largest unit of local government in France and in some former French colonies. The *départements* were originally created in 1790. Each *département* is governed by an elected general council, which holds responsibility for local services, laws, and budget; an officer called a commissioner represents the national government and is the council's executive agent.

Prior to the French Revolution the local unit in France was the military *gouvernement,* which roughly corresponded to the old provinces, such as Franche Comté, Provence, Bourgogne, Bretagne, and so on. But by the time of the French Revolution this division seemed too closely bound up with the administrative mismanagement of the ancien régime, and at the suggestion of the Comte de Mirabeau, the "provinces" were divided into *départements,* which were roughly equal to a certain average of size and population and which derived their names principally from rivers, mountains, or other prominent geographical features. In 1860 three new *départements* were created out of the newly annexed territory of Savoy and Nice. The three *départements* of Bas-Rhin, Haut-Rhin, and Moselle, which were lost after the Franco-German War in 1871, were restored in 1919. Other *départements* have been created on occasion because of population or territorial changes. By the late 20th century the number of *départements* had grown to around 100. The largest city in a *département* usually serves as the departmental capital.

Each *département,* presided over by its commissioner, is subdivided into *arrondissements,* each under the charge of a subprefect. *Arrondissements* are again subdivided into cantons and these into communes, which are somewhat equivalent to the English parish.

department store, retail establishment that sells a wide variety of goods. These usually include women's and girls' ready-to-wear apparel and accessories, men's and boys' ready-to-wear apparel and accessories, yard goods and household textiles, small household wares, furniture, electrical appliances and accessories, and, often, food. These goods are separated into divisions and departments supervised by managers and buyers. There are also departmental divisions of merchandising,

advertising, service, accounting, and budgetary control.

The Bon Marché (*q.v.*) in Paris, which began as a small shop in the early 19th century, is often considered the first department store. The development of department stores was linked to the growth in the 19th century of large population centres, transportation, and the harnessing of electricity for power and lighting. During that century many general merchandise stores grew into department stores by broadening their stocks. In the United States in the 1920s some stores began opening branches in various cities. The first such chains were J.C. Penney and Sears, Roebuck.

depersonalization, in psychology, a state in which an individual feels that his self or the outside world is unreal. In addition to a sense of unreality, depersonalization may involve the feeling that one's mind is dissociated from one's body; that the body extremities have changed in relative size; that one sees oneself from a distance; or that one has become a machine.

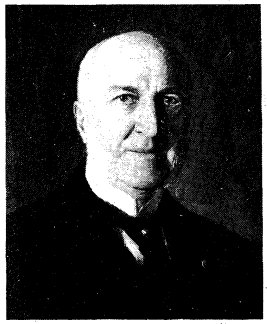
Mild feelings of depersonalization occur during the normal processes of personality integration and individuation of a high percentage of adolescents and young adults and need not impair social or psychological functioning. Such feelings may also occur in adults after long periods of emotional stress. When significant social or occupational impairment continues, an individual is considered to have a disorder which should be treated. Feelings of depersonalization may also be present as secondary symptoms in disorders such as depression, hysteria, or schizophrenia.

According to Sigmund Freud's psychoanalytic theory, since ego is the "representative of reality," depersonalization is a result of impairment of ego functioning. Depersonalization is often interpreted as a defensive reaction to an unconscious need to escape from an intolerable or threatening reality.

The term *depersonalization* has also been used to refer to social alienation resulting from the loss of individuation in the workplace and the community.

Depew, Chauncey Mitchell (b. April 23, 1834, Peekskill, N.Y., U.S.—d. April 5, 1928, New York City), U.S. railroad lawyer and politician who is best remembered as an orator, a wit, and an after-dinner speaker.

Entering politics as a Republican, Depew served as a member of the New York Assembly (1861–62) and as secretary of state of New York (1864–65). In 1866 he declined an appointment as the first U.S. minister to Japan in order to become an attorney and lobbyist for Cornelius Vanderbilt's New York and Harlem Railroad. Eventually he rose to be president of the New York Central and Hudson River Railroad (1885–98) and board chairman of the entire Vanderbilt railway system (from 1898). A candidate for the Republican nomination for president in 1888, he withdrew in favour of Benjamin Harrison, whose successful campaign he strongly supported. In 1892 he declined Harrison's offer of the secretaryship of state. He later served two terms (1899–1911) as a U.S. senator from New York.



Depew, detail of an oil painting by Vilma Parlachy; in Yale University Art Gallery

Yale University Art Gallery, gift of Mrs. Charles Carroll Glover, Jr.

depletion allowance, in corporate income tax, the deductions from gross income allowed investors in exhaustible mineral deposits (including oil or gas) for the depletion of the deposits. The theory behind the allowance is that an incentive is necessary to stimulate investment in this high-risk industry.

The depletion allowance is similar to the depreciation (*q.v.*) allowance afforded other firms for their investments. There are substantial differences, however. One is that it is difficult to estimate what proportion of a mineral deposit has been exhausted. Another is that the value of the deposit is often substantially larger than the amount invested. The search for a deposit entails considerable risk, but once it is found, it may justify high levels of investment even without tax incentives.

The first depletion allowance in the United States, called the "discovery depletion," was enacted in 1918 to stimulate oil production for World War I (even though the war had just ended). Discovery value proved too hard to estimate, however, so this was changed in 1926 to the "percentage depletion" for oil and gas property, under which the corporation deducts a fixed percentage of its sales as a depletion allowance, regardless of the amount invested. In addition, producers can deduct their capital costs, thus gaining a double benefit. After 1931, Congress expanded the use of "percentage depletion" to many other extractive industries, such as those concerned with metals, sulfur, and coal.

Proponents of the depletion allowance claim that special treatment for the oil and gas industry is justified because of the high risks involved and because reliable oil supplies are vital to national defense. Opponents argue that overly beneficial depletion allowances lead to over-investment in the favoured industries and excessive exploitation of some minerals while distorting allocation of resources. After years of debate, the depletion allowance for oil and gas was reduced from 27.5 percent to 22 percent in 1969 and completely eliminated for certain large producers in 1975. Only small, independent companies and royalty owners, as well as owners of geopressurized methane gas wells, were allowed a percentage depletion, but it was to decline gradually to 15 percent beginning in 1984.

deportation, expulsion by executive agency of an alien whose presence in a country is deemed unlawful or detrimental. Deportation has often had a broader meaning, including exile, banishment, and the transportation of criminals to penal settlements.

In Roman law, deportation originally described a form of banishment for life to a foreign country, usually an island. Deportation was at first inflicted upon political criminals, but, in time, it became a means of removing those whose wealth and popularity rendered them objects of suspicion. It was also a punishment for adultery, murder, poisoning, forgery, embezzlement, and other crimes. Deportation was attended by the confiscation of property, loss of citizenship, and loss of civil rights. The practice of transporting criminals to foreign soil began in Europe in the 15th century, when Portugal sent convicts to South America, where they became some of the earliest settlers of Brazil. France initiated deportation during the Revolutionary period; the practice survived until 1938 despite much public criticism of the prison conditions on the islands of French Guiana, particularly the notorious Devil's Island. Peter I the Great of Russia ordered political prisoners to Siberia in 1710, thus beginning a practice that has continued through the 20th century.

In England deportation developed from the policy of allowing an arrested man the option to abjure the realm. He would take an oath to depart and never return. Often this represented the convict's only alternative to execution. Gradually a formal system of transportation of convicted criminals developed as a substitute for capital punishment. The inhuman treatment of criminals sentenced to servitude in the colonies of North America and Australia generated public pressure for penal reform, and the practice was abandoned in the 1850s.

In Anglo-American law today, deportation is a civil enactment imposed on persons who are neither native-born nor naturalized citizens. The alien is ordinarily, but not necessarily, returned to the country from which he came, usually because he has entered the deporting country illegally or without proper passport or visa. Aliens who become public charges, commit crimes involving moral turpitude, or engage in subversive activities can also be subjected to deportation proceedings. U.S. courts have shown leniency in circumstances in which families are split apart unjustifiably and left with no means of support.

Deportation differs from exclusion, extradition, and exile. Exclusion is the refusal by a governing authority to admit an alien. Extradition is the removal of a criminal to the country from which he has fled to avoid criminal prosecution or prison. Exile is a prolonged absence from one's country, either voluntary or by direction of the sovereign. *See also* exile and banishment; penal colony.

deposit, certificate of (CD), a receipt from a bank acknowledging the deposit of a sum of money. Among the common types are demand certificates of deposit and time certificates of deposit. Demand certificates of deposit are payable on demand, without drawing interest. They are used primarily by contractors as evidence of good faith when submitting a bid or as a guaranty of performance. They may also be used as collateral to secure a loan. Time certificates of deposit bear interest and are payable on or after a specific date. Interest on time deposits is higher than for passbook or statement savings accounts. A depositor who withdraws money deposited on a time basis before the maturity date of the certificate is subject to loss of interest. Since their introduction in the early 1960s, they have become a significant method of saving. Both types of certificates of deposit are usually negotiable, but checks may not be written against them.

Treasury rate certificates of deposit, recently allowed by the United States government, pay interest according to the discount rate for U.S. Treasury bills at the time that the certificate of deposit is purchased, and the interest rate is guaranteed for the life of the certificate. Sterling certificates of deposit were first issued in 1968 and are subject to the controls of the Bank of England.

In the United States, some certificates are negotiable and are acceptable as security for loans. The United States government sets a ceiling on the interest that may be offered on interest-bearing certificates of deposit.

deposit account: *see* time deposit.

depot trade: *see* silent trade.

depreciation, accounting charge for the decline in value of an asset spread over its economic life. Depreciation covers deterioration from use, age, and exposure to the elements. It also includes obsolescence—*i.e.,* loss of usefulness arising from the availability of newer and more efficient types of goods serving the same purpose. It does not cover losses from sudden and unexpected destruction resulting from fire, accident, or disaster.

Depreciation applies both to tangible property such as machinery and buildings and to intangibles of limited life such as leaseholds and copyrights. For convenience, depreciation accounts are usually kept for groups of assets with similar characteristics and working life.

The general rule of charging off a depreciable asset during its life does not determine what the charge will be each year. Straight-line, fixed-percentage, and, more rarely, annuity methods of depreciation (giving, respectively, constant, gradually decreasing, and gradually increasing charges) are standard. Sometimes charges vary with use (*e.g.*, with the number of miles per year a truck is driven). Special rules allow depletion of nonreproducible capital (such as a body of ore being mined) for tax purposes to exceed original cost.

Basing depreciation on historical cost rather than on probable replacement cost and on arbitrary rules rather than on actual use has been practiced to establish definite tax liability and to standardize audits of accounts; in times of shifting price levels, however, such bases for measuring depreciation have proved especially imperfect.

depressant, in medicine, a drug or other agent that slows the activity of vital organs of the body. Depressants acting on the central nervous system include general anesthetics, opiates, alcohol, and hypnotics. Tranquilizing drugs (ataractics) act primarily on the lower levels of the brain, relieving tension without reducing mental sharpness.

depression, in economics, major downswing in the business cycle (*q.v.*) that is characterized by sharply reduced industrial production, widespread unemployment, serious declines or cessations of growth in construction activity, and great reductions in international trade and capital movements. Unlike minor business contractions that may occur in one country independently of business cycles in other countries, severe depressions have usually been nearly worldwide in scope. The Great Depression (*q.v.*) beginning in 1929, for example, was the most severe and widespread economic decline in the 20th century. *Compare* recession; panic.

depression, in psychology, a mood or emotional state that is marked by sadness, inactivity, and a reduced ability to enjoy life. A person who is depressed usually experiences one or more of the following symptoms: feelings of sadness, hopelessness, or pessimism; lowered self-esteem and heightened self-depreciation; a decrease or loss of ability to enjoy daily life; reduced energy and vitality; slowness of thought or action; loss of appetite; and disturbed sleep or insomnia. Depression differs from simple grief, bereavement, or mourning, which are appropriate emotional responses to the loss of loved persons or objects. Where there are clear grounds for a person's unhappiness, depression is considered to be present if the depressed mood is disproportionately long or severe vis-à-vis the precipitating event. When a person experiences alternating states of depression and mania (extreme elation of mood), he is said to suffer from a manic-depressive psychosis (*q.v.*).

Depression is probably the most common psychiatric complaint and has been described by physicians from at least the time of Hippocrates, who called it melancholia. The course of the disorder is extremely variable from person to person; it may be fleeting or permanent, mild or severe, acute or chronic. Depression is more common in women than in men. The rates of incidence of the disorder increase with age in men, while the peak for women is between the ages of 35 and 45.

Depression can have many causes. The loss of one's parents or other childhood traumas and privations can increase a person's vulnerability to depression later in life. Stressful life events in general are potent precipitating causes of the illness, but it seems that both psychosocial and biochemical mechanisms can be important causes. The chief biochemical cause seems to be the defective regulation of the release of one or more naturally occurring monoamines in the brain, particularly norepinephrine and serotonin. Reduced quantities or reduced activity of these chemicals in the brain is thought to cause the depressed mood in some sufferers.

There are three main treatments for depression. The two most important are psychotherapy and drug therapy. Psychotherapy aims to resolve any underlying psychic conflicts that may be causing the depressed state, while also giving emotional support to the patient. Antidepressant drugs, by contrast, directly affect the chemistry of the brain, and presumably achieve their therapeutic effects by correcting the chemical imbalance that is causing the depression. The tricyclic antidepressant drugs are thought to work by inhibiting the body's physiological inactivation of the monoamine neurotransmitters. This results in the buildup or accumulation of these neurotransmitters in the brain and allows them to remain in contact with nerve cell receptors there longer, thus helping to elevate the patient's mood. By contrast, the antidepressant drugs known as monoamine oxidase inhibitors interfere with the activity of monoamine oxidase, an enzyme that is known to be involved in the breakdown of norepinephrine and serotonin. In cases of severe depression in which therapeutic results are needed quickly, electroconvulsive therapy has proven helpful. In this procedure, a convulsion is produced by passing an electric current through the person's brain. In many cases of treatment, the best therapeutic results are obtained by using a combination of psychotherapy with drug therapy or with electroshock treatment.

depression (meteorology): *see* cyclone.

Depression, Great: *see* Great Depression.

Depretis, Agostino (b. Jan. 13, 1813, Mezzana Corti, Kingdom of Italy—d. July 29, 1887, Stradella, Italy), Italian statesman, a leftist figure in the Risorgimento who later served three times as premier of Italy. He provided a fairly stable government by the tactics of *trasformismo,* which brought together members of different parties in the same Cabinet.

After graduating from law school at Pavia (1834), he spent several years running his family's estate. In 1848, the year of revolutionary upheavals in Europe, he was elected deputy to the first Piedmontese Parliament, a position he held continuously until his death. As a deputy he consistently opposed Count Cavour, the premier of the kingdom of Piedmont–Sardinia.

Probably because he foresaw its failure, Depretis did not participate directly in the 1853 uprising in Milan planned by Giuseppe Mazzini, the extreme-left nationalist. After Cavour's resignation in 1859, Depretis briefly served as governor of Brescia in the province of Lombardy, which Piedmont had newly annexed from Austria.

Italy was politically unified in 1861, and Depretis became successively minister of public works (1862), minister of the navy (1866), and minister of finance (1867) in the weak national governments that followed unification. As nominal head of the leftists after Urbano Rattazzi's death in 1873, Depretis was invited to become premier in March 1876. For the next 11 years he was the dominant force in Italian politics. A scandal in March 1878 brought down his government before his moderately liberal reforms could be introduced. Returning to power in December 1878, he formed a more conservative government that lasted eight months.

In May 1881 Depretis organized a government that lasted until July 1887, a period notable for its lack of change. The major reform achieved by his government was the extension of suffrage from 2 percent to 7 percent of the population (1882).

In 1882 Depretis signed the Triple Alliance, which allied Italy with Austria–Hungary and Germany. He was then persuaded to colonize Africa. When 500 Italian troops were killed by Ethiopians at the Battle of Dogali in January 1887, his government resigned. In April Depretis was again chosen as prime minister, but he died in office a few months later.

The diverse and unstable parties and factions in early Italian national politics made strict party government almost impossible. In response to this problem, Depretis perfected the art of *trasformismo* ("transformism"), by which, in order to build up his own personal following in parliament, he ignored party labels and took ministers from both the right and left. A prime minister could stay in office longer by means of the shifting government coalitions thus created. Cavour had done much the same thing as Italy's first prime minister, but under Depretis this practice became the established technique of Italian parliamentarism.

depth charge, also called DEPTH BOMB, a type of weapon that is used by surface ships or aircraft to attack submerged submarines. The first depth charges were developed by the British in World War I for use against German submarines. They consisted of a canister filled with explosives that was rolled or dropped off the stern of a ship in the presumed vicinity of the submerged submarine. The canister would sink through the water, and its explosive charge would be detonated at a preselected depth by means of a hydrostatic valve. The depth charge rarely exploded close enough to sink the submarine, but its shock waves loosened the submarine's joints and damaged its instruments, thus forcing it to the surface, where it could be finished off by naval gunfire. An attacking ship would try to drop a pattern of depth charges around a submarine to increase the chances of one exploding near enough to damage the sub.

Late in World War I, devices were developed to propel depth charges through the air over distances of 100 or more yards, thus widening the effective radius at which a ship could attack submarines. The Royal Navy's Hedgehog depth charge of World War II consisted of a salvo of 24 small, high-explosive bombs that could be launched to a distance of 250 yards (228 m) and which exploded on contact as they sank through the water. Other, more conventional depth charges weighing as much as 3,000 pounds (1,360 kg) were used in World War II. Modern depth-charge launchers are computer-controlled mortars that can fire 400-pound (180-kilogram) depth charges in patterns 2,000 yards (1,800 m) away from a ship. Atomic depth charges are fitted with a nuclear warhead and have a vastly increased killing radius owing to their great explosive power. Other depth charges have been developed that can be launched from aircraft.

depth finder, also called ECHO SOUNDER, device used on ships to determine the depth of water by measuring the time it takes a sound (sonic pulse) produced just below the water surface to return, or echo, from the bottom of the body of water. Sonic depth finders are in operation on practically every important class of ship, naval and merchant, and are also used on small craft.

Sonic pulses are also sent out to detect underwater objects by the same principle. During World War II the name sonar (*q.v.*) was applied in an analogy to radar, and the device was used extensively to detect submarines. In

addition to protecting ships from shoal water, peacetime uses include locating fish, measuring the thickness of ice in Arctic regions, and oceanographic charting. Sonic depth finders can be operated repetitively, recording thousands of soundings per hour, to prepare a profile of the ocean floor. Hydrographers use echo sounders in charting the oceans and in survey work to discover underwater pinnacles and shoals.

One of the first practical depth sounders, the so-called Hayes sonic depth finder, developed by the U.S. Navy in 1919, consisted of (1) a device to generate and send sound waves to the ocean floor and receive the reflected waves and (2) a timer calibrated at the speed of sound in seawater that directly indicated water depth. About 1927 a similar device was manufactured under the trade name Fathometer. The basic principles used in these early devices have not been significantly changed.

In the modern system a transmitter supplies a powerful pulse of electrical energy, and a transducer converts the pulse into an acoustical pressure wave in the water and receives its echo, converting it back into electrical energy, which can be amplified and applied to an indicator. Audible frequencies of less than 15 kilohertz are commonly employed.

Der'ā (Syria): *see* Dar'ā.

Dera Ghāzi Khān, town, Punjab province, central Pakistan. The town was founded by Ghāzī Khān, son of a Baluchi chieftain and vassal of the Langāh sultans of Multān. Incorporated as a municipality in 1867, the town was partially destroyed by a flood of the Indus River in 1908–09. The new town (founded 1911) is connected by road with Multān over the Taunsa Barrage and by a bridge of boats at low water over the Indus with Ghāzi Ghāt and Muzaffargarh. Rug and carpet weaving and the production of wooden toys were traditional industries; newer industries include rice and flour milling, cotton textiles, and rope and fibre products. The town has a hospital and a college affiliated with the University of the Punjab. Wheat, millet, and dates are the chief crops grown in the surrounding area, and cattle breeding is widespread. Pop. (1981) town, 102,007.

Dera Ismāīl Khān, town, North-West Frontier province, Pakistan. The town, just west of the Indus River, was named for Ismā'īl Khān, son of the 15th-century Baluchi chief who founded the town. The old town, 4 miles (6 km) east, was washed away by the Indus River in 1823. The new town, laid out by Durrānī chiefs, was constituted a municipality in 1867. Dera Ismāīl Khān is an important transportation junction that is connected to Darya Khān (12 miles [19 km] east) by a bridge spanning the Indus. Lacquered woodwork, glasswork, mat and ivory work, and lungis (sarongs) are the chief hand-manufactured goods; industry includes textile, flour, oil, and rice mills and soap factories. Wheat, millet, gram, and sorghum are the major crops cultivated in the surrounding area, and camels and sheep are extensively bred. The region is the junction of the Pashtun and Baluchi tribes. Dera Ismāīl Khān's facilities include a hospital, two parks, four main bazaars, and several colleges affiliated with the University of Peshāwar. Gomal University was opened in 1974. Pop. (1981 prelim.) town, 68,000.

Derain, André (b. June 10, 1880, Chatou, Fr.—d. Sept. 8, 1954, Garches), French painter who was one of the principal Fauvists.

Derain studied painting in Paris at the Académie Carriere and at the Académie Julian. He developed his early style in association with Maurice de Vlaminck, whom he met in 1900, and with Henri Matisse, with whom he became acquainted in 1905. Together with these two painters, Derain was one of the principal exponents of Fauvism

"Self-Portrait," oil painting by André Derain; in the Bridgestone Gallery, Tokyo

By courtesy of the Bridgestone Art Gallery, Tokyo

(*q.v.*) in the period from 1905 to 1908. He painted landscapes and figure studies in brilliant, sometimes pure colours and used broken brushstrokes and impulsive lines to define his spontaneous compositions. Derain broke with Fauvism in 1908, when he temporarily came under the influence of the works of Paul Cézanne. He worked for a few years in a stylized form of Cubism, but by the 1920s his paintings of nudes, still lifes, and portraits had become increasingly Neoclassical, and the spontaneity and impulsiveness that had distinguished his earlier work gradually disappeared. His art underwent virtually no change after the 1920s. Derain had considerable ability as a decorator and created theatrical designs, notably for the Ballets Russes. He also produced numerous book illustrations.

derasha, also spelled DERASHAH (Hebrew: "discourse," or "homily"), plural DERASHOT, or DERASHOTH, in Judaism, a homily or sermon, generally preached by a rabbi in the synagogue.

In a broad sense, the prophets were the first to preach to the Jewish people, but they had no official status as interpreters of the Law, nor did they address their words to a formal congregation. The first *derashot,* properly so called, were preached by Ezra (5th century BC), who sensed the usefulness of following the reading of the Torah texts with a vernacular explanation for the common people. Long before the Christian era, such discourses became an integral part of the Jewish liturgy. In form and content, the *derashot* gradually changed with changing times. Some preachers provided didactic explanations of the Law, while others had recourse to allegory, parable, anecdote, or folklore.

Derashot were used by rabbis for the inspiration, encouragement, and sometimes the admonition of their congregations. Many early *derashot* from this era have been preserved in nonlegal sections of the Talmud and constitute a large portion of the Midrash (collected explanations of the underlying meaning of biblical texts). *Derashot* could serve as vehicles for social criticism and reform or as entertaining and instructive demonstrations of a rabbi's eloquence and learning. Ethical teachings, however, remained the basis of the *derasha.*

Modern *derashot* continue to be flexible in form and content, but their reliance on ancient sources and traditions gives them a distinctive Jewish flavour. A typical *derasha* remains a speech of exhortation and instruction based on a particular text from the Scriptures.

Derbent, city, Dagestan Autonomous Soviet Socialist Republic, Russian S.F.S.R. It lies in the narrow gap between the Caspian Sea and the Caucasus Mountains at their closest approach. Derbent was founded in AD 438 as a fortress to guard the principal caravan route from southwestern Europe to Southwest Asia. It fell to Arabs in 728, Tatars in 1220, and Russians in 1813. Many ancient monuments survive, including the ruins of the 5th-century citadel and an 8th-century cathedral mosque. The modern city's industries include wool spinning, wine making, and a large cannery. Pop. (1987 est.) 83,000.

Derby, town and port in West Kimberley shire, northern Western Australia. It lies on the western shore of a peninsula in King Sound (an inlet of the Indian Ocean), near the mouth of the Fitzroy River. Founded in 1883 to serve a pastoral district, it was named after Lord Derby, who was then the British secretary of state for the colonies. The town boomed during the Kimberley gold rush (1885) in the hinterland. Situated near the Great Northern Highway to Perth (1,500 miles [2,400 km] southwest), Derby is the major port for the cattle of West Kimberley. Beef cattle from the Fitzroy Valley and King Leopold Ranges are brought to slaughterhouses in Derby. The output of these and the nearby Glenroy Station works is shipped along the coast from a 1,800-foot (550-metre) jetty at Derby that was built to partially overcome difficulties presented by a 35-foot (11-metre) tidal range. Derby also serves the iron mines on Cockatoo and Koolan islands in Yampi Sound (80 miles [130 km] north). Pop. (1981) 2,933.

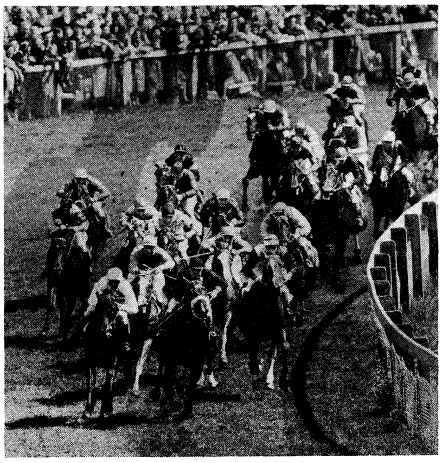
Derby, city ("district"), county of Derbyshire, England. It lies along the River Derwent at an important route focus at the southern end of the Pennines. It was a county borough from 1888 until 1974. The extent of the present district is 30 square miles (78 square km).

Just northeast, at Little Chester, is the Roman site of Derventio. Derby was founded in the 9th century by the Danes as Deoraby, from which the present name is derived. Early royal charters were granted in 1154–56 and 1204. The manufacture of porcelain in the locality began in 1750. After a visit by George III in 1773, the town was granted a patent to mark the china with a crown, and the local product was known thereafter as Crown Derby, amended to Royal Crown Derby by Queen Victoria in 1890. Silk throwing, or spinning by machine, was introduced into the town from Italy in 1719. Many people in Derby were formerly employed in the manufacture of silk hosiery, lace, and cotton, and textile factories are still important in the city's economy.

Derby's early factories were helped by a canal network, and in the 19th century the city became a major railway centre. Rail and aircraft engineering are also important industries in the city. Derby has large cattle markets, and All Saints Church (cathedral from 1927) has a tower, 210 feet (64 m) high, built in 1509–27. Pop. (1986 est.) 216,200.

Derby, city, coextensive with the town (township) of Derby, New Haven county, southwestern Connecticut, U.S. It lies at the junction of the Housatonic and Naugatuck rivers, a few miles west of New Haven. Early settlement developed around a trading post established by Captain John Wakeman in 1642 in an area bought from the Paugusset Indians. In 1675 it became a town and was renamed for Derby, Eng. Its boundary was reduced when Oxford (1798), Seymour (1850), and Ansonia (1889) were separately incorporated. The city of Derby was incorporated (1893) and consolidated with the town. Derby prospered as a shipbuilding, shipping, and fishing centre, but these activities had declined by the mid-19th century. The economy is now based on diversified manufacturing. Pop. (1987 est.) 12,124.

Derby, one of the classic English horse races, with the Saint Leger, the Oaks, the One Thousand Guineas, and the Two Thousand Guineas. It dates from 1780 and is named for Edward Stanley, 12th earl of Derby. With a field limited to three-year-old colts and fillies, the race is run the first Wednesday in June over a 1½-mile (about 2,400-metre) course



The Derby at Epsom Downs
UPI—EB Inc.

at Epsom Downs, Surrey. Many other horse races have been named for the Derby (*e.g.*, Kentucky Derby), and the term itself has come to signify a race or contest of any type. For winners of the Derby since 1949, *see* Sporting Record: *Horse racing.*

Derby, EARLS OF, titled English nobility of several creations, most notably in the family Stanley, grouped below chronologically and indicated by the symbol •.

• **Derby, Henry, earl of:** *see* Henry IV *under* Henry (England).

• **Derby, Thomas Stanley, 1st earl of,** also called (1459–85) 2ND BARON STANLEY (b. *c.* 1435—d. July 29, 1504, Lathom, Lancashire, Eng.), a prominent figure in the later stage of England's Wars of the Roses.

Great-grandson of Sir John Stanley (d. *c.* 1414), who created the fortunes of the Stanley family, Thomas Stanley began his career as a squire to King Henry VI in 1454. At the Battle of Blore Heath in August 1459, Stanley, though close at hand with a large force, did not join the royal army, while his brother William fought openly for York. In 1461 Stanley was made chief justice of Cheshire by Edward IV, but 10 years later he sided with his brother-in-law Warwick in the Lancastrian restoration. Nevertheless, after Warwick's fall, Edward IV made Stanley steward of his household. About 1482 he married, as his second wife, Margaret Beaufort, mother of the exiled Henry Tudor (the future Henry VII).

Stanley was one of the executors of Edward IV and was at first loyal to the young king Edward V. However, he acquiesced in Richard III's accession and retained his office as steward, avoiding entanglement in the rebellion (1483) on behalf of Henry Tudor in which his wife was deeply involved. He was made constable of England and was granted possession of his wife's estates with a charge to keep her safe in some secret place at home. Richard III could not well afford to quarrel with so powerful a noble, but he became suspicious when, early in 1485, Stanley asked leave to retire to his estates in Lancashire, and in the summer Richard asked Stanley to send his son Lord Strange to court as a hostage. After Henry Tudor had landed, Stanley made excuses for not joining the King. On the morning of Bosworth (August 22), when Richard summoned Stanley to join him, he received an evasive reply and thereupon ordered Lord Strange to be executed, although his order was neglected and Strange escaped. After the Battle of Bosworth Field, Stanley, who had taken no part in the fighting, placed the crown on Henry's head. Henry VII confirmed him in all his offices and created him earl of Derby. His son Thomas succeeded him as 2nd earl of Derby.

• **Derby, Edward Stanley, 3rd earl of** (b. 1508/09—d. Oct. 24, 1572, Lathom House, near Ormskirk, Lancashire, Eng.), second son of the 2nd earl, succeeding to the earldom on his father's death in May 1521. During his minority Cardinal Wolsey was his guardian, and as soon as he came of age he began to take part in public life. He helped to quell the rising known as the Pilgrimage of Grace in 1536, but, remaining true to the Roman Catholic faith, he disliked and opposed the religious changes made under Edward VI. Under Elizabeth his younger sons, Sir Thomas (d. 1576) and Sir Edward Stanley (d. 1609), were concerned in a plot to free Mary, Queen of Scots, and he himself was suspected of disloyalty.

• **Derby, James Stanley, 7th earl of,** also called (until 1642) BARON STRANGE, byname GREAT EARL OF DERBY (b. Jan. 31, 1607, Knowsley, Lancashire, Eng.—d. Oct. 15, 1651, Bolton, Lancashire), prominent Royalist commander in the English Civil War, who was executed by the Parliamentarians.

Eldest son of William, the 6th earl, he was returned to Parliament for Liverpool in 1625 and on March 7, 1628, entered the House of Lords as Baron Strange. When the Civil War broke out in 1642, Lord Strange devoted himself to the cause of King Charles I, fighting chiefly in Lancashire. After several defeats he left for the Isle of Man in June 1643 to deal with the disturbances that had broken out there, and in the summer of 1644 he took part in Prince Rupert's successful campaign in the north. He followed Rupert to Marston Moor and, after the complete defeat of Charles's cause in the north, withdrew to the Isle of Man, where he held out for the King and offered an asylum to Royalist fugitives.

By the death of his father on Sept. 29, 1642, he had succeeded to the earldom, and on Jan. 12, 1650, was chosen by Charles II to command the forces of Cheshire and Lancashire in the proposed Royalist rising. On Aug. 15, 1651, he landed at Wyre Water in Lancashire but on August 25 was totally defeated at Wigan, being severely wounded and escaping with difficulty. He joined Charles at Worcester; after the battle he accompanied him to Boscobel and, while on his way north alone, was captured near Nantwich, court-martialed at Chester on September 29, and condemned to death. When his appeal for pardon to Parliament was rejected, though supported by Oliver Cromwell, he endeavoured to escape but was recaptured and executed at Bolton. His eldest son, Charles (1628–72), succeeded him as 8th earl.

• **Derby, Edward (George Geoffrey Smith) Stanley, 14th earl of** (b. March 29, 1799, Knowsley Park, Lancashire, Eng.—d. Oct. 23, 1869, London), English statesman, important as leader of the Conservative Party during the long period 1846–68, thrice prime minister, and one of England's greatest parliamentary orators; nevertheless, he has no great political reputation.

Entering Parliament as a Whig in 1820, he held office under Viscount Goderich (1827–28) and became chief secretary for Ireland under Lord Grey in 1830, joining the Cabinet in 1831. In 1834 he resigned over the Irish Church question but served under Sir Robert Peel (1841), only to resign (1845) over the repeal of the Corn Laws. He succeeded to the earldom in 1851 and was premier in 1852, 1858, and 1866; among his legislation were the removal of Jewish discrimination in Parliament membership, the transfer of India's administration from the East India Company to the crown, and the Reform Bill of 1867.

He disliked the drudgery of office and as Conservative leader seemed weak and indolent beside Benjamin Disraeli, who nonetheless admitted, "He abolished slavery, he educated Ireland, he reformed parliament." He is chiefly remembered as epitomizing the aristocratic amateur; he excelled in whatever he did: as racehorse owner, as a benevolent if autocratic landowner, and as a scholar who won the chancellor's Latin verse prize at Oxford and published a blank verse translation of the *Iliad* (1864). He nurtured the Conservatives and helped the protectionists survive difficult years, while he educated them to accept Disraeli as his successor and to prepare for electoral victory.

Derby ware, porcelain figures and servicewares made in Derby, central England, *c.* 1750–1848. The best known early figures were characterized by glaze retractions about the base. Known as "dry-edge" figures, their modelling and execution was excellent, the porcelain soft and heavy; a pair known as the "Florentine Boars," after Italian bronzes, is the most noted example.

In 1756 William Duesbury established another factory at Derby. Advertising itself as "the second Dresden," it produced finely modelled, palely coloured figures often imitative of Chelsea (with which it was often confused) and Meissen wares. Flowers and colourful insects were favourite decorations of the serviceware. After Duesbury purchased the Chelsea works in 1770, a design trend away from Rococo porcelain toward the Neoclassical began;

"Tithe Pig," a Derby soft-paste porcelain group, Chelsea-Derby period, c. 1780; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

during the last decades of the century the painting of the wares achieved a marked excellence, while the unglazed (biscuit) figures, some based on those produced at Sèvres, Fr., became the most delicate and expensive of the Derby wares. Duesbury died in 1786; in 1815 the factory was leased, and *c.* 1845 many of the molds were sold. In general, the 19th-century works were inferior to those produced earlier. The modern Royal Crown Derby factory dates from 1875.

Derbyshire, county in the East Midlands of England. The landscape varies from the bleak moorlands of the north to the Trent lowlands in the south, and industry ranges from tourism in the High Peak district to mining and engi-

neering in the eastern and southern coalfield. Apart from gaining the rural district of Tintwistle from Cheshire, the county remained unaltered by the administrative reorganization in 1974. With an area of 1,016 square miles (2,631 square km), it is divided into nine districts: Amber Valley, Bolsover, Chesterfield (borough), Erewash (borough), High Peak (borough), North East Derbyshire, South Derbyshire, Derbyshire Dales, and the city of Derby. Matlock is the administrative centre of the county.

Topographically the county may be divided into two sections: a northern upland region culminating in the High Peak district; and a smaller southern lowland area around Derby. A large part of the county's northwestern portion lies within the Peak District National Park (1951), which was the first national park in Britain. The Pennines (uplands) reach their southern end in the Derbyshire Dome of northern Derbyshire. The dome is a plateau area of limestone flanked by gritstones. In the north the dome forms the heather- and peat-covered plateaus of Kinder Scout and Bleaklow. Coal measures outcrop on the dome's eastern portion with economically important coal seams. In the southern part of the county, marls and pebble beds, sometimes overlain with boulder clay, form rolling countryside. To the southeast of Derby, the River Derwent, whose drainage basin lies almost entirely within Derbyshire, joins the River Trent.

There are many prehistoric remains in the county, including the important paleolithic site at Cresswell Crags and the early Bronze Age site Arbor Low, near Youlgreave, which consists of a large circle of almost flat stones. The Romans established a military network of roads and forts in Derbyshire, but the only clearly nonmilitary site is at Buxton (Aquae Arnemetiae), a Roman spa town. The Romans also exploited the lead deposits found in the area.

With the coming of the Anglo-Saxons, Derbyshire formed part of the kingdom of Mercia. In 873 the Danes captured Repton, a Mercian religious centre, and later settled in the area and founded the borough of Derby. Derbyshire remained a largely pastoral county, with some mining and quarrying, until the 18th century. Lead from the Peak area was in great demand during the Middle Ages.

The iron ores of eastern Derbyshire began to be exploited on a considerable scale in the 17th century, and the county's industries developed further in the 18th century. The first modern factory in England, a silk mill in Derby, was built in 1717, and in 1771 Sir Richard Arkwright opened the first water-powered cotton spinning mill at Cromford. The valleys of Derbyshire became important sites for textile mills in the 18th and early 19th centuries, and in the east of the county iron and coal working developed in importance. Derby also developed as an engineering centre, and in 1908 Rolls-Royce Ltd. (founded 1906) established its first factory there. The eastern and southern coalfields developed rapidly in the 19th century, and towns such as Chesterfield, Bolsover, Alfreton, and Ilkaston became the centres of Derbyshire industry.

The county's traditional industries have declined in the 20th century. Coal mining is now concentrated in a few large collieries, and the last Derbyshire blast furnaces closed in 1974, although the county remains a leading producer of many types of iron and steel castings. Engineering and chemical industries remain important, and limestone quarrying around Buxton and Wirksworth produces about one-fifth of the national production. Tourism is important in the north, and, apart from its attractive countryside, Derbyshire is richly endowed with great houses dating from the 15th century onward. Among the best-known of these are Haddon, Hardwick, Chatsworth, Bolsover, Sudbury, and Sutton Scarsdale. There are also many architecturally important small houses and picturesque towns and villages. Pop. (1987 est.) 918,700.

Derbyshire Dales, formerly WEST DERBYSHIRE, district, county of Derbyshire, England. About half of the scenic district's 307 square-mile (795 square-kilometre) area lies within the Peak District National Park.

The Romans mined lead in the area between Wirksworth and Castleton, and lead mining continued until the 19th century. In the 18th century cotton textiles became important when Sir Richard Arkwright built the first water-powered cotton spinning mill at Cromford in 1771. Other textile mills soon followed, using waterpower provided by the fast-flowing streams.

Agriculture, mainly dairying, remains the most important industry of the district. There are numerous villages and small towns; Monyash, Wirksworth, Bonsall, and Tideswell grew as lead-mining communities, while Bakewell and Ashbourne developed as agricultural market towns. Matlock is a string of settlements along the valley of the River Derwent and includes Matlock Bath, a 19th-century spa. Among the many historic buildings in the district are the great houses of Chatsworth, Haddon, and Sudbury. Pop. (1986 est.) 66,800.

derebey (Turkish: "valley lord"), any of several feudal lords in Anatolia who, from the early 18th century, became virtually independent of the Ottoman central government. After these feudatories disappeared in the 19th century, the term came to designate great hereditary landlords in southern and eastern Turkey who exercised "quasi-feudal" rights over the peasants.

The financial and military obligations of the *derebeys* to the central government came to be well defined: in time of war they served, with their own men, in the Ottoman armies and were given titles by the sultan, as deputy lieutenant governors and tax collectors. They were, however, independent within their territories, where they struck deep roots and formed local dynasties with strong loyalties. Moreover, not threatened by short tenures, as were appointed governors, they were able to undertake long-term policies concerning the well-being of their people and the development of trade.

The reliance of the Ottoman government on *derebey* assistance during the 1768–74 Russo-Turkish War increased their influence, and, during the reign of Selim III (ruled 1789–1807), they not only controlled most provinces of Anatolia but also played an important part in Ottoman affairs. During the reign of Sultan Mahmud II (1808–39), however, the power of most *derebeys* was broken, and their administrative functions were taken over by appointed governors from Istanbul. The process of centralization continued after Mahmud's death (1839), and in 1866 a military expedition subjugated the remaining *derebeys* in the Çukurova region.

Derekh Eretz, also spelled DEREKH EREẒ (Hebrew: "correct conduct," or "way of the land"), in Judaism, the decorum, dignified behaviour, and gentlemanly conduct that should characterize a Jew at all times. Rabbinic scholars have applied the notion, for example, to all aspects of family life and marriage, to the qualities expected of a scholar, and to relationships between friends. *Derekh Eretz* applies also to one's manner of speaking, of eating, and of dressing and imposes on everyone the obligation of supporting himself so that others will not be unduly burdened. *Derekh Eretz* manifests itself in politeness toward others, whoever they be, and in genuine concern for their welfare. For Jews, *Derekh Eretz* is not only postulated in the Torah (the Law); without it, the Torah itself is rendered sterile. Two independent treatises have been written on the subject, both appended to the Babylonian Talmud: *Derekh Eretz Rabba* ("the Great") and *Derekh Eretz Zuṭa'* ("the Minor").

Derg, Lough, Irish LOCH DEARG, or DEIRGEIRT, lake on the River Shannon, situated at the boundary of Counties Tipperary, Galway, and Clare, in Ireland. Lough Derg is 24 miles (39 km) long and 0.5 to 8 miles (1 to 13 km) wide. It is 37 square miles (96 square km) in area, with a maximum depth of 119 feet (36 m). The lake has many islands, and a gorge at its southern end was used for the first modern hydropower system in Ireland. The town of Portumna is located at the lake's northern end, and Killaloe and Ballina are at the southern. The lake is not to be confused with another lake of the same name on the River Derg in County Donegal.

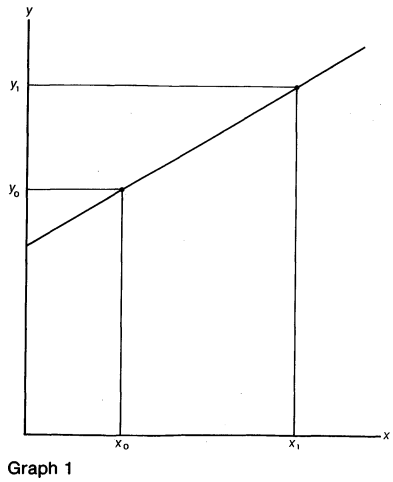
Deringer, Henry (b. Oct. 26, 1786, Easton, Pa., U.S.—d. 1868), American gunsmith who was the inventor of the Derringer pistol. He was the son of Henry Deringer, Sr., a colonial gunsmith who made Kentucky rifles.

The younger Deringer began his career as an apprentice to a firearms maker in Richmond, Va. In 1806 he settled in Philadelphia and began his own arms-manufacturing plant. He won contracts to supply various types of guns to the United States government. His early percussion-cap pistols were long-barreled weapons that were designed to fit a belt. After 1825 he concentrated on making single-shot pistols. His small caplock pocket pistol became his most famous product. This pistol was easy to handle and accurate at short ranges. It was less than six inches long and was bored in calibres from .36 to .45, with .41 being the most common. This model was copied by many other manufacturers and was quite popular between the 1840s and the American Civil War. It was manufactured and sold into the late 20th century by Colt and others, often in .22 calibre, and sometimes gold-plated.

John Wilkes Booth used a Deringer pocket pistol to assassinate President Abraham Lincoln. A reporter assembling the details called the gun a "Derringer" pistol in his story, adding an extra "r." This incorrect spelling was widely repeated, and the pistol became known as the derringer.

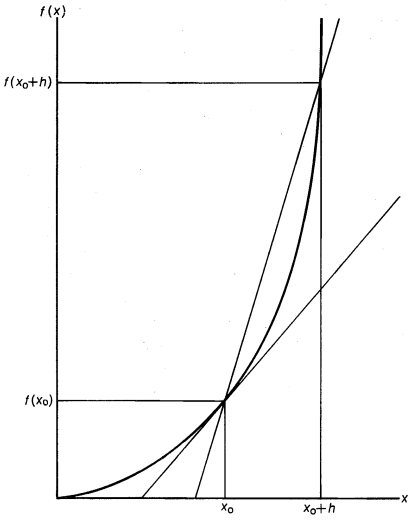
derivative, in mathematics, the rate of change, or instantaneous velocity, of a function with respect to a variable.

Geometrically, the derivative of a function can be interpreted as the slope of the graph of the function or, more precisely, as the slope of the tangent line at a point. Its calculation, in fact, derives from the slope formula for a straight line, except that a limiting process must be used for curves. The formula for the



Graph 1

slope of a straight line is $(y_1 - y_0)/(x_1 - x_0)$, or $[f(x_0 + h) - f(x_0)]/h$, if h is used for $x_1 - x_0$ and $f(x)$ for y (*see* Graph 1). For a curve, this ratio will depend upon where the points are chosen, reflecting the idea that a curve has a different slope at different points. To find the slope at a desired point, the choice of the second point needed to calculate the ratio represents a difficulty, because, in general, if the second point is far from the first, the ratio will represent an average slope along the portion of the curve cut off, rather than the slope at either point (*see* Graph 2). To get around this difficulty, a limiting process is used whereby the second point is not fixed but specified by a variable, as h in the ratio for the straight line above. Finding the limit (*q.v.*) in this case is a process in which a number is found that the ratio (also called the difference quotient) approaches as h approaches 0, so that the limiting ratio will represent the actual slope at the given point.



Graph 2

Some manipulations must be done on the quotient $[f(x_0 + h) - f(x_0)]/h$ so that it can be rewritten in a form in which the limit as h approaches 0 can be seen more directly. In finding the derivative of x^2 when x is 2, the quotient is $[(2 + h)^2 - 2^2]/h$. By expanding the numerator, the quotient becomes $(4 + 4h + h^2 - 4)/h = (4h + h^2)/h$. Both numerator and denominator still approach 0, but if h is not actually zero but only very close to it, then h can be divided out, giving $4 + h$, which is easily seen to approach 4 as h approaches 0.

To sum up, the derivative of $f(x)$ at x_0, written as $f'(x_0)$, $(df/dx)(x_0)$, or $Df(x_0)$, is defined as

$$\lim_{h \to 0} [f(x_0 + h) - f(x_0)]/h$$

if this limit exists.

Differentiation—*i.e.*, calculating the derivative—seldom requires the use of the basic definition but can instead be accomplished through a knowledge of the three basic derivatives, the use of four rules of operation, and a knowledge of how to manipulate functions. *See* differentiation.

Derivatives are involved in all phases of calculus and differential equations and find applications in problems of velocity, maxima, curve analysis, and approximations.

dermal leishmaniasis: *see* Oriental sore.

dermatitis, also called ECZEMA, an inflammation of the skin. Dermatitis is usually characterized by redness, swelling, blister formation, and oozing and almost always by itching. The term eczema, which formerly referred to the blistered, oozing state of inflamed skin, has by common usage come to have the same meaning as dermatitis.

Dermatitis may be classified into several types. Contact dermatitis results from contact of the skin with an irritating substance or a substance to which the person is allergic. The inflammation can result from contact with a strong acid or alkali or some other chemical, or it can result from contact with innocuous substances (*e.g.*, cosmetics, soap, clothing) which are not primarily irritating in themselves but which produce a reaction in a person who has been sensitized by repeated exposure to them. The most common cause of contact dermatitis in the United States and some other countries is poison ivy. Many other plants can cause the condition. Chemical compounds that may cause contact dermatitis include such metals as nickel and chromium, certain aniline dyes, and many types of drugs. The prevention of contact dermatitis rests upon the identification of the particular irritant and subsequent avoidance of it.

Atopic dermatitis is a disorder of infants, children, and young adults. It is characterized by a redness, thickening, and scaling of the skin in patches, typically on the face, neck, hands, and feet, in the crook of the elbow, or behind the knee. The skin becomes extremely dry, and this leads to itching. The cause of atopic dermatitis is not known, but it tends to run in families whose members have hay fever and asthma.

Stasis dermatitis is a skin inflammation affecting the ankles and lower legs. The condition is caused by chronic poor blood flow in the veins and particularly by varicose veins. The poor blood flow brings about swelling and a progressively more acute irritation of the skin that may lead to ulceration. Stasis dermatitis can be prevented if steps are taken early to improve the blood circulation of the legs, such as wearing supportive stockings or having surgery performed on the varicose veins.

Seborrheic dermatitis is a scaly skin condition that most frequently affects the scalp, dandruff being the common name for the skin particles that scale off the scalp. The condition generally involves body areas that are rich in sebaceous, or oil-secreting, glands, and it can also affect the forehead and eyebrows, midface, the area behind the ears, and the armpits. Most individuals with seborrheic dermatitis tend to have an oily skin. During infancy, seborrheic dermatitis may commonly manifest itself as a yellowish scaling of part of the scalp, a condition referred to as cradle cap.

Neurodermatitis refers to a skin inflammation that is apparently caused by the patient's own repeated and chronic scratching of an itchy area of his skin.

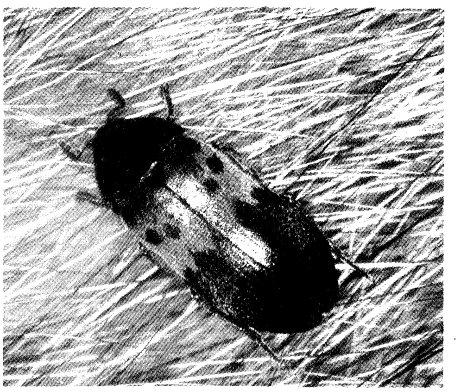
dermatology, medical specialty dealing with the diagnosis and treatment of diseases of the skin. Dermatology developed as a subspecialty of internal medicine in the 18th century; it was initially combined with the diagnosis and treatment of venereal diseases, because syphilis was an important possible diagnosis in any skin rash. Modern dermatology emerged in the early 20th century, after the discovery of an effective drug therapy for syphilis.

Because of the ease of observation of cutaneous symptoms, dermatology had early become a separate branch of medicine. Its scientific basis, however, was not established until the mid-19th century by the Austrian physician Ferdinand von Hebra. Hebra emphasized an approach to skin diseases based on the microscopic examination of skin lesions. Following Hebra's work, dermatologists concentrated chiefly on the description and classification of skin diseases, but a new emphasis on the biochemistry and physiology of these diseases, begun by Stephen Rothman in the 1930s, led to the development of more sophisticated and effective treatments in the latter half of the 20th century. Dermatologists have gained the capacity to control fungal diseases of the skin, to recognize and treat skin cancers at an early stage, to control the life-threatening skin diseases pemphigus and lupus erythematosus, and to alleviate psoriasis.

dermatomyositis, chronic degenerative inflammation of the skin and voluntary muscles, particularly the muscles of the shoulders and the corresponding muscles of the pelvis. The affected muscles are painful and weakened. The face and neck may be reddened, and there may be a violet coloration of the upper eyelids and the skin around the eyes. Calcium commonly is deposited in the affected skin and muscles. When the skin is not affected or is only slightly affected, the disorder is termed polymyositis (*q.v.*). In 10 to 20 percent of the adults in whom both skin and muscle are affected, cancer is present (for example, in the breast, stomach, ovary, or kidney); removal of the cancer may cause the dermatomyositis to regress. The course of the disease is highly variable. Children with dermatomyositis usually react more favourably to corticosteroid treatments than do adults. Significantly fewer adults than children with the disease survive.

dermestid beetle, any member of the approximately 700 species of the widely distributed insect family Dermestidae (order Coleoptera). These important household pests are usually brown or black, although some are brightly coloured or patterned. They vary in shape from elongated to oval, range in size from 1 to 12 mm (up to ½ inch), and are covered with either hairs or scales that easily rub off. The wormlike larvae, the only beetle larvae that are covered with hair, feed on furs, skins, feathers, horn, and hair, causing more damage than the adults.

The larder beetle larva (*Dermestes lardarius*) feeds on cheese and dried meats, especially ham and bacon. The adult beetle is oval, black or brown with yellowish bands and dark spots, and 6 to 7.5 mm long. The beetles are usually discovered inside a house when the adult emerges from its pupal stage and is seen around windows trying to get outside to feed on pollen.

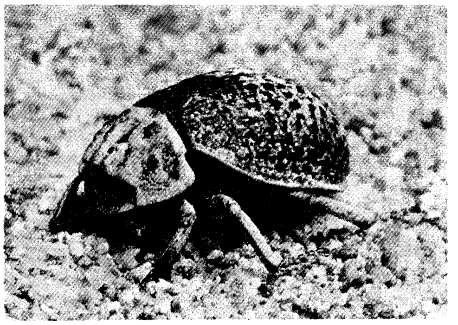


Larder beetle (*Dermestes lardarius*)
Javier Palaus Soler—Ostman Agency

The red-brown or golden-brown carpet beetle larva (*e.g., Anthrenus*) is about 5 mm long and very destructive; it attacks fur, furniture, rugs, carpets, and clothing. The oval adults feed on pollen, are usually between 2.2 and 3.5 mm in length, have brightly coloured scales, and resemble ladybird beetles.

Anthrenus verbasci and *A. musaeorum* are two important museum pests; they feed on and have destroyed collections of stuffed mammals, birds, and insects. Museums and private collectors must either have pestproof

display shelves or continuously apply pesticides to protect their collections. The larvae of carrion-feeding species are sometimes used in museums and by taxidermists to clean the soft tissue attached to animal skeletons.



Dermestid beetle (*Trox scabrosus*)
William E. Ferguson

The khapra beetle (*Trogoderma granarium*), a small beetle native to the Indian subcontinent, is a serious pest in most parts of the world. It is unique among dermestids because the larvae feed on stored grain.

dermis, also called CORIUM, the thicker, deeper layer of the skin underlying the epidermis and made up of connective tissue. It is present in varying degrees of development among various vertebrate groups, being relatively thin and simple in aquatic animals and progressively thicker and more complex in terrestrial species.

The dermis from its earliest evolutionary appearance has been a depository of bone, as expressed in dermal armour (primitive fishes), scales (fishes and certain amphibians), and plates (crocodile, lizard, turtle, armadillo). The fin rays of fishes are dermal derivatives, as are many types of pigment cells. The dermis of mammals is of greater thickness relative to the epidermis than is that of other vertebrates, partly because it contains abundant collagenous connective tissue. When treated with tannic acid, the dermis becomes leather.

In humans the dermis projects into the overlying epidermis in ridges called papillae. Nerves that extend through the dermis and end in the papillae are sensitive to heat, cold, pain, and pressure. Sweat glands and oil glands lie in the deeper stratum reticulare, as do the bases of hair follicles, the nail beds, and blood and lymph vessels.

Dermot MACMURROUGH, Irish DIARMAID MACMURCHADA (d. May 1, 1171), Irish king of Leinster whose appeal to the English for help in settling an internal dispute led to the Anglo-Norman invasion and conquest of Ireland by England.

After succeeding to the throne of his father, Enna, in 1126, Dermot faced a number of rivals who disputed his claim to the kingship. He established his authority by killing or blinding 17 rebel chieftains of northern Leinster in 1141. In 1153 he abducted the wife of Tiernan O'Ruark, king of Breifne (modern counties of Leitrim and Cavan).

A bitter feud ensued, and in 1166 Dermot was driven from Ireland. King Henry II of England then granted the exiled ruler permission to enlist the aid of several Anglo-Norman lords of south Wales, notably Richard de Clare, 2nd earl of Pembroke. Returning to Leinster in 1167 with an advance party of Anglo-Normans, Dermot established a foothold there. Pembroke arrived in August 1170, and Dermot then helped the invaders capture Dublin. Dermot married his daughter Eva to Pembroke, and at Dermot's death Pembroke succeeded as ruler of Leinster.

Dermoût, Maria, in full HELENA ANTONIA MARIA ELISABETH DERMOÛT-INGERMANN (b. June 15, 1888, Pekalongan, Java, Dutch East Indies [now in Indonesia]—d. June 27, 1962, Noordwijk, Neth.), Dutch novelist and short-story writer known for her subtle and evocative portraits of colonial life in the Dutch East Indies.

Dermoût, who was the descendant of employees of the Dutch East Indies Company, spent her childhood on a sugar plantation in central Java. She attended school in The Netherlands but returned to the islands as a young wife and remained there most of her life.

Her work was not published until she was in her 60s. Her first two novels, *Nog pas gisteren* (1951; *Yesterday*) and *De tienduizend dingen* (1955; *The Ten Thousand Things*), are fictionalized accounts of her youth. Although written in an economic style, the two novels are rich in details of island life as experienced by both the colonials and the native people. Among Dermoût's other books are three volumes of short stories—*De juwelen haarkam* (1956; "The Jeweled Haircomb"), *De sirenen* (1963; "The Sirens"), and *De kist; en enige verhalen* (1958; "The Wooden Box: A Unique Account")—and a book of sketches, *Spel van Tifagongs* (1954; "Tifagong's Play"). Her work is critically acclaimed not only for its clarity but for its sensitive account of colonialism coexisting with a lush, primitive beauty and power.

Derna (Libya): *see* Darnah.

Derpt (Estonian S.S.R.): *see* Tartu.

derrick, apparatus with a tackle rigged at the end of a beam for hoisting and lowering. Its name is derived from that of a famous early 17th-century hangman of Tyburn, Eng. In the petroleum industry, a derrick consisting of a framework or tower of wood or steel is erected over the deep drill holes of oil wells to support the tackle for boring, to raise and lower the drilling tools in the well, and to insert and remove the well casing or pipe. Similar smaller structures mounted on trucks are also called derricks. The derrick is a type of crane (*q.v.*).

Derrida, Jacques (b. July 15, 1930, El Biar, Alg.), French philosopher, whose critique of Western philosophy encompasses literature, linguistics, and psychoanalysis.

Derrida studied at the Ecole Normale Supérieure in Paris, where he taught the history of philosophy from 1965. From 1960 to 1964 he taught at the Sorbonne. In 1962 he published his first books, a translation (with introduction) of a section of a work on geometry by Edmund Husserl. In 1967 three influential works by him were published: *La Voix et le phénomène* (*Speech and Phenomena*), a study of Husserl; and two collections of essays, *L'Écriture et la différence* (*Writing and Difference*) and *De la Grammatologie* (*Of Grammatology*). Three works published in 1972 were *Marges de la philosophie* (*Margins of Philosophy*); *Positions* (a series of interviews); and *La Dissémination* (*Dissemination*).

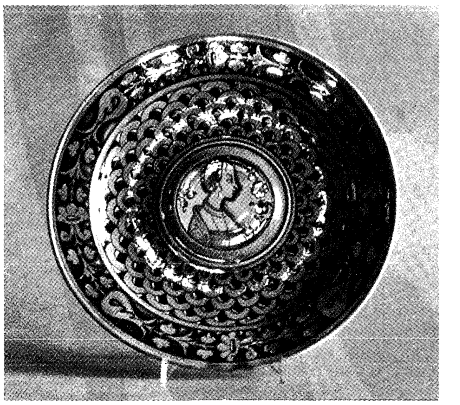
Derrida's thought is based on his disapproval of the search for some ultimate metaphysical certainty or source of meaning that has characterized most Western philosophy. In his works he offers a way of reading philosophic texts, called "deconstruction," which enables him to make explicit the metaphysical suppositions and a priori assumptions used even by those philosophers who are the most deeply critical of metaphysics. Derrida eschewed the holding of any philosophical doctrine and instead sought to analyze language in an attempt to provide a radical alternative perspective in which the basic notion of a philosophical thesis is called into question.

His later works include *Glas* (1974), *La Vérité en peinture* (1978; "Truth in Painting"), and *La Carte Postale* (1980).

derringer, also spelled DERINGER, pocket pistol produced in the early 19th century by Henry Deringer (*q.v.*), a Philadelphia gunsmith.

Derry (Northern Ireland): *see* Londonderry.

Deruta ware, outstanding tin-glazed earthenware, or maiolica, produced during the first half of the 16th century in the town of Deruta on the Tiber River, near Perugia, Italy. Deruta ware is characterized especially by a unique mother-of-pearl, metallic lustre and by certain decorative features. In the art of lustre, Deruta potters, who introduced an iridescent gold lustre decoration, may be held second only to the potters of Gubbio. Although Deruta maiolica displays most of the decorative features common in the Renaissance, it is innovative in at least two respects: the molding of plates with a design in slight relief, the lower part coloured dark to give an even more lustrous effect; and the division of the broad borders of the plates into panels with alternating geometric stripes. These dishes, illustrating subjects from



Lustered maiolica dish from Deruta, Italy, 1515; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

mythology or religion, are at times somewhat harsh and heavy, and the designs of vases and jars are sometimes flat or crude, but, at its most successful, Deruta maiolica has a distinctive flamboyance.

Derviş Mehmed Zilli (Ottoman traveler): *see* Evliya Çelebi.

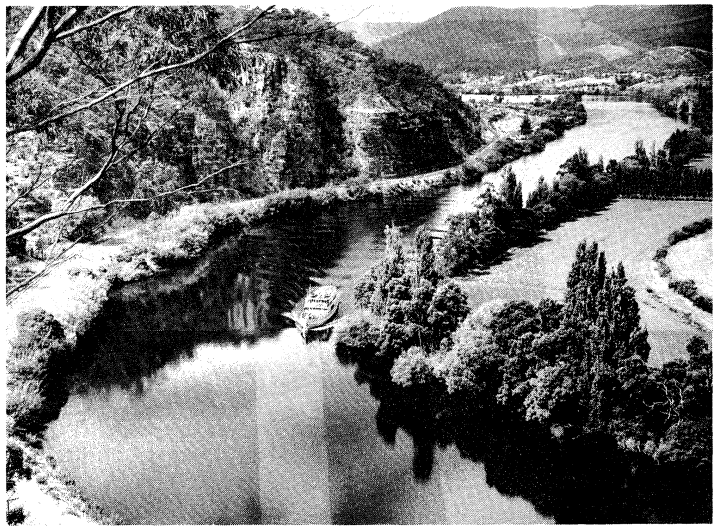
dervish, Arabic DARWĪSH, any member of a Ṣūfī (Muslim mystic) fraternity, or tariqa. Within the Ṣūfī fraternities, which were first organized in the 12th century, an established leadership and a prescribed discipline obliged the dervish postulant to serve his sheikh, or master, and to establish a rapport with him. The postulant was also expected to learn the *silsilah,* the spiritual line of descent of his fraternity.

The main ritual practiced by the dervish is the dhikr, which involves the repeated recitation of a devotional formula in praise of Allah as a means of attaining an ecstatic experience. The rituals of the Ṣūfī brotherhoods stress the dervishes' attainment of hypnotic states and ecstatic trances through ritual recitation and through such physical exertions as whirling and dancing. Dervishes can be either resident in community or lay members, both of these groups being generally drawn from the lower classes. In the Middle Ages, dervish communities played a vital role in religious, social, and political life in the central Islāmic lands, but their monasteries now are often under government control, and their theological standing is discounted by orthodox theologians. A wandering or mendicant dervish is called a fakir (faqir).

Derwent, River, river in North Yorkshire, England, that rises on Fylingdales Moor only 6 miles (10 km) inland from the North Sea

but flows 57 miles (92 km) through alternating gorges and vales to its junction with the River Ouse. This peculiar course results from the blockage of its former path by an ice sheet. Glacial overflow channels were cut through the tabular hills around Hackness at Langdale and Forge Valley and the Hawardian Hills near Malton. In contrast, the course through the vales of Pickering and York over thick glacial outwash and lacustrine deposits is strikingly flat. The name derives from the Celtic Dwrgent ("Clear Water").

Derwent River, river in Tasmania, Australia, rising in Lake St. Clair on the central plateau and flowing 113 miles (182 km) southeast to enter Storm Bay through a 3½-mile-(5½-kilometre-) wide estuary. Its major upper-course tributaries, the Jordan, Clyde, Ouse (now draining the Great Lake), and Dee, are extensively developed for hydropower. Hops are grown on irrigated alluvial terraces along its middle course, while in the rich farming area around New Norfolk fruit orchards predominate. The city of Hobart is situated on the estuary, 12 miles (19 km) from the river's mouth. This stretch of the river forms an excellent deepwater port and is spanned by



The Derwent River from Pulpit Rock, Tasmania
By courtesy of the Australian News and Information Bureau

the Tasman Bridge. The river was sighted and named Rivière du Nord by the French admiral Bruni d'Entrecasteaux in 1793 and later that same year was renamed after the River Derwent in England.

Derwent Water, lake, county of Cumbria, England, in the Lake District National Park. It is about 3 miles (5 km) long and from ½ to 1¼ miles (0.8 to 2 km) wide. Its maximum depth is 72 feet (22 m). The River Derwent enters its southern end from Borrowdale, its mountain-girded upper valley, and leaves the lake's northern end near the market town of Keswick, at the foot of Skiddaw. Several sites on the well-wooded shores are the property of the National Trust and are frequented by tourists. Lords Island, one of several in the lake, was once the residence of the earls of Derwent Water.

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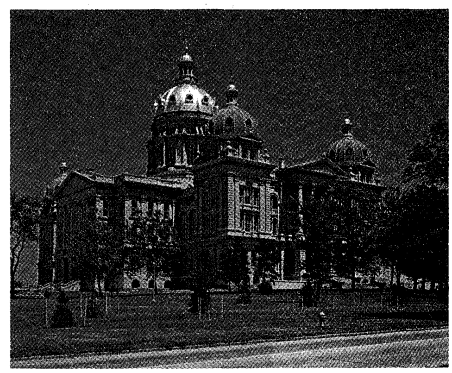
Derwentside, district, county of Durham, northeastern England. It occupies an area of 105 square miles (271 square km) in the north-central part of the county, about 12 miles (20 km) southwest of the city of Newcastle upon Tyne. Derwentside was a historically important coal-mining (mostly for coking) area of Great Britain encompassing an outlying section (400 to 1,000 feet [120 to 305 m] high) of the northeastern Pennines. Surface mining, often on the sides of steep hills, began in the 17th century; in the 19th and early 20th centuries exploitation became more intense with the completion of railroad lines to Newcastle upon Tyne and other nearby ports. Only three coal pits remained open in the late 20th century, and the remains of the small, stone-built collieries and terraces of former mining villages dot the countryside. The district's other sizable town, Stanley, 6 miles (10 km) east of Consett, has textile and steel-processing industries. Pop. (1985 est.) 86,300.

Derzhavin, Gavrila Romanovich (b. July 14 [July 3, Old Style], 1743, Kazan province, Russia—d. July 20 [July 8], 1816, Zvanka, Novgorod province, Russia), Russia's greatest and most original 18th-century poet, whose finest achievements lie in his lyrics and odes.

Born into an impoverished noble family, Derzhavin joined the army as a common soldier in 1762 and was made an officer in 1772. In 1777 he entered the civil service in St. Petersburg (now Leningrad), and during the next 26 years his posts included those of provincial governor at Olonets and Tambov, senator, and minister of justice. His *Oda k Felitse* (1782; "Ode to Felicia"), addressed to Catherine the Great, gained her favour, and he was, for a time, her private secretary. His liberal political inclinations finally put an end to his career in 1803, at which time he retired to his estate at Zvanka.

Derzhavin preserved the grandeur and solemnity of the classical ode as practiced in Russia but made it less restrictive and more lyrical and personal in its tone and subject matter. His odes are notable for the passages of magnificent imagery that they contain. Derzhavin worked in many other poetic genres, and his poems express both lofty and idealistic moralism and his strongly sensual appreciation of life. His work helped to break down the strictures of the classical poetic genres. His lyrics and odes include *Na smert knyazya Meshcherskogo* (1779; "On the Death of Prince Meshchersky"), *Bog* (1784; *Ode to the Deity*), and *Vodopad* (1791–94; "The Waterfall").

Des Moines, city, capital of Iowa, U.S., and seat (1845) of Polk County, in the south-central part of the state, in the heart of the Corn Belt. It is the focus of a metropolitan area that includes West Des Moines, Urbandale, and Pleasant Hill. Fort Des Moines was established in 1843 at the juncture of the Raccoon and Des Moines rivers to protect the rights of the Sauk and Fox Indians. The area was opened to white settlers in 1845. East Des Moines developed and by 1856 had amalgamated with Fort Des Moines to form the present city. The origin of the place-name is controversial; it is possibly a French corruption of the Indian name for the river, Moingona, or it may be derived from the French *de moyen* ("middle"), being midway between the Missouri and Mississippi rivers. When the



State Capitol, Des Moines, Iowa
By courtesy of the Iowa Development Commission

state capital was moved there from Iowa City in 1857, its growth was assured. The capitol (1871–96), in revived classical Roman style, stands in an 80-acre (32-hectare) park.

From 1910 to 1920 Des Moines expanded rapidly because of the development of local coal deposits. The state's largest city, it is a communication hub and also a major insurance, wholesaling, retailing, manufacturing (notably tires and farm implements), governmental, and publishing centre (especially for farm journals). Des Moines is the site of Grand View College (1896), Drake University (1881), College of Osteopathic Medicine and Surgery (1898), and the KRNT Theatre (one of the nation's largest theatres). Also in the city are the Iowa State Fair Grounds with Heritage Village (displaying early farm machinery and replicas of pioneer buildings) and the Iowa Museum of Agriculture. Living History Farms in Urbandale features a Pioneer Farm of 1840, a Horse Farm of 1900, and a modern farm. Inc. town, 1851; city, 1857. Pop. (1986 est.) city, 186,991; metropolitan area (MSA), 381,300.

Des Moines Register, The, morning daily newspaper published in Des Moines, Iowa, one of the most influential regional newspapers in the United States.

It was founded in 1856. It absorbed its older competitor, the *Des Moines Leader* (1849) in a merger in 1902, becoming the *Register and Leader.* In the following year, Gardner Cowles, Sr., bought the paper; in 1908 Cowles purchased an afternoon daily, the *Des Moines Tribune,* and publication of both papers—the morning *Register* and the afternoon *Tribune,* each with a separate editorial staff—continued under the Des Moines Register and Tribune Company. By 1927 the two remaining local competitors, the *Daily News* and the *Capital,* had gone out of business. Later in the century the separate *Tribune* was discontinued.

The Des Moines Register became famous for its editorials, its outstanding statewide news coverage, and its editorial cartoons. Its editorial cartoonist, J.N. ("Ding") Darling, was widely syndicated in the early 20th century. In 1925 Cowles engaged the young George Gallup to survey reader preferences—the first Gallup opinion poll.

Des Moines River, river rising in Lake Shetek in southwestern Minnesota, U.S., near Pipestone, and flowing 525 mi (845 km) in a southeasterly direction to join the Mississippi River 2 mi southwest of Keokuk, Iowa. Above

Humboldt, Iowa, the river is known as the West Fork. The East Fork and the Raccoon River are its principal tributaries. For a distance of 25 miles (40 km) above its mouth, the river serves as the boundary between Iowa and Missouri. Along its course, the river falls a total of 1,375 feet (419 m) and drains an area of 15,807 square miles (40,940 square km).

From the late 1830s until the close of the American Civil War, the Des Moines River was the main artery of commerce for central Iowa. A decline in river traffic came with the development of railroads. The river was early utilized for power, and, although none survive, 80 mills for grinding grain were built along its banks between 1840 and 1890. The Red Rock and Saylorville dams were authorized in 1958 for flood control. Major riparian cities include Ottumwa, Des Moines, Fort Dodge, and Estherville, all in Iowa.

Des Périers, Bonaventure (b. *c.* 1500, Arnay-le-duc, Fr.?—d. *c.* 1544, Lyon), French storyteller and humanist who attained notoriety as a freethinker.

In 1533 or 1534 Des Périers visited Lyon, then the most enlightened town of France and a refuge for many liberal scholars. He assisted Robert Olivétan and Lefèvre d'Étaples in the preparation of the vernacular version of the Old Testament and Étienne Dolet in the *Commentariorum linguae Latinae.* Margaret of Angoulême, queen of Navarre, made him her valet de chambre in 1536. He acted as her secretary and transcribed her *Heptaméron;* some writers have maintained that he in fact wrote the *Heptaméron.*

The free discussions permitted at Margaret's court encouraged a license of thought as displeasing to the Calvinists as to the Roman Catholics; it became skepticism in Des Périers's *Cymbalum Mundi* (1537; *Cymbalum Mundi: Four Very Ancient Joyous and Facetious Dialogues*), a brilliant and violent attack upon Christianity. The allegorical form of its four dialogues in imitation of Lucian did not conceal its real meaning, and the Sorbonne was able to have it suppressed (*c.* 1538), but it was reprinted in Paris in the same year. His book made many bitter enemies for Des Périers, who prudently left Paris and settled at Lyon. Tradition has it that he killed himself in 1544, but this is questionable.

His collected works, published in 1544, include his poems, the *Traité des quatre vertus cardinales après Sénèque* ("Treatise on the Four Cardinal Virtues After Seneca"), and a translation of Plato's *Lysis. Nouvelles récréations et joyeux devis* (*The Mirrour of Mirth and Pleasant Conceits,* or *Novel Pastimes and Merry Tales*), the collection of stories and fables on which his fame rests, appeared at Lyon in 1558. The stories are models of simple, direct narration in the vigorous, witty, and picturesque French of the 16th century.

Des Plaines, city, northwestern suburb of Chicago, Cook county, Illinois, U.S., on the Des Plaines River. Originally called Rand, for Socrates Rand from Massachusetts, who settled there in 1835, it was renamed after the river (French: "of the plains") in 1869. In 1925 Des Plaines annexed the village of Riverview. The community was primarily residential until the development in the 1950s of O'Hare International Airport (immediately south) stimulated its industrial growth. A campus of Oakton Community College opened in Des Plaines in 1980. Inc. village, 1873; city, 1925. Pop. (1988 est.) 55,882.

Des Plaines River, river rising in Kenosha county, southeastern Wisconsin, U.S., and flowing south into Illinois through the northwestern suburbs of Chicago to Forest View. It then continues southwest past Lockport and Joliet, where it joins the Kankakee River after a course of 110 miles (177 km). The Illinois River is formed by the confluence of the Des Plaines and Kankakee. In fur-trading days the Chicago River was linked by a short portage to the Des Plaines and Mississippi rivers. In 1900 the Metropolitan Sanitary District of Greater Chicago completed a drainage canal from the south branch of the Chicago River to the Des Plaines at Joliet (where it joined the Illinois and Michigan Canal). This, combined with work in the Chicago River, reversed the flow of the latter and permitted water from Lake Michigan to flow through the canal into the Des Plaines River and thence to the Illinois. A Great Lakes-to-Mississippi River waterway was opened in 1933. A branch of the canal system, extending from the Sag junction of the Calumet Sag with the Des Plaines River about 10 miles (16 km) north of Lockport eastward to Lake Calumet and connecting with Calumet Harbor, was widened in 1967.

Des Prés, Josquin (Renaissance composer): *see* Josquin des Prez.

Desaguadero River (Nicaragua): *see* San Juan River.

Desai, Morarji (Ranchhodji) (b. Feb. 29, 1896, Bhadeli, Gujarāt province, India), prime minister of India (1977–79).

The son of a village teacher, Desai was educated at the University of Bombay and in 1918 joined the provincial civil service of Bombay as a minor functionary. In 1930 he resigned to join Mohandas Gandhi's civil-disobedience movement and spent almost 10 years in British jails during the struggle for independence. During the 1930s and '40s he alternated prison service with ministerial posts in the government of Bombay, rising to the chief ministerial post in 1952. He gained a reputation for administrative skill as well as for harshness.

In 1956 Desai was named commerce and industry minister in the Indian government, for which he worked in high capacities until 1963, when he resigned. He became deputy prime minister in 1967. In 1969 he again resigned to become chairman of the opposition Congress Party working against Indira Gandhi. He was arrested in 1975 for his political activities and detained in solitary confinement until 1977, whereupon he became active in the coalition Janata Party. That same year, Prime Minister Indira Gandhi unexpectedly held elections after a 19-month suspension of political processes, and Janata achieved a surprising and overwhelming victory. Desai was chosen to be prime minister as a compromise candidate among Janata's leaders. After two years of political tension the Janata coalition, composed of four smaller parties, began to unravel. Desai announced his resignation on July 15, 1979, after numerous defections from the coalition in Parliament, to avoid a vote of no confidence.

"De," "la," and similar components of a name, when followed by a space, are alphabetized as separate words (e.g., *De Forest, Lee*). *When they are joined to the following part of a name, the combination is treated as a single word* (e.g., *DeForest, John William*).

Desaix de Veygoux, Louis-Charles-Antoine, also called CHEVALIER (knight) DE VEYGOUX (b. Aug. 17, 1768, near Riom, Fr.—d. June 14, 1800, Marengo [Italy]), French military hero who led forces in the German, Egyptian, and Italian campaigns of the French Revolutionary Wars (from 1792).

The son of Gilbert-Antoine Desaix, seigneur de Veygoux, he was known at first as the chevalier de Veygoux. A regular officer, he was compromised and imprisoned after Louis XVI's deposition but had the remarkable fortune in 1793–94 of being retained and promoted general by the deputies with the Army of the Rhine, in spite of orders from revolutionary Paris. He showed his worth in Germany at Strasbourg (1793), Mainz (1794), Mannheim (1795), and Bavaria (1796) and in the retreat through the Black Forest. After being wounded at the passage of the Rhine in 1797, he went to Italy to see Napoleon and in his *Journal de voyage* (ed. by A. Chuquet, 1907) admirably described the army and its chiefs. Desaix took a division to Egypt in 1798 and after the Battle of the Pyramids occupied upper Egypt against tough opposition from the Mamlūk Murad Bey.

Napoleon did not take Desaix back to France but called for him when he was conducting a negotiation for evacuating Egypt. Desaix was captured at sea and could not reach Napoleon until June 11, 1800, in Piedmont. Sent at once with two divisions toward Genoa, he had not gone far (because of floods) when he was called to the battlefield of Marengo (June 14). He was beginning the counterattack, which turned the battle to victory, when he was shot through the heart.

desalination, also called DESALTING, the removal of dissolved salts from seawater and in some cases from the brackish waters of inland seas, highly mineralized groundwaters (*e.g.,* geothermal brines), and municipal waste waters. This process renders such otherwise unusable waters fit for human consumption, irrigation, industrial applications, and various other purposes. Existing desalination technology requires a substantial amount of energy, and so the process is expensive. For this reason, it is generally used only where sources of fresh water are not economically available.

The desalting of seawater is an ancient notion. Aristotle described an evaporation method used by Greek sailors of the 4th century BC. An Arab writer of the 8th century AD produced a treatise on distillation. In the 19th century the development of steam navigation created a demand for noncorroding water for boilers; the first patent for a desalination process was granted in England in 1869. The same year, the first water-distillation plant was built by the British government at Aden, to supply ships stopping at the Red Sea port. The first large still to provide water for commercial purposes was built in 1930 in Aruba, the Netherlands Antilles, near Venezuela.

Distillation remains the most widely used desalination process. Either a multiple-effect or a flash evaporator may be used. The first consists of a series of evaporators in which salt water is heated and vaporized in long, vertical tubes. The hot vapour is used to heat salt water entering the next evaporator; in doing so, the vapour is cooled and condensed into fresh water. Because the multiple-effect evaporator reuses heat, it requires less fuel to treat incoming water than a single evaporator.

In flash evaporation, heated seawater is sprayed into a tank kept under reduced pressure. At this reduced pressure, the water vaporizes at a lower temperature, so that flash evaporators require less heat and thus less fuel. Multistage-flash distillation systems consist of a series of flash chambers operating at decreasing pressures. Such systems are more efficient and have greater capacity than single-stage units, and so are employed in very large desalination plants, such as the facility at al-Jubayl in Saudi Arabia that can produce 1,000,000 cubic m (264,000,000 gallons) of desalted water per day.

In regions where salt water and intense sunlight are both abundant, a simple distillation apparatus can be used. The heat of the Sun partially vaporizes salt water under a transparent cover; on the underside of the cover, the vapour condenses and flows into a collecting trough. The principal difficulty in this process

is concentrating the energy of the sunlight within a small area.

Membrane processes are usually used with brackish inland water, the salt content of which, though undesirable, is considerably below that of seawater. One such process is reverse osmosis, by which brine, subjected to pressure, is forced against a membrane; fresh water passes through while the concentrated mineral salts remain behind.

Another membrane process, electrodialysis, uses electrical potential to drive the positive and negative ions of the dissolved salts through separate semipermeable membranous filters, leaving fresh water between the filters.

Several desalting processes make use of the fact that when salt water is frozen, the ice crystals contain no salt. In practice, however, objectionable amounts of salt water remain trapped between the crystals, and the amount of fresh water needed to wash the salt water away is comparable to the amount of fresh water produced by melting the crystals.

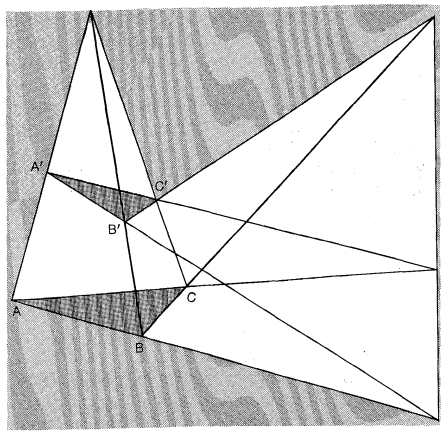
In the late 20th century, more than 8,000,000 cubic m (2,112,000,000 gallons) of fresh water were produced each day by several thousand desalination plants throughout the world. Distillation processes are used in about half of all the plants and account for roughly three-quarters of the world's desalted water. Most of the other plants employ membrane processes. The world's desalination capacity expanded rapidly during the 1970s and '80s as the oil-rich countries of the Middle East improved their standard of living, with attendant changes greatly increasing the consumption of fresh water. The Middle Eastern countries produce about 75 percent of all the world's desalinated water. The United States produces about 10 percent, and Europe and Africa each account for approximately 5 percent. The world's largest desalination plants are in the Arabian Peninsula.

Desargues, Girard (b. March 2, 1591, Lyon, Fr.—d. October 1661, France), French mathematician who introduced the principal concepts of projective geometry.

As an engineer, Desargues was a technical adviser to the cardinal de Richelieu and the French government. According to René Descartes's biographer, Adrien Baillet, Desargues served at the siege of La Rochelle in 1628, where he met Descartes. About 1630 Desargues became part of a group of mathematicians in Paris whose most noted member was Marin Mersenne. Desargues's *Traité de la section perspective* ("Treatise on the Perspective Section"), containing his theorem on the perspective of two triangles, was published in 1636 but was not appreciated by his contemporaries.

Desargues's most important work, *Brouillon project d'une atteinte aux événemens des rencontres d'un cône avec un plan* (1639; "Proposed Draft of an Attempt to Deal with the Events of the Meeting of a Cone with a Plane"), presents innovations in projective geometry as applied to the theory of conic sections. It significantly influenced one of his disciples, the French mathematician Blaise Pascal. Unfortunately, Desargues embodied in his *Brouillon project* a unique system of mathematical terms derived from botanical names and failed to include Cartesian symbolism, thus ensuring two centuries of obscurity for his work. Only with the discovery of a handwritten copy in 1845 and the ensuing rebirth of interest in projective geometry was his contribution fully recognized. He also published a short manual on musical composition (1636) and a treatise on stonecutting (1640).

Desargues's theorem, in geometry, mathematical statement discovered by the French mathematician Girard Desargues in 1639 that motivated the development, in the first quarter of the 19th century, of projective geometry by another French mathematician, Jean-Victor Poncelet. The theorem states that if two triangles ABC and A′B′C′, situated in three-dimensional space, are related to each other in such a way that they can be seen perspectively from one point (*i.e.,* the lines AA′, BB′, and CC′ all intersect in one point), then the points of intersection of corresponding sides all lie on one line (*see* Figure), provided that no two corresponding sides are parallel. Should this last case occur, there will be only two points of intersection instead of three, and the theorem must be modified to include the result that these two points will lie on a line parallel to the two parallel sides of the triangles. Rather than modify the theorem to cover this special case, Poncelet instead modified Euclidean space itself by postulating points at infinity, which was the key for the development of projective geometry. In this new projective space (Euclidean space with added points at infinity), each straight line is given an added point at infinity, with parallel lines having a common point. After Poncelet discovered that Desargues's theorem could be more simply formulated in projective space, other theorems followed within this framework that could be stated more simply in terms of only intersections of lines and collinearity of points, with no need for reference to measures of distance, angle, congruence, or similarity.



Desargues's theorem

Desbordes-Valmore, Marceline (b. June 30, 1786, Douai, Fr.—d. July 23, 1859, Paris), French poet and woman of letters of the Romantic period.

Marceline Desbordes-Valmore, detail of a drawing by Carrière, 1823

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Her family was ruined by the French Revolution and moved to the French colony of Guadeloupe. She returned to Paris upon her mother's death, supporting herself by acting at the Opéra-Comique and the Odéon. She married a second-rate actor, Prosper Lanchantin, called Valmore.

When illness threatened her stage voice, Desbordes-Valmore turned to writing. Her poetry—*Pauvres Fleurs* (1839; "Poor Flowers"), *Les Pleurs* (1833; "The Tears"), and *Bouquets et prières* (1843; "Bouquets and Prayers")—is poignant and elegiac and concerns religion, sadness, death, and the author's love for her daughters and her native Douai. Her prose work *L'Atelier d'un peintre* (1833; "A Painter's Studio") is autobiographical. The poet Charles Baudelaire esteemed her writing, and Paul Verlaine admitted his debt to her, giving her a place in his *Poètes maudits* (1884; "Damned Poets").

Desborough, John, Desborough also spelled DESBOROW, or DISBROWE (baptized Nov. 13, 1608, Eltisley, Cambridgeshire, Eng.—d. 1680, London), English soldier, Oliver Cromwell's brother-in-law, who played a prominent part in Commonwealth politics.

Desborough married Cromwell's sister Jane in June 1636. He was a member of Cromwell's cavalry regiment at the beginning of the Civil War and distinguished himself in succeeding campaigns. He fought at the Battle of Worcester (September 1651) as major general and almost captured Charles II near Salisbury.

During the Commonwealth, Desborough held many high offices and was a member of the Parliaments of 1653, 1654, and 1656. In 1655 he was the major general in charge of administering the six western counties of England. In spite of his near relationship to Cromwell, Desborough violently opposed the suggestion that Cromwell should assume the crown. After Cromwell's death he was, with Charles Fleetwood, the chief instigator and organizer of the hostility of the army toward Richard Cromwell's administration and forced Cromwell to dissolve his Parliament in April 1659.

After the Restoration Desborough escaped to the Netherlands, where he engaged in republican intrigues. He was ordered home in April 1666, on pain of incurring the charge of treason, and was imprisoned in the Tower of London from July 1666 to February 1667.

descant (from Latin *discantus,* "song apart"), also spelled DISCANT, countermelody either composed or improvised above a familiar melody. Descant can also refer to an instrument of higher-than-normal pitch, such as a descant recorder. In late medieval music, discantus referred to a particular style of organum featuring one or more countermelodies added to a newly rhythmicized plainsong melody. Discantus in this sense is usually spelled discant in English translation.

Descartes, René, Latin RENATIUS CARTESIUS (b. March 31, 1596, La Haye, Touraine, Fr.—d. Feb. 11, 1650, Stockholm, Swed.), French mathematician, scientist, and philosopher who has been called the father of modern philosophy. He radically distinguished between the mind, which he perceived as indubitable, and the body (or matter in general), which he explained on the basis of purely mechanistic principles. The axiom *Cogito, ergo sum* ("I think, therefore I am") is his most famous formulation.

A brief treatment of René Descartes follows. For full treatment, *see* MACROPAEDIA: Cartesianism, Descartes and.

An exceptionally intelligent boy, Descartes was sent at the age of eight to the newly opened Royal College at La Flèche, where for 10 years he received a Jesuit education, revealing a marked inclination toward mathematics. In 1616 he took a degree in law at the University of Poitiers. In 1618 Descartes joined the army of the Prince of Orange in Holland, where he met Isaac Beekman, who exposed him to many recent developments in mathematics. After a period of travel, he joined for a time the army of the Duke of Bavaria in 1619, in the early stages of the Thirty Years' War. It was in March of that year that he first described the idea of a unitary universal

science that would link all possible human knowledge together into an all-embracing wisdom. On November 10, according to Descartes, a visionary dream revealed the nature of this science more clearly. Interpretation of this episode has remained controversial. Descartes's life continued to remain peripatetic until 1628, when he moved to Holland, where he was to live, except for short absences, until 1649.

During this period in Holland he composed the works that made him famous in his own time and influenced succeeding ages. The *Discours de la méthode* (1637; *Discourse on Method*), his most widely read work, sets forth four rules for the pursuit of knowledge: to accept nothing as true unless clearly recognized as such; to solve problems systematically by analyzing them part by part; to proceed from simple to more complex considerations; and to review everything thoroughly to make sure that nothing has been omitted. In addition, the *Discourse* presents the metaphysical foundations of his doctrine. The universal application of doubt it describes culminates in the self-evident certainty (*cogito ergo sum*) from which all his philosophical propositions derive. The *Meditationes de prima philosophia* (1641; *Meditations on First Philosophy*) further develops the metaphysical doctrine of the *Discourse*. The *Principia philosophiae* (1644; *Principles of Philosophy*) attempts to give a logical account of all natural phenomena in one single system of mechanical principles. *Les Passions de l'âme* (1649; *Passions of the Soul*) outlines his ethical views.

In September 1649 Descartes left Amsterdam to serve as instructor to Queen Christina of Sweden. He died the following winter of complications from a severe chill.

descent, the system of acknowledged social parentage, which varies from society to society, whereby a person may claim kinship ties with another. If no limitation were placed on the recognition of kinship, everybody would be kin to everyone else; but in most societies some limitation is imposed on the perception of common ancestry, so that a person regards many of his associates as not his kin.

The practical importance of descent comes from its use as a means for one person to assert rights, duties, privileges, or status in relation to another person, who may be related to the first either because one is ancestor to the other or because the two acknowledge a common ancestor. Descent has special influence when rights to succession, inheritance, or residence follow kinship lines.

One method of limiting the recognition of kinship is to emphasize the relationships through one parent only. Such "unilineal" kinship systems, as they are called, are of two main types—patrilineal (or agnatic) systems, in which the relationships through the father are emphasized; and matrilineal (or uxorial) descent systems, in which the maternal relationships are stressed.

In systems of double unilineal descent, patrilineal and matrilineal principles operate in the same society, and there are two series of enduring groups, a person belonging to groups in each series. Ambilateral (or ambilineal) descent systems are those in which membership in a kinship group may be claimed through either parent.

Unilineal systems differ radically from so-called cognatic systems, in which everyone has obligations and duties of much the same kind toward both his paternal and maternal kin and, conversely, can expect rights and privileges from them. Thus, whereas in a matriliny, for example, a person would feel cousin obligations only to the children of his mother's siblings, in a cognatic system he is in some sense allied to the children of both parents' siblings. The practical significance of this cognatic system may be either that an individual establishes claim on another person of common descent or that he enjoys some status or privilege by virtue of his lineage or descent. Both structurally and in terms of rights and duties, the cognatic system is vague and tends to characterize the more industrialized countries, in which individual rights and duties are defined to an increasing extent institutionally or legally.

Deschamps (de Saint-Amand), Émile (b. Feb. 20, 1791, Bourges, Fr.—d. April 23, 1871, Versailles), poet prominent in the development of Romanticism.

Deschamps's literary debut came in 1818, when, with Henri de Latouche, he produced two plays. Five years later, with Victor Hugo, he founded *La Muse française,* the journal of the Romantic, and the preface to his *Études françaises et étrangères* (1828) formed a manifesto of the movement. His translations of *Romeo and Juliet* (1839) and *Macbeth* (1844), though never performed, were also important. He wrote several libretti, notably that for Berlioz' *Roméo et Juliette,* and his prose works include *Contes physiologiques* (1854) and *Réalités fantastiques* (1854).

Deschamps, Eustache, byname MOREL (French: "Nightshade") (b. *c.* 1346, Vertus, Fr.—d. *c.* 1406), poet and author of *L'Art de dictier* (1392), the first treatise on French versification.

The son of middle-class parents, Deschamps was educated in Reims by the poet Guillaume de Machaut, who had a lasting influence on him. After law studies in Orléans, he held administrative and diplomatic posts under the kings Charles V and VI. His leisure was devoted to poetry, and he was immensely prolific, producing farces, traditional love poetry, and satires—notably a satire on women.

By his own description, Deschamps was jovial and good-humoured. The Hundred Years' War embittered him, however, and his later poetry is a realistic reflection of his times, showing sympathy for the sufferings of the people and affection for his country. He influenced the English poet Geoffrey Chaucer, to whom he addressed a ballade.

Deschanel, Paul(-Eugène-Louis) (b. Feb. 13, 1855, Brussels—d. April 28, 1922, Paris), French political figure who was an important parliamentary leader during the Third Republic and served as its 10th president (Feb. 17 to Sept. 20, 1920).

Deschanel was a brilliant student of philosophy, law, and literature who chose to combine journalism and politics for a career. After a brief term in the prefectorial administration, he was elected to the Chamber of Deputies from the Eure-et-Loir *département* (1885). He took a seat with the Progressive Republicans and concentrated on social problems and foreign affairs. He was elected to the Académie Française in 1899 and throughout his life continued to write books on politics and literature, including *La Question sociale* (1898), *Orateurs et hommes d'état* (1888), *Essai de philosophie politique* (1899), and *Gambetta* (1920).

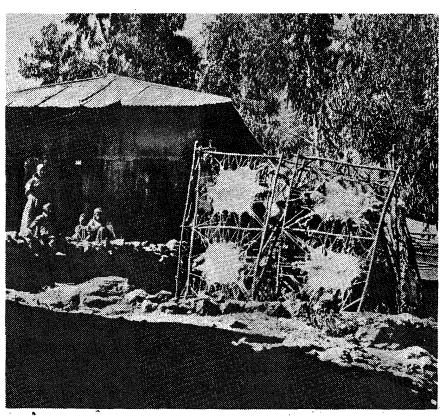
Deschanel
H. Roger-Viollet—Harlingue

Deschanel served two terms as president of the Chamber of Deputies (1898–1902; 1912–20). When he was elected president of the republic, he was the first person with no prior ministerial experience to attain that post. His brief term was marked by ministerial instability and his own deteriorating health, which forced his resignation after only seven months.

descloizite, vanadate mineral containing lead, copper, and zinc that usually forms brownish red to blackish brown crusts of intergrown crystals or rounded fibrous masses; its physical appearance is varied, however, and specimens have been found in shades from orange-red to black and various greens. The chemical formula for descloizite is $(Zn,Cu)PbVO_4(OH)$. Descloizite forms a solid-solution series with the similar mineral mottramite, in which copper replaces zinc in the crystal structure. These minerals occur with vanadinite in the oxidized zone of copper and lead deposits, as in the Otavi region, Namibia, where they are abundant; San Luis Potosi, Mex.; Baden, Ger.; and New Mexico. For detailed physical properties, *see* vanadate mineral (table).

descriptive ethics: *see* comparative ethics.

Dese, also spelled DESSYE, or DESSIE, town, central Ethiopia, situated on the western escarpment of the Great Rift Valley at an elevation of 7,500 feet (2,300 m). Dese (Amharic: "My Joy") is a commercial and communications centre, 16 miles (25 km) northwest of Kembolcha, which is at the junction of roads to Asmera, Addis Ababa, and Aseb. Dese is a long-established market for grains, oilseeds, hides, skins, honey, and beeswax and a distribution centre for imported goods. It also has artisan industries and flour mills. Pop. (1984 prelim.) 68,848.



Drying skins in Dese, Eth.
Victor Englebert—De Wys Inc.

Deseado River, Spanish RÍO DESEADO, river in southern Argentina, rising in Buenos Aires Lake in the Andes of southern Chile and Argentina. It flows generally eastward and southeastward through Santa Cruz province. Near Koluel Kayke and Jaramillo it sometimes disappears into the dry soils of Patagonia, but it reemerges and empties into the Atlantic at Puerto Deseado. The total length of the Deseado is approximately 380 miles (610 km). It is used for irrigation along its lower course.

desensitization, also called HYPOSENSITIZATION, treatment that attempts to eliminate allergic reactions, as of hay fever or bronchial asthma, by a series of injections in graded strengths of the substance to which the person is sensitive (*e.g.,* pollen, house dust). Extracts of the material to be injected are purified and put into an alkaline buffer solution, to which epinephrine (adrenaline) is often added to

minimize local inflammatory reactions. The first injections contain little antigen, but, as desensitization progresses, more and more is added. A three-month program of injections often suffices for hay-fever sufferers, but asthmatics may require a longer program.

Desensitization is successful in about 80 percent of hay-fever sufferers and up to 90 percent of asthmatics; treatment is more effective in persons with a few, well-defined allergies than in those allergic to many substances. The success of desensitization is attributed to special antibodies, called blocking antibodies, that appear in the serum after treatment and combine preferentially with allergen. This prevents the reaction of allergen with allergic antibodies in the skin and precludes an allergic reaction. Desensitization can also be required when a penicillin-sensitive person contracts a disease such as bacterial endocarditis, which is best treated with penicillin. *See also* allergy; anaphylaxis; antigen; antibody.

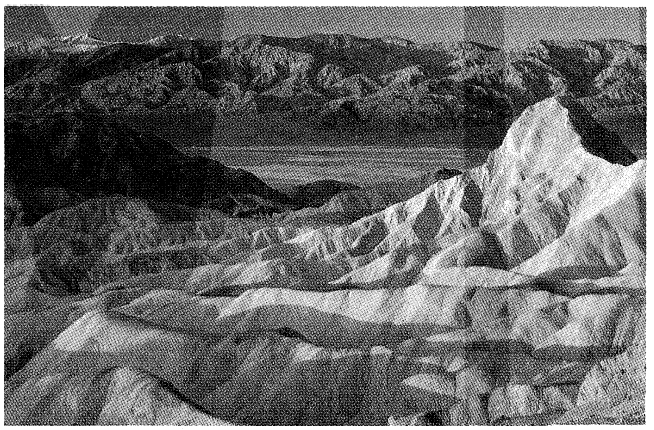
Deseret News, The, daily newspaper published in Salt Lake City, Utah, by the Church of Jesus Christ of Latter-day Saints (Mormons). It was founded as a biweekly in 1850. The word Deseret means "Land of the Honey Bee," according to the Book of Mormon, and was to have been the name of the anticipated Mormon state. *The Deseret News* was forced to move from Salt Lake City to Fillmore, Utah, during the armed conflicts of 1857–58. Partly because newsprint was scarce, *The Deseret News* did not become a daily until 1867. It is one of the few successful religious dailies in the English language. In addition to church news *The Deseret News* carries world news, much of it from news agencies.

desert, any large, extremely dry area of land with fairly sparse vegetation. It is one of the Earth's major types of ecosystems, supporting a community of distinctive plants and animals specially adapted to the harsh environment.

A brief treatment of deserts follows. For full treatment, *see* MACROPAEDIA: Biosphere. For a detailed discussion of the topographic features associated with the desert environment and the processes responsible for their evolution, *see* Continental Landforms; Geomorphic Processes.

The level of aridity commonly used to delimit desert areas is a mean annual precipitation value equal to 250 mm (10 inches) or less. Approximately 5 percent of the Earth's land surface receives such limited rainfall. Deserts are concentrated in high-latitude, circumpolar areas and in two discontinuous, Earth-girdling bands at middle and low latitudes. The high-latitude cold deserts include the perennial ice deserts of Antarctica and Greenland and portions of the seasonally snow- and ice-free tundra of North America and Eurasia. Precipitation is meagre in these polar regions, with various areas receiving only up to about 127 mm (5 inches) annually. The desertlike, rocky, barren lands within the tundra, however, result from complex causes that are partially but not entirely related to aridity, because most tundra areas are adequately supplied with water during the short, cool growing season.

Hot, arid regions furnish examples of the most familiar desert features. These regions have little physical or biological relationship to cold polar deserts. Tropical deserts, occurring between about 15° and 30° north and south of the equator, include the Sahara of northern Africa, the Sind of the Indian subcontinent, the Victoria of Australia, and the Kalahari of southwestern Africa. These deserts owe their origin and location largely to aridity that results from the high moisture-holding capacity of air warmed by compression as it descends from the high-pressure belt of the horse latitudes to the belt of tropical trade winds. Decreased precipitation and extraordinarily high rates of evaporation are the two main factors that combine to desiccate the land, particularly on the western sides of the continents.



Desert terrain in Death Valley, California, showing (front to back) badlands, the valley floor, and the Panamint Range
Larry Ulrich/DRK PHOTO

The Gobi and Takla Makan deserts of central Asia are deep within continental interiors far from moisture-laden winds, whereas the deserts east of the Andes in southern Argentina exemplify the rain-shadow effect created by high mountains lying across the path of moist winds.

Climatic conditions are characteristically extreme in all deserts, and variations are considerable from one to another. Differences in seasonal temperature regimes sharply differentiate tropical from mid-latitude deserts. Seasonal as well as diurnal temperature ranges are greatest in the latter. For example, in the Gobi, winter winds are violent and severe blizzards common, and parts of this area may have mean temperatures below freezing for as many as six months each year. But during the hottest months the air temperature may average 41° to 43° C (105° to 110° F). A distinguishing characteristic of most arid climates is variability of precipitation. Several years may elapse without any measurable rainfall, only to be followed by a deluge. In general, such variability is inversely related to the mean annual precipitation, increasing as the total rainfall decreases.

Desert terrain may consist of rugged mountains, high plateaus, or plains. A large number of deserts occupy broad mountain-rimmed basins, which are known as bolsons in certain regions. Surface materials in deserts include bare bedrock, plains of gravel and boulders, and vast tracts of shifting sand. Wind-blown sands, commonly thought to be typical of deserts, make up only about 2 percent of North American deserts, 10 percent of the Sahara, and 30 percent of the Arabian desert.

Outside of the polar regions, desert landscapes are primarily shaped by weathering, eolian, and fluvial processes. Rock fragmentation occurs principally as a result of expansion and contraction induced by wide temperature fluctuations. Winds transport enormous clouds of dust and impel large quantities of sand along the ground, all particles behav-

Deserts of the world

desert (location)	area	
	square miles	square km
Africa		
Sahara (northern Africa)	3,320,000	8,600,000
Libyan (Libya, Egypt, and Sudan)	...	...
Kalahari (southwestern Africa)	100,000	260,000
Namib (southwestern Africa)	52,000	135,000
America, North		
Great Basin (southwestern United States)	190,000	492,000
Chihuahuan (northern Mexico)	175,000	450,000
Sonoran (southwestern U.S. and Baja California)	120,000	310,000
Colorado (California, U.S., and northern Mexico)	...	...
Yuma (Arizona, U.S., and Sonora, Mexico)	...	...
Mojave (southwestern United States)	25,000	65,000
America, South		
Patagonian (southern Argentina)	260,000	673,000
Atacama (northern Chile)	54,000	140,000
Asia		
Arabia (southwestern Asia)	900,000	2,330,000
Rub'al-Khali (southern Arabian Peninsula)	250,000	650,000
Gobi (Mongolia and northeastern China)	500,000	1,300,000
Kyzylkum (southwestern U.S.S.R.)	115,000	300,000
Takla Makan (northern China)	105,000	270,000
Kara-Kum (southwestern U.S.S.R.)	135,000	350,000
Kavīr (central Iran)	100,000	260,000
Syrian (Saudi Arabia, Jordan, Syria, and Iraq)	100,000	260,000
Thar (India and Pakistan)	77,000	200,000
Lūt (eastern Iran)	20,000	52,000
Australia		
Great Victoria (Western and South Australia)	250,000	647,000
Great Sandy (northern Western Australia)	150,000	400,000
Gibson (Western Australia)	...	...
Simpson (Northern Territory)	56,000	145,000

ing as abrasive tools that carve, facet, and polish rocks. Continued removal of fine materials produces deflation basins with surfaces of residual gravel and boulders. Infrequent rains of high intensity and short duration cause flash floods, which rush from highlands as sheet floods or as torrents raging through usually dry arroyos or wadis. Flowing at high velocity, streams transport large quantities of mud, sand, and rock debris short distances into the desert basins before the water is dissipated by penetration into the ground and by evaporation. Centripetal drainage of bolsons often produces pediments consisting of upper eroded bedrock surfaces and lower undulating slopes of coalescing alluvial fans. Mineral salts leached from the highlands are carried to the centre of the basins, where they accumulate in ephemeral lakes that, lacking outlets to the sea, become increasingly saline.

Plant and animal populations tend to differ qualitatively and quantitatively in various deserts, but all possess physiological and behavioral traits that favour obtaining and conserving a meagre water supply. Plants are primarily low growing, thorny, small leaved or leafless, grayish to light green in colour, with extensive and, in most cases, deep roots. Reduced surfaces, daytime closure of stomata, water-impervious cuticle and waxy coatings, and succulent organs that accumulate large quantities of water are genetic characteristics of importance to perennial species. Drought-evading, ephemeral annuals, dormant during dry periods, appear in profusion after rains. The dominant xerophytic (adapted to arid habitats) plants include agaves, cacti, composites, and yuccas.

Typical desert fauna consists of insects (and arthropods), reptiles, birds, many rodents, and a few larger mammals. Nocturnal habits are well-developed characteristics among the rodents, but most desert birds and reptiles are diurnal. The majority of animals drink water when it is available, but in its absence they depend on water obtained by eating succulent plants or the blood and other tissues of their prey. Many insects and some rodents (*e.g.*, the kangaroo rat and pocket mouse) utilize metabolic water, and even the camel derives a significant water supply from oxidation of fats accumulated in its hump. Conservation of water is accomplished in diverse ways. Reptiles and some insects have water-impervious integuments, mammals concentrate urine by reabsorption of water before excretion, and reptiles excrete nitrogenous waste as uric acid crystals without water loss. Nocturnal habits permit avoidance of water stress, and some animals, such as the ground squirrel, estivate during extreme heat and drought.

Desert Artesian Basin (Australia): *see* Canning Basin.

Desert cultures, in North America, ancient cultures centred on the Great Basin in the area of Nevada, Utah, and Arizona; they lasted from about 7000 or 8000 BC to about 2000 BC. Subsistence was based on gathering wild seeds and plants and on hunting small game; social groups were probably small and nomadic. The people used baskets, nets, crude milling stones, simple bone tools, and stemmed or notched chipped-stone projectile points. *See also* Cochise culture.

desert dormouse (rodent): *see* Selevin's mouse.

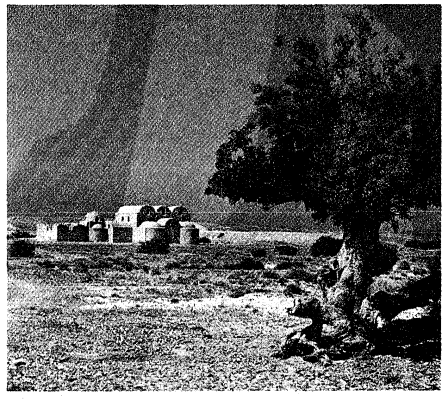
Desert Fathers, early Christian hermits whose practice of asceticism in the Egyptian desert, beginning in the 3rd century, formed the basis of Christian monasticism. One of these hermits, Pachomius of the Thebaid (*c.* AD 290–346; *see* Pachomius, Saint), who organized nine monasteries for men and two for women, is credited with being the founder of cenobitic (communal) monasticism in the Western world.

Following the example of Jesus' life of poverty, service, and self-denial, the early monks devoted themselves to vows of austerity, prayer, and work. Believers who chose to go into the desert as hermits were said to be answering the call of Christ: "Jesus said to him, 'If you would be perfect, go, sell what you possess and give to the poor, and you will have treasure in heaven; and come, follow me' " (Matt. 19:21). *See* monasticism.

Desert Fox, The (German field marshal): *see* Rommel, Erwin.

desert lynx: *see* caracal.

desert palace, any country dwelling built in Syria, Jordan, and Palestine by Umayyad (AD 661–750) rulers and aristocrats. At one time the complexes were thought to be rural retreats for nomadic rulers and members of ruling families who tired of city life, but, because all of these desert residences now seem to have been located on irrigated estates, in military encampments, and at trade centres, they appear to have served as forts and hunting lodges as well. Besides living quarters, most include a mosque, baths, and an official hall that may have been a throne room or an entertainment room.



Umayyad desert palace at Qaṣr 'Amrah, Jordan, 712–715
Holle Bildarchiv

Many of the remaining palaces are known for their rich decoration, which often resembles, in larger scale, the patterned textiles used to ornament nomadic tents. The elaborate vaults and domes of the baths at Khirbat al-Mafjar; the carved stucco facade of Qaṣr al-Ḥayr; the limestone frieze at Mshattā; and the frescoes at Qaṣr 'Amrah are some of the best known features of the extant desert palaces.

desert pavement, surface of angular, interlocking fragments of pebbles, gravel, or boulders in arid areas. Desert pavement forms on level or gently sloping desert flats, fans, or bajadas and old Pleistocene lake and river terraces.

The percolation of the infrequent precipitation tends to cause lateral and downslope movement of silt particles beneath the surface of the ground. This leads to the concentration of gravel, and this process is enhanced by the constant removal of fine sediment at the surface by wind action. Gravel concentrations in desert areas are sometimes called lag gravels, in reference to the residue left by the removal of fine material. Pavements, therefore, are produced by the combined effects of water and wind. Evaporation of capillary water may cause the precipitation of calcium carbonate, gypsum, and other salts that cement the pebbles together to form a desert conglomerate. The pebbles are often so packed and smooth that no more wind deflation can occur, and such areas in the Sahara are generally followed by caravan routes. A similar area is the hamada (or hammada), in which wind has removed most of the material, leaving only bare rock surfaces scattered with large rocks.

desert varnish, also called PATINA, thin, dark red to black mineral coating (generally iron and manganese oxides and silica) deposited on pebbles and rocks on the surface of desert regions. As dew and capillary water evaporate, their dissolved minerals are deposited on the surface; studies indicate that the varnish materials are generally extracted from the surrounding rock and earth material. Wind abrasion removes the softer salts and polishes the patina to a glossy finish. The rate of formation varies; varnish is generally considered to have required about 2,000 years for its formation in arid areas, because it coats artifacts and natural objects known to be of such antiquity. Varnish has formed in less than 50 years in the Mojave Desert, however. Both high evaporation rates and sufficient precipitation are necessary for desert varnish formation.

Desértica de Moçâmedes (Angola): *see* Moçâmedes Desert.

desertification, also called DESERTIZATION, spread or encroachment of a desert environment into arid or semiarid regions, caused by climatic changes, human influence, or both. Climatic factors include periods of temporary but severe drought and long-term climatic changes toward aridity. Human factors include the artificial alteration of the climate, such as degradation of the biological environment in arid regions by removing vegetation (which can lead to unnaturally high erosion), excessive cultivation, and exhausting surface or groundwater supplies for irrigation or industry, strip-mining, etc.

Desertification drains an arid or semiarid land of its life-supporting capabilities. The process is characterized by a declining groundwater table, salinization of topsoil and water, diminution of surface water, increasing erosion, and the disappearance of native vegetation. Areas undergoing desertification may show all of these symptoms, but the existence of only one is usually evidence enough that the process is taking place. Desertification usually begins in areas made susceptible by drought or overuse by human populations and spreads into arid and semiarid regions.

Desertification is not limited to non-desert regions. It can also occur in areas within deserts where a delicate balance exists between wildlife and plant populations. The Sonoran and Chihuahuan deserts of the southwestern United States, for example, have become observably more barren in the last 100 years as the wildlife and plant populations have diminished.

Public awareness of desertification increased during the severe drought in the Sahel in Africa (1968–73), a drought that accelerated the southward movement of the Sahara (desert). In 1977 the worldwide consequences of desertification were the subject of a UN Conference on Desertification (UNCOD), held in Nairobi, Kenya.

Desgarcins, Magdeleine-Marie, original name LOUISE DESGARCINS (b. 1769, Mont Dauphin, Fr.—d. Oct. 27, 1797, Paris), one of the greatest of French tragediennes.

Desgarcins made her debut at the Comédie-Française in Jean Racine's *Bajazet* (1788) and was at once made a full member of the company. When the conflicts of the Revolution caused a split in the company in 1791, she and François Talma, with whom she usually appeared, formed a new company in which she triumphed in *King Lear*, *Othello*, and La Harpe's *Mélanie et Virginie*. She died insane.

Deshoulières, Antoinette du Ligier de la Garde (b. Jan. 1, 1638, Paris—d. Feb. 17, 1694, Paris), French poet who, from 1672 un-

til her death, presided over a salon that was a meeting place for the prominent literary figures of her day. She was also a leading member of the coterie that attacked Jean Racine's *Phèdre.*

Deshoulières's poems, the first of which were published in the *Mercure Galant* in 1672, were appreciated throughout the 18th century, her idylls and eclogues being especially popular. Her early poems celebrate the simple joys of nature and mark the small and large events in the lives of French royalty. Her later poems describe her sufferings from old age, cancer, and poverty; if she is still read today, it is for these later, sombre works. In addition to poems, Deshoulières wrote an opera, *Zoroastre* (1680), and two tragedies, *Jules-Antoine* and *Genséric* (1680); the latter was at one time attributed to the Duke of Nevers.

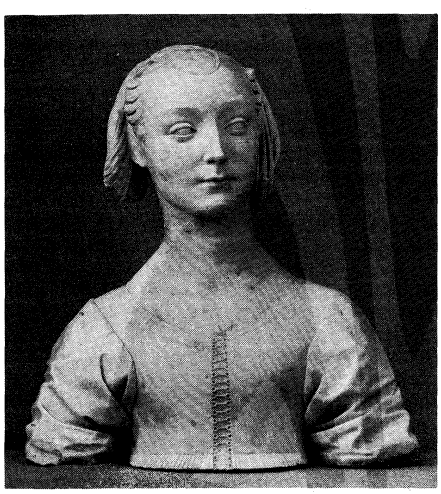
Desiderio DA SETTIGNANO (b. *c.* 1430, Settignano, Republic of Florence—d. January 1464, Florence), Florentine sculptor whose works, particularly his marble low reliefs, were unrivalled in the 15th century for subtlety and technical accomplishment.

Desiderio was raised in a family of stone masons and entered the Stone and Wood Carvers' Guild of Florence in 1453. Little is known about his education, although he was influenced by the Italian relief sculptor Donatello.

Desiderio's delicate, sensitive, highly original style is perhaps most exquisitely manifest in his sensuous portrait busts of women and children. These lyrical pieces convey a wide range of moods and emotions, from joy and charm to melancholy and pensiveness. His sense of design and highly refined skill as a marble cutter established him as a master of low reliefs. Some of the most notable are his studies of the Madonna and Child, St. John, and Christ as an infant.

Sometime after 1453 Desiderio designed and carved the monument of the Humanist Carlo Marsuppini in the church of Sta. Croce in Florence. With its rich architectural detail and its admirable effigy, this tomb is exceptionally important in the history of Florentine wall monument. He carved the frieze of heads for Filippo Brunelleschi's Pazzi Chapel in Florence sometime after 1451 and completed the marble Altar of the Sacrament in S. Lorenzo, Florence (1461), which is considered to be one of the decorative masterpieces of the 15th century.

Desiderio masterfully employed the technique of *rilievo stiacciato* (low, or flattened, relief) in a style related to that of Donatello. The delicacy of contrast in his carvings gives his surfaces a glowing, ethereal quality, as seen in his "Angel from the Altar of the Sacrament" (1458–61) and many of his busts of women.



"Bust of a Young Lady," marble, by Desiderio da Settignano, *c.* 1460–64; in the Staatliche Museen Preussischer Kulturbesitz, Berlin

By courtesy of the Staatliche Museen Preussischer Kulturbesitz, Berlin-Dahlem

Desiderius (pope): *see* Victor III, Blessed.

design, the process of developing plans or schemes of action; more particularly, a design may be the developed plan or scheme, whether kept in mind or set forth as a drawing or model. Thus, one can speak of Napoleon's designs on Europe and of the designs for next year's automobiles. The execution of a plan is not, properly, designing, except insofar as the plan may continue to develop in order to meet originally unanticipated requirements. Similarly, the end result is not a design, but it is reasonable to speak of its design, that is, of the antecedent plan or scheme discoverable in it, as in the design of Dante's *Divine Comedy.*

A plan or scheme as the pattern for making a product indicates primarily an interrelation of parts intended to produce a coherent and effective whole, ordinarily planned with four limiting factors in mind: the capacities of the materials employed, the influence of methods adapting these materials to their work, the impingement of parts within the whole, and the effect of the whole on those who may see it, use it, or become involved in it. Design in the sense of pattern for making a product has become a synonym for work in the applied arts, and a designer is one who practices them. Design in the fine arts is often considered to be the creative process per se, while in engineering, on the contrary, it may mean a concise record of the embodiment of appropriate concepts and experiences. In architecture and product design the artistic and engineering aspects of design tend to merge; that is, an architect, craftsman, or graphic or industrial designer cannot design according to formulas alone, nor as freely as can a painter, poet, or musician.

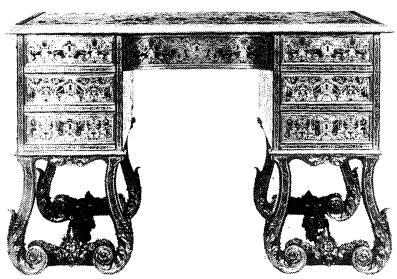
Design is a word used loosely in all the arts, and particularly in their instruction, to mean composition, style, or decoration. Composition is the framework of relationships in a thing, considered analytically in isolation from the parts and from the whole; this is the meaning of phrases like "the design of Raphael's 'Sistine Madonna'." Neoclassical design means the Neoclassical style of design. An all-over design is a regularly repeated decoration covering an expanse. Such loose, localized uses of the word are usually comprehensible in context but may confuse readers or listeners who correctly suspect that design in aeronautics, for example, is another thing.

Desio, town, Milano province, Lombardia (Lombardy) region, northern Italy. The name derives from the Latin *ad decimum,* Desio being 10 (*decimus*) Roman miles north of Milan on the road to Como (one Roman mile was a thousand paces, approximately 4,860 ft, or 1,482 m). In the Middle Ages the parish had more than 40 churches. Achille Ratti, later Pope Pius XI, was born there in 1857. The town has silk-weaving, food-canning, and metallurgical industries. Pop. (1981 prelim.) mun., 32,664.

Desiosi, Compagnia dei, one of the Italian acting troupes performing commedia dell'arte (improvised popular comedy) in the late 16th and early 17th centuries. This period is considered the golden age of the genre, and the performers were noted for their sophistication and varied skills. The Desiosi's director, Diana da Ponti, was well known both as an actress and as a poet. The name Desiosi means "the desired." Cardinal Montalto was the company's patron. Documents of the Desiosi's activities go back to 1581, including tours of Mantua, Cremona, Verona, Milan, Bologna, Genoa, and Rome. The actor Tristano Martinelli, renowned for his portrayal of the mischievous servant Arlecchino, performed with the Desiosi until he left the company to assume a leadership role with the Accesi, another great company of the time.

Désirade, La, island in the middle of the windward group of the Lesser Antilles in the Caribbean Sea and a dependency of Guadeloupe, an overseas *département* of France. It lies 6 mi (10 km) east of the island of Grande-Terre. La Désirade is made of coral and is roughly oblong in shape, with an area of 27 sq mi (70 sq km). For more than 200 years, until 1958, it was a leper colony, which provided employment and income. The population is very poor, living mainly from fishing, working on sailboats, and a little cultivation. Pop. (1982) 1,602.

desk, piece of furniture designed to aid reading or writing, frequently with a sloping table or board top for the support of reading or writing materials. In Byzantine times a combination desk and lectern was used that consisted of a flat-topped cupboard from which rose a lectern on a stand. Early English desks that had derived from the ecclesiastical lectern were massive; after the development of printing, they gave way to smaller, portable chests with sloping lids called writing boxes, some of which featured drawers and letter holes. Most lids were hinged either at the front or back, those hinged at the front often supported in a horizontal position by slides that could be pulled out of the framework, by hinged stays fixed inside the lid, or by a combination of both. By the late 16th century these boxes were usually mounted on stands. During the next century, small, portable "ladies' desks" became popular in England.



Kneehole desk, French, early 18th century; in the Wallace Collection, London

By courtesy of the trustees of the Wallace Collection, London

A great variety of desk styles were produced in the 18th century, particularly in France, where the habit of writing little notes became something of a social mania. During this time, many desks contained ingenious mechanical devices, such as the flat desk with a top that folds forward while a tier of drawers rises at the back. Two popular desks of the period were the cylinder top and the rolltop desks. The cylinder top was a rigid, quarter-circle shutter covering the interior. The top could be slid back into the body of the desk while, at the same time, a writing surface might be drawn forward. The first rolltop desk, called the "Bureau du Roi Louis XV," was designed for the French king by Jean-François Oeben, an outstanding French cabinetmaker. It was surmounted by a clock with a dial on both sides and was one of the most luxurious pieces of furniture ever made. It was begun in 1760 and was finished by Jean-Henri Riesener nine years later at enormous cost.

In England the kneehole desk was developed in the early 18th century. Its top was supported by two banks of cupboards, or drawers, separated by a space for the legs of the person seated at the desk. Larger versions—known as library tables or partners' desks—enabled two people to work facing each other. School desks, popular since early Victorian times, developed from the portable and lectern desks.

Deskey, Donald (b. Nov. 23, 1894, Blue Earth, Minn., U.S.—d. April 29, 1989, Vero Beach, Fla., U.S.), American industrial designer who helped establish industrial design as a profession.

Deskey attended the University of California (1915–19), the Mark Hopkins Art School in San Francisco, the Art Institute of Chicago, the Colarossi, and the École de la Grandechamière in Paris. He became the director of the art department at Juniata College, Huntington, Pa., and later the director of the industrial-design department of New York University, where his work received international recognition in the field of design and fine arts.

After starting his career in advertising, Deskey began to work on furniture and interior design. His inventive use of industrial materials for decorative purposes brought him recognition and caught the attention of the Rockefeller Center, Inc., which in 1932 awarded him one of the largest contracts on record for the interior decoration and furnishings for Radio City Music Hall. The extraordinary results of this assignment helped Deskey firmly establish Donald Deskey Associates, the consulting firm he had founded in 1926.

In addition to package and product designs for major corporations, Deskey's firm designed certain U.S. exhibitions for the world's fairs of New York and Seattle, the interiors of several clubs, restaurants, and hotels in New York City, as well as the interiors of several government buildings. He also invented a high-pressure laminate known as Weldtex.

Deskey's firm also produced a number of projects for various world's fairs. These include structures for the New York exhibitions of 1939–40 and 1964–65 and the Seattle World's Fair of 1962. Deskey also designed the Confluence Theater of the U.S. Pavilion at HemisFair 1968 (held in San Antonio, Texas), which is still in use there.

"De," "la," and similar components of a name, when followed by a space, are alphabetized as separate words (e.g., *De Forest, Lee*). *When they are joined to the following part of a name, the combination is treated as a single word* (e.g., *DeForest, John William*).

Deslandres, Henri-Alexandre (b. July 24, 1853, Paris—d. Jan. 15, 1948, Paris), French physicist and astrophysicist who in 1894 invented a spectroheliograph, an instrument that photographs the Sun in monochromatic light. (About a year earlier George E. Hale had independently invented a spectroheliograph in the United States.)

Deslandres
Harlingue—H. Roger-Viollet

After graduating from the École Polytechnique (1874) and spending seven years in the army, Deslandres worked in the laboratories of the École Polytechnique and the Sorbonne. From 1886 to 1891 he studied the spectra of radiation emitted by molecules and formulated laws describing these radiations. Joining the Paris Observatory in 1889, he turned his energies to astrophysics, first studying molecular spectra and then the spectra of planets, the Sun, and other stars. He continued his work at the Meudon Observatory and in 1908 was appointed its director. Under his management, the Paris and Meudon observatories merged in 1926, and he remained in charge of them until his retirement in 1929. During his career, Deslandres was elected to several scientific societies, including the Académie des Sciences, the Royal Astronomical Society and the Royal Society in Britain, and the National Academy of Sciences of the United States.

desman, either of two semiaquatic mammals of the mole family, Talpidae: *Desmana moschata* of slow rivers of the south-central U.S.S.R. and *Galemys pyrenaicus* of fast streams of the Pyrenees Mountains of Europe. Desmans have long snouts that flare slightly at the tip, webbed hindfeet, more or less flattened tails, and dense, brown fur. The Russian desman is 42 cm (17 inches) long, including its 21-centimetre (8.5-inch) tail; the Pyrenees desman is slightly smaller.

Desman (*Desmana moschata*)
Painting by Donald C. Meighan

Desmarest, Nicolas (b. Sept. 16, 1725, Soulaines, Fr.—d. Sept. 28, 1815, Paris), French geologist whose discovery of the volcanic origin of basalt disproved the Neptunist theory that all rocks were formed by sedimentation from primeval oceans.

From 1757 Desmarest was employed by the government to help spread better manufacturing methods throughout France and to introduce new processes from other countries. By 1788 he had risen to the post of inspector general and director of manufactures. In 1792, during the French Revolution, Desmarest was imprisoned and narrowly escaped execution, but he was later recalled to government service.

In 1763 he first ventured into the Auvergne of central France, where he found large basalt deposits that he traced as lava flows from nearby ancient volcanoes. Over the next 11 years he studied the region, mapping it in exacting detail and preparing essays outlining his findings. His investigations revealed that many valleys are formed by the erosion of the rivers that flow in them. His numerous maps and essays showing the igneous origin of basalt were instrumental in reforming much of geological theory.

By the time he died, Desmarest had prepared four volumes of a planned five-volume work, *Dictionnaire de géographie physique,* which later appeared, with the posthumously edited fifth volume, in *Encyclopédie méthodique* (1781–1832).

Desmarets, Nicolas, MARQUIS DE MAILLEBOIS, Desmarets also spelled DES MARETS (b. Sept. 10, 1648, Paris—d. May 4, 1721, Paris), minister of finance during the last seven years of the reign (1643–1715) of Louis XIV of France.

A nephew of Louis' great finance minister Jean-Baptiste Colbert, Desmarets rose rapidly in financial administration, but on Colbert's death (1683) he was exiled for his alleged (though unproven) involvement in a counterfeiting scheme. Allowed to return to Paris

Nicolas Desmarets, engraving by C. Randon, 1678, after a painting by Pierre Mignard
By courtesy of the Bibliotheque Nationale, Paris

in 1686, he produced a remarkable series of memoranda exposing France's desperate economic situation. The fiscal crisis became particularly acute after France engaged the Austrians, British, and Dutch in the War of the Spanish Succession (1701–14). In 1703 Louis XIV's finance minister, Michel Chamillart, made Desmarets director of finances; and in 1708 he replaced Chamillart as controller general. He immediately postponed repayment of loans made to the government and obtained a lower rate of interest on some types of loans. In addition, he created a royal lottery, devalued metal currency, and instituted in 1710 a 10 percent tax on income. Although his skillful fiscal measures saw France through the war, the public debt had become unmanageable. In 1715 Desmarets recommended that the state should declare itself bankrupt.

After the death of Louis XIV (September 1715) and the accession of young Louis XV, Desmarets was dismissed from office by the regent Philippe II, duke d'Orléans.

Desmarets de Saint-Sorlin, Jean (b. 1595, Paris—d. Oct. 28, 1676, Paris), French prose writer, poet, dramatist, Christian polemicist, and political figure. One of the original members and the first chancellor of the French Academy, Desmarets opened the long literary battle, since called the *querelle des anciens et des modernes* (*see* ancients and moderns), by arguing that the true models for modern French literature were Romance legends and the Bible rather than classical Greek and Roman writers.

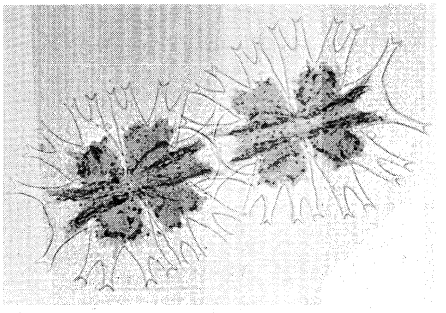
Jean Desmarets de Saint-Sorlin, engraving by P. Lombart after a portrait by H. Gascar
H. Roger-Viollet

Desmarets had written a number of literary works before the publication of his popular romance *Ariane* (1632) finally gained for him entrance to Parisian literary circles; flattery soon won him the favour of Cardinal de Richelieu, under whose patronage he was

given a succession of important government posts and wrote a number of tragedies and tragicomedies, the best of which was *Les Visionnaires* (1637).

He became a fervent Christian propagandist, directing his intolerance particularly against the Jansenists; his opposition to the ancients was also based on the conviction that literature should reflect Christian conviction. Several works reflected this point of view, among them two works that initiated the debate regarding the ancients and the moderns, *La Comparaison de la langue et de la poésie française avec la grecque et la latine* (1670) and *Défense de la poésie et de la langue française* (1675).

desmid, any of the beautiful, single-celled (sometimes filamentous or colonial), microscopic green algae of the order Zygnematales, class Chlorophyta, characterized by extensive variation in cell shape. Typically the cell is di-



Desmid (*Micrasterias*), highly magnified
Winton Patnode—Photo Researchers

vided symmetrically into semicells connected at a central point. The three-layered cell wall is impregnated with openings or pores and pectin spicules; irregular desmid movement is caused by the flow of a gelatinous substance through these pores. Conjugation (temporary union for the exchange of nuclear material) is the usual method of sexual generation. When a conjugation tube is not formed, the two protoplasts unite in a gelatinous sheath that surrounds the cells. Usually cell division occurs across the contact point, each half develops another semicell, and two complete desmids are formed. Spores are rare. The distribution of desmids is worldwide, usually in acid bogs or lakes. Since most species have a limited range, the presence of specific desmids is helpful in characterizing water samples. One of the more common desmid genera, the sickle-shaped *Closterium,* often contains gypsum crystals.

Desmond, Old Irish DES-MUMA (South Munster), an ancient territorial division of Ireland approximating the modern counties of Kerry and Cork. Between the 11th and 17th centuries, the name was often used for two quite distinct areas. Gaelic Desmond extended over the modern County Kerry south of the River Maine and over the modern County Cork west and north of the city of Cork; Anglo-Norman Desmond extended over north Kerry from the River Maine, over most of the modern county of Limerick, southwest Tipperary, east and south County Cork, and east Waterford. In 1329 Maurice Fitzgerald was created earl of Desmond, and his descendants became almost independent rulers during the 15th century. His line ended in 1601, and the earldom was eventually granted to a member of the English family of Feilding, from 1675 being held in conjunction with that of Denbigh.

Desmond, Gerald Fitzgerald, 14th (or 15th) earl of, byname THE REBEL EARL (b. *c.* 1538—d. Nov. 11, 1583, Glenageenty, County Kerry, Ire.), Irish Roman Catholic nobleman who led one of the three major Irish rebellions against English rule under Queen Elizabeth I. The son of James FitzJohn, 13th earl of Desmond, he succeeded to his father's title and lands in Munster (southwestern Ireland) in 1558 and was soon embroiled in territorial disputes with Thomas, 10th earl of Ormonde. The two rivals pleaded their cases before Elizabeth in 1560, but Desmond's manner so provoked the Queen that she had him imprisoned for a short time.

Returning to Ireland in 1564, Desmond quickly took up arms against Ormonde; early in 1565 he was wounded and captured in battle at Affane. The Queen then decided the feud in favour of Ormonde, and when Desmond failed to abide by the agreement he was arrested in 1567 and kept in honourable detention in Dublin and London for six years. During this interval Desmond's cousin James (Fitzmaurice) Fitzgerald launched a rebellion against the English but came to terms in February 1573, shortly before the Earl's release.

Then in July 1579 Fitzmaurice invaded Ireland with a small force of Italians and Spaniards, backed by the Pope and King Philip II of Spain. Desmond did not join them until after Fitzmaurice was killed in August. Desmond took charge of the papal army and appealed to the Irish lords to join in the defense of Catholicism against the English Protestants. The English brutally suppressed the insurgents and then left Ormonde to hunt down Desmond. The death of the Earl in a minor skirmish brought to a close a conflict that had devastated Munster.

Whether Gerald Fitzgerald is designated the 14th or 15th earl depends on an earlier disputed succession.

Desmoulins, (Lucie-Simplice-)Camille (-Benoist) (b. March 2, 1760, Guise, Fr.—d. April 5, 1794, Paris), moderate democrat who was one of the most influential journalists and pamphleteers of the French Revolution.

Desmoulins, portrait by an unknown French artist, 18th century; in the Musée Carnavalet, Paris
Giraudon

The son of an official of Guise, Desmoulins was admitted to the bar in 1785, but a stammer impeded his effectiveness as a lawyer. Nevertheless, after the outbreak of the Revolution in 1789, he suddenly emerged as an effective crowd orator, urging a Parisian crowd to take up arms (July 12, 1789). The ensuing popular insurrection in Paris was climaxed with the storming of the Bastille on July 14. Soon thereafter Desmoulins published his pamphlet *La France Libre* ("Free France"), which summed up the main charges against France's rapidly crumbling ancien régime. In addition, his famous *Discours de la lanterne aux Parisiens* ("The Streetlamp's Address to the Parisians"), published in September 1789, supported the bourgeois-democratic reforms of the revolutionary National Assembly and set forth republican ideals.

Two months later Desmoulins launched his lively newspaper *Les Révolutions de France et de Brabant* ("The Revolutions in France and in Brabant"), in which he attacked policies that were impeding the democratic movement. After Louis XVI's abortive flight from Paris in June 1791, Desmoulins intensified his campaign for the deposition of the King and the establishment of a republic. The assembly retaliated by ordering his arrest on July 22, 1791, but he went into hiding until he was granted an amnesty in September.

Meanwhile, Desmoulins had formed close working relations with Georges Danton in the Jacobin and Cordelier clubs. After participating in the popular insurrection that overthrew the monarchy on Aug. 10, 1792, he was made secretary general under Danton in the Ministry of Justice. Elected to the National Convention, which convened in September, Desmoulins joined the other Montagnards (deputies from the Jacobin Club) in a bitter struggle against the moderate Girondin faction. Desmoulin's *Histoire des Brissotins* ("History of the Brissotins"), issued in mid-May 1793, severely undermined the Girondins' influence by portraying them as agents in the pay of foreign enemies. On June 2 the Montagnards expelled the leading Girondins from the National Convention and took control of the Revolution.

Nevertheless, by December 1793 Desmoulins and Danton had become leaders of a moderate faction—called the Indulgents or Dantonists—within the Jacobin camp. Their chief enemies were Jacques Hébert's left-wing Jacobins who, in alliance with the Parisian lower classes, had forced the National Convention to inaugurate a state-regulated economy and institute the reign of terror against suspected counterrevolutionaries. In the first two issues of his new paper, *Le Vieux Cordelier* ("The Old Cordelier," Dec. 5–30, 1793), Desmoulins attacked the Hébertists for instigating the "de-Christianizing" movement that sought to destroy all Roman Catholic institutions. His friend Robespierre, by now the chief spokesman of the all-powerful Committee of Public Safety, supported this anti-Hébertist campaign, but in the next four issues of his paper Desmoulins lashed out against the committee's use of economic controls and political terror. Robespierre then retaliated by demanding that copies of *Le Vieux Cordelier* be burned (Jan. 7, 1794).

Robespierre had the leading Hébertists guillotined on March 24, and on the night of March 29–30 he acquiesced to the arrest of Desmoulins, Danton, and their friends. Charged with complicity in a "foreign plot," the Dantonists were guillotined on April 5.

Desnos, Robert (b. July 4, 1900, Paris—d. June 8, 1945, Terezín, Czech.), French poet who joined André Breton in the early Surrealist movement, soon becoming one of its most valuable members because of his ability to fall

Desnos
By courtesy of the Editions Gallimard

into a hypnotic trance, under which he could recite his dreams, write, and draw. Texts from this period appeared in the Surrealist review *Littérature* and in his book *La Liberté ou*

l'amour! (1927; "Liberty or Love!"). Humour, tenderness, and eroticism pervade his works, in which acrobatic verbal techniques never detract from the spontaneity of the inspiration. Dreams and reality merge in freely associated images in *Corps et biens* (1930; "Bodies and Goods"). In 1930 he broke from the doctrinaire Surrealist rigidity of Breton and for a decade wrote motion-picture and radio scripts, including the highly successful *Complainte de Fantomas* (1933; "Fantomas' Lament"). Later he abandoned the eccentric experiments in Surrealistic verse in favour of more traditional and classical forms to express his humanitarian sympathies aroused by World War II.

In the 1940s he became, with Paul Éluard and Louis Aragon, the poet of man's hope. His works of this period include *Fortunes* (1942), *État de veille* (1943; "The Wakeful State"), and *Contrée* (1944; "Country"). Arrested for his activity in the Resistance, he was deported and died of typhus a few days after his liberation by U.S. troops. A collection including both his early Surrealist poems and his later works, *Domaine public* ("Public Domain"), appeared in 1953.

Desnoyers, Auguste-Gaspard-Louis, Baron, original name AUGUSTE-GASPARD-LOUIS BOUCHER-DESNOYERS (b. Dec. 19, 1779, Paris—d. Feb. 16, 1857, Paris), French engraver who studied engraving and drawing and, after visiting Italy, entered the studio of Pierre-Alexandre Tardieu in 1800, becoming one of the most eminent line engravers of his time. Desnoyer's fame was established in 1805 by an engraving after Raphael, whereupon Napoleon I commissioned him to reproduce his full-length portrait in coronation robes by Gérard. He became a member of the Institute (1816) and engraver to King Charles X (1825). He is accredited with 75 plates.

Despard, Edward Marcus (b. 1751, County Leix, Ire.—d. Feb. 21, 1803, London), British army officer and colonial administrator; organizer of a conspiracy against the British government. Despard entered the army in 1766 and attained the rank of colonel. After serving in Jamaica, he was sent to Central America in 1781; there he was made governor of Roatán Island, off the Honduras coast, and soon afterward of the British Mosquito Coast and Bay of Honduras.

In 1784 he took over the administration of British Yucatán. There he supported the land claims of recent immigrants from the Mosquito Coast against those of earlier settlers, on whose complaints he was recalled in 1790. Charges against him were dismissed in 1792, but the British government refused to employ him further. He was imprisoned from 1798 to 1800 on no specific charge, though it has been suggested that he was involved in the Irish Rebellion.

Subsequently Despard began to organize a conspiracy in which he hoped to combine an army mutiny with a rising in London to assassinate King George III and capture the Tower of London and the Bank of England. His grandiose plot became known, and he was arrested on Nov. 16, 1802. Though Lord Nelson testified in his behalf, he was convicted of high treason (along with several fellow conspirators) and was put to death in Newington jail.

Despenser, Hugh Le and Hugh Le, in full, respectively, HUGH LE DESPENSER, EARL OF WINCHESTER, and SIR HUGH LE DESPENSER, bynames HUGH LE DESPENSER THE ELDER and HUGH LE DESPENSER THE YOUNGER (respectively b. 1262—d. Oct. 27, 1326, Bristol, Gloucestershire, Eng.; d. Nov. 24, 1326, Hereford, Herefordshire), unpopular favourites of England's King Edward II, who were executed by Edward's opponents, Queen Isabella and Roger Mortimer.

Hugh the Elder was summoned to Parliament as a baron in 1295. He fought in France and Scotland for Edward I and was sent by him on several embassies, including two to the Pope. He was one of the few supporters, in 1308, of Piers Gaveston, Edward II's favourite; after Gaveston's death in 1312 he became the King's chief adviser until Thomas, earl of Lancaster, leader of the baronial opposition, procured his dismissal from court and council in February 1315. He then worked to further the interests of his son, Hugh the Younger, who had been in the King's household when he was prince of Wales. The younger Hugh was appointed the king's chamberlain in 1318, but both father and son were attacked in Parliament by the magnates in 1321; the intense hatred with which the barons regarded the Despensers was due to the enormous wealth that had passed into their hands and to the arrogance and rapacity of the younger Hugh. At last the King was forced to agree to their disinheritance and exile. The elder Hugh went abroad but the younger remained in the Cinque Ports and engaged in piracy.

After the collapse of the opposition at the Battle of Boroughbridge (March 1322), the Despensers returned to power, and the elder Hugh was created earl of Winchester. Hugh the Younger worked to enhance the importance of the chamberlain's office, diverting to it from the Exchequer the revenue from certain lands and developing it as a department equipped with its own seal and providing private income for the king. But he was rapacious and grasping, and his administration aroused discontent. He had married (1306) Eleanor, coheiress of Gilbert de Clare, earl of Gloucester (d. 1314). Hugh's attempt to acquire the sole inheritance had been foiled by a division of Clare's estates in 1317; but even so he received lands in Glamorgan and Wales. At the rebellion of Queen Isabella and Roger Mortimer, both Despensers fled westward with the King. The elder, sent to defend Bristol, surrendered it to Isabella on October 26 and, after summary trial, was hanged the next day. The younger Despenser was captured with the King and tried and hanged at Hereford a month later.

Despiau, Charles (b. Nov. 4, 1874, Mont-de-Marsan, Fr.—d. Oct. 30, 1946, Paris), French sculptor who developed a sensitive, classical style akin to that of Aristide Maillol. The nude studies he drew for his sculptures are also highly esteemed.

"Paulette," sculpture by Charles Despiau, 1910; in the Musée National d'Art Moderne, Paris

By courtesy of the Musee National d'Art Moderne, Paris; Cliche Musees Nationaux, permission A.D.A.G.P. 1971, by French Reproduction Rights, Inc.

Despiau was an assistant to Auguste Rodin but came to reject Rodin's Romanticism in favour of a return to the severe simplicity of archaic classical sculpture. Modelling principally in plaster but sometimes working in stone, he completed only one large-scale work, a war memorial (1920–22) for the town of his birth.

Though particularly noted for the sensitive characterizations in his portrait busts, Despiau also executed life-size figures, frequently nude. Among his bronzes are "Faunesse" (1924), "Eve" (1925), and "Dominique" (1926). "Assia" (1938) is one of his efforts in terra-cotta.

Desportes, Alexandre-François (b. 1661, Champigneulle, Fr.—d. April 20, 1743, Paris), French painter who specialized in portraying animals, hunts, and emblems of the chase; he was among the first 18th-century artists to introduce landscape studies using nature as a model.

"Portrait of a Hunter," a self-portrait, oil on canvas by Alexandre-François Desportes, 1699; in the Louvre, Paris

Cliche Musees Nationaux

At the age of 12 Desportes was sent by his father to Paris, where he worked and studied in the studio of Nicasius Bernaerts, an artist who taught him to observe nature carefully. Desportes executed small decorative works for other artists, and he enjoyed considerable success at portraiture. Spending some time (1695–96) at the court of Poland by invitation of King John III Sobieski, Desportes painted a number of portraits of members of the royal family.

When he returned to France, Desportes decided that he could not compete successfully as a portrait painter and began to paint chase and hunt scenes, studies of dogs, and still-life pictures of flowers and fruit. In 1699 he was admitted to the French Royal Academy, and he succeeded in winning the favour of Louis XIV, who gave him a pension and lodging at the Louvre. Desportes became a recorder of royal hunts, and many of his works show the King's favourite dogs. He also worked on decorations for several of the royal châteaus. In 1712 he went to London, where he was much in vogue. Returning to France six months later, he continued to work for the regency and received many commissions under Louis XV. One of his biggest projects was the tapestry series "Indies" (1687–1730). In 1735 he was ordered to redo the work, retaining the subject but changing the composition. This appeared as "New Indies." One of his last works was the great "Deer Hunt."

Desportes, Philippe (b. 1546, Chartres, Fr.—d. Oct. 5, 1606, Abbey of Bonport), French courtier poet whose light, facile verse prepared the way for the new taste of the 17th century in France and whose sonnets served

Philippe Desportes, detail of a drawing by an unknown artist
H. Roger-Viollet

as models for the late Elizabethan poets. Desportes based his style on that of the Italians—chiefly Petrarch, Ludovico Ariosto, and Pietro Bembo.

About 1567 he displaced Pierre de Ronsard as the favourite poet of Henry, duke of Anjou, whom he accompanied to Kraków when Henry was elected king of Poland (1573). Desportes returned with him on the death of Charles IX (1574). His *Premières Oeuvres* (1573; "First Works") made him Ronsard's rival. He wrote sonnets and elegies, in graceful alexandrines, for Henry III and others to present to their mistresses. In 1583 he received the abbeys of Tiron and Josaphat, enjoying the revenues of other benefices also and entertaining an intellectual circle in a princely manner.

His *Dernières amours* (1583; "Last Loves"), also known as *Cléonice*, mark his farewell to secular verse. His translations of the Psalms (1591, 1598, 1603) were attacked by François de Malherbe and vigorously defended by the poet Mathurin Régnier, Desportes's nephew. Desportes is not a personal poet. His elegant poems sound much the same whether they are addressed to his own mistresses or to those of the great. Nonetheless, his clear, harmonious style found ready acceptance by the English poets Edmund Spenser, Michael Drayton, Samuel Daniel, and others.

Desprez, Jean-Louis (b. *c.* 1743, Lyon—d. March 29, 1804, Stockholm), French painter, stage designer, and architect, an important figure in the transition from the rational classicism of the mid-18th century in France to the more subjective Revolutionary Neoclassicism associated with the innovative works of Étienne-Louis Boullée and Claude-Nicolas Ledoux.

A student of J.-F. Blondel, Desprez early on received a *prix d'émulation* from the Academy for a *temple funéraire* (funeral temple). Desprez had a continuing poetic fascination with tombs and cemeteries and became well known for stage designs that showed them.

In 1776 Desprez received the *grand prix d'architecture* for a château project and was enabled to travel beginning in 1777. His drawings of Egyptian monuments, which he made in Rome about 1780, are considered the first examples of the intrusion of Egyptian architectural forms on the Greek and Roman models that had previously dominated classical taste.

Desprez's own style may be most correctly termed Romantic Classicism. He, along with N.-H. Jardin, introduced the classical style to Scandinavia. King Gustav III of Sweden had met him in Rome and took Desprez to Stockholm, where he executed decorations for the opera *Gustaf Wasa,* in which the King had collaborated. Plans for a château to be built for the King were arrested by Gustav's assassination in March 1792. But Desprez did complete the Botanicum at Uppsala in 1788, noted for its low portico supported by a "primitive" order of Doric columns.

Desrosiers, Léo-Paul (b. April 11, 1896, Berthier, Que., Can.—d. April 20, 1967, Montreal), French-Canadian writer best known for his historical novels.

In addition to writing fiction, Desrosiers worked as a journalist, an editor, and a librarian. His *Ames et paysages,* stories of the Quebec countryside, won him the Prix d'Action Intellectuelle in 1922. His first novel, *Nord-Sud* (1931), also takes place in the countryside. Set in the 1840s, at the height of the gold rush, it describes the efforts of its protagonist to escape provincialism by fleeing to California. *Les Engagés du Grand Portage* (1938) received the Prix David. Set around 1800, this novel depicts the cutthroat behaviour exhibited by rival fur companies. Desrosiers's trilogy *Vous qui passez, Les Angoisses et les tormentes,* and *Rafles sur les cimes* (1958–60) illustrates his philosophical approach to contemporary middle-class society.

Dessalines, Jean-Jacques (b. *c.* 1758, West Africa—d. Oct. 17, 1806, Jacmel, Haiti), emperor of Haiti who proclaimed his country's independence in 1804.

Brought to the French West Indian colony of Saint-Domingue (Haiti) as a slave, Dessalines worked as a field hand for a black master until 1791, when he joined the slave rebellion that broke out in the colony amid the turmoil caused by the French Revolution. In the decade that followed he distinguished himself as a lieutenant of the black leader Toussaint-Louverture, who established himself as governor general of Saint-Domingue with nominal allegiance to Revolutionary France. When Toussaint was deposed in 1802 by a French expedition sent by Napoleon Bonaparte to reconquer the colony, Dessalines at first submitted to the new regime. In 1803, however, when Napoleon declared his intention to reintroduce slavery (which had been abolished by the French Convention in 1794), Dessalines and other black and mulatto (racially mixed) leaders rose in rebellion. With British help they expelled the French from Saint-Domingue, and on Jan. 1, 1804, Dessalines, as governor general, proclaimed it an independent country under its Arawakan name, Haiti. The following September he adopted the title of emperor as Jacques I.

Dessalines continued many of Toussaint's policies, including the use of forced labour on plantations to prevent reversion to a purely subsistence economy, but he was far more hostile to whites. He confiscated their land, made it illegal for them to own property, and, perhaps fearing them as a potential fifth column in the event of another French invasion, launched a campaign of extermination against the country's white inhabitants in which thousands were killed. These massacres, together with his property law (which remained in force for more than a century), effectively prevented any renewal of white dominance over the blacks, who formed more than 80 percent of the population. He also discriminated against the elitist mulattoes and was finally killed trying to put down a revolt under the mulatto leader Alexandre Sabès Pétion, after which Pétion and the black leader Henry Christophe divided Haiti between them.

Dessau, city, Saxony-Anhalt *Land* (state), east-central Germany, on the Mulde River at its confluence with the Elbe River, northwest of Halle. The German town, which developed from a Sorbian settlement, was first mentioned in 1213. From 1603 until 1918 it was the residence of the counts, princes, and dukes of Anhalt, and it remained the capital of Anhalt *Land* (state) until 1945. In the 18th century the Anhalt line had a castle built in the Mosigkau district of the town in the southwest; it contains a museum of the Rococo period and a notable collection of paintings. Dessau was the seat of the Bauhaus architectural school under Walter Gropius from 1925 to 1933. Extensive bombing in World War II destroyed many historic buildings. The Landestheater, the town hall, and the Johanniskirche (1690–1702; St. John's Church) have been restored. Moses Mendelssohn, the philosopher, was born (1729) in Dessau.

Dessau was the site of a large aircraft works before World War II; its present industries include a shipyard where dredging machines are produced, nationally owned armaments enterprises, and vehicle, machinery, apparatus, and chemical works. A railway junction with repair shops, on the Berlin–Belzig–Leipzig line, Dessau also has an inland harbour and an airfield. Pop. (1989 est.) 103,867.

Dessau, Paul (b. Dec. 19, 1894, Hamburg—d. June 28, 1979, East Berlin), German composer and conductor best known for his operas and other vocal works written in collaboration with Bertolt Brecht, whose socialist philosophy he enthusiastically shared. His conducting career included posts in Cologne (1919–23) and Berlin (1925–33).

His long collaboration with Brecht began in 1942 in the United States, where he wrote the music for the play *Mutter Courage und ihre Kinder* (1946), the most popular of the Brecht-Dessau works. From 1948, they continued their partnership in East Germany, where Dessau composed his most successful opera, *Das Verhör des Lukullus* (1949), with libretto by Brecht. Dessau's other works include a cantata on the death of Stalin (1953) and the opera *Einstein* (1971–73).

dessert, the last course of a meal. In the United States dessert is likely to consist of pastry, cake, ice cream, pudding, or fresh or cooked fruit. British meals traditionally end with nuts, fruits, and port or other dessert wine, while French practice is to end with fruit, cheese, and wine; in both cuisines, a more elaborate meal would have included a sweet course preceding the dessert offerings. In Spain, Portugal, and Latin-American countries, desserts of flan, a baked caramel custard, are ubiquitous. Other rich sweets based on eggs, milk, and fruits are also preferred. The elaborate cakes and tarts of central and northern Europe make the dessert course a glory of these cuisines. Indian cuisine offers sweet puddings and dense cakes flavoured with rosewater, honey, and nuts.

In many cuisines, however, there is no usual sweet course; rather, fresh fruit, tea, or coffee constitute the end of the meal. In Japan and China elaborate confections are usually eaten as snacks rather than as part of a meal.

The dessert course reached its zenith in the banquets of the European courts of the 18th and 19th centuries, when the desire for ostentation and artifice happily coincided with the widespread availability of refined sugar and flour. On a table decorated with flowers and architectural fantasies in sugar and pastry were presented dozens of creams, tarts, fruits, cakes, pastries, puddings, jellies, and meringues.

Sweet dessert dishes demand sweet wines; notable among these are sweet port, sherry, and madeira; Tokaj Aszu of Hungary; sauternes (especially Chateau d'Yquem); Greek mavrodaphne; and German Auslese, Beerenauslese, and Trockenbeerenauslese bottlings. Sweet or dry liqueurs and brandies are offered as *digestifs* at the meal's close.

Dessie, also spelled DESSYE (Ethiopia): *see* Dese.

Dessoir, Ludwig (b. Dec. 15, 1810, Posen, Prussia [now Poznań, Pol.]—d. Dec. 30, 1874, Berlin, Ger.), German actor whose fame rested on his portrayals of Shakespearean characters.

After years of apprenticeship on many stages, Dessoir in 1839 joined the court theatre at Karlsruhe, where he stayed for 10 years. From 1849 to 1872 he was associated with the Berlin court theatre, traveling all over Germany to give guest performances. In 1855 he played in London, where critics compared his Othello favourably to the portrayals by Edmund Kean and William Charles Macready. His Othello had a quiet intensity that was in marked contrast to the melodramatic violence with which it had become customary to play the Moor.

Destinn, Emmy, original name EMA KITTL (b. Feb. 26, 1878, Prague, Austria-Hungary [now in Czechoslovakia]—d. Jan. 28, 1930, Ceské Budějovice, Czech.), Bohemian soprano noted for the power and vibrant richness of her voice and for her great intelligence and dramatic gifts. She adopted the name of her singing teacher, Maria Loewe-Destinn, and during World War I used the Czech form of the name, Ema Destinnová.

Destinn made her debut in Berlin in 1898 as Santuzza in Pietro Mascagni's *Cavalleria rusticana.* Richard Strauss chose her to sing the title role in his opera *Salome* at its premiere (1906) in Berlin and Paris. She first sang at Covent Garden, London, in 1904 as Donna Anna in Mozart's *Don Giovanni* and in 1908 made a triumphant first appearance at the Metropolitan Opera, New York City, as Aida in Verdi's opera. Other roles in her extensive repertory included Minnie in Puccini's *La fanciulla del west* (*The Girl of the Golden West*), Pamina in Mozart's *Die Zauberflöte* (*The Magic Flute*), Valentine in Giacomo Meyerbeer's *Les Huguenots,* and Eva in Wagner's *Die Meistersinger.*

Destiny, Stone of: *see* Scone, Stone of.

Destouches, Philippe Néricault (b. April 9, 1680, Tours, Fr.—d. July 4, 1754, Fortoiseau), dramatist whose plays brought to the tradition of French Classical comedy influences derived from the English Restoration theatre.

After classical studies in Tours and Paris, he entered the diplomatic service. He was posted to Switzerland and, in 1717, to London. There he became acquainted with English writers and developed an affection for English customs and for Restoration drama. Following his return to Paris, he was successful with his comedy *Le Philosophe marié* (1727; *The Married Philosopher*), although his plays were found too moralizing for the taste of many of his contemporaries. His masterpiece, *Le Glorieux* (1732; *The Conceited Count*), presents the conflict between the nobility, represented by the conceited count himself, and the bourgeoisie.

Destour, byname of AL-ḤIZB AL-ḤURR AD-DUSTŪRĪ AT-TŪNUSĪ, English TUNISIAN LIBERAL CONSTITUTIONAL PARTY, Tunisian political party, especially active in the 1920s and '30s in arousing Tunisian national consciousness and opposition to the French protectorate.

The forerunner of the Destour, the Young Tunisians, had engaged the Tunisian intellectual elite but lacked widespread support. Forced underground in 1912 after the arrest of its leaders Ali Bash Hamba and Shaykh Abd al-Aziz ath-Thaalibi, the Young Tunisians reemerged on June 4, 1920, as the Destour Party. Arguing that the legal force of the suspended Tunisian constitution (*dustūr*) of 1861 could still be rightfully reinstated by the Tunisians, they began by advocating complete independence. When conservative Tunisians balked at this, they accepted the protectorate temporarily. When the French began encroaching on traditionally Muslim prerogatives in the early 1930s—as by setting up French judges in Tunisian law courts—the Destour organized and led protests, strikes, and boycotts.

The Destour was officially proscribed in May 1933, and in March 1934 some of its younger members broke away to form their own organization, the Neo-Destour (*see* Destourian Socialist Party). The old Destour made several unsuccessful attempts to regain its influence in the 1940s and 1950s before finally passing out of existence in 1957.

Destourian Socialist Party, formerly (1934–64) NEO-DESTOUR, French PARTI SOCIALISTE DESTOURIEN, or NEO-DESTOUR, political party that, from its creation in 1934, led the Tunisian national struggle for independence from France.

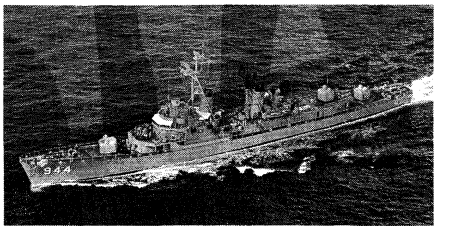
The Neo-Destour was formed by discontented young members of the more conservative Destour (*q.v.*). After a bitter struggle with the parent organization, it became the predominant party under the leadership of Habib Bourguiba in 1937. Harassed by French authorities throughout the 1940s, it began an armed rebellion in 1953 that led to Tunisian independence in 1956.

A Neo-Destour government was then formed, and the elections that followed the proclamation of independence (March 20, 1956) gave the party a solid electoral backing. In 1958 Bourguiba was appointed the first premier of Tunisia and in 1959 was overwhelmingly voted president.

Internally, however, the Neo-Destour had begun to split in the early 1950s, one group supporting Bourguiba, the other aligning itself with Salah Ben Yusuf, who had led the party when Bourguiba had been imprisoned by the French. Ben Yusuf was expelled from the party in 1955, established himself in Cairo, and initiated a guerrilla campaign against the Neo-Destour, the French, and Bourguiba. After several years of terrorist activity, Ben Yusuf was found murdered on Aug. 14, 1961, and his followers soon disappeared.

The Neo-Destour meanwhile consolidated its hold on all levels of Tunisian society and constituted itself as Tunisia's sole political party. In 1964 the party was renamed the Destourian Socialist Party. It dominated the political scene, especially after opposition parties were banned in 1963. The party was renamed the Democratic Constitutional Rally (Rassemblement Constitutionnel Democratique) in 1988. It remained Tunisia's dominant party after winning free, multiparty legislative elections in 1989.

destroyer, fast naval vessel that has served a variety of functions since the late 19th century. The term destroyer has its origin in the 250-ton vessels built in the 1890s to protect battleships from torpedo boats. These torpedo-boat destroyers, as they were called, then became super torpedo boats themselves, so that, by World War I, they were commonly deployed ahead of the battle fleet to scout for the enemy fleet, beat back its destroyers with cannon fire, and then launch torpedos against its battleships and cruisers.



USS *Mullinnix,* destroyer of the Forrest Sherman class

By courtesy of the U.S. Navy

As the submarine became the principal torpedo-launching vessel, destroyers were equipped with hydrophones and depth charges to protect merchant ship convoys and battle fleets against submarine attack. In World War II, with the addition of radar and antiaircraft guns, this escort role was expanded to include air defense.

In the postwar years the destroyer's dual antiaircraft/antisubmarine role has continued through the transition to guided missiles. A modern destroyer's armament consists of surface-to-air missiles, antisubmarine torpedos, antiship missiles, and one or two main guns of about four or five inches in calibre. Many destroyers carry submarine-hunting helicopters. Modern destroyers range from 4,000 to 7,000 tons in displacement, are capable of speeds of more than 30 knots, and carry crews of about 300.

Destutt de Tracy, Antoine-Louis-Claude, Comte (Count) (b. July 20, 1754, Bourbonnais, Fr.—d. March 9, 1836, Paris), French philosopher, soldier, and chief Idéologue, so called after the philosophical school of Idéologie, which he founded.

Born into a noble family of soldiers originating in Scotland who settled in France in the 15th century, Destutt de Tracy became colonel of the Penthièvre regiment before being elected to the States General of 1789. He was promoted brigadier early in 1792 but soon resigned his commission. He was imprisoned for nearly a year under the Reign of Terror during the French Revolution. An associate member of the French Institut National, he was also a member of the Académie Française (1808), a senator during the reign of Napoleon I, and a peer after the restoration of the monarchy.

Destutt de Tracy coined the word *idéologie* (English: "ideology") in 1796 as a name for his own "science of ideas." Influenced by the work of John Locke, he presented his basic ideas in *Éléments d'idéologie,* 4 vol. (1801–15). Like the sensationalism of Étienne Bonnot de Condillac (1715–80), Idéologie stressed the importance of human sensations in the formation of knowledge. Destutt de Tracy, however, further refined Condillac's views to emphasize the physiological nature of sensation. Human thought, he asserted, is nothing but an elaboration of sensations, an activity of the nervous system. The four principal realms of conscious behaviour—perception, memory, judgment, and will—all employ various combinations of sensations. As a result of its extreme dependence on the human senses for verification of knowledge, Idéologie threatened not only religious doctrine but secular authority as well, and the movement was suppressed by Napoleon from 1803.

In addition to an unfinished treatise on the human will, *Traité de la volonté et de ses effets* (1805; "Treatise on the Will and Its Effects"), Destutt de Tracy's other writings include *Grammaire générale* (1803) and *Logique* (1805). His *Commentaire sur l'Esprit des lois de Montesquieu* (*Commentary and Review of Montesquieu's Spirit of Laws*), written in 1808, was translated and revised in 1811 by Thomas Jefferson, with whom Destutt de Tracy corresponded.

detached retina, separation of most layers of the retina, the light-sensitive layer of tissue that lines the back and sides of the eye, from the choroid, the pigmented middle layer of the eyeball. After the separation, the outermost layer of the retina—the layer, called the pigment epithelium, that is farthest from the centre of the eye—remains attached to the choroid. As a rule, retinal detachment occurs only in persons who are middle-aged or older (an exception is retrolental fibroplasia, *q.v.*). There is usually no immediate cause, but the detachment may be the result of a physical accident. There is no pain when the separa-

tion occurs, but progressively greater blurring of vision occurs in the affected eye. Restoration of the retina to its normal position is achieved by draining the fluid from behind it and applying heat, a laser beam, or extreme cold to the wall of the eye. The resultant inflammation acts as a glue to hold the retina in position.

Detaille, (Jean-Baptiste-)Édouard (b. Oct. 5, 1848, Paris—d. Dec. 23, 1912, Paris), French painter known for his accurate portrayals of battles and military life.

Detaille studied with J.L.E. Meissonier and employed a technique of literal exactitude based on that of his master. Detaille developed a wide knowledge of military detail, making his work an important source for the study of late 19th-century military history; *e.g.*, in 1883 he produced, with Alphonse de Neuville, a profusely illustrated two-volume work, *L'Armée française*. His paintings of the Franco-German War (*e.g.*, "The Defense of Champigny," 1879) made him famous. His most characteristic works, however, infused with legend and sentiment, are his pictures of Napoleon I and his armies. Detaille also painted some portraits and nonmilitary subjects and was a gifted actor.

detection, in electronics, the process of rectifying a radio wave and recovering any information superimposed on it; it is essentially the reverse of modulation (*q.v.*).

detective story, type of popular literature dealing with the step-by-step investigation and solution of a crime, usually murder.

The traditional elements of the detective story are: (1) the seemingly perfect crime; (2) the wrongly accused suspect at whom circumstantial evidence points; (3) the bungling of dim-witted police; (4) the greater powers of observation and superior mind of the detective; and (5) the startling and unexpected denouement, in which the detective reveals how he has ascertained the identity of the culprit. Detective stories frequently operate on the principle that superficially convincing evidence is ultimately irrelevant. Usually it is also axiomatic that the clues from which a logical solution to the problem can be reached be fairly presented to the reader at exactly the same time that the sleuth receives them and that the sleuth deduce the solution to the puzzle from a logical interpretation of these clues.

The first detective story was "The Murders in the Rue Morgue" by Edgar Allan Poe, published in April 1841. The profession of detective had come into being only a few decades earlier, and Poe is generally thought to have been influenced by the *Mémoires* (1828–29) of François-Eugene Vidocq, who in 1817 founded the world's first detective bureau, in Paris. Poe's fictional French detective, C. Auguste Dupin, appeared in two other stories, "The Mystery of Marie Roget" (1845) and "The Purloined Letter" (1845). The detective story soon expanded to novel length.

The French author Emile Gaboriau's *L'Affaire Lerouge* (1866) was an enormously successful novel that had several sequels. Wilkie Collins' *The Moonstone* (1868) remains one of the finest English detective novels. Anna Katharine Green became one of the first American detective novelists with *The Leavenworth Case* (1878). *The Mystery of a Hansom Cab* (1886) by the Australian Fergus Hume was a phenomenal commercial success.

The greatest of all fictional detectives, Sherlock Holmes, along with his loyal, somewhat obtuse companion Dr. Watson, made his first appearance in Sir Arthur Conan Doyle's novel *A Study in Scarlet* (1887) and continued into the 20th century in such collections of stories as *The Memoirs of Sherlock Holmes* (1894) and the longer *Hound of the Baskervilles* (1902). So great was the appeal of Sherlock Holmes's detecting style that the death of Conan Doyle did little to end Holmes's career; several writers, often expanding upon circumstances mentioned in the original works, have attempted to carry on the Holmesian tradition.

The early years of the 20th century produced a number of distinguished detective novels, among them Mary Roberts Rinehart's *The Circular Staircase* (1908) and G.K. Chesterton's *The Innocence of Father Brown* (1911) and other novels with the clerical detective. From 1920 on, the names of many fictional detectives became household words: Inspector French, introduced in Freeman Wills Crofts's *Cask* (1920); Hercule Poirot, in Agatha Christie's *The Mysterious Affair at Styles* (1920), and Miss Marple, in *Murder at the Vicarage* (1930); Lord Peter Wimsey, in Dorothy L. Sayers' *Whose Body?* (1923); Philo Vance, in S.S. Van Dine's *The Benson Murder Case* (1926); and Ellery Queen, conceived by Frederic Dannay and Manfred B. Lee, in *The Roman Hat Mystery* (1929).

In a sense, the 1930s was the golden age of the detective novel, with the detectives named above continuing in new novels. The decade was also marked by the books of Dashiell Hammett, who drew upon his own experience as a private detective to produce both stories and novels, notably *The Maltese Falcon* (1930) featuring Sam Spade. In Hammett's work, the character of the detective became as important as the "whodunit" aspect of ratiocination was earlier. *The Thin Man* (1932), with Nick and Nora Charles, was more in the conventional vein, with the added fillip of detection by a witty married couple. Successors to Hammett included Raymond Chandler and Ross Macdonald, who also emphasized the characters of their tough but humane detectives Philip Marlowe and Lew Archer, respectively. At the end of the 1940s, Mickey Spillane preserved the hard-boiled crime fiction approach of Hammett and others, but his emphasis on sex and sadism became a formula that brought him amazing commercial success beginning with *I, the Jury* (1947).

The introduction of the mass-produced paperback book in the late 1930s made detective-story writers immensely wealthy, among them in the U.S. Erle Stanley Gardner, whose criminal lawyer Perry Mason unravelled crimes in court; Rex Stout, with his fat, orchid-raising detective Nero Wolfe and his urbane assistant Archie Goodwin; and Frances and Richard Lockridge, with another bright married couple, Mr. and Mrs. North. In France, Georges Simenon produced novel after novel at a rapid-fire pace, making his hero, Inspector Maigret, one of the best known detectives since Sherlock Holmes. Other writers who carried out the tradition of Holmes or broke new ground included Nicholas Blake (pseudonym of the poet C. Day-Lewis), Michael Innes, Dame Ngaio Marsh, Josephine Tey, and Carter Dickson (John Dickson Carr).

The Mystery Writers of America, a professional organization founded in 1945 to elevate the standards of mystery writing, including the detective story, has exerted an important influence through its annual Edgar Allan Poe Awards for excellence. After the advent of the Cold War had increased interest in espionage and international intrigue, the suspense novel made some inroads on the popularity of the detective story, but the heirs of Poe and Conan Doyle still commanded a large readership.

Notable works on the detective story include Howard Haycraft's *Murder for Pleasure* (1941; enlarged ed., 1968) and Jacques Barzun and Wendell H. Taylor's *Catalogue of Crime* (1971). *See also* mystery story; hard-boiled fiction.

detention, preventive (law): *see* preventive detention.

detergent, any of various surface-active agents particularly effective in dislodging foreign matter from soiled surfaces and retaining it in suspension. The term usually denotes a synthetic substance that is not prepared by saponifying fats and oils (as is soap).

A brief treatment of detergents follows. For full treatment, *see* MACROPAEDIA: Industries, Chemical Process.

Dishwashing and laundering of clothing are the principal applications of detergents for which the liquid bath is water. Detergents also are used as emulsifiers in many applications. Detergents that function in nonaqueous media include dispersing agents added to lubricating oils used in automotive engines to prevent the accumulation of varnish-like deposits on the cylinder walls; to gasoline to prevent the buildup of gummy residues in the carburetor; and to dry-cleaning solvents to facilitate the removal of soil from garments. *See also* surface-active agent. *Compare* soap.

determinant, in genetics, the component of hereditary materials that specifies the characteristics of different cells. The term was first used in the late 19th century by the German biologist August Weismann, one of the founders of the chromosomal theory of heredity. Weismann postulated that only the sex cells retain a full set of determinants, which can be passed on to offspring, and that other cells retain only those needed to specify the characteristics of the organ or tissue in which they occur.

determinant, in linear and multilinear algebra, a value, denoted det A, associated with a square matrix A of n rows and n columns. Designating any element of the matrix by the symbol a_{rc} (the subscript r identifies the row and c the column), the determinant is evaluated by finding the sum of $n!$ terms, each of which is the product of the coefficient $(-1)^{r+c}$ and n elements, no two from the same row or column.

For the trivial case of $n = 1$, the value of the determinant is the value of the single element a_{11}. For $n = 2$, the matrix is

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

and the determinant is $a_{11}a_{22} - a_{12}a_{21}$.

Larger determinants ordinarily are evaluated by a stepwise process, expanding them into sums of terms, each the product of a coefficient and a smaller determinant. Any row or column of the matrix is selected, each of its elements a_{rc} is multiplied by the factor $(-1)^{r+c}$ and by the smaller determinant M_{rc} formed by deleting the rth row and cth column from the original array. Each of these products is expanded in the same way until the small determinants can be evaluated by inspection. At each stage, the process is facilitated by choosing the row or column containing the most zeros.

For example, the determinant of the matrix

$$A = \begin{bmatrix} 2 & 0 & 3 \\ 4 & 1 & -1 \\ 1 & 0 & 7 \end{bmatrix}$$

is most easily evaluated with respect to the second column:

$$\det A = 0 \cdot (-1)^3 M_{12} + 1 \cdot (-1)^4 M_{22} + 0 \cdot (-1)^5 M_{32} = M_{22} = (2 \cdot 7 - 3 \cdot 1) = 11.$$

determinism, in philosophy, theory that all events, including moral choices, are completely determined by previously existing causes that preclude free will and the possibility that man could have acted otherwise. The theory holds that the universe is utterly rational because complete knowledge of any given

situation assures that unerring knowledge of its future is also possible. Pierre-Simon, marquis de Laplace, in the 18th century framed the classical formulation of this thesis. For him, the present state of the universe is the effect of its previous state and the cause of the state that follows it. If a mind, at any given moment, could know all of the forces operating in nature and the respective positions of all its components, it would thereby know with certainty the future and the past of every entity, large or small. The Persian poet Omar Khayyam expressed a similar deterministic view of the world in the concluding half of one of his quatrains:"And the first Morning of Creation wrote / What the Last Dawn of Reckoning shall read."

Indeterminism, on the other hand, though not denying the influence of behavioral patterns and certain extrinsic forces on human actions, insists on the reality of free choice. Exponents of determinism strive to defend their theory as compatible with moral responsibility by saying, for example, that evil results of certain actions can be foreseen, and this in itself imposes moral responsibility and creates a deterrent external cause that can influence actions.

deterrence, military strategy under which one major power uses the threat of instant, overwhelming reprisal effectively to exclude nuclear attack from an adversary power's available alternatives. Since the advent of nuclear weapons, deterrence has become the basic strategy of the nuclear powers and of the major alliance systems, based on the maintenance by each power of a high level of assured destruction capability against any aggression, *i.e.,* the ability, visible and credible to a would-be attacker, to inflict unacceptable damage upon an attacker with surviving forces following a surprise attack. An essential element in successful deterrence is a degree of uncertainty on the part of a would-be aggressor whether his victim, although attacked and badly damaged, will nonetheless retaliate—even at the risk of suffering further, crippling damage in a second attack. In short, two basic conditions must be met: the ability to retaliate after a surprise attack must be perceived and credible, and the will to retaliate must be perceived as a possibility, though not necessarily as a certainty.

Detmold, *Regierungsbezirk* (administrative district), northeastern North Rhine-Westphalia *Land* (state), northwestern Germany. Detmold is bordered by Lower Saxony *Land* to the north and east, Hesse *Land* to the southeast, and the *Regierungsbezirke* of Arnsberg to the southwest and Münster to the west. The district occupies an area of 2,515 square miles (6,515 square km) and is coextensive with the northeastern portion of the larger historic region of Westphalia (*q.v.*) and the small former German state of Lippe. Detmold *Regierungsbezirk* was created in 1947 and takes its name from that of its administrative seat.

The level Münsterland lowland, an extension of the North German Plain, penetrates in a wide baylike formation into western Detmold between the Weserbergland, a hilly region bordering the Weser River, and the Sauerland plateau. The region's mixture of clay and sand soils and much rainfall support ideal pastures for livestock grazing. Gütersloh, the chief city of the Detmold lowland, has a diversified industrial structure; many surrounding towns specialize in furniture construction. The Senne, located on the very eastern fringe of the Münsterland, is covered by deposits of fluvial-glacial sand approximately 80 feet (25 m) thick, forming an extensive belt of heath vegetation. Paderborn, which is also situated on the eastern fringe in the Hellweg rail-and-road routeway, serves as the marketing and export centre for the surrounding agricultural region.

The Weserbergland, comprising a number of independent ranges politically divided between Detmold and Lower Saxony, extends around the east and northeast sides of the Münsterland bay. The Detmold hills are characterized by several inward-facing escarpments and narrow elongated ridges, including those of the Teutoburger Wald (Teutoburg Forest) and Eggegebirge (Egge Mountains) curving southeast and the Wiehengebirge (Wiehen Mountains) in the north. The cities of Detmold and Bielefeld, the district's largest, lie on the north slope of the wooded Teutoburger Wald ridge. Bielefeld has a highly diversified industrial structure but is most famous for its traditional linen industry. Situated between the escarpments is the Ravensberger Hügelland depression with the town of Herford in its centre. The depression is covered by fertile clay and marl soils and planted in sugar beets, wheat, and vegetables. The sandstone hills of the Lippe Bergland extend along the eastern border with Lower Saxony. Beech forests interspersed with cultivated fields and pastures supply local furniture and paper industries. North of the Wiehengebirge ridge, the Weserbergland is bordered by the North German Plain. Here the Weser River leaves the hill country through the picturesque Porta Westfalica water gap near Minden. Numerous health spas are located in the Weserbergland, among them Bad Salzuflen, Bad Oeynhausen, Bad Meinberg, and Bad Driburg.

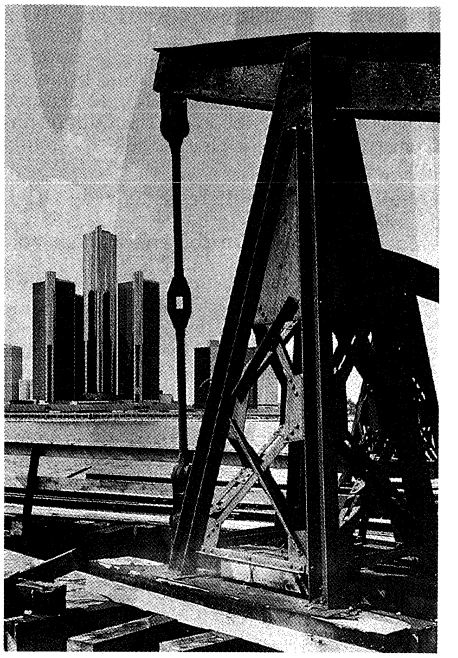
The majority of the population of Detmold *Regierungsbezirk* are descendants of the western Saxons and speak a Low German dialect. More than 65 percent of the people are Protestants and about 30 percent are Roman Catholics. Population densities in the district range from fewer than 130 persons per sq mi (50 per sq km) in the Senne and remote areas of the Weserbergland to more than 2,600 persons per sq mi (1,000 per sq km) in Bielefeld. The predominant rural settlement pattern is one of dispersed or loosely grouped farmsteads. Higher education in the district is centred at the Universität Bielefeld and the Gesamthochschule Paderborn, a university-level institution for advanced technical training. Pop. (1989 est.) 1,816,878.

Detmold, city, North Rhine-Westphalia *Land* (state), northwestern Germany, situated on the eastern slope of the Teutoburger Wald (Forest), on the Werre River. The capital, from the 12th century, of the former principality and *Land* of Lippe, it was chartered about 1350. Three miles (5 km) southwest, on the Grotenburg (mountain), 1,250 feet (381 m) high, stands Ernst von Bandel's colossal statue (188 feet [57 m]) of Arminius, or Hermann, the leader of the Cherusci who defeated the Romans there in AD 9. Detmold (then called Theotmalli) was also the scene of a conflict between the army of Charlemagne and the Saxons in 783.

A picturesque residential city with half-timbered buildings and tree-lined avenues, Detmold has two former residences of the princes of Lippe-Detmold: the Renaissance château (1550) and the New Palace (1708–18; enlarged 1850). The latter now houses the state museum and the North West German Academy of Music. Furniture making is the chief industry. Pop. (1989 est.) 66,809.

detonator: *see* blasting cap.

Detroit, city, seat of Wayne County, southeastern Michigan, U.S., on the Detroit River (connecting Lakes Erie and St. Clair), opposite Windsor, Ont. It was founded in 1701 by a French trader, Antoine de la Mothe Cadillac, who built a fort on the river and named it Fort-Pontchartrain-du-Détroit (of the strait) in honour of his patron. It became an important



The Renaissance Center, Detroit, along the Detroit River

Colour Library International

fur-trading post, and later the British called it simply Detroit.

In 1760, during the French and Indian Wars, Detroit was surrendered to the British. France's Indian allies, notably the Ottawa under Chief Pontiac, tried to capture the fort in 1763 but were defeated. The Jay Treaty (Nov. 19, 1794) provided for the evacuation of the British in the Northwest Territories, and in 1796 Detroit passed under U.S. control.

In 1805 Detroit became the capital of the newly created Michigan Territory. In the same year a fire destroyed many buildings, and the town had to be rebuilt. Soon after the outbreak of the War of 1812, Detroit was again surrendered to the British, but the Americans recaptured it in September 1813. In 1815 Detroit was incorporated as a city.

In 1818 the first steamboat on the upper Great Lakes began regular runs between Buffalo and Detroit. By railroad and water, grain and other agricultural produce poured into Detroit for processing and forwarding to other parts of the nation or to Europe. Detroit was then recognized as one of the flour-milling centres of the United States. It was the capital of Michigan state from its creation in 1837 until 1847, when the capital was moved to Lansing.

After the U.S. Civil War (1861–65) Detroit changed from its early role as a country merchant to that of industrial magnate. It became the automobile capital of the world with the help of the manufacturer Henry Ford, who introduced the assembly line and the $5-a-day minimum wage (1914). Detroit's industrial development accelerated during World War I, when it was a major producer of military armaments, and attracted a large number of migrants, particularly blacks from the South. In 1943 fighting broke out between whites and blacks in the city. Other racial disturbances occurred in 1967 and caused extensive property damage. As a result, several organizations were established to ease racial tensions and to improve community relations.

In spite of a diversified manufacturing and shipping base, the city's economy remains unusually sensitive to national and international events that affect the prosperity of the automobile industry. Economic booms and depressions tend to be felt more heavily in Detroit than in most areas of the country. In the early 1980s the city continued to lose

industry and some of the more affluent white community to the suburbs. Its inability to meet the rising cost of social services also remained a major problem.

After World War II municipal planning included a civic centre on the riverfront. Many old and unsightly buildings were demolished, and in 1950 the first of the new civic buildings—the Veterans Memorial—was completed. Other points of interest now include the City-County Building; the Henry and Edsel Ford Auditorium, where the Detroit Symphony Orchestra performs; Cobo Hall, a convention and exhibit building; Cobo Arena; and a 73-story hotel in the Renaissance Center (1977).

Among the colleges and universities in the city are Wayne State University and the University of Detroit. Important cultural institutions include the Cranbrook Academy of Art and the Detroit Cultural Centre, comprising the main public library, the Detroit Institute of Arts, and several museums. In suburban Dearborn, the Henry Ford Museum exhibits all forms of transportation equipment, while the adjoining Greenfield Village contains reconstructions of early American buildings and exhibits of early crafts.

Since 1914 Detroit has maintained a symphony orchestra. Summer concerts are presented outdoors at Belle Isle Park, which also has a botanical garden, a children's zoo, and an aquarium. Three airports serve the city. Pop. (1988 est.) city, 1,035,920; Detroit PMSA, 4,352,400; Detroit-Ann Arbor CMSA, 4,620,200.

Detroit Institute of Arts, art museum in Detroit, Mich., that is noted for its collection of American paintings from the 19th century and its Dutch, Flemish, and Italian paintings from the Renaissance through the Baroque periods. The collection of American art is augmented by the Archives of American Art, a regional research centre (one of five) affiliated with the Smithsonian Institution.

The museum was founded in 1885 by a group of Detroit citizens, was given to the city in 1919, and moved into its present neoclassical structure in 1927. It was enlarged by additions completed in 1966 and 1971. The museum's central courtyard is decorated with a series of 27 murals by the Mexican painter Diego Rivera that depict the automobile industry.

Detroit River, river forming part of the boundary between Michigan, U.S. (west), and Ontario, Can. (east), and connecting Lake St. Clair (north) with the west end of Lake Erie (south). The river flows southwest and south for 32 miles (51 km) past Detroit and Windsor, Ont. It is crossed completely by a bridge and a tunnel and is 1 to 1.5 miles (1.5 to 2.5 km) wide. The largest islands in the river are Belle Isle (a city park of Detroit) and Grosse Ile (a residential area with a U.S. naval base and airport), both in Michigan, and Fighting Island in Ontario. The river is heavily used by both pleasure craft and Great Lakes shipping.

Detroy, Jean-François (French painter): *see* Troy, Jean-François de.

Dettifoss, waterfall, northeastern Iceland, on the island's second longest river, Jökulsá á Fjöllum. Dettifoss has a vertical drop of 144 feet (44 m). It is the largest Icelandic waterfall in volume and has the greatest hydroelectric power potential of any location in Iceland. Its scenic beauty and accessibility by road from Akureyri have made it a tourist attraction.

Deucalion, in Greek legend, the son of Prometheus (the creator of mankind), king of Phthia in Thessaly, and husband of Pyrrha; he was also the father of Hellen, the mythical ancestor of the Hellenic race.

When Zeus, the king of the gods, resolved to destroy all mankind by a flood, Deucalion constructed an ark in which, according to one version, he and his wife rode out the flood and landed on Mount Parnassus. Offering sacrifice and inquiring how to renew the human race, they were ordered to cast behind them the bones of their mother. The couple correctly interpreted this to mean they should throw behind them the stones of the hillside ("mother earth"), and did so. Those stones thrown by Deucalion became men; those thrown by Pyrrha, women.

Deulino, Truce of (December 1618), agreement suspending for 14½ years the Russo-Polish hostilities that resulted from Polish intervention in Russia during the Time of Troubles (1606–13). In 1609, during the unstable reign (1606–10) of the Russian tsar Vasily Shuysky, the Polish king Sigismund III declared war on Muscovy. His army laid siege to Smolensk (September 1609), and Sigismund tried to place his son Władysław on the Muscovite throne.

In August 1610 the leading Muscovite boyars accepted Władysław and opened their city's gates to the Polish troops; but Sigismund, deciding that he wanted the Russian throne for himself, resumed the war against Muscovy. His troops burned much of Moscow and occupied Smolensk. Nevertheless, a Russian army captured Moscow, and a *zemsky sobor* ("assembly of the land") named Michael Romanov the new tsar (1613). Władysław then launched a new campaign against Russia (1617–18). The Truce of Deulino, which concluded Władysław's campaign, placed Smolensk, as well as other conquered western Russian territories, in Poland's possession. In addition, Władysław refused to relinquish his claim to the Russian throne (although Sigismund had already done so).

When the truce expired (1632), hostilities were resumed. The Russians, however, failed to regain Smolensk and accepted the Treaty of Polanowo, or Polyanov (1634). The Russians had to pay 20,000 rubles to the Poles, but Władysław recognized Michael as the legitimate tsar of Russia.

Deus (Nogueira Ramos), João de (b. March 8, 1830, São Bartolomeu de Messines, Algarve, Port.—d. Jan. 11, 1896, Lisbon), lyric poet whose work is both the last important expression of Portuguese Romantic poetry and the first indication of the revolt against it.

As a student at Coimbra, João de Deus devoted himself to bohemian life and to composing poems that were mainly only declaimed to his friends. Many of his lyrics, however, were salvaged by his friends and printed in reviews. He graduated in the faculty of law in 1859 after taking 10 years to complete a five-year course, but he remained in Coimbra until 1862, an influential figure among the younger poets who were to break with the literary formalism of the period. Though his first collection of poems, *Flores do Campo* (1868; "Wildflowers"), was well received, he was constantly in financial difficulties. His friends succeeded in having him elected to Parliament in 1869, but he renounced his office over a question of principle, a gesture that brought him great popularity but little material comfort. After his marriage he was forced to eke out a living by composing verses on commission for tradesmen and by doing menial jobs. During this depressed period he discovered the old-fashioned school primers and devoted himself to developing a new method of teaching reading. His second volume of verse, *Fôlhas Sôltas* ("Loose Leaves"), and his *Cartilha Maternal* ("Maternal Primer") both appeared in 1876. His reading method was officially adopted in 1888, and he was appointed to introduce it. He was now a famous man. His collected works, *Campo de Flores* ("Field of Flowers"), were published in 1893; he was publicly proclaimed the greatest Portuguese poet of his generation in 1895; and he was ceremoniously honoured by schoolchildren in 1896, shortly before his death.

João de Deus was a major influence in the Portuguese literature of the early 20th century. Though he lacked intellectual interests and his themes were limited, he pruned the excesses of Romanticism and fashioned a more expressive poetic language. He is mainly appreciated for his direct visual imagery and his sincerity and simplicity in the expression of love. He revitalized the lyric poetry of his day.

Deus, detail of an engraving, 19th century

By courtesy of the Secretaria de Estado da Informacao e Turismo, Lisbon

deus ex machina (Latin: "god from the machine"), in ancient Greek and Roman drama, the timely appearance of a god to unravel and resolve the plot. The deus ex machina was named for the convention of the god appearing in the sky, an effect achieved by means of a crane (Greek: *mēchanē*). The dramatic device dates from the 5th century BC; a god appears in Sophocles' *Philoctetes* and in most of the plays of Euripides to solve a crisis by divine intervention.

Since ancient times, the phrase has also been applied to an unexpected saviour, or to an improbable event that brings order out of chaos (*e.g.*, the arrival, in time to avert tragedy, of the U.S. cavalry in a western film).

deus otiosus (Latin: "neutral god," or "hidden god"), in the history of religions and philosophy, a high god who has withdrawn from the immediate details of the governing of the world. He has delegated all work on Earth to ancestors or nature spirits, who act as mediators between him and man. This concept of god occurs widely in Africa, Melanesia, and South America.

In Western philosophy, the *deus otiosus* concept has been attributed to Deism, a 17th–18th-century Western rationalistic religio-philosophical movement, in its view of a nonintervening creator of the universe. Although this stark interpretation was accepted by very few Deists during the period in which they flourished, many of their antagonists attempted to force them into the position of stating that after the original act of creation God virtually withdrew and refrained from interfering in the processes of nature and the ways of man.

Deusdedit, SAINT, also called DEUSDEDIT I, or ADEODATUS I (b. Rome [Italy]—d. Nov. 8, 618, Rome; feast day November 8), pope from 615 to 618. His pontificate is chiefly noteworthy for an unsuccessful resumption of the Byzantine war against the Lombards in Italy and for a reversal of the policy of popes Gregory I and Boniface IV, who favoured monks over the secular clergy.

deuterium (D, or ^2H), also called HEAVY HYDROGEN, isotope of hydrogen with atomic weight of approximately 2. Its nucleus, consisting of one proton and one neutron, has double the mass of the nucleus of ordinary hy-

drogen. Deuterium is a stable atomic species found in natural hydrogen compounds to the extent of 0.014–0.015 percent.

Deuterium was discovered (1931) by Harold C. Urey (Nobel Prize for Chemistry, 1934) and his associates F.G. Brickwedde and G.M. Murphy. Urey predicted a difference between the vapour pressures of molecular hydrogen (H_2) and of a corresponding molecule with one hydrogen atom replaced by deuterium (HD) and, thus, the possibility of separating these substances by distillation of liquid hydrogen. The deuterium was detected (by its atomic spectrum) in the residue of a distillation of liquid hydrogen. Deuterium was first prepared in pure form by G.N. Lewis, using the electrolytic method of concentration discovered by E.W. Washburn. When water is electrolyzed—*i.e.*, decomposed by an electric current (actually a water solution of an electrolyte, usually sodium hydroxide, is used)—the hydrogen gas produced contains a smaller fraction of deuterium than the remaining water, and, hence, deuterium is concentrated in the water. Very nearly pure deuterium oxide (D_2O; heavy water) is secured when the amount of water has been reduced to about one hundred-thousandth of its original volume by continued electrolysis. This method of preparation of D_2O was used before World War II, but during the war, other methods were used to produce large quantities of the substance.

Deuterium enters into all chemical reactions characteristic of ordinary hydrogen, forming equivalent compounds. Deuterium, however, reacts more slowly than ordinary hydrogen, a criterion that distinguishes the two forms of hydrogen. Because of this property, among others, deuterium is extensively used as an isotopic tracer in investigations of chemical and biochemical reactions involving hydrogen.

The nuclear fusion of deuterium atoms or of deuterium and the heavier hydrogen isotope, tritium, at high temperature is accompanied by release of a large amount of energy; such reactions have been used in thermonuclear weapons. Since 1953, the stable solid substance lithium deuteride (LiD) has been used in place of deuterium itself and the much rarer tritium.

The physical properties of the molecular form of the isotope deuterium (D_2) and the molecules of hydrogen deuteride (HD) are compared with those of the molecules of ordinary hydrogen (H_2) in the Table.

Comparison of the physical properties of molecular forms of hydrogen

	H_2	HD	D_2
gram molecular volume of the solid (cu cm) at the triple point (K)	23.25	21.84	20.48
triple point, K	13.96	16.60	18.73
vapour pressure at triple point (mm)	54.0	92.8	128.6
boiling point (K)	20.39	22.13	23.67
heat of fusion at triple point	28.0	38.1	47.0
heat of vaporization (cal/mole)	216 *	257 †	293 ‡

*At 20.39 K. †At 22.54 K. ‡At 23.67 K.

deuterium oxide: *see* heavy water.

Deutero-Isaiah, also called SECOND ISAIAH, section of the Old Testament Book of Isaiah (chapters 40–66) that is later in origin than the preceding chapters. *See* Isaiah, Book of.

deuterocanonical books, biblical literature accepted in the Roman canon but treated as apocryphal by Jewish and Protestant canons; also, an authentic biblical work added to the canon later. *See* apocrypha.

Deuteromycetes, also called FUNGI IMPERFECTI, artificial assemblage, or form-class, of fungi (division Mycota) in which a true sexual state is uncommon or unknown. Many of these fungi reproduce asexually by spores (conidia or oidia) or by budding. Conidial stages are similar to those in the class Ascomycetes, but those of some species show affinities to lower (primitive) fungi and the class Basidiomycetes.

The Deuteromycetes is divided into four orders based on the presence or absence of fruiting bodies, which contain the spores: Sphaeropsidales, conidia borne in a pycnidium (a flask-shaped fruiting body); Melanconiales, conidia borne in an acervulus (a cushion-like fruiting body); Moniliales, conidia not borne in a fruiting body; and Mycelia Sterilia, no conidia produced.

Many members are of great economic importance, some causing serious diseases of plants—anthracnose, botrytis blight, and wilt (*qq.v.*)—and animals, including man—aspergillosis, candidiasis, and ringworm (*qq.v.*), molds of the genus Penicillium (*q.v.*) are of great industrial importance.

deuteron, nucleus of deuterium (heavy hydrogen) that consists of one proton and one neutron. Deuterons are formed chiefly by ionizing deuterium (stripping the single electron away from the atom) and are used as projectiles to produce nuclear reactions after accumulating high energies in particle accelerators. A deuteron also results from the capture of a slow neutron by a proton, accompanied by the emission of a gamma photon.

Deuteronomic Reform, great religious reformation instituted in the reign of King Josiah of Judah (*c.* 640–609 BC). It was so called because the book of the Law found in the Temple of Jerusalem (*c.* 622 BC), which was the basis of the reform, is considered by scholars to be the same as the law code in the book of Deuteronomy (chapters 12–26). The reform comprised removal of pagan altars and idols from the Temple, destruction of rural sanctuaries and fertility cults, and centralization of worship at the Temple of Jerusalem.

Deuteronomist (D), biblical source, so named by biblical scholars to the supposed author or authors of one of the sources of the Pentateuch, especially Deuteronomy, as well as of Joshua, Judges, Samuel, and Kings. D uses a distinctive vocabulary and style of exhortation to call for Israel's conformity with Yahweh's Covenant laws and to stress Yahweh's election of Israel as his special people. *See also* biblical sources.

Deuteronomy, Hebrew DEVARIM (Words), fifth book of the Old Testament, written in the form of a farewell address by Moses to the Israelites before they entered the Promised Land of Canaan. The speeches that comprise this address recall Israel's past, reiterate laws that Moses had communicated to the people at Horeb (Sinai), and emphasize that observance of these laws is essential for the well-being of the people in the land they are about to possess. The title Deuteronomy, derived from Greek, thus means a "copy," or a "repetition," of the law rather than "second law," as the word's etymology seems to suggest.

Although Deuteronomy is presented as an address by Moses, scholars generally agree that it dates from a much later period of Israelite history. An early edition of Deuteronomy as it exists today has been identified with the book of the Law discovered in the Temple of Jerusalem in about 622 BC (II Kings 22:8; II Chron. 34:15). This early edition, corresponding roughly to chapters 5–26 and 28 of Deuteronomy as it now stands, expresses a cultic liturgy. Chapters 5–11 contain an introductory speech by Moses, largely hortatory. In chapters 12–26 laws are reiterated that the people are exhorted to obey. The section closes with a report of the formulation of a Covenant between God and his chosen people. Chapter 28 recounts in elaborate detail the blessings or curses that will come upon the people, depending on their response to laws that explicate their covenantal obligations. This arrangement of materials corresponds to the liturgy of Covenant renewal festivals that were celebrated in Israel's premonarchic period. Within this cultic context very ancient laws were preserved and transmitted.

To this original core of materials other materials were added by interested parties in the years following the reforms instituted by King Josiah (reigned *c.* 640–609 BC). The final form is due to the work of a historian who added, among other things, a second introduction (chapters 1–4) and made Deuteronomy the book of first principles for his history of the Israelite people in the land of Canaan. Deuteronomy might thus be viewed as the first part of the history that follows rather than as the last book of the Pentateuch, the generally accepted order most scholars prefer.

The principles governing the Deuteronomic historian's presentation of Israel's history are set forth in the book of Deuteronomy: faithfulness to Yahweh and obedience to his commands bring blessings; the worship of foreign gods and negligence of Yahweh's statutes bring a curse; Yahweh can be worshipped in only one sacred place (Jerusalem) by all Israel; priests, prophets, and kings are subject to Yahweh's law granted through Moses. Thus, the attribution of Deuteronomy to Moses tends to place Israel in an advanced stage of its history—when kings and a centralized cult were contemporary concerns—under the requirements of renewed ancient traditions.

Deuterostomia (Greek: "second mouth"), group of animals—including the Echinodermata (*e.g.*, starfish, sea urchins), Chordata (*e.g.*, vertebrates), Chaetognatha (arrowworms), and Brachiopoda (*e.g.*, lamp shells)—classified together on the basis of embryological development. During that process the mouth of the Deuterostomia develops from an opening into the embryonic gut other than the blastopore, which develops into the anus. The coelom (body cavity) develops from buds off the embryonic gut. A number of Deuterostomia have larval forms. The Deuterostomia constitute one of two divisions of the coelomates (animals having a coelom). *Compare* Protostomia.

deutoplasm: *see* yolk.

Deutsch (painter): *see* Manuel, Niklaus.

Deutsche Angestellten-Gewerkschaft (DAG), English GERMAN SALARIED EMPLOYEES' UNION, white-collar labour organization in Germany. The DAG was organized in West Germany in 1945, shortly after the end of World War II, in the belief that white-collar workers should have a single organization separate from those of other workers. In 1964 about 40 percent of the members worked in commercial offices; others were employed by government and financial institutions. The federation has a strong central administration and has generally avoided close political ties.

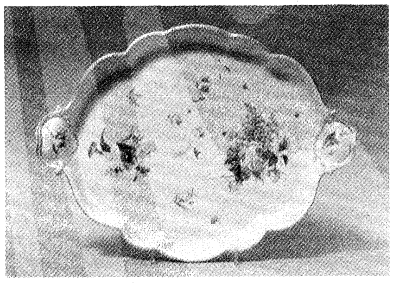
Deutsche Bank AG, German banking house founded in 1870 in Berlin and headquartered since 1957 in Frankfurt am Main. The largest bank in the country, it operates more than 1,200 branches in Germany, as well as foreign offices in London, Tokyo, and South America; and, through its membership in European Banks' International Company and its links with other international and national banking concerns, it provides banking services worldwide.

The first bank was licensed by King William I of Prussia on March 10, 1870, and began operation in Berlin on April 9. Branches were opened in Bremen in 1871, in Ham-

burg, Shanghai, and Yokohama in 1872, and in London in 1873. By the end of the century it had absorbed a number of other German banks and multiplied its capital about tenfold, under its managing director Georg von Siemens (1839–1901). In the 20th century expansion continued, and more mergers were capped in 1929 by the amalgamation of Deutsche Bank with its older rival, Disconto-Gesellschaft. After experiencing difficulties at the onset of the Great Depression, the company prospered hugely under the Nazi regime.

With the collapse of the Third Reich, Deutsche Bank's offices in Berlin and East Germany were closed by the Russians or expropriated; branches in West Germany were "decartelized," coalescing in 1947–48 as 10 independent banks. However, as the Cold War progressed and as West Germany's economic growth and cooperation became more eagerly sought, NATO opposition to West German economic consolidation lessened. By 1952 the 10 banks had been reduced to three; and in 1957 the three successor institutions were reunited to form a single Deutsche Bank AG.

deutsche Blumen, in pottery, floral decoration consisting of naturalistically painted German (*i.e.*, European) flowers appearing individually or in bouquets. Although Vienna had produced a type of naturalistic floral decoration in about 1730, *deutsche Blumen* became popular only after they had appeared on Meissen porcelain, produced from around 1740. The flowers used to decorate the porcelain were at first copied from contemporary natural history books or engravings; but by about 1750 they were being studied from nature and appear less stiff in presentation. The widely imitated style spread after the mid-18th century to such centres as Höchst, Frankenthal, and Berlin in Germany and to Chelsea, Bow, and Worcester in England.



Deutsche Blumen decoration on a Meissen porcelain tray, *c.* 1750; in the Victoria and Albert Museum, London

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

Deutsche Bücherei, one of the largest general research libraries in Germany, located in Leipzig. It was founded in 1912 and collects books produced in Germany, German books published abroad, translations of German books, and literature dealing with Germany and Germans. It issues a German national bibliography (*Deutsche Nationalbibliographie*), maintains a central cataloging service, and has nearly 7,000,000 volumes.

Deutsche Bundesbahn, English GERMAN FEDERAL RAILWAY, the state-owned railroad system of Germany established after World War II. Railroad service in Germany began with the opening of a five-mile line between Nürnberg and Fürth on Dec. 7, 1835. By 1850 there were about 3,600 mi (6,000 km) of railroads, and by 1900, over 31,000 mi (51,000 km).

After 1870 the German states began transferring the privately owned railroads to public ownership. By 1920 the entire network was operated by one national rail corporation, the Reichsbahn (State Railway), which had 35,000 miles of track in the mid-1930s. The division of Germany after World War II left West Germany with about 19,000 miles of railroad. The network, severely damaged in the war, was largely rebuilt and reequipped; by 1970, over 5,300 miles had been electrified.

Like other railroad systems, the Bundesbahn has lost much of its traffic to competing transportation services, particularly long-haul trucking. Between 1950 and 1975, its share of total freight shipments declined from 50 percent to less than 10 percent. Considerable progress was made in improving passenger service, however; express trains, for example, can cover the 522 miles from Hamburg in the north to Munich in the south in seven hours, crusing at speeds of 90 miles an hour and higher.

Deutsche Ideologie, Die (Hegelianism): *see* German Ideology.

Deutscher Gewerkschaftsbund (DGB), English GERMAN TRADE UNION FEDERATION, dominant trade union organization of industrial workers in Germany. When founded in 1949, its approximately 2,000,000 members were organized in industrial unions in the British zone of occupation. Shortly thereafter it expanded throughout Western-occupied Germany; in 1950, with more than 5,000,000 members, it was reestablished in the newly created German Federal Republic. Unlike the German unions that had been closely associated with the Socialists in the days of the pre-Nazi Weimar Republic, the DGB avoided party ties. Like its white-collar counterpart (Deutsche Angestellten-Gewerkschaft, or DAG), the DGB developed strongly centralized power, with policy being formed at the federation level.

Deutscher Werkbund (German Association of Craftsmen), founded in Munich in 1907, the first organization of artists influential in its attempts to inspire good design and craftsmanship for mass-produced goods and architecture. The Werkbund was composed of artists, artisans, and architects who designed industrial, commercial, and household products as well as practicing architecture.

The group's intellectual leaders, architects Hermann Muthesius and Henry van de Velde, were influenced by William Morris, who, as leader of the 19th-century English Arts and Crafts Movement, proposed that industrial crafts be revived as a collaborative enterprise of designers and craftsmen. Van de Velde and Muthesius expanded Morris' ideas to include machine-made goods. They also proposed that form be determined only by function and that ornamentation be eliminated.

Soon after the Werkbund was founded, it divided into two factions. One, championed by Muthesius, advocated the greatest possible use of mechanical mass production and standardization of design. The other faction, headed by van de Velde, maintained the value of individual artistic expression. The Werkbund adopted Muthesius' ideas at its annual meeting in Cologne in 1914.

The Werkbund exerted an immediate influence, and similar organizations soon grew up in Austria (Österreichischer Werkbund, 1912) and in Switzerland (Schweizerischer Werkbund, 1913). Sweden's Slöjdföreningen was converted to the approach by 1915, and England's Design and Industries Association (1915) also was modelled after the Deutscher Werkbund.

The Werkbund's influence was further enhanced by their exhibition of industrial art and architecture in Cologne (1914). Among the buildings exhibited were some of the most notable examples of modern architecture in steel, concrete, and glass. These included a theatre by van de Velde and an administrative office building, the Pavilion for Deutz Machinery Factory, and garages by the architect Walter Gropius.

World War I interrupted the Werkbund's activity, but after the war it reasserted itself with a significant exhibition in Stuttgart (1927). Organized by the German architect Ludwig Mies van der Rohe, the exhibition formed a compendium of contemporary European developments in domestic architecture and construction. Many of the exhibiting architects, such as Mies, Gropius, and Le Corbusier, followed the ideas of Muthesius and employed a high degree of standardization of materials and design, making it possible to build housing units inexpensively on a large scale.

The Werkbund also participated in the Paris exhibition of industrial arts and building held in 1930. Organized by Gropius, along with László Moholy-Nagy, Marcel Breuer, and Herbert Bayer, the Werkbund's displays successfully reemphasized the value of mass-produced housing units achieved through standardization of materials and design.

The Deutscher Werkbund was disbanded in 1933 with the advent of Nazi rule in Germany. It was revived, however, after World War II.

Deutsches Museum, in full DEUTSCHES MUSEUM VON MEISTERWERKEN DER NATURWISSENSCHAFT UND TECHNIK (German: German Museum of Masterpieces of Natural Science and Technology), museum of science and industry established in Munich in 1903 and opened in 1925. Its pattern of organization and administration became the model for such later foundations as the Museum of Science and Industry in Chicago.

The Deutsches Museum owed its existence to the perseverance and initiative of Oskar von Miller, who convinced industry and government authorities of the usefulness of his idea and built up the museum over a period of two decades. Though many of its valuable collections in the history of technology and in the physical sciences were destroyed during World War II, they were later replaced.

Deutsches Theater (German: German Theatre), private dramatic society founded in Berlin in 1883 by the dramatist Adolf L'Arronge in reaction to an outmoded theatrical tradition. It presented plays in the ensemble style of the influential Meiningen Company. In 1894 it was affiliated with the Freie Bühne under Otto Brahm, who promoted the new naturalistic style of production. The company experienced another revival under the direction of Max Reinhardt from 1905 and again during the 1920s with Bertolt Brecht. The society was disbanded after World War I but was later revived under Heinz Hilpert, who was acting there and who had succeeded Reinhardt in 1937 Hilpert directed there into the 1950s as well as at the Deutsches Theatre at Göttingen.

Deutsches Wörterbuch (German: German Dictionary), the first German dictionary conceived on scientific lines; initiated by Jacob and Wilhelm Grimm. The dictionary was designed to give the etymology and history, illustrated by quotations, of all the words in the (New) High German literary language from the time of Luther (*c.* 1500) to that of Goethe (died 1832), as well as significant dialectical words and forms; pronunciations were to be omitted. The Grimm brothers completed four volumes of the massive projected work, Jacob being responsible for volumes I (published at Leipzig in 1852), III, and IV up to the word *Frucht* ("fruit") and Wilhelm for volume II. Other German philologists, essentially agreeing with the aims and principles established by the Grimms, continued to labour on the dictionary after the death of the brothers. Cooperation between scholars from East and West Germany expedited its completion (1960).

Deutschland: *see* Germany.

Deutschlandlied (German: "Song of Germany"), formerly (1922–45) DEUTSCHLAND, DEUTSCHLAND ÜBER ALLES ("Germany, Germany above all"), national anthem of Germany from 1922 to 1945, of West Germany from 1950 to 1990, and of unified Germany from 1990. The verses were written in 1848 by the nationalist poet and university professor August Heinrich Hoffmann von Fallersleben and were sung to a tune originally composed by Joseph Haydn in 1797 as an Austrian imperial anthem. (The tune appears in his *Emperor Quartet,* Opus 76, No. 3, and was used as an Austrian anthem for more than a century.) On Aug. 11, 1922, the Weimar Republic adopted the song and its first verse as the German national anthem:

Deutschland, Deutschland über Alles,
über Alles in der Welt,
Wenn es stets zu Schutz und Trutze
brüderlich zusammen hält,
Von der Maas bis an die Memel,
von der Etsch bis an den [Little] Belt,
Deutschland, Deutschland über Alles,
über Alles in der Welt!

Germany, Germany above all,
above all else in the world,
When it steadfastly holds together,
offensively and defensively,
with brotherhood.
From the Maas to the Memel,
from the Etsch to the [Little] Belt,
Germany, Germany above all,
above all else in the world.

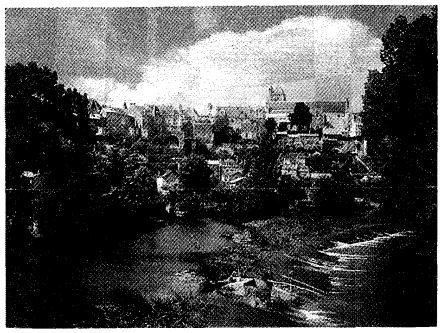
It was retained as the anthem of Nazi Germany, along with the party anthem, the Horst Wessel Song. However, during the Nazi Era these lyrics took on unfortunate connotations. What was originally intended in 1848 as a call to place the concept of a unified nation above regional differences—with geographic borders marking the extent to which culturally German settlers had spread—became reinterpreted as a justification for German expansionism and misinterpreted by some as a claim to German world hegemony. For this reason, it was dropped for a while after World War II but then restored in 1950 by West Germany, using officially the third verse:

Einigkeit und Recht und Freiheit
für das deutsche Vaterland!
Danach lasst uns alle streben
brüderlich mit Herz und Hand!
Einigkeit und Recht und Freiheit
sind des Glückes Unterpfand.
Blüh im Glanze dieses Glückes,
blühe deutsches Vaterland!

Unity and rights and freedom
for the German fatherland.
Let us strive for it together,
brotherly with heart and hand.
Unity and rights and freedom
are the basis of good fortune.
Flower in the light of this good fortune,
flower German fatherland.

Deutschnationale Volkspartei: *see* German National People's Party.

Deux-Sèvres, *département,* Poitou-Charentes region, western France, separated from the Bay of Biscay to the west by Vendée *département* and to the southwest by the Charente-Maritime *département.* It is divided into the *arrondissements* of Niort, Parthenay, and Bressuire and is in the educational division of Poitiers. Created mainly from the historic province of Poitou but also including small portions of Aunis, Saintonge, and Angoumois, it has an area of 2,318 sq mi (6,004 sq km). In the shape of an upright rectangle, it is named after two rivers—Sèvre Niortaise and Sèvre Nantaise—which flow through it. The Sèvre Niortaise, in the southern half, flows westward through Niort, the capital. The Sèvre Nantaise rises in the north central part of the *département* and flows along the northwest border, ultimately joining the Loire at Nantes. The Thouet, another tributary of the Loire, flows northward through the medieval town of Thouars.



The Thouet River at Thouars, *département* of Deux-Sèvres, France

Danese—Rapho/Photo Researchers

The *département,* which is almost entirely agricultural, has only small market towns and is an area of rural exodus. It has mild winters and warm summers, with more than 200 days of rain a year. Cattle raising predominates in the tree-bordered fields of the hilly north, and there is cultivation of cereal grains in the south. Woodlands abound in the east and on the southern border. The fertile reclaimed marshlands of the Marais Poitevin extend from the west to Niort.

Parthenay and Thouars, like Niort, are among the oldest towns in France. Saint-Maixent-l' École has a celebrated military school. The town of Melle is the centre of a region in which donkeys are bred. There is some industry at Niort. Pop. (1982) 342,812.

deva (Sanskrit: "divine"), Iranian DAEVA, in Vedic India, one of many divine powers, roughly divided on the basis of their identification with the forces of nature into sky, air, and earth divinities (*e.g.,* Varuṇa, Indra, Soma). In the later monotheistic systems the *devas* became subordinate to the one supreme being. During the Vedic period the gods were divided into two classes, the *devas* and the *asuras* (in Iranian, *daevas* and *ahuras*). In India the *devas* came to be more powerful than the *asuras,* and the latter word eventually took on the meaning of demon. In Iran the reverse took place, and the *daevas* were denounced as demons by Zoroaster. They still survive as such in the *dīvs* of Persian folklore, especially through Ferdowsī's epic, *Shāh-nāmeh* (1010; "Book of Kings"). *See also* asura.

Deva, city, capital of Hunedoara *judeţ* (district), west central Romania, on the banks of the Mureş River, at an elevation of 590 ft (180 m). The town is dominated by Citadel Hill (1,217 ft), shaped like a truncated cone, which affords a commanding view of the Mureş Valley. Atop the hill are the ruins of a citadel, built in the 13th century at the time of the Mongol invasions. The city grew in the protective shadow of the citadel during the 13th and 14th centuries, but an explosion of an arsenal in the early 19th century destroyed the structure. At the foot of the hill rises Bethlen Castle, also known as Magna Curia, built in 1621; it now houses the regional museum. Deva has little industry, but there is some food processing, and nearby are small copper and andesite mines. Pop. (1982 est.) 72,362.

Devadāsī (Sanskrit: Handmaiden of the God), caste of women connected originally with great temples in southern India, where they dedicated themselves to the service of each temple's patron god.

The caste appears to date from the 9th and 10th centuries, the great period of temple building in South India. The women attended the god—fanned the icon, honoured it with lights, and sang and danced for the god's amusement. They played an important part in preserving the cultural heritage. Their sons and daughters had equal rights of inheritance, an unusual practice among Hindu castes. Until the 20th century they were quite visible; in about 1800 the main temple of Kānchipuram (Conjeeveram) had 100 Devadāsīs. As their occupation also involved temple prostitution, they came to be held in low social regard, and the caste—and its occupations—has begun to disappear.

Devadatta (fl. 6th century BC, India), Buddhist monk who sought to reform the *saṅgha* (the Buddhist monastic community) by imposing upon it a stricter code of life. He was a cousin of the Buddha.

Devadatta is said to have joined the *saṅgha* along with Ānanda, who was possibly his brother, in the 20th year of Gautama's ministry. Fifteen years later, strengthened by his friendship with the Crown Prince of Magadha, Ajātaśatru, Devadatta proposed formally at a meeting of the *saṅgha* that the Buddha retire and hand over the leadership to him. This proposal was rejected, and Devadatta is said to have successfully instigated Ajātaśatru to execute Bimbisāra, his aged father, the King of Magadha, and to have made three abortive attempts to bring about the death of the Buddha—by hiring assassins, by rolling a rock off a mountainside at him, and by arranging for a mad elephant to be let loose in the road at the time of the collection of alms.

Sensing popular approval, Devadatta proposed stricter ascetic rules for the *saṅgha.* When these were refused, he persuaded some 500 of the Buddha's followers to join in a secession. Nothing further is known about Devadatta's movement, but it may possibly be referred to under the name of the Gotamakas in the *Aṅguttara Nikāya* (a canonical text), for Devadatta's family name was Gotama (Gautama). The Chinese pilgrim Hsüan-tsang recorded that in the 7th century monks of a monastery in Bengal were following a certain regulation of Devadatta's.

Devagiri (village, India): *see* Daulatābād.

devaluation, reduction in the exchange value of a country's monetary unit in terms of gold, silver, or foreign monetary units. Devaluation is employed to eliminate persistent balance-of-payments deficits, because devaluation has the effect of decreasing prices of the home country's exports in terms of the importer's currency and, at the same time, increasing prices of imports to home country buyers. If the demand for both exports and imports is relatively elastic (if the quantity purchased is more than proportionately responsive to changes in price), the nation's income from exports will rise, and its expenditure for imports will fall. Thus, its trade will be more in balance and its balance of payments improved.

An additional benefit may arise if the increase in exports results in a general expansion of the economy with an increase in the interest rate unaccompanied by an expansionary monetary policy. In that case, capital inflows will increase and outflows decrease. Devaluation will not be effective if the balance-of-payments disequilibrium is a result of basic structural faults in a nation's economy.

Revaluation, on the other hand, involves an increase in the exchange value of a country's monetary unit in terms of gold, silver, or foreign monetary units. It may be undertaken when a country's currency has been undervalued in comparison with others, causing persistent balance-of-payments surpluses.

Devanāgarī, also called NĀGARĪ, Indian script used to write the Sanskrit, Prākrit, Hindi, and Marathi languages, developed from the North

Indian monumental script known as Gupta and ultimately from the Brāhmī alphabet, from which all modern Indian writing systems are derived. In use from the 7th century AD and occurring in its mature form from the 11th century onward, Devanāgarī is characterized by long, horizontal strokes at the tops of the letters, usually joined in modern usage to form a continuous horizontal line through the script when written. Devanāgarī is written from left to right and uses 48 letters—34 consonants and 14 vowels and diphthongs. In practice, the script—though alphabetic in origin—is syllabic, with a short *a* sound being understood after each consonant unless the sign for an alternative vowel is used; in the past, Devanāgarī was frequently written without the vowel signs, sometimes resulting in confusion.

devarāja, in ancient Cambodia, the cult of the "god-king" established early in the 9th century AD by Jayavarman II, founder of the Khmer Empire of Angkor. For centuries, the cult provided the religious basis of the royal authority of the Khmer kings.

The *devarāja* cult grew out of both Hindu and indigenous traditions. It taught that the king was a divine universal ruler, a manifestation of the Hindu god Śiva, whose divine essence was represented by the *liṅga*, a phallic idol housed in a special mountain temple.

The king was deified in an elaborate and mystical ceremony, requiring a high priest, in which the divine essence of kingship was conferred on the ruler through the agency of the *liṅga*. The safeguarding of the *liṅga* became bound up with the security of the kingdom, and the great temple architecture of the Khmer period attests to the importance attached to the belief.

Devawongse Varoprakar, Prince (b. Nov. 27, 1858, Bangkok—d. June 28, 1923, Bangkok), foreign minister of Siam from 1885 to 1923, whose policies enabled the kingdom to survive as an independent state.

The 42nd child of King Mongkut, Devawongse was the younger half brother of King Chulalongkorn. After only a smattering of formal Thai and English education in schools his brother organized in the early 1870s, he began his government career in the king's personal secretariat. He demonstrated a natural flair for foreign affairs, and Chulalongkorn named him foreign minister in 1885. Devawongse then established Siam's first modern bureaucratic ministry, with Western-style paperwork and office hours.

The chief characteristics of Devawongse's foreign policy were genial accommodation and a determination that Siam should be treated as an equal by the Western countries with which the kingdom earlier had signed unequal treaties. He was able to escape the most aggressive imperialist pressures only by conceding large tracts of territory in Laos and Cambodia to France (1893, 1904, 1907) and on the Malay Peninsula to Great Britain (1909). Skillfully using a series of Belgian and U.S. advisers, Devawongse devoted his last two decades in office to ending Western extraterritoriality in Siam, an effort that proved successful in the months immediately following his death.

devekut (Judaism): *see* devequt.

development, in biology, the progressive changes in size, shape, and function during the life of an organism by which its genetic potentials (genotype) are translated into functioning adult systems (phenotype).

A brief treatment of biological development follows. For full treatment, *see* MACROPAEDIA: Growth and Development, Biological.

The simplest form of development is a change (usually an increase) in size of an organ system or structure; simple growth, however, seldom occurs without accompanying chemical or functional changes. In general, biological development consists of an increase in both size and complexity of the entire organism and of its component organs, but under some circumstances, as when an early motile stage metamorphoses into a sessile or parasitic adult, loss or reduction of certain structures may occur. Development may be divided into morphogenesis, the process by which organ systems become structurally distinct, and differentiation, the process by which cells and tissues adopt specific and unique biological functions. In most cases the two processes go hand in hand, because a specific structure may be required to fulfill a necessary physiological function. In both plants and animals, these processes may occur at different rates in different organ systems; the human brain, for example, may reach its full adult size and complexity before the reproductive system has even begun its adult development.

Animal and plant development follow very different paths. Plants in general employ a type of multiphasic development, in which two distinct forms succeed each other in alternating generations; one form, created by the union of sexual cells (gametes), contains two sets of similar chromosomes (diploid). At sexual maturity, this form, called the sporophyte, produces an offspring (gametophyte) with cells containing only one set of genetic instructions (haploid). At their sexual maturity, gametophytes produce haploid gametes that unite to begin a new cycle.

Animal cells also go through a haploid phase, but the reduction of chromosomes occurs only within the sex organs of the diploid parents; gametes from the two parents immediately reunite to form a diploid embryo, without an intervening haploid generation. The male sperm fertilizes a female ovum to form the zygote, which immediately begins to divide into many smaller cells (cleavage). The embryos of animals that lay their eggs on land, such as reptiles and birds, are nourished by a yolk throughout development. Lower vertebrates that lay their eggs in water have smaller yolks and hatch less developed offspring, which draw their nutrients directly from their environment. Most mammals have very small eggs that attach to the mother's uterus and that develop a placenta, by which nutrients are transmitted from mother to child. Insects and other invertebrates produce immature larval forms that metamorphose into the adult form.

After several divisions, the embryo forms a hollow ball called a blastula, which differentiates into three types of cells (ectoderm, mesoderm, and endoderm). In gastrulation, these cells migrate into their proper positions: ectoderm, from which develop the skin, sense organs, and nervous system, on the outside; endoderm, from which develop the digestive tract, urinary system, and lungs, on the inside; and mesoderm, from which develop muscles, skeleton, and connective tissues, between the two.

Gastrulation is followed by organogenesis, during which the various organ systems of the adult first begin to take primitive shape. A fold on the embryo's surface closes off into a tube that further subdivides by constriction and dilation of the cell mass, as in the nervous system. A pocket in the tissue's surface gradually lengthens and branches, as in the vertebrate lung, and local thickenings develop from primordial tissues, as in the development of the musculoskeletal system of vertebrates.

Development in animals is not completed at birth. Many invertebrates and lower vertebrates hatch as distinctly different forms, called larvae, which feed and grow until they have sufficient mass to sustain life as adults. Then, structures with functional importance to the larva but not to the adult (*e.g.*, a tadpole's tail) disintegrate, while new structures (*e.g.*, a frog's legs) are created from embryonic tissues that remained quiescent during the larval stage. This transformation is called metamorphosis.

Other vertebrates, such as the mammals, are born as essentially miniature adults requiring minor further development. The sex organs are incomplete at birth, and their maturation constitutes the transition to adulthood. In humans, for example, much of the postnatal development occurs during puberty, when secondary sexual characteristics such as pubic and facial hair appear, female breasts develop, and mature sex cells are produced by the male testes and female ovaries.

All plants develop through two distinct generational forms, although in some, as in the algae, the physical appearance of succeeding generations is identical, while in others, as in the flowering plants, one of the forms (usually the haploid gametophyte) goes through its entire life cycle within the body of the parent. Among higher plants, the male gametophyte may consist of as few as three cells, which form a pollen grain that is carried by the wind, water, or animals to the female gametophyte within the female flower. The male then grows through the tissues surrounding the female reproductive cell to fertilize it, again forming a zygote. As in the animal, the zygote divides into smaller cells, which quickly become differentiated; after only three cell divisions, the cells' eventual development into seed leaves (cotyledons), shoot, root, and hypocotyl (the part of the shoot between the cotyledons and the root) has already been determined. Development continues until a tiny plant, or seedling, is formed; at this point, further development may be arrested in the higher plants until germination, which occurs only after the seed has been dispersed and environmental conditions propitious for growth are encountered.

At germination, the seedling first grows larger simply by absorbing water from its environment, but soon begins active growth through the division of cells at growth zones (meristems) at the tip of the root and shoot. Each cell division in the meristem produces one dividing cell to continue growth and a vegetative cell that helps extend the plant behind the growing tip. Smaller clusters of meristemic cells at intervals along the stem produce leaves, the shape of which is determined by the rate of growth of different cells within the meristem. Branches of the original meristem produce secondary roots underground and lateral branches from the shoot.

Within the plant, vegetative cells produced by the meristem form long chains behind it. In some of these chains, a stiff compound called lignin is deposited, cutting off diffusion across the cell wall and killing the cell; the empty cell walls form long tubes, called xylem, through which water flows. Other molecules, cutin and suberin, are deposited in the walls of cells on the outer surface of the stem, creating the cork and phloem, which carries nutrients and other substances through the plant. New vascular cells are produced by a layer of reproductive tissue, the cambium, between the layers of vascular tissue. The entire growth process is controlled by plant hormones called gibberellins.

development bank, national or regional financial institution designed to provide medium- and long-term capital for productive investment, often accompanied by technical assistance, in less developed areas.

The number of development banks has increased rapidly since the 1950s; they have been encouraged by the International Bank for Reconstruction and Development and its affiliates. The large regional development banks include the Inter-American Development Bank, established in 1959; the Asian

Development Bank, which began operations in 1966; and the African Development Bank, established in 1964. They may make loans for specific national or regional projects to private or public bodies or may operate in conjunction with other financial institutions. One of the main activities of development banks has been the recognition and promotion of private investment opportunities. Although the efforts of the majority of development banks are directed toward the industrial sector, some are also concerned with agriculture.

Development banks fill a gap left by undeveloped capital markets and the reluctance of commercial banks to offer long-term financing. Development banks may be publicly or privately owned and operated, although governments frequently make substantial contributions to the capital of private banks. The form (share equity or loans) and cost of financing offered by development banks depend on their cost of obtaining capital and their need to show a profit and pay dividends.

developmental psychology, also called LIFE-SPAN PSYCHOLOGY, the branch of psychology concerned with the changes in cognitive, motivational, psychophysiological, and social functioning that occur throughout the human life span. During the 19th and early 20th centuries, developmental psychologists were concerned primarily with child psychology. In the 1950s, however, they became interested in the relationship between personality variables and child rearing, and the behavioral theories of B.F. Skinner and the cognitive theories of Jean Piaget were concerned with the growth and development of children through adolescence. At the same time, the German psychologist Erik Erikson insisted that there are meaningful stages of adult psychology that have to be considered in addition to child development. Psychologists also began to consider the processes that underlie the development of behaviour in the total person from birth to death, including various aspects of the physical–chemical environment that can affect the individual during the intrauterine period and at birth. By the latter part of the 20th century, developmental psychologists had become interested in many broad issues dealing with the psychological process throughout life, including the relation of heredity and environment, continuity and discontinuity in development, and behavioral and cognitive elements in the development of the total person. *See also* child psychology; psychological development.

Deventer, *gemeente* (municipality), Overijssel *provincie* (province), east central Netherlands, on the IJssel River at the west end of the Overijssel Canal. It developed in the 8th century around a chapel established by St. Lebuinus. During the Middle Ages it prospered as a member of the Hanseatic League, had a monopoly of the dried-cod trade, and was noted for its five annual fairs. It became a famous medieval intellectual centre, where the saintly scholar Thomas à Kempis, the great Humanist Erasmus, and Pope Adrian VI studied. In the 14th century, Gerhard Groote founded his religious movement, the Brethren of the Common Life, in Deventer. The town was the most important Dutch printing centre *c.* 1500.

Famous for its carpets, tapestries, and honey cakes (*Deventerkoek*), it also has machine shops and foundries and manufactures bicycles and bricks. Medieval buildings include the Grote Kerk (on the site of the original chapel of St. Lebuinus), with an 11th-century crypt; the Bergkerk (St. Nicholas Church), with Romanesque towers; the town hall (dating from the 13th century); and the Gothic Weighhouse (1528), now a museum. Parts of the old city walls remain. Deventer has a municipal museum and a museum of tropical agriculture, and its Athenaeum Library houses valuable manuscripts from the 10th century. Pop. (1983 est.) 64,455.

Deventer, Conrad Theodor van (b. Sept. 29, 1857, Dordrecht, Neth.—d. Sept. 27, 1915, The Hague), Dutch jurist and statesman whose pamphlet *Een eereschuld* ("A Debt of Honour") and ideas had a profound influence on the development of the colonial Ethical Policy in the Dutch East Indies.

Van Deventer, educated in the law, left in 1880 for the Indies, where he worked as a lawyer and held various judicial posts. The outer islands (*i.e.*, those outside Java) were of particular interest to him. On returning to The Netherlands in 1897, he joined the Liberal Democratic Party and drafted a new colonial program that emphasized welfare of the indigenous peoples, decentralization of administrative authority, and employment of more Indonesians in high government positions. In 1899 *Een eereschuld* appeared in *De Gids,* a progressive periodical. The Dutch, he insisted, should repay the full amount that had been extracted from the Indies since 1867 (when Parliament took over responsibility for the colonies) by pouring money into the Indies' education and economy. His suggestions formed the basis of the Ethical Policy, which was adopted in 1901, and which recognized the moral responsibilities of Dutch guardianship of the Indies.

Van Deventer served twice in Parliament, in 1905–09 and from 1913 until his death.

devequt, also spelled DEVEKUT (Hebrew: "attachment"), in Jewish religious thought, an adherence to or communion with God that stops short of mystical union. The notion of *devequt* apparently derived from the biblical reference to "loving the Lord your God, walking in all his ways, and holding fast to him" (Deuteronomy 11:22). As a fundamental concept of the Jewish mystical system called the Kabbala, *devequt* was considered one of the three highest values of a mystic and, for some, was equated with ecstasy.

The Kabbalistic view of *devequt* as a privilege of the spiritual aristocracy was modified in the religious and social movement called Ḥasidism, for, in its lower, or minor, stage, *devequt* found expression in the social sphere and was, in principle, open to every Ḥasid. Maimonides, the great 12th-century codifier of Jewish law, classified *devequt* as a commandment.

Devereux, Robert: *see* Essex, Robert Devereux, 2nd earl of; Essex, Robert Devereux, 3rd earl of.

Devereux, Walter: *see* Essex, Walter Devereux, 1st earl of.

Devers, Jacob L(oucks) (b. Sept. 8, 1887, York, Pa., U.S.—d. Oct. 15, 1979, Washington, D.C.), U.S. general during World War II, whose 6th Army Group successfully penetrated German-held positions in central Europe and helped wrest the mainland from Nazi control.

At the outbreak of World War II (1940), he was commanding general of the 9th infantry division, becoming chief of armoured forces from 1941 to 1943. After serving as commanding general of the European theatre of operations in 1943, he became in the next year commander of the North African theatre and deputy supreme Allied commander of the Mediterranean theatre.

Devers was next appointed (September 1944) commander of the 6th Army Group, made up of U.S. and French forces. In early 1945 his units cleared Alsace, crossed the Rhine River, and swept through southern Germany to the Swiss border, eventually entering Austria and linking up with Allied forces in northern Italy.

Devers, 1946
By courtesy of the U.S. Army

He headed the army ground forces before his retirement in 1949.

Devey, George (b. 1820, London—d. November 1886, Hastings, East Sussex, Eng.), British architect who influenced nonacademic architects in England in the late 19th and early 20th centuries.

Richard Norman Shaw, probably through his sometime partner William Eden Nesfield, perfected Devey's informal domestic design. More directly affected by Devey were Nesfield himself and C.F.A. Voysey, who as a young man worked for Devey. Particularly influential was a Devey brick house at Betteshanger, Kent (1857), which was studied carefully by Nesfield and by the school architects E.R. Robson and J.J. Stevenson. The London School Board's standard design from 1870, when Robson became its official architect, was based on this residence. During his lifetime Devey was best known for altering and enlarging country mansions, *e.g.*, Penshurst Place, Kent. The necessary derivativeness of this type of work and Devey's aversion to publicity concealed his true importance, which was overlooked by architectural historians until the middle of the 20th century.

devil (from Greek *diabolos,* "slanderer," or "accuser"), the spirit or power of evil. Though sometimes used for minor demonic spirits, the word devil generally refers to the prince of evil spirits and as such takes various forms in the religions of the world.

In the monotheistic Western religions, the devil is viewed as a fallen angel who in pride has tried to usurp the position of the one and only God. In Judaism, and later Christianity,

"Lucifer's Descent into Hell," illumination from *Queen Mary's Psalter*; in the British Library, MSS Royal 2B VII
By courtesy of the trustees of the British Library

the devil was known as Satan. In the Old Testament, Satan is viewed as the prosecutor of Yahweh's court, as in Job, chapters 1 and 2, but he is not regarded as an adversary of God. In postbiblical Judaism and in Christianity, however, Satan became known as the "prince of devils" and assumed various names: Beelzebub (the Lord of Flies) in Matt. 12:24–27, often cited as Beelzebul (Lord of Dung), and Lucifer (the fallen angel of Light).

In Christian theology the devil's main task is that of tempting man to reject the way of life and redemption and to accept the way of death and destruction. The leader of the angels who have fallen from heaven because of pride, Satan has as his main adversary in Christian thought, legend, and iconography the archangel Michael, leader of God's heavenly hosts.

Islāmic theology is rich in references to Iblīs, the personal name of the devil, who is also known as ash-Shayṭān (The Demon) and ʿaduw Allah (Enemy of God). In the Qur'ān, Iblīs first appears in the story of the creation of the world. He alone of the angels refuses God's order to bow before Adam, the first man. He is then cursed by God; his punishment is to come on the Day of Judgment, but until then he is empowered to tempt the unfaithful (but not true believers). Iblīs next appears as the tempter of Adam and Eve in the Garden of Eden. In Islāmic theology, Iblīs is described as an angel, a *jinn* (spiritual creature capable of good or evil), or an angel who was the leader of the *jinni*. The questions of his sins of pride and disobedience are especially important in the Ṣūfī traditions, in which he is sometimes presented as a true monotheist who would bow only to God.

The devil was also an important figure in certain syncretic religions. In Gnosticism the devil was often called the Demiurge (the Creator) and in Manichaeism the Prince of Darkness, as well as other names.

The devil, as the great power of evil, has been much depicted in religious and secular literature and art. At various intervals in history, devil worship becomes significant for certain individuals dissatisfied with existing religious institutions, and exorcism (the casting out of demons) is often consequently reinstated by these institutions.

"De," "la," and similar components of a name, when followed by a space, are alphabetized as separate words (e.g., *De Forest, Lee*). *When they are joined to the following part of a name, the combination is treated as a single word* (e.g., *DeForest, John William*).

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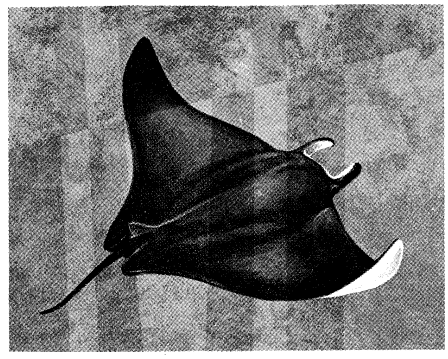
devil ray, also called MANTA RAY, any of several genera of marine rays comprising the family Mobulidae (class Selachii). Flattened, and wider than they are long, devil rays have fleshy, enlarged pectoral fins that look like wings; extensions of these fins, looking like devils' horns, project as the cephalic fins from the front of the head. Devil rays have long, whiplike tails provided, in some species, with one or more stinging spines.

Devil rays, related to sharks and skates, are found in warm temperate and tropical waters along continents and islands. They swim at or near the surface, propelling themselves by flapping their pectoral fins and, at times, leaping or somersaulting out of the water. They feed on plankton and small fishes that they sweep into their mouths with their cephalic fins.

The smallest of the devil rays, *Mobula diabolis* of Australia, grows no more than 60 centimetres (2 feet) across, but the Atlantic manta, or giant devil ray (*Manta birostris*), largest of the family, may grow more than 7 metres (23 feet) wide. The Atlantic manta is a well-known species, brown or black in colour



Atlantic manta (*Manta birostris*)
Painting by Richard Ellis

and very powerful, but inoffensive. It does not, old tales to the contrary, envelop pearl divers and devour them.

devil worship: *see* satanism.

Deville, Édouard Gaston (Daniel) (b. Feb. 21, 1849, La Charité, Fr.—d. Sept. 21, 1924, Ottawa), French-born Canadian surveyor of Canadian lands (1875–1924), who perfected the first practical method of photogrammetry, or the making of maps based on photography.

Deville served in the French Navy, conducting hydrographic surveys in the South Sea islands, Peru, and elsewhere until 1874. He then went to Canada, where he was appointed (1875) inspector of surveys in the province of Quebec. In 1881 he became inspector of Dominion land surveys and four years later surveyor general.

Deville devised a system of making maps by plotting intersections from photographs taken from tripods on the ground. Among his several articles and books is *Photographic Surveying* (1895).

Deville, Henri-Étienne Sainte-Claire: *see* Sainte-Claire Deville, Henri-Étienne.

devil's advocate, Latin ADVOCATUS DIABOLI, in the Roman Catholic Church, the promoter of the faith, who critically examines the life of and miracles attributed to an individual proposed for beatification or canonization (*q.v.*). He is popularly called the devil's advocate because his presentation of facts includes everything unfavourable to the candidate. Pope Leo X, in the early 15th century, seems to have introduced the term, but Sixtus V formally established the office in 1587.

devil's arrow, also called DEVIL'S DARNING NEEDLE: *see* dragonfly.

Devil's Island, French ÎLE DU DIABLE, rocky islet off the Atlantic coast of French Guiana. The smallest of the three Îles du Salut, about 10 mi (16 km) from the mainland and the Kourou River mouth, it is a narrow strip of land about 1,300 yd (1,200 m) long and 440 yd broad, mostly covered by palm trees.

Part of a penal settlement, the island housed the convicts' leper colony until the Îles du Salut were made a maximum security area. The island's most famous prisoner was Alfred

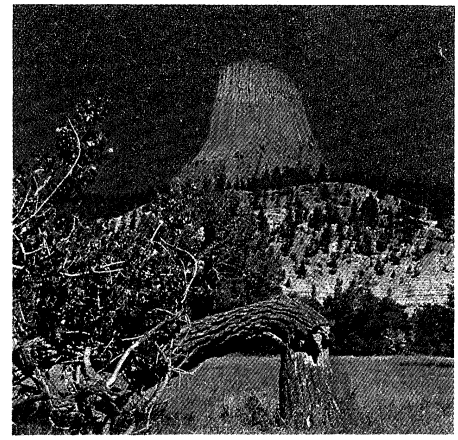
Devil's Island off the coast of French Guiana
Bjorn Klingwall—Ostman Agency

Dreyfus, a French army officer unjustly condemned for treason, who arrived on April 13, 1895; he was released on June 5, 1899, having written a journal and more than 1,000 letters in captivity. Dreyfus was succeeded by other political prisoners and, during World War I, by spies and deserters, chiefly from tropical countries and not of French birth. Transportation of prisoners to French penal colonies was abolished by a decree of June 17, 1938, although the last prisoners did not leave Devil's Island until 1953.

The island was later promoted as a winter resort and has a growing tourist trade.

Devils Lake, city, seat of Ramsey County, northeast central North Dakota, U.S. The community was established with the opening of a land office in 1882 as Creelsburg (later Creel City) and was the head of steamboat navigation on Devils Lake, a saline body of water originally about 30 mi [50 km] long. By 1909, when the lake had receded 4 mi from the city, navigation ceased. The city developed as a trade centre for an agricultural area producing grain, livestock, poultry, and dairy products. Chief manufactures are sheet-metal products, flour, farm implements, and liquid fertilizer. The city is the site of Lake Region Junior College (1941). The Sully's Hill National Game Preserve is 12 mi southwest. Fort Totten Indian Reservation is 15 mi south; the fort (*c.* 1867) is preserved as a state historic site and houses a museum. St. Michael's Indian Mission (1874), just east of Fort Totten, is the site of an Indian school. Inc. city, 1894. Pop. (1980) 7,442.

Devils Tower National Monument, the first U.S. national monument, established in 1906 in northeastern Wyoming, U.S., near the Belle Fourche River. It encompasses 1,347 ac (545 ha) and features a natural rock tower, the remnant of a volcanic intrusion now exposed



Devils Tower National Monument, Wyoming
By courtesy of the Wyoming Travel Commission

by erosion. The tower has a flat top and fluted sides and is 865 ft (263 m) high. It probably formed when molten rock, pushing upward, encountered a hard-rock layer and was forced to spread into a flat-topped shape. Its colour is mainly light gray and buff. Lichens cover parts of the tower, and sage, moss, and grass grow on its top. Chipmunks and birds live on the summit, and a pine forest covers some of the surrounding country. The monument contains a museum and campground.

devil's walking stick (plant): *see* angelica tree.

Devine, Maj. M.J. (religious leader): *see* Divine, Father.

devir (Judaism): *see* Holy of Holies.

devitrification, process by which glassy substances change their structure into that of crystalline solids. Most glasses are silicates in which the atomic structure does not have the repetitive arrangement required for the formation of crystals. Glass is formed by the cooling of a rock magma too rapidly for this structural regularity to become established. Glasses typically are not stable at low temperatures, however, and a readjustment of the atomic arrangement may take place to form more stable structures. This devitrification process is very slow, but over millions of years, a glass will form a completely crystalline mass; thus, the occurrence of very old glassy rocks is rare.

Devizes, town ("parish"), Kennet district, county of Wiltshire, England. It lies along the disused Kennet and Avon Canal, at the edge of Roundway Down.

It was the site of a Roman fortification, Castrum Divisarum, and in about 1132 Roger, bishop of Salisbury, built a castle there. The name Devizes possibly came from a medieval Latin reference to the castle *ad divisas* ("at the boundaries"). The town that grew around the castle received its first charter in 1141, was represented in Parliament from 1295, and had an important medieval market. The castle was razed in 1645 by the army of Oliver Cromwell. Devizes today is a grain, cattle, and pig market and has bacon and cheese factories, tileworks, and engineering plants; it is the country's oldest manufacturer of snuff. Pop. (1981) 10,649.

Devolution, War of (1667–68), conflict between France and Spain over possession of the Spanish Netherlands (present-day Belgium).

Devolution was a local custom governing the inheritance of land in certain provinces of the Spanish Netherlands, by which daughters of a first marriage were preferred to sons of subsequent marriages; and Louis XIV of France began the war on the pretext that this custom should apply to sovereign territories also, so that his wife, Marie-Thérèse, should succeed her father, Philip IV of Spain (d. 1665), in the majority of the Spanish possessions in the Netherlands in preference to her younger half-brother, Charles II of Spain, a sickly epileptic unlikely to live long or produce heirs.

The French army under Marshal de Turenne advanced into Flanders in May 1667 and easily secured its objectives. Louis then turned to diplomacy and in January 1668 concluded a treaty with the Holy Roman emperor Leopold I whereby they agreed to partition the Spanish dominions between themselves on the Spanish king's death and in which it was also stipulated how much territory in the meantime France was to annex in the Netherlands. The French had also tried to win English support for their claims, but a new ministry in England turned instead to an alliance with the Dutch and with Sweden. These allies sought to contain the French advance by persuading Spain to agree to moderate terms and by supporting Spain in war if this proved of no avail. The settlement envisaged was much the same as that on which Louis XIV and the emperor had agreed, and so peace was soon concluded at Aix-la-Chapelle in April 1668, though not before the Prince de Condé had overrun Franche-Comté with a French army. The latter province was returned to Spain, but France retained Bergues, Furnes, Armentières, Oudenaarde, Courtrai, Lille, Douai, Tournai, Binche, Ath, and Charleroi.

Devon, county of England, forming part of the South West Peninsula of Great Britain, bounded on the west by Cornwall and on the east by Dorset and Somerset. It is England's third largest county and has an area of 2,591 square miles (6,711 square km). The county comprises the districts of Torridge, North Devon, West Devon, Mid Devon (formerly Tiverton), Teignbridge, Exeter, East Devon, Plymouth, Torbay, and South Hams. The cathedral city of Exeter is the long-established seat of county administration.

Within Devon's boundaries is a wide variety of scenery, including the Dartmoor National Park and, in the north, part of the Exmoor National Park. Dartmoor is a granite plateau rising to more than 2,000 feet (600 m), the crests capped by granite tors (rocky peaks), with shallow marshy valleys, thin infertile soils, and a vegetation of coarse grasses, heather, and bracken. The moor is used for rough grazing, reforestation, reservoirs, and military training and is a popular area for tourists. Exmoor, reaching more than 1,575 feet (480 m), is a plateau that has more farmland than Dartmoor; rough grazing and tourism are also important. These two areas of moorland contain the main sources of rivers for the county. From Dartmoor the rivers flow in a radial pattern to the north and south coasts and to the River Tamar (the Cornish boundary); from Exmoor they flow seaward via the River Exe and northward to the Bristol Channel. Much of central and northwestern Devon is given over to grassland. The soils in South Hams, south of Dartmoor, often produce good farmland. The most fertile soil is in southeastern Devon. The county's generally mild climate becomes more extreme with elevation and distance from the sea, and rainfall increases from about 30 inches (760 mm) on the south coast to more than 60 inches (1,500 mm) on Exmoor and 80 inches (2,000 mm) on Dartmoor.

Prehistoric remains abound; they include the limestone caves near Torquay (including Kent's Cavern, one of the two oldest human dwellings in Britain), numerous high-altitude Bronze Age remains on Dartmoor, and later Iron Age hill forts and earthworks fringing the moor and guarding river routes. The largest, Hembury Fort, was probably the capital of the Dumnonii, a British tribe, until the foundation of Exeter as a Roman frontier station at the termination of Fosse Way. The Dumnonii survived the 7th-century Saxon conquests, but both Saxon and Briton became subjects of Wessex. Devon was recognized as a shire in the late 8th century and suffered subsequently from Danish raids (851–1003). The Saxons created four strongholds, called *burhs,* at Exeter, Barnstaple, Totnes, and Lydford. Exeter was taken by the Norman William I the Conqueror in 1068, and a castle was built there in 1348. The Normans built castles at Totnes, Okehampton, and Plympton; these, like the *burhs,* acted as nuclei for the growth of towns.

Tin mining on Dartmoor was important from the 12th to the 17th century, and the miners formed a separate community with its own courts. By the 19th century, lead, silver, iron ore, copper, and manganese had all been worked. The ports of Exeter, Plymouth, Barnstaple, and Dartmouth thrived from medieval times on the export of tin and cloth (a staple industry) until these both declined in the 19th century, causing rural depopulation that was alleviated only by the rise of tourism, which rapidly increased during the railway era.

Agriculture is Devon's most valuable single industry; about 30 percent of the working population is dependent on agriculture and related industries. It is based on livestock, supported by permanent grassland and ley, cereals—especially barley—potatoes, market gardening, horticulture, fruit, and fodder crops. About 25 percent of the country is heath or moorland, providing rough grazing mainly on Exmoor and Dartmoor. Dairy farming is important, and Devonshire "clotted cream" is still produced. Dairy cattle are most important in eastern, northwestern, and southern Devon; beef cattle are raised throughout, especially in the south and west. Sheep are important throughout the county, including Dartmoor and Exmoor, with the exception of eastern Devon. Between 1964 and 1980 the number of farm holdings fell by 25 percent, but the average size increased. Soft fruit and flowers are grown in sheltered areas, but traditional cider orchards are declining in acreage, and the cider is now produced in factories.

Tourism dominates the coastal areas and is also important in the rural interior. The main resorts, apart from Ilfracombe, lie on the south coast and include Torbay, Paignton, and Brixham, while both coasts abound with picturesque small towns and villages, such as Salcombe, Lynmouth, and Clovelly. Fishing is still important, especially at Brixham and Plymouth, which is also an important naval base. Kaolin (china clay) from Dartmoor and ball clay from the Bovey basin are the chief mineral exports. Local industries include textiles (Tiverton), dairy produce (Totnes), glass (Dartington), woolens (Axminster), lace (Honiton), and the complex industries of the Devonport dockyard. Plymouth and Exeter are the main industrial centres, followed by Torbay, Barnstaple, and Newton Abbot. Service trades employ two-thirds of the working population, more than the national average, reflecting the importance of tourism and the large retired population that is attracted by the mild winter climate and scenery.

Devon's main centres of population are coastal, except the city of Exeter. There are three main urban areas that act as the major retail and service centres: Plymouth; Exeter, the county town and cathedral and university city; and Torbay, one of the country's leading holiday resorts. Pop. (1987 est.) 1,010,000.

Devonian period, interval of geologic time from 408 to 360 million years ago. The fourth period of the Paleozoic era, it follows the Silurian and precedes the Carboniferous. The Devonian is often divided into the Early Devonian epoch (408 to 387 million years ago), Middle Devonian epoch (387 to 374 million years ago), and Late Devonian epoch (374 to 360 million years ago). The rocks that originated during the period comprise the Devonian system.

A brief treatment of the Devonian period follows. For full treatment, *see* MACROPAEDIA: Geochronology.

Rocks of the Devonian system are found in every continent, but they were first recognized as a major group in the counties of Devon and Cornwall in southwestern England. The research of the early geologists Sir Roderick I. Murchison and Adam Sedgwick established the Devonian in 1839. Their work was soon corroborated by that of European and American investigators studying similar strata elsewhere.

The period was one of significant changes in world paleogeography. The physiognomy of the Earth was substantially different from what it is today; a giant continent was situated in the Southern Hemisphere, and other land masses were located in the equatorial regions. Siberia was separated from Europe by a broad ocean. The continents of North America and Europe had collided during the Early Devonian, resulting in the Caledonian orogeny (mountain-building episode). This event involved much igneous activity, as, for example, the intrusion of huge granitic bodies known as plutons. In the Middle Devonian, the Acadian mountain-building episode took place in northern Appalachia in what is now the eastern United States. There were also major movements of the tectonic plates (those that make up the Earth's crust and upper mantle) in northern and western North America, western South America, East Asia, and eastern Australia. Many parts of the world also experienced intense volcanism and seismic activity.

The equatorial seas separating the continents contained extensive reefs built by corals and

other organisms. Large landlocked areas of shallow sea in North America, the present-day Soviet Union, and Australia became evaporite basins in which great quantities of rock salt, gypsum, and other minerals were precipitated. On the continental platforms themselves and at their margins, vigorous erosion of the uplifted mountainous areas produced great volumes of coarse sediment, which were deposited in the lowlands and seas to become the Old Red Sandstone formations. Desert conditions prevailed in many areas, whereas in others there was abundant rainfall. The Devonian year is thought to have had some 400 days, each consisting of about 21 hours. This would have had a small but not insignificant effect on tides and perhaps rates of coastal erosion, aiding the rapid spread of the seas.

Evidence indicates that the volcanic activity along the fissures of oceanic ridges was influential in the great flooding of the continents in Devonian times. As the ridges increased in size by the extrusion of molten rock material, the ocean waters rose onto the margins of the continents, covering by Late Devonian times a substantially larger percentage of the Earth than today.

The Devonian was characterized by varied faunal and floral life forms. Among the marine invertebrates, the bivalve brachiopods and conodonts became highly diversified and abundant. The mollusks made evolutionary strides and the ammonoids (a group of now-extinct cephalopods) emerged, evolving from their continuing nautiloid ancestors. Corals and similar animals were abundant, and reef habitats for other invertebrates became widespread. In contrast to these successful organisms, the graptolites became extinct and the trilobites declined (only the proetaceans survived).

Many types of primitive fish appeared and proliferated in both marine and freshwater environments during the Devonian. Because of this, the period is commonly referred to as the "Age of Fishes." Jawless, heavily armoured varieties (those of the class Agnatha) developed, as did sharklike forms and lungfish. By the end of the period the rhipidistians, a group of air-breathing, lobe-finned bony fishes, apparently gave rise to four-footed amphibians.

Vascular plants underwent tremendous diversification during Devonian times. The colonization of ferns and primitive gymnosperms resulted in the formation of the first forests, such as the Gilboa forest in the northeastern United States. These were the forerunners of the great swamp forests of the Carboniferous period (from 360 to 286 million years ago).

Toward the end of the Devonian, a number of marine invertebrates suffered extinction. Particularly hard hit were the colonial tabulate corals, stromatoporoids, and various other groups associated with the reef environment (*e.g.*, orthid and pentamerid brachiopods).

No hypothesis explaining this worldwide event has been entirely acceptable. More plausible causes include the deepening of the shallow shelf seas, which led to the destruction of the reefs and related fauna, or the widespread occurrence of anoxic (oxygen-deficient) conditions following the major transgression and regression of oceanic waters at this time.

Devonian series, three major worldwide divisions—Lower, Middle, and Upper—of rocks formed during the Early, Middle, and Late epochs of the Devonian period, which lasted from 408 to 360 million years ago.

In North America, Lower Devonian formations are thin and consist largely of limestones and calcareous shales. Important sections are exposed in the northeast. The North American landmass was above sea level during much of Early Devonian time.

The Middle Devonian series is characterized in North America by the Acadian mountains of the northeast, which were produced by a crustal disturbance. Elsewhere, the Old Red Sandstone dominates the Middle Devonian series of western Europe, whereas shales predominate in central Europe and limestones in Germany.

Upper Devonian rocks are varied in composition; they have been divided into numerous stages, often bearing regional names, that represent both marine and nonmarine environments of deposition. The first terrestrial vertebrates, primitive amphibians, are represented in the fossil record of Late Devonian time.

Devonport, town, northern Tasmania, Australia. It lies along the River Mersey estuary, near Bass Strait. One of the state's largest communities, it was formed through the amalgamation in 1893 of the villages of Torquay (east bank) and Formby (west), both of which had been founded in the 1850s. A major service centre with port facilities, Devonport is on the Bass Highway and a rail line (freight only) to Launceston, 45 miles (70 km) southeast, and has ferry and air links to Melbourne. From sheltered wharves on the west bank, the city exports paper, textiles, carpets, processed foods, potatoes, cement, and sawn timber. Its hinterland, primarily agricultural, is noted for its fruit. Pop. (1986) 22,645.

Devonport, borough and residential suburb of Auckland, northwestern North Island, New Zealand. It is situated on a peninsula, north of the entrance to Waitemata Harbour, linked to the mainland by Narrow Neck. Widely known as the North Shore, it was made a borough in 1886. Its attractions include several extinct volcanic cones, a popular beach, a naval base, and a monument marking the place where the first Maoris are said to have landed in New Zealand (1350). Devonport is connected to Auckland to the southwest by road bridge and ferry. Pop. (1989 est.) 10,500.

Devonshire, EARLS AND DUKES OF, titled English nobility of two creations, in the families Blount and (since 1618) Cavendish, grouped below chronologically and indicated by the symbol •.

• **Devonshire, Charles Blount, Earl of:** *see* Mountjoy, Charles Blount, 8th Lord.

• **Devonshire, William Cavendish, 1st Duke and 4th Earl of** (b. Jan. 25, 1640—d. Aug. 18, 1707, London, Eng.), a leader of the parliamentary movement that sought to exclude the Roman Catholic James, duke of York (afterwards James II) from succession to the British throne and that later invited the invasion of William of Orange.

On his return from a youthful grand tour of Europe, in 1661, he took a seat in Parliament and soon became conspicuous as one of the most determined and daring opponents of the general policy of the court of Charles II. In 1679 he was made a privy councillor by Charles II, but he soon withdrew from the board with his friend Lord William Russell (afterwards 1st Duke of Bedford) when he found that the Roman Catholic interest uniformly prevailed. He carried up to the House of Lords the articles of impeachment against Lord Chief Justice Scroggs, for his arbitrary proceedings in the Court of King's Bench; and, when Charles II declared his resolution not to sign the bill for excluding the Duke of York from the succession, he moved in the House of Commons that a bill might be brought in for the association of all his majesty's Protestant subjects. He also openly denounced the king's counselors and voted for an address to remove them.

He appeared in defense of Lord Russell at his trial and, after Russell's condemnation, offered to exchange clothes with him in the prison, remain in his place, and so allow him to effect his escape. Cavendish succeeded to the earldom in November 1684.

He opposed the government under James II and, for quarreling at court, was fined and briefly imprisoned. The Revolution of 1688 again brought him into prominence. He was one of the seven who signed the original paper inviting William of Orange to England and was made lord high steward of the new court.

He was created Marquis of Hartington and Duke of Devonshire in 1694 by William and Mary, on the same day on which the head of the house of Russell was created Duke of Bedford. His last public service was assisting to conclude the union of England and Scotland (1707).

• **Devonshire, William Cavendish, 4th Duke of,** also called (1751–55) MARQUESS OF HARTINGTON (b. 1720—d. Oct. 3, 1764, Spa, Liège [now in Belgium]), prime minister of Great Britain from November 1756 to May 1757, at the start of the Seven Years' War.

Eldest son of William Cavendish, the 3rd duke (1698–1755), he was elected to the House of Commons in 1741 and 1747, and in 1751 he moved to the House of Lords, as Marquess of Hartington and Lord Cavendish of Hardwicke. After becoming lord lieutenant and governor-general of Ireland (1754), he succeeded to the dukedom (1755); and the following year he agreed to become nominal prime minister. William Pitt had refused to serve in the ministry of the Duke of Newcastle, and the great Whig families balked at Pitt himself becoming prime minister. Thus, Devonshire was summoned to the post, while Pitt became the ministry's real authority as secretary of state to manage the war. When Pitt reconciled with Newcastle the following year, Devonshire, without having made much of a mark on events, resigned and became lord chamberlain of the household, a post he held until 1762. His health declining, he died two years later.

• **Devonshire, Spencer Compton Cavendish, 8th Duke of,** also called (1858–91) MARQUESS OF HARTINGTON (b. July 23, 1833, Lower Holker, Lancashire, Eng.—d. March 24, 1908, Cannes, Fr.), British statesman whose opposition to the Irish Home Rule policy of his own Liberal Party caused him to assume (1886) the leadership of the Liberal Unionist Party and to become increasingly identified with the Conservatives. On three occasions (1880, 1886, and 1887) he declined the office of prime minister.

Entering the House of Commons in 1857, Lord Hartington was secretary of state for war from February to July 1866. During William Ewart Gladstone's first prime ministership, he was postmaster general (1868–71), directing the nationalization of the British telegraph services, and afterward was chief secretary for Ireland. In January 1875, when Gladstone temporarily retired from politics, Hartington became the Liberal leader in the House of Commons. In Gladstone's second administration (1880–85), Hartington was secretary of state for India until December 1882, and then he returned to the war office. He shared the responsibility for assigning General Charles George ("Chinese") Gordon to evacuate British troops from the Sudan in 1884, but he repeatedly and unsuccessfully urged the Cabinet to hasten General Garnet Joseph Wolseley's expedition to relieve Gordon.

Throughout this period, Hartington led the Cabinet opposition to conciliating the Irish nationalists. Gladstone's attempt to placate him through his younger brother Lord Frederick Cavendish, who was made Irish secretary May 4, 1882, resulted in the tragedy of Lord Frederick's murder in Dublin two days later. When Gladstone became premier once more in February 1886, Hartington rejected his chief's conversion to full Irish Home Rule and

became the leader of the new Liberal Unionist Party. In June he secured the defeat of Gladstone's Home Rule Bill in the House of Commons and the fall of the government. Robert Arthur Talbot Gascoyne-Cecil, 3rd marquess of Salisbury, leader of the Conservative Party, on finding that his majority in the House of Commons depended on the Unionists, offered to serve in a ministry headed by Hartington, who, however, declined this proposal twice (July 1886 and January 1887).

In September 1893 the Duke of Devonshire (as he had become in 1891) led another defeat of a Gladstonian Home Rule bill, this time in the House of Lords. Refusing the foreign secretaryship in 1895, he served in Lord Salisbury's third ministry (1895–1902) and in the subsequent Conservative government of Arthur James Balfour (1902–05) as lord president of the council, with responsibility for the school system. Strongly believing in free trade, he resigned over that issue in October 1903. Among the Unionists, his free traders were outnumbered by those who supported the imperial protectionism of Joseph Chamberlain, the colonial secretary; and in May 1904 the Duke resigned as Liberal Unionist Association chairman in favour of Chamberlain.

The Life of Spencer Compton, Eighth Duke of Devonshire, 2 vol. (1911), was written by his private secretary, Bernard Holland.

devotio moderna, religious movement within Roman Catholicism from the end of the 14th to the 16th century stressing meditation and the inner life, attaching little importance to ritual and external works, and downgrading the highly speculative spirituality of the 13th and 14th centuries. *Devotio moderna* (Latin: "modern devotion") originated in the Netherlands and spread to Germany, northern France, Spain, and possibly Italy. Gerhard Groote, father of the movement, founded the Brethren of the Common Life; after his death, disciples established a house of Augustinian Canons at Windesheim (near Zwolle, Holland). These two communities—the former living in the world, the latter monastic—became the principal exponents of *devotio moderna.* The *Imitation of Christ,* traditionally attributed to Thomas à Kempis, is a classic expression of the movement.

Devrient, Eduard (b. Aug. 11, 1801, Berlin—d. Oct. 4, 1877, Karlsruhe, Ger.), actor, director, manager, translator of Shakespeare into German, and author of the first detailed account of the development of the German theatre, *Geschichte der deutschen Schauspielkunst* (1848; "History of German Dramatic Art").

Nephew of the great Romantic actor Ludwig Devrient, Eduard began his career as an opera singer and in March 1829 sang the part of Christ in the first revival of J.S. Bach's *St. Matthew Passion.* Devrient was an actor and a stage director in Dresden from 1844 until 1852, when he became director of the Hoftheater at Karlsruhe, a post held until 1870.

Reorganizing the court theatre company, Devrient achieved high standards with a repertory of German classics and Shakespeare. The German renderings of Shakespeare that he made, though bowdlerized, proved more suitable to the stage than any previous translations.

Devrient, Emil (b. Sept. 4, 1803, Berlin—d. Aug. 7, 1872, Dresden, Ger.), German actor of the 19th century who gained prominence in youthful heroic parts.

Nephew of the great Romantic actor Ludwig Devrient, he made his debut in Brunswick in 1821. By way of Bremen, Leipzig, and Hamburg, he reached Dresden in 1831, where he remained associated with the court theatre there until his retirement in 1868. His greatest successes were in the title roles of Goethe's *Torquato Tasso* and *Egmont* and Shakespeare's *Hamlet,* which he played to favourable reviews in London in 1852–53.

Devrient, Karl August (b. April 5, 1797, Berlin—d. Aug. 3, 1872, Hanover, Ger.), German actor who achieved popularity in heroic and character roles such as in the title roles of Friedrich Schiller's *Wallenstein,* Goethe's *Faust,* and Shakespeare's *King Lear.*

Nephew of the great Romantic actor Ludwig Devrient, he began his career in 1819 in Brunswick. From 1821 to 1835 he acted in Dresden, where he married his first wife, the singer Wilhelmine Schröder-Devrient. Karlsruhe (1835–39) was the stepping-stone to Hanover, where he remained for the rest of his life, achieving his greatest triumphs.

Devrient, Ludwig (b. Dec. 15, 1784, Berlin—d. Dec. 30, 1832, Berlin), greatest and most original actor of the Romantic period in Germany, whose temperament, characterizations, and life invite comparison with his English contemporary Edmund Kean. His characterizations conformed to no existing school of acting and owed nothing to any previous performer.

Born to a family of wholesale drapers, Devrient refused to work in his father's business and ran away from home several times. On one occasion he joined the army. When he decided to become an actor, he appeared under an assumed name so as not to embarrass his parents further. He served his apprenticeship with a provincial company in Thuringia, later appearing at the court theatre in Dessau, where he developed his talent for character parts. In 1809 he joined the city theatre at Breslau, where he achieved artistic maturity. When the actor and dramatist August Wilhelm Iffland saw him there, he was struck with his genius and helped him obtain a position with the company of the Royal Court Theatre in Berlin; he made his debut there in 1814 as Franz Moor in Friedrich Schiller's *Die Raüber* (*The Robbers*).

In 1816 Devrient was appointed stage manager but only for comedy and was given comedy roles only. Preferring tragedy, he grew dispirited, drank heavily, and as the years passed became ill and crippled with gout. In 1828, in an appearance at the Vienna Burgtheater, he recovered his spirit and performed as of old. The last few years of his life in Berlin, however, were years of dissipation; he was only 48 years old at the time of his death. His greatest roles were Franz Moor and Shakespearean parts, including Shylock, King Lear, Richard III, and Falstaff. His nephews, Karl August, Eduard, and Emil, along with Eduard's son Otto and Karl's son Max, also made important contributions to the German stage.

Devrient, Max (b. Dec. 12, 1857, Hanover, Hannover—d. June 13, 1929, Chur, Switz.), German actor who excelled in tragic roles, particularly in the plays of Goethe, Schiller, and Shakespeare, but who was also much admired in comedy, especially as Petruchio in Shakespeare's *Taming of the Shrew.*

Grandnephew of the great Romantic actor Ludwig Devrient and son of the noted character actor Karl August Devrient, Max made his debut in 1878 in Dresden as Bertrand in Friedrich Schiller's play *Die Jungfrau von Orleans.* Subsequently he toured extensively throughout Germany. In 1882 he made his first appearance with the famed Vienna Burgtheater in Schiller's drama *Die Räuber,* remaining with the company for many years. From 1920 he directed.

Devrient, Otto (b. Oct. 3, 1838, Berlin—d. July 23, 1894, Stettin, Ger.), German actor, director, producer, and playwright.

Grandnephew of the great Romantic actor Ludwig Devrient, Otto was trained by his father, Eduard Devrient, who was a director, a translator of Shakespeare, and a stage historian. His early engagements included Karlsruhe, Stuttgart, Berlin, and Leipzig. In 1863 he returned to Karlsruhe to direct, and 10 years later he went to the Weimar Court Theatre, where in 1876 he played Mephistopheles in his own production of Goethe's *Faust,* directing it on a three-level stage. Subsequently he served as stage director in Mannheim and Frankfurt. In 1883 he wrote and staged a Passion play at Jena for a festival in honour of Martin Luther. In 1884 he moved to Oldenburg as a director and, except for a season in Berlin, remained there until his death. He also wrote several tragedies.

dew, deposit of waterdrops formed at night by the condensation of water vapour from the air onto the surfaces of objects freely exposed to the sky. It forms on clear nights when the air is calm or, preferably, when the wind is light. If the temperature of the surface is below the freezing point of water, the deposit takes the shape of hoarfrost (*see* frost). Dew forms on clear nights because on such nights freely exposed surfaces lose heat to the sky by radiation. Unless this loss is offset by an efficient conduction of heat from the interior of the object, the surface will cool. Most objects, including grass blades, leaves, and petals, are much better radiators than air and, as a result, are usually colder at night than is the air. The cold surface cools the air in its vicinity, and, if the air contains sufficient atmospheric humidity, it may cool below its dew point. When this happens, water vapour will condense out of the air onto the surface.

The formation of dew is sustained by the diffusion of water vapour. Regarding the vertical diffusion of water vapour over soils carrying vegetation, there are two possible situations. First, there is the downward movement of water vapour from the atmosphere, which occurs when the water vapour content of the air increases with height. Second, there is the upward movement of water vapour, which occurs when the soil surface temperature is higher than that of the leaves. Accordingly, dew may be classified (1) as formed when water vapour diffuses downward in the air and (2) as formed from water vapour diffusing from the underlying soil surface. The name dewfall is proper to (1), and dew arising from (2) may be called distillation.

There have been various attempts to measure dew. Among the various instruments are R. Leick's porous gypsum plates and S. Duvdevani's dew gauge, consisting of a wooden slab treated with paint. To determine the amount of dew, Leick's plates are weighed, whereas Duvdevani's gauge involves the use of an optical dew scale. Other investigators developed recording dew balances whose surface and exposure conform with the surrounding surface as far as possible. It is by means of such dew balances that one can best observe the phenomenon of distillation: on some occasions no gain in weight or even some loss in weight may be recorded despite the fact that dew had formed on the leaves. Clearly, this dew must be attributed to the diffusion of water vapour from one part of the weighed system to another; *i.e.,* from soil to leaves.

The amount of dew formed on plants is not well known. It would appear that during dew nights the amounts vary from very small quantities to about 0.02 inch (0.51 millimetre). G. Hofmann (*Die Thermodynamik der Taubildung,* 1955) estimated that the maximum possible amount is about 0.03 in. for a 10-hour night, but such amounts would occur only under exceptional circumstances. Total annual dew precipitation may lie between about 0.5 in. in cold climates and in nearly arid warm climates, to about 3 in. in semihumid warm climates. Because dew produced by distillation from the soil cannot be regarded as a gain of moisture, not all of the

annual dew may be significant from a hydrological point of view. In some desert areas and semiarid regions the net gain may be a substantial fraction of the rainfall, however, and dew may be the principal moisture source for plants and animals. Under such conditions, it also may assume an important role in some aspects of rock weathering. From the biological viewpoint, the usefulness of dew is doubtful, as dew may stimulate the growth of fungi harmful to plants.

dewan: *see* dīwān.

Dewantoro, Ki Hadjar, original name RADEN MAS (Lord) SUWARDI SURJANINGRAT (b. May 8, 1889, Jogjakarta, Java—d. April 26, 1959), founder of the Taman Siswa (literally Garden of Students) school system, an influential and widespread network of schools that encouraged modernization but also promoted indigenous Indonesian culture.

Dewantoro was born into a noble family of Jogjakarta and attended STOVIA (School Tot Opleiding Van Indische Artsen; *i.e.,* School for the Training of Native Doctors) but failed to complete the course. Active in the nationalist cause, he belonged to a faction favouring direct action and the use of Western methods to destroy the power of the Dutch. He was also a member of the Bandung chapter of Sarekat Islām (Islāmic Association) and a founder of the Socialist Indische Partij (Indies Party). An article he wrote during this period, "If I Were a Netherlander," published in the Indische Partij's *De Express,* led to his exile to The Netherlands between 1913 and 1918.

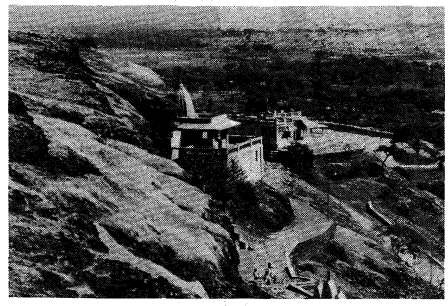
In The Netherlands he became converted to the idea of using Indonesian cultural traditions to cope with problems of colonialism. He felt that education was the best means to strengthen Indonesians and was deeply influenced by the progressive theories of the Italian educational reformer Maria Montessori and the Indian poet and philosopher Rabindranath Tagore. The first Taman Siswa schools were established in July 1922. Instruction, carried on informally, emphasized traditional skills and values of Javanese life, particularly music and dance. Western subjects were taught, too, in order to help students cope with the demands of modern life. Overcoming initial official hostility, the Taman Siswa schools had spread throughout the archipelago and were by World War II subsidized by the government. Based on traditional Javanese concepts, the Taman Siswa schools appealed primarily to those segments of Indonesian society termed *abangan,* in which the Islāmic faith is less deeply entrenched. Dewantoro continued his leadership of Taman Siswa after the war and upon his death was acclaimed a national hero.

Dewar, Sir James (b. Sept. 20, 1842, Kincardine-on-Forth, Scot.—d. March 27, 1923, London), British chemist and physicist whose study of low-temperature phenomena entailed use of a double-walled vacuum flask of his own design which has been named for him.

Educated at the University of Edinburgh, Dewar became a professor at the University of Cambridge (1875) and at the Royal Institution of Great Britain, London (1877), holding both posts throughout his life.

Dewar developed structural formulas for benzene (1867), did research in spectroscopy for more than 25 years, and by 1891 succeeded in producing liquid oxygen in quantity. About 1892 he used his vacuum-jacketed vessel to store liquefied gases. He liquefied hydrogen in 1898 and solidified it in 1899. He was knighted in 1904. His discovery (1905) that cooled charcoal can be used to help create high vacuums later proved useful in atomic physics. With Sir Frederick Augustus Abel he developed cordite, an explosive.

Dewās, town, administrative headquarters of Dewās district, Madhya Pradesh state, central India. It is located on the Mālwa Plateau at the foot of the conical Chamunda Hill, which rises to a Devīvaśinī shrine. Jaina and Hindu temple ruins lie just south in Nagara. The



Devīvaśinī shrine atop Chamunda Hill, Dewās, Madhya Pradesh, India
Baldev—Shostal Assoc./EB Inc.

town is a major road junction and agricultural trade centre. Cotton and flour milling, handloom weaving, and soap manufacture are the chief industries. Dewās, formerly the joint capital of Dewās Senior and Junior princely states, has a musical academy and a government college of education affiliated with Vikram University.

Dewās district (2,708 sq mi [7,014 sq km]) takes in Dewās Senior and Junior states and much additional territory. It consists chiefly of level plains of the Mālwa Plateau, watered by the Narmada, Sipra, and Kāli Sindh rivers. Wheat, sorghum, rice, cotton, and oilseeds are the chief crops. Dewās was founded by two Panwār Marāṭhā brothers who entered Mālwa in 1728. From 1841 the senior and junior branches of the family ruled their own portions independently as part of the British Central India Agency. Both states merged with Madhya Pradesh in 1956. Pop. (1981) town, 83,465; district, 795,309.

dewberry, any blackberry of the genus *Rubus* (family Rosaceae) so lacking woody fibre in the stems that it trails along the ground. *See* blackberry.

Dewey, George (b. Dec. 26, 1837, Montpelier, Vt., U.S.—d. Jan. 16, 1917, Washington, D.C.), U.S. naval commander who defeated

George Dewey
Brown Brothers

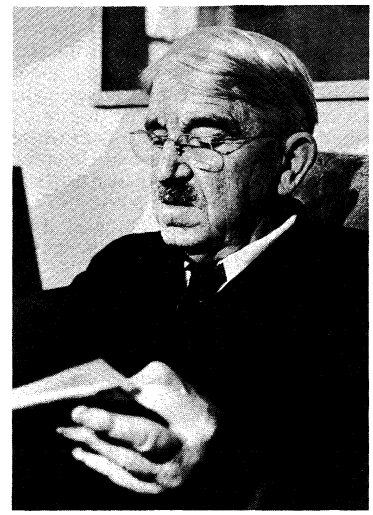
the Spanish fleet at the Battle of Manila Bay during the Spanish–American War (1898).

A graduate of the U.S. Naval Academy at Annapolis, Md., in 1858, Dewey was commissioned a lieutenant three years later. In the U.S. Civil War (1861–65), he served with Union naval forces in the battles of New Orleans (1862) and Port Hudson and Donaldsonville, La. (1863). In 1864–65 he was in the North Atlantic Blockading Squadron.

After periodic promotions, Dewey was assigned (1897), at his own request, to the U.S. Asiatic Squadron. Anticipating war with Spain, he undertook an intensive study of the Spanish-owned Philippine Islands and prepared his fleet for battle. When war did break out (April 1898), he sailed from Hong Kong to the Philippines and on May 1 engaged a Spanish squadron in Manila Bay. The Spaniards offered little effective resistance, and Dewey defeated them without the loss of a single man. His victory led to the U.S. acquisition of the Philippines and signalled the expansion of U.S. power into the western Pacific.

Dewey was welcomed home to New York with a great ovation; newspapers and politicians speculated that he could be a formidable candidate for president. Promoted to the permanent rank of admiral (1899), for the last seven years of his life he served as president of the general board of the navy.

Dewey, John (b. Oct. 20, 1859, Burlington, Vt., U.S.—d. June 1, 1952, New York City), U.S. philosopher and educator who was one of the founders of the philosophical school



John Dewey
EB Inc.

of Pragmatism, a pioneer in functional psychology, and representative of the progressive movement in U.S. education.

Early life. Dewey's family origins were modest. Three generations of his forebears were Vermont farmers, and both his parents were born and reared on a Vermont farm. Archibald Dewey, John's father, when a young man, broke with family tradition, however, and entered the grocery business in Burlington. Here many years later, at the age of 44, Archibald met and married Lucina Artemisa Rich, 20 years his junior. The couple had four sons, of whom John was the third.

The Burlington in which Dewey lived as a youth had a population of approximately 15,000, divided almost equally between native- and foreign-born; the latter came chiefly from Ireland and Quebec. The native-born included the "old Americans," descendants of middle-class Anglo-Saxon Protestant families long established in Vermont or some other part of New England, and it was in the traditions of this group that Dewey was brought up.

Dewey attended the public schools of Burlington and there entered the University of Vermont. Particularly significant to him were the studies of the fourth year, designed to introduce the student to fundamental political, economic, philosophical, and religious theories and intended to be the capstone of the student's undergraduate academic experience. Dewey found these courses interesting and provocative, and his thinking along broad intellectual and philosophical lines may be said to have started during his senior year in college.

Dewey's high school and college days marked

the time when his intellectual interests were broadening and when he sought the company of books. He was, as he himself wrote, a "voracious reader" at this time and found in books a source of deep satisfaction. His parents encouraged him in his reading, and Dewey was free to peruse almost any book that caught his fancy.

Interest in books, however, did not at this time crowd out other interests, as it threatened to do in Dewey's graduate-student years. He welcomed opportunities to swim and fish in Lake Champlain, only three blocks away from where he lived as a boy, and to hike and camp overnight in the Green Mountains. During the summer, he worked in the extensive lumber yards that at the time lined the shores of Burlington Bay.

Though he was allowed considerable freedom in his studies and recreational activities, Dewey was restricted in other ways. His mother required that her sons properly observe the sabbath. As they grew older she cautioned them against temptations in neighbourhoods bordering Burlington's industrial area on the lakefront, and when they had been out for an evening, she would question them as to where they had been and what they had done. In later years Dewey recalled with distaste this phase of his upbringing and recalled also the sense of guilt that this questioning evoked, even when there was nothing to be guilty about.

After finishing college, Dewey taught three years in high school and, in the fall of 1882, entered Johns Hopkins University, in Baltimore, for advanced study in philosophy. Here he came under the influence of George Sylvester Morris, visiting professor of philosophy from the University of Michigan and a leading exponent of Neo-Hegelianism, a revival of the thought of the 19th-century German philosopher Hegel. Dewey found in this philosophy, with its emphasis on the spiritual and organic nature of the universe, what he had been vaguely groping for, and he eagerly embraced it.

While at Johns Hopkins, Dewey devoted himself almost exclusively to his studies and tended to neglect other activities. This preoccupation with study was noticed by the president of the university, who strongly advised him to study less and socialize more.

Upon being awarded the Ph.D. degree by Johns Hopkins University, in 1884, Dewey, in the fall of that year, went to the University of Michigan, where, at the urging of Morris, he had been appointed an instructor in philosophy and psychology. With the exception of the academic year 1888–89, when he served as professor of philosophy at the University of Minnesota, Dewey spent the next 10 years at Michigan. During this time his philosophical endeavours were devoted mainly to an intensive study of Hegel and the British Neo-Hegelians and to the new experimental physiological psychology then being advanced in the United States by G. Stanley Hall and William James.

Dewey's interest in education began during his years at Michigan. His readings and observations revealed that most schools were proceeding along lines set by early traditions and were failing to adjust to the latest findings of child psychology and to the needs of a changing democratic social order. The search for a philosophy of education that would remedy these defects became a major concern for Dewey and added a new dimension to his thinking.

At the end of his second year at Michigan, Dewey married Harriet Alice Chipman of Fenton, Mich. She had been a student in a number of Dewey's classes, and the friendship culminated in their marriage on July 28, 1886. Alice's academic interests centred mostly on social and educational problems, and it was in large measure because of her that Dewey's interests widened to include these. Alice had an outgoing personality, liked people, and helped her husband overcome the shyness with strangers that had troubled him since early adolescence. Both Alice and Dewey were fond of children and were pleased as their family grew to include three sons and three daughters. Two of the sons died in early childhood, and, to help soften their loss, the Deweys, while travelling in Italy, adopted an Italian boy near the age of one of the sons who had died. The adoption proved a happy one.

Career at the University of Chicago. Dewey left Michigan in 1894 to become professor of philosophy and chairman of the department of philosophy, psychology, and pedagogy at the University of Chicago. Dewey's achievements there brought him national fame. The increasing dominance of evolutionary biology and psychology in his thinking led him to abandon the Hegelian theory of ideas, which views them as somehow mirroring the rational order of the universe, and to accept instead an instrumentalist theory of knowledge, which conceives ideas as tools or instruments in the solution of problems encountered in the environment. These same disciplines contributed somewhat later to his rejection of the Hegelian notion of an Absolute Mind manifesting itself as a rationally structured, material universe and as realizing its goals through a dialectic of ideas. Dewey found more acceptable a theory of reality holding that nature, as encountered in scientific and ordinary experience, is the ultimate reality and that man is a product of nature who finds his meaning and goals in life here and now.

Since these doctrines, which were to remain at the centre of all of Dewey's future philosophizing, also furnished the framework in which Dewey's colleagues in the department carried on their research, a distinct school of philosophy was in operation. This was recognized by William James in 1903, when a collection of essays written by Dewey and seven of his associates in the department, *Studies in Logical Theory,* appeared. James hailed the book enthusiastically and declared that with its publication a new school of philosophy, the Chicago school, had made its appearance.

Dewey's contributions to psychology were also noteworthy. Many of the articles written at that time are now accepted as classics in psychological literature and assure him a secure place in the history of psychology. Most significant is the essay "The Reflex Arc Concept in Psychology," generally taken to mark the beginnings of functional psychology—*i.e.,* one that focusses on the total organism in its endeavours to adjust to the environment.

His writings on education, notably his *The School and Society* (1899) and *The Child and the Curriculum* (1902), presented and defended what were to remain the chief underlying tenets of Dewey's philosophy of education. These were that the educational process must begin with and build up on the interests of the child; that it must provide opportunity for the interplay of thinking and doing in the child's classroom experience; that the school should be organized as a "miniature community"; that the teacher should be a guide and co-worker with the pupils, rather than a taskmaster assigning a fixed set of lessons and recitations; and that the goal of education is the growth of the child in all aspects of its being.

Among the results of Dewey's administrative efforts were the establishment of an independent department of pedagogy and of the Laboratory Schools in which the educational theories and practices suggested by psychology and philosophy could be tested. The schools, which began operations in January 1896, attracted wide attention and enhanced the reputation of the University of Chicago as a foremost centre of progressive educational thought.

The city of Chicago provided Dewey with an excellent opportunity to observe the operations of raw, unrestricted industrialism and to note its effects on large segments of the city's population. As a trustee of Hull House, a settlement house in a Chicago slum area, he became familiar with the exploitation of immigrant and minority groups and joined radicals and other liberals like himself in supporting legislation to aid the underprivileged, legalize labour unions, and curtail the power of monopolies. At Hull House, Dewey was introduced to Jane Addams, the distinguished founder of the organization. A warm and lasting friendship developed between them.

Career at Columbia University. The disagreement between Pres. William Rainey Harper of the University of Chicago and Dewey concerning the administration and financing of the university's educational program led, in 1904, to Dewey's resignation of his posts and to his acceptance of a professorship of philosophy at Columbia University in New York City.

Dewey was associated with Columbia for 47 years, first as professor and then as professor emeritus of philosophy. During his 25 years of active teaching, his fame and the significance of what he had to say attracted thousands of students from at home and abroad to his classes, and he became one of the most widely known and influential teachers in America.

Dewey's scholarly output at Columbia was enormous; one bibliography devotes approximately 125 pages to listing the titles of his publications during these years. His thought covered a wide range of topics, including logic and theory of knowledge, psychology, education, social philosophy, fine arts, and religion. Major works dealing with each of these fields appeared over the years and clearly established Dewey as the foremost philosopher in America and as one of the nation's most productive scholars. His *Experience and Nature,* published in 1925, brings together in a systematic way the more important aspects of his philosophy and is generally regarded as his magnum opus.

His interest in current affairs prompted Dewey to contribute regularly to liberal periodicals, especially *The New Republic.* His articles focussed on domestic, foreign, and international developments and were designed to reach a wide reading public. Because of his skill in analyzing and interpreting events, he soon was rated as among the best of American commentators and social critics.

A man of action as well as of thought, Dewey gave generous amounts of time and energy to the support of organizations and causes in which he believed. After World War I, with S.O. Levinson, a Chicago attorney and long-time friend, he played an important role in the "outlawry of war" movement, which helped bring the Kellogg–Briand Pact of 1928 into existence. He was one of the founders and the first president of the American Association of University Professors and was a charter member of the first teachers' union in New York City. He helped found the New School for Social Research in 1919 and the University-in-Exile in 1933, established for scholars being persecuted in countries under totalitarian regimes, and he held office in the American Civil Liberties Union, the League for Industrial Democracy, and the People's Lobby. He thought that the two major parties in Congress had failed to come to grips with the problems generated by the Depression of the 1930s, accused them both of being the "errand boys of big business," and took a leading part in an attempt to organize a third political party. In 1937, at age 78, he headed a commission of inquiry that went to Mexico

City to hear Leon Trotsky's rebuttal of the charges made against him in the Moscow trials of 1936 and 1937.

His reputation brought Dewey invitations from a number of foreign countries, among them Japan, China, Turkey, Mexico, Russia, and South Africa. Russia, Mexico, China, and Turkey were undergoing social upheavals, which Dewey reported on in articles sent to *The New Republic.*

Later years. Great personal loss was suffered by Dewey when his wife died in 1927. The two had been unusually close, and her death left a void not easily filled. After her death Dewey shared an apartment with one or another of his children until 1946, when he married Roberta Lowitz Grant, whose parents he had known when Roberta was a child in her early teens. Dewey was 87 and Roberta 42 when they were married. Shortly thereafter they adopted two Belgian children, a sister and brother, made orphans by the war.

Dewey was the recipient of many honours. He was awarded honorary degrees from at least 13 colleges and universities at home and abroad and was decorated with the Order of the Jade by the government of China in 1939 and the Order of Merit by the Chilean government in 1949. He was elected honorary president of the National Education Association in 1932, honorary president for life of the American Philosophical Association in 1938, and honorary vice president of the New York State Liberal Party in 1952. Meetings and dinners celebrating his 70th, 80th, and 90th birthdays and attended by notables from all walks of life were held in his honour in cities throughout the nation.

During the last two decades of his life, Dewey's philosophy of education was the target of numerous and widespread attacks. Greatly agitated by the alleged failure of the schools to train pupils adequately in essential core subjects and in manners and discipline, critics blamed Dewey and his progressive ideas for these failures and in article after article made him the scapegoat of their grievances and frustrations.

Dewey enjoyed remarkably good health, and rarely during his long career was he forced to miss classes or cancel off-campus engagements because of illness. But his advancing years were exacting their toll, and during his 80s he required repeated hospital attention. He remained physically active, however, and participated in the celebration of his 90th birthday in New York City and in his native Burlington and also accepted in person the honorary degree awarded him by Yale University at its 250th commencement in June 1951.

In November 1951, Dewey broke his hip, and the failure of the bones to knit properly kept him weakened and confined to his apartment during the winter and spring of 1952. Yet he remained intellectually busy and continued to work on projects he had begun earlier, including a revised edition of his *Experience and Nature.* On May 31 he was stricken with pneumonia, from which he failed to recover.

(G.Dy.)

MAJOR WORKS. *Education. The School and Society* (1899); *Democracy and Education* (1916); *Experience and Education* (1938).

Psychology and philosophy. Psychology (1887); *Studies in Logical Theory* (1903); *Ethics,* with James Tufts (1908); *How We Think* (1910); *Reconstruction in Philosophy* (1920); *Human Nature and Conduct* (1922); *Experience and Nature* (1925); *The Public and Its Problems* (1927); *The Quest for Certainty* (1929); *Art As Experience* (1934); *A Common Faith* (1934); *Logic, the Theory of Inquiry* (1938); *Freedom and Culture* (1939); *Knowing and the Known,* with Arthur F. Bentley (1949).

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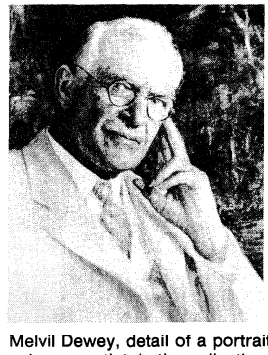
A list of the abbreviations used in the MICROPAEDIA *will be found at the end of this volume*

Dewey, Melvil (b. Dec. 10, 1851, Adams Center, N.Y., U.S.—d. Dec. 26, 1931, Lake Placid, Fla.), U.S. librarian who devised the Dewey Decimal System of Classification for



Melvil Dewey, detail of a portrait by an unknown artist; in the collection of the New York State Library, Albany

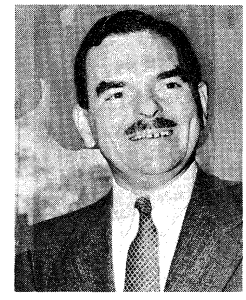
By courtesy of the New York State Library, Albany

library cataloging and, probably more than any other individual, was responsible for the development of library science in the United States.

He was graduated in 1874 from Amherst College and became acting librarian there. In 1877 he moved to Boston, where, with R.R. Bowker and Frederick Leypoldt, he founded and edited the *Library Journal.* He was also one of the founders of the American Library Association. In 1883 he became librarian of Columbia College, New York City, and there set up the School of Library Economy, the first institution for training librarians. The school was moved to Albany, N.Y., as the State Library School under his direction.

From 1889 to 1906 he was director of the New York State Library. He also served as secretary of the State University of New York (1889–1900) and as state director of libraries (1904–06). He completely reorganized the state library, making it one of the most efficient in the U.S., and established the system of travelling libraries and picture collections.

Dewey, Thomas E(dmund) (b. March 24, 1902, Owosso, Mich., U.S.—d. March 16, 1971, Bal Harbour, Fla.), vigorous U.S. prosecuting attorney whose successful racket-busting career won him three terms as governor of New York (1943–55). A long-time Republican leader, he was his party's presidential nominee in 1944 and 1948 but lost in both elections.



Thomas E. Dewey, 1944

UPI Compix/EB Inc.

Admitted to the New York bar in 1926, Dewey launched his government career five years later as chief assistant to the U.S. attorney for the southern district of the state. Between 1935 and 1937 he gained national attention as special prosecutor in an investigation of organized crime in New York; he obtained 72 convictions out of 73 prosecutions of long-established racketeers. Elected district attorney in 1937, he continued to impress the electorate with his legal acumen and personal drive and integrity.

Although unsuccessful in his first bid for governor (1938), Dewey was elected for three successive terms beginning in 1942. In office he earned a reputation for political moderation and administrative efficiency, putting the state on a pay-as-you-go basis for capital building, reorganizing departments, and establishing the first state agency to eliminate discrimination in employment.

As Republican nominee for president in 1944, Dewey was not expected to overcome the enormous wartime prestige of the incumbent, Pres. Franklin D. Roosevelt. The pollsters flatly predicted victory for his candidacy in 1948, however, though the political picture was confused by the entrance of two minority extremist factions—the Progressives and the States' Rights (Dixiecrat) Party. Waging a noncommittal campaign purposely designed to avoid offending any segment of the electorate, Dewey was unexpectedly defeated by Pres. Harry S. Truman, who surprisingly retained the loyalty of both farm and labour circles.

As a leader of the Eastern Republicans at the 1952 national convention, he played a key role in the nominations of Gen. Dwight D. Eisenhower for president and Sen. Richard M. Nixon for vice president. At the end of his third term as governor (1955), Dewey returned to a lucrative private law practice. He remained a close adviser to Republican administrations but thought his age precluded acceptance of an offer by President Nixon in 1968 to serve as Chief Justice of the U.S. Supreme Court.

Dewey Decimal Classification, hierarchical system for dividing and organizing knowledge in a library based on the decimal principle. In it, knowledge is divided into 10 groups, with each group assigned 100 numbers; *e.g.,* religion is in the 200s, the arts in the 700s, and so on. Within each class the principal subseries are divided by 10; *e.g.,* Christian Church is placed in the 260s. In practice, the notation always consists of at least three digits, although

its theoretical expression could be extremely long.

Based on W.T. Harris' classification for the St. Louis Public Library, the Dewey system was first formulated by the American librarian Melvil Dewey in 1873 for application in the Amherst College Library and by the late 1980s had gone through 19 editions.

The numerical classification provides a shorthand identification and location tool. To distinguish works within a class and to expedite retrieval, many libraries add a book number created from the Cutter, or Cutter-Sanborn, Tables, which provide further specifications for author and genre. Terminology is both scientific and popular. Notation consists basically of Arabic numerals. The primary basis for Dewey Decimal Classification is by discipline; a subject may appear in one or many of the disciplines. The notation lends itself to memory through the constant repetition of a standard pattern (area arrangement; numbers for languages), through parallel subject developments (each book of the Bible given the same development as the Bible as a whole), and through patterned repetition of standard subdivisions (theory, study and teaching, history, geography, etc.). Because an abridged as well as a full schedule of the system has been developed, the Dewey Decimal Classification is adaptable to libraries of various sizes. The Index to the Dewey Decimal systems, a relative one (*i.e.,* one having cross-references), arranges all topics expressed or implied, with every synonym in alphabetical order.

The names Dewey Decimal Classification and Dewey (when referring to the former) are trademarks of the Lake Placid Educational Foundation.

Dewi, SAINT: *see* David, Saint.

DeWitt, Lydia Maria Adams, *née* Adams (b. Feb. 1, 1859, Flint, Mich., U.S.—d. March 10, 1928, Winter, Texas), American experimental pathologist and investigator of the chemotherapy of tuberculosis.

In 1878 she married Alton D. DeWitt, a teacher. Lydia DeWitt earned a medical degree at the University of Michigan in 1898 and taught anatomy there until 1908. She subsequently taught at Michigan State University (1908–10), Washington University (1910–12), and the University of Chicago (1912–26).

DeWitt is best known for her studies of the pathology of tuberculosis. She analyzed the linkages of dyes and toxic metals for the potential treatment of tuberculosis, and her investigations set the standard for later studies that led to the successful treatment of the disease. She also conducted influential investigations on the anatomy of the nervous system and on public health practices.

Her numerous publications include the coauthorship of the studies "Chemotherapy of Tuberculosis" (1893) and *The Chemistry of Tuberculosis* (1923).

Dewsbury, locality in Kirklees district, metropolitan area of West Yorkshire, Eng., on the River Calder, 9 miles (14 km) south-southwest of Leeds. The parish church of All Saints, mostly rebuilt in the 18th century, retains 9th-century Anglo-Saxon carvings. Dewsbury (which was mentioned in Domesday Book of 1086) had a woolen industry as early as the 13th century, but there was no great expansion until the Industrial Revolution, when the town became the natural centre of a heavy woolen district. The chief industries are weaving, coal mining, and engineering.

There is a tradition that Paulinus, the first archbishop of York, preached in AD 627 at Dewsbury, which had in Saxon times a parish of more than 400 square miles (1,000 square km) in area. Another tradition holds that Robin Hood died and was buried in the extensive park at Kirlees, where there are the remains of a 12th-century Cistercian convent. Inc. 1862. Pop. (1981) urban area, 50,046.

Dexippus, Publius Herennius (b. *c.* 210—d. after 270), Roman historian and Athenian statesman, one of the principal authorities for the history of the mid-3rd century AD. The *Bibliotheca*, a 9th-century encyclopaedia by Photius, patriarch of Constantinople, credits Dexippus with three major works: a four-book history of the *diadochoi* (successors) of Alexander the Great, a history of the struggle of Rome against the Goths after AD 238, and a 12-book annalistic chronicle from legendary times to AD 270. Although none of these survive, numerous fragments have been recognized in the compilations of later historians. Several Athenian inscriptions attest to the high public offices held by Dexippus, his father, and his children.

dextromethorphan, also called *d*-3-METHOXY-N-METHYLMORPHINAN, synthetic drug related to morphine and used in medicine as a cough suppressant. The hydrobromide salt of dextromethorphan is administered orally in syrups and tablets. It acts upon the central nervous system to suppress the cough reflex. It does not produce addiction or central depression, as do a number of other morphine derivatives, and it has no analgesic effect.

Dextromethorphan hydrobromide occurs as white crystals or a white crystalline powder, soluble in water, alcohol, and chloroform.

dextrose (sugar): *see* glucose.

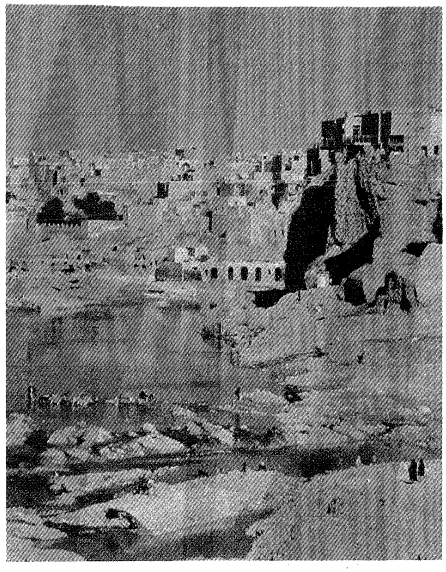
dey, in the Ottoman provinces of Algiers and Tunis, an honorary title conferred upon exceptionally able corsair leaders; also, a lower rank of officer in the Janissaries. In late 16th-century Tunis, a dey commanded the army and eventually was in sole control of the state, but by 1705 the title had disappeared from official lists. The head of the Algerian regency, elected by fellow Janissary officers (from 1689), was titled dey, and, though his family life was restricted to prevent succession claims and he was confined to Algiers, he had virtually absolute power; 30 such deys ruled Algiers in succession between 1671 and 1830.

Deyssel, Lodewijk van, pseudonym of KAREL JOAN LODEWIJK ALBERDINGK THIJM (b. Sept. 22, 1864, Amsterdam—d. Jan. 26, 1952, Haarlem, Neth.), leading Dutch writer and critic of the late 19th and early 20th centuries.

The son of J.A. Alberdingk Thijm (who promoted a Roman Catholic cultural revival in The Netherlands), he joined the largely agnostic individualistic group associated with the avant-garde literary magazine *De nieuwe gids* ("The New Guide"). His passionate critical writings were published as *Verzamelde opstellen*, 11 vol. (1894–1911; "Collected Essays"). He began writing as an admirer of Émile Zola and published a naturalistic novel, *Een liefde* (1887; "A Love Affair"). Later he abandoned Naturalism and wrote highly personal impressionistic prose and clever, somewhat overwrought "prose-verses." A sensitive artist with great powers of observation and a keen eye for detail, he was a powerful influence on Dutch literature, as both an original and critical writer, for many years.

Dez Dam, formerly PAHLAVI DAM, an arch dam across the Dez River in Iran, completed in 1963. The dam is 666 feet (203 m) high, 696 feet wide at the crest, and has a volume of 647,000 cubic yards (495,000 cubic m). Until the late 1960s it was the largest Iranian development scheme.

Dezfūl, also spelled DIZFŪL, city, southwestern Iran, on the high left bank of the Dez River, 469 feet (143 m) in elevation, close to the foothills of the Zagros Mountains. The



Dezfūl on the left bank of the Dez River, Iran
Fred J. Maroon—Photo Researchers

name, meaning Dez Bridge, is derived from the imposing bridge, 1,345 feet (410 m) long, that spans the river and was allegedly erected by King Shāpūr II (died 379). The city witnessed riots by the local people in 1978, prior to the Iranian Revolution. Iraqi planes attacked Dezfūl during the Iranian–Iraqi War.

Dezfūl is the principal winter market for the Lorestān (Luristan) region's nomadic population; it connects by road with the highland and with Ahvāz. The Trans-Iranian Railway stops on the other side of the river, and there is an airfield. The great Dez Dam, 20 miles (32 km) upstream, was designed to provide abundant power and to increase irrigation. Pop. (1985 est.) 123,000.

Dezhev, Cape: *see* Dezhnyov, Cape.

Dezhnyov, Cape, also spelled DEZHNËV, Russian MYS DEZHNYOVA, English EAST CAPE, cape, Russian Soviet Federated Socialist Republic, the easternmost point of the Chukchi Peninsula and of the entire Eurasian landmass. It is separated from Cape Prince of Wales in Alaska by the Bering Strait. The Russian name was given in 1879 in honour of a Russian explorer S.I. Dezhnyov, who with F.A. Popov first rounded it in 1648.

Dezhnyov, Semyon Ivanov, Dezhnyov also spelled DEZHNËV (b. *c.* 1605, Veliky Ustyug, Russia—d. early 1673, Moscow), Russian explorer, the first European known to have sailed through the Bering Strait.

Dezhnyov served as a Cossack in Siberia, where he traveled a great deal in the north beginning in the early 1640s. In 1648 he sailed from the Kolyma River eastward to the Bering Strait, rounding the northeast tip of Asia (now called Cape Dezhnyov) and reaching the Anadyr River. He thus proved the separation of Asia and North America, but his report lay buried in the archives at Yakutsk until the German historian Gerhard Friedrich Müller found it in 1736, so the discovery was not known about until nearly a century had passed and after Vitus Bering and others had explored the area.

Dezhou (China): *see* Te-chou.

Dga'-ldan, also spelled GALDAN (b. 1644?, Central Asia—d. May 3, 1697, East Turkistan [now Sinkiang, China]), leader of the Dzungar tribes of Mongols (reigned 1676–97). He conquered an empire that included Tibet in the southwest and ranged across Central Asia to the borders of Russia on the northeast.

Dga'-ldan was a descendant of Esen, a Mongol chieftain who harassed the northern border of China during the 15th century, and

his father was a powerful Dzungar chief. As a younger son, Dga'-ldan was sent to Tibet, a Dzungar protectorate since 1636, where he was educated to be a Buddhist lama. In 1671, however, when his brother, who had become the tribal leader, was murdered, Dga'-ldan returned to Turkistan to seek vengeance. Because of his great military ability and his prestige as a lama, he rapidly gained authority over the other Dzungar chiefs. He avenged his brother's death and then occupied all of East Turkistan (now in Uighur Autonomous Region of Sinkiang), subduing the Muslim population there. He then conquered Outer Mongolia (now the Mongolian People's Republic), expelling the Khalkha Mongols from their land.

In 1690 Dga'-ldan led his armies toward Peking, the Chinese capital, but the Chinese forces were able to stop him short of his destination. Finally in 1696, after several years of indecisive fighting, the emperor K'ang-hsi of China, in alliance with the Khalkhans, personally led some 80,000 troops across Mongolia in pursuit of Dga'-ldan. K'ang-hsi's use of Western artillery, made under instruction from Jesuit missionaries, crushed Dga'-ldan at Dzuunmod, near present-day Ulaanbaatar. The battle signaled the beginning of Chinese domination over the Central Asian nomads who had harassed the empire for a millennium.

Although his wife and son were killed, Dga'-ldan refused to surrender. He fled with a small band of followers to the Altai Mountains. When news came the next year that the Emperor was leading another expedition against him, Dga'-ldan reportedly poisoned himself.

Dge-lugs-pa, also spelled GELUKPA (Tibetan: "Model of Virtue"), also called YELLOW HAT SECT, since the 17th century, the predominant Buddhist order in Tibet and the sect of the Dalai and Paṇ-chen lamas.

The Dge-lugs-pa sect was founded in the late 14th century by Tsong-kha-pa, who was himself a member of the austere Bka'-gdams-pa school. Tsong-kha-pa's reforms represented a return to tradition. He enforced strict monastic discipline; restored celibacy and the prohibition of alcohol and meat; established a higher standard of learning for monks; and, while continuing to respect the Vajrayāna tradition of esotericism that was prevalent in Tibet, allowed Tantric and magical rites only in moderation. Three large monasteries were quickly established near Lhasa: at Dga'ldan (Ganden) in 1409, 'Bras-spungs (Drepung) in 1416, and Se-ra in 1419. The abbots of the 'Bras-spungs monastery first received the title Dalai Lama in 1578, and a period of struggle for the leadership of Tibet followed, principally with the Karma-pa sect. The Dge-lugs-pa eventually appealed to the Mongol chief Güüshi Khan for help, and his defeat in 1642 of the King of Gtsang, who favoured the Karma-pa, secured the temporal authority of Tibet for the Dge-lugs-pa. They continued to rule the country through their leader, the Dalai Lama, until the Chinese Communists took over the country in 1950. During a popular revolt at Lhasa in 1959, the Dalai Lama escaped to India. A new Paṇchen Lama, installed as a figurehead by the Chinese, was dismissed in 1964.

The name Yellow Hat refers to the distinctive yellow headdress adopted by the Dge-lugs-pa to distinguish themselves from the Karma-pa sect, whose monks wear red hats.

DGI, abbreviation of DIRECCIÓN GENERAL DE INTELIGENCIA, the secret intelligence agency of Cuba. The agency was established with the help of the Soviet KGB in 1961, following Castro's rise to power. The DGI provided Castro with advanced warning of the Bay of Pigs invasion backed by the U.S. Central Intelligence Agency in 1962. The agency is responsible for intelligence, counterintelligence, and disinformation activities inside Cuba and abroad.

DGSE, abbreviation of DIRECTION GÉNÉRALE DE LA SÉCURITÉ EXTÉRIEURE ("General Board of External Security"), formerly (1947–81) SDECE, or SERVICE DE DOCUMENTATION EXTÉRIEURE ET DE CONTRE-ESPIONNAGE ("External Documentation and Counterespionage Service"), secret intelligence and counterintelligence service that operates under the defense ministry of the French government. This agency was established in 1947 to combine under one head a variety of separate agencies, some dating from the time of Napoleon and some from the Free French of World War II. It was independent until the mid-1960s, when the SDECE was discovered to have been involved in the kidnapping and presumed murder of Mehdi Ben Barka, a Moroccan revolutionary living in Paris. Following this scandal, the agency was placed under the control of the defense ministry. It was restructured in 1981. DGSE gathers foreign intelligence and provides internal security. Details of its operations and organization are not made public.

Dhahabī, al-: *see* Aḥmad al-Manṣūr.

Dhahran (Saudi Arabia): *see* Ẓahrān, aẓ-.

Dhākā, also spelled DACCA, national capital of Bangladesh, located just north of the Burhi Ganga River, a channel of the Dhaleśwarī, in the south central part of the country. Its name is said to refer to the dhak tree, once common in the area, or to Dhākéswarī ("The Hidden Goddess"), whose shrine is located in the western part of the city.

Dhākā's history can be traced to the 1st millennium AD, but it did not rise to prominence until the 17th century, when it served as the Mughal capital of Bengal province (1608–39 and 1660–1704). It was the centre of a flourishing sea trade, attracting English, French, and Dutch traders.

Historic buildings of the Muslim period include Lāl Bāgh fort (1678) and its tomb of Bībī Parī, wife of a governor of Bengal (died 1684); the Barā Katrā (great caravansary; 1664); the Chhota Katrā (small caravansary; 1663); and Ḥusaynī Dālān (a religious monument of the Shī'ī sect; 1642). Other 17th-century buildings include the Hindu Dhākeśwarī temple and Tejgaon church, built by the Portuguese. The more than 700 mosques, including Bayt ul-Mukarram, date back to the 15th century; Dacca also houses Burmese and Thai religious buildings.

With the removal of the provincial capital to Murshidābād (1704) and the decline of the muslin industry, Dhākā entered a period of decline. It passed under British control in 1765, was constituted a municipality in 1864, but continued to decay until it was designated capital of Eastern Bengal and Assam province (1905–12). During the early 20th century Dhākā served as a commercial centre and seat of learning. It became the capital of East Bengal province (1947) and of East Pakistan (1956). Dhākā suffered heavy damage during the war of independence in 1971 but emerged as the capital of Bangladesh.

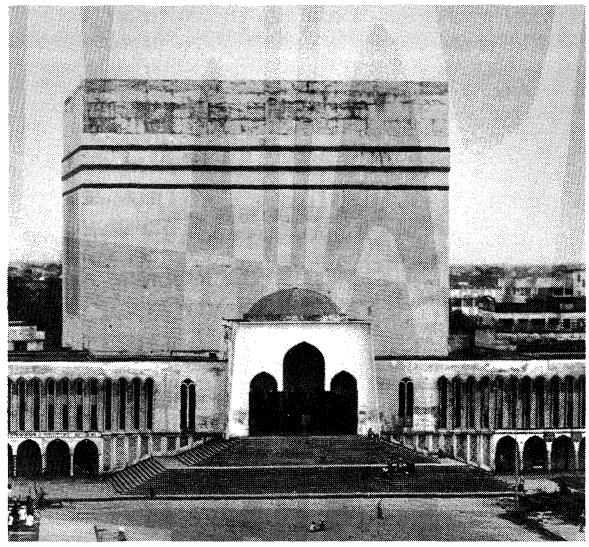
Together with its river port of Nārāyanganj, 10 miles (16 km) south, Dhākā now houses the largest industrial concentration in the country. Traditional products include *jāmdānī* (fine-quality muslin), embroidery, silk, and jewelry.

The city also contains the University of Dhākā (1921) and numerous affiliated government colleges, an engineering and technology university, an agricultural university, a nuclear-science training and research centre, and a library.

The area around Dhākā consists of a level plain bounded by the Meghna, Padma (Ganges), and Jamuna (Brahmaputra) rivers. The plain is crossed by a network of streams and rivers, the chief being the Dhaleśwarī, Burhi Ganga, and Lakhya. Important crops are rice, jute, sugarcane, and oilseeds; there is also a government cattle farm. Industries include jute processing and the manufacture of rope, string, baskets, cotton cloth, and boats. The area includes the ancient city of Vikrampur, former capital of the Pāla rulers of Bengal (8th–12th centuries). Pop. (1981) city, 2,790,000; (1984 est.) metropolitan area, 3,950,000.

Dhamār, town, south central Yemen (Ṣan'ā'), lying in the Yemen Highlands, in a valley 12 miles (19 km) wide between two volcanic peaks at 8,000 feet (2,400 m) above sea level. Although local tradition dates many of the sites in the district to biblical times, the first certain historical mention of Dhamār is by the Arab geographer and philologist Yāqūt (1179–1229), who wrote of its fine public buildings and of the fertility of the surrounding countryside.

Long the principal religious centre of the Zaydī sect of Islām, dominant in Yemen for many centuries, Dhamār was the seat of a renowned *madrasah* (theological school). As the former capital of the Central, or Dhamār, *liwā'* (province) under the monarchy, it was ruled as an emirate by the princely Āl Wazīr family until 1944, when the country's administration was reorganized.



Bayt ul-Mukarram Mosque and shopping mall, Dhākā, Bangladesh

Frederic Ohringer from the Nancy Palmer Agency—EB Inc.

The town is built in two sections, divided by a belt of irrigated market gardens. There are some typical Yemeni multistory houses, but most dwellings are of one-story mud-brick construction; the town also has several fine mosques. Dhamār is a market centre for the surrounding grain-growing countryside and also has some handicraft industries. The area has long been renowned for its horses. Pop. (1980) 39,195.

dhamma (religious concept): *see* dharma.

Dhammapada (Pāli: "Words of Doctrine," or "Way of Truth"), probably the best-known book in the Pāli Buddhist canon and the most quoted in other Buddhist writings. It is an anthology of basic Buddhist teachings (primarily ethical teachings) in a simple aphoristic style. As the second text in the *Khuddaka Nikāya* ("Short Collection") of the *Sutta Piṭaka* ("Basket of Discourse"), the *Dhammapada* contains 423 stanzas arranged in 26 chapters. It also appears in somewhat different versions in Prākrit, Sanskrit, and Chinese, and there are translations in other languages. More than half the verses are excerpted from other canonical texts and include many of the most famous Buddhist sayings; others come from the storehouse of pithy sayings drawn upon by much of Indian literature.

The book is popular in Buddhist countries of both Theravāda and Mahāyāna traditions. In Sri Lanka it has been used for centuries as a manual for novices, and it is said that every monk can recite it from memory.

Dhamtari, town, southeastern Madhya Pradesh state, central India, just west of the Mahānadi River. The town is a rail-spur terminus and trade centre for agricultural and forest products. Rice and flour milling and shellac manufacture are the chief industries. Dhamtari has an industrial school and two colleges affiliated with Ravishankar University. It was constituted a municipality in 1881. Pop. (1981) town, 55,797.

Dhānbād, town, eastern Bihār state, northeastern India. It lies in the Dāmodar River (*q.v.*) Valley near the Jharia coalfield and is an important agricultural trade centre. The Indian School of Mines, affiliated with the University of Bihār, and the Central Fuel Research Institute are located there.

The Dāmodar River, which crosses from east to west the region in which Dhānbād is sited, is flanked by irrigation tanks and fields of rice, corn (maize), and oilseeds. The nearby Jharia and Rānīganj coalfields have helped make the region India's leading coal producer. Pop. (1981) town, 120,221; metropolitan area, 678,069.

Dhanvantari, also spelled DHANWANTARI, in Hindu mythology, the physician of the gods. According to legend, the gods and the demons sought the elixir *amṛta* by churning the milky ocean, and Dhanvantari rose out of the waters bearing a cup filled with the elixir. The Āyurveda, a traditional system of medicine, is also attributed to him. The name has also been applied to other semilegendary and historical physicians and to a legendary king.

Dhār, town, western Madhya Pradesh state, central India. The town, a major agricultural centre, is connected by road with Indore. Cotton ginning and handicraft weaving are the chief industries. On the northern slopes of the Vindhya Range, Dhār commands one of the gaps leading to the Narmada Valley.

An ancient town, it served (9th–14th century) as the capital of the Paramāra Rājputs and was a centre of learning under the celebrated Raja Bhōj (1010–55). It was conquered by the Muslims in the 14th century, was under Mughal dominion, and fell to the Marāṭhās in 1730, after which it served as the capital of Dhār princely state, founded in 1742 by Anand Rāo Panwār, a Marāṭhā chieftain.

Dhār's Lāṭ Masjid, or Pillar Mosque (1405), was built out of the remains of Jaina temples. Its name was derived from an overthrown iron pillar (13th century) bearing a later inscription recording the visit of the Mughal emperor Akbar in 1598. Dhār also houses the Kamal Maula mausoleum and a mosque known as Raja Bhōj's school, built in the 14th or 15th century; its name was derived from its paved slabs covered with inscriptions giving Sanskrit grammatical rules. Just north stands a 14th-century fort, said to have been built by Muḥammad ibn Tughluq, which contains the raja's palace. The town has a library, a hospital, a musical academy, and a government college affiliated with Vikram University.

The region around Dhār comprises portions of the Mālwa Plateau and the Nimār tract, separated by the Vindhya Range. Sorghum, corn (maize), pulses, and cotton are the chief crops, irrigated by the Mahi, Narmada, and Chambal river systems. Pop. (1981) town, 48,870.

Dharamsāla (India): *see* Dharmsāla.

dharana, Sanskrit DHĀRAṆĀ, in the Yoga system of Indian philosophy, the sixth of the eight stages intended to lead the aspirant to samadhi ("self-collectedness"), the state of perfect concentration. In dharana, the mind concentrates its attention on a single external object. Sufficient prolongation of dharana results in a deeper state of concentration, dhyana (Sanskrit: "concentrated meditation"), in which there is a constant identification between the meditator and the object of meditation. These two stages and the final one of samadhi are much alike and may be difficult to differentiate from one another.

dharani, Sanskrit DHĀRAṆI, in Buddhism and Hinduism, a sacred verse of great efficacy, used by the common man as a verbal protective device or talisman and by the yogi (spiritual adept) as a support or instrument for concentration. The dharani is a short summary of the essential doctrine contained in a much longer sacred text and serves as an aid to its retention. Properly recited, the dharani conveys the same merit as reading the entire work. The meaning of a dharani is often very difficult to determine and may sound to the uninitiated like a string of meaningless words, the accuracy of which is, nevertheless, carefully guarded when passed on from teacher to pupil. *Compare* mantra.

dharma, Sanskrit DHARMA, Pāli DHAMMA, key concept with multiple meanings in Hinduism, Buddhism, and Jainism.

In Hinduism dharma is the religious and moral law governing individual conduct and one of the four ends of life, to be followed according to one's class, status, and station in life. It constitutes the subject matter of the dharmasutras, religious manuals that are the earliest source of Hindu law, and in the course of time has been extended into lengthy compilations of law, the dharmashastra (*q.v.*).

In Buddhism, dharma is the doctrine, the universal truth common to all men at all times, proclaimed by the Buddha. Dharma, the Buddha, and the sangha (community of believers) make up the triratna, or "three jewels," the primary statement of Buddhist belief. In Buddhist metaphysics the term in the plural (dharmas) is used to describe the interrelated elements that make up the empirical world.

In Jaina philosophy, dharma, in addition to being commonly understood as moral virtue, also has the meaning—unique to Jainism—of an eternal "substance" (*dravya; q.v.*), the medium that allows beings to move.

Dharma-Ṭhākur, also called DHARMA-RAY, folk deity of eastern India of complex characteristics and obscure origins. Dharma-Ṭhākur is worshiped as the "high god" of a large number of villages of Raṛh, a region that comprises the greater part of modern West Bengal state. Dharma-Ṭhākur has no prescribed form; he is worshiped in the form of stones, as a wooden votive slab, or through a pair of wooden sandals. Among other attributes he is a fertility god and a healer of disease. Worship of Dharma-Ṭhākur is correlated with sun worship, and Dharma-Ṭhākur's annual worship, known as Dharma-pūjā, has been described as a kind of sympathetic magic to make the monsoon rains begin to fall.

Scholars are not agreed on the origins of worship of Dharma-Ṭhākur; some find in the deity and his worship a degenerate form of the Buddha and Buddhism; others trace the cult and deity to either pre-Aryan or tribal sources. Among the neighbouring literate tribal peoples there are a number of cult practices and deities that share some of the characteristics of Dharma-Ṭhākur and his cult. The majesty and exploits of Dharma-Ṭhākur are presented in a major class of works in Bengali literature known as *Dharma-maṅgal.*

Dharmakīrti (fl. 7th century), Indian Buddhist philosopher and logician. He asserted that inference and direct perception are the only valid kinds of knowledge and that, in the processes of the mind, cognition and the cognized belong to distinct moments. According to him, the object of inference, either analytical or synthetic, is the universal (*sāmānyalakṣaṇa*) and the object of perception—which may be perceived by the five senses, by the mind, by self-consciousness, or by the practice of Yoga—is the pure particular (*svalakṣaṇa*).

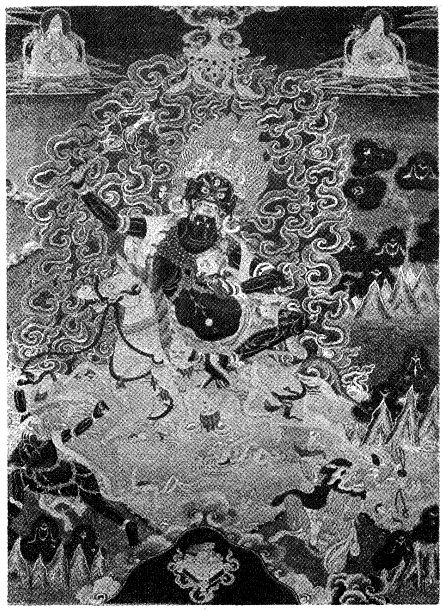
Dharmakīrti claimed that every person is a transitory being and, in his turn, assumes the continuous existence of an individual. The individual is a continuation of moments, compiled by imaginative and discriminative thinking.

dharmapāla (Sanskrit: "defender of the religious law"), Tibetan DRAG-GSHED ("cruel, wrathful hangman"), in Tibetan Buddhism, any one of a group of eight divinities who, though benevolent, are represented as hideous and ferocious in order to instill terror in evil spirits.

Worship of *dharmapālas* was initiated in the 8th century by the magician-saint Padmasambhava, who is said to have conquered the malevolent deities in Tibet and forced them to take an oath promising to protect Buddhists and the Buddhist faith. Many of the *dharmapālas* can be linked to Hindu, Bon (the indigenous religion of Tibet), or folk deities.

The *dharmapālas* are shown in painting, in sculpture, and in masks used by dancers as scowling figures with a third eye and disheveled hair, wearing crowns of skulls and garlands of severed heads; they are depicted treading on human beings or animals, usually in the company of their female consorts. They are worshiped singly or in a group called the "Eight Terrible Ones," which most commonly includes the following: (1) Lhamo (Tibetan: Goddess; Sanskrit Śrī-devī, or Kāla-devī), fierce city goddess of Lhasa and the only feminine divinity in the group; (2) Tshangs-pa Dkar-po (Tibetan: White Brahmā; Sanskrit Sita-Brahmā); (3) Beg-tse (Tibetan: Hidden Sheet of Mail); (4) Yama (Sanskrit; Tibetan Gshin-rje), the god of death, who may be accompanied by his sister, Yamī; (5) Kubera, or Vaiśravaṇa (*q.v.*; Tibetan Rnam-thos-sras), god of wealth and the only one among the eight who is never represented in a fierce form; (6) Mahākāla (Sanskrit: Great Black One; Tibetan Mgon-po); (7) Hayagrīva (Sanskrit: Horse Neck; Tibetan Rta-mgrin); and (8) Yamāntaka (Sanskrit: Conqueror of Yama, or Death; Tibetan Gshin-rje-gshed).

The *dharmapālas* are worshiped in the *mgon khang,* a subterranean room, the entrance to



Lha-mo, one of the *dharmapālas*, 19th-century Tibetan painting; in the Rijksmuseum voor Volkenkunde, Leiden, Neth.

By courtesy of the Rijksmuseum voor Volkenkunde, Leiden, Neth.

which is often guarded by stuffed wild yaks or leopards. Priests wear special vestments and use ritual instruments often made of human bone or skin. Worship includes the performance of masked dances (*'cham*).

Dharmapuri, town, northwestern Tamil Nādu state, southeastern India. It was known in early Tamil *caṅkam* literature as the home of the poet Avvaiyār (2nd century AD). It is now an agricultural trade centre and contains some light industry. About 30 miles (48 km) west are the Hogenakal Falls of the Cauvery River, a famous pilgrimage and healing centre.

Considerable deposits of saltpetre and salts of soda are mined in the region in which Dharmapuri is situated. The principal crops of the area are millets, but rice is extensively grown under irrigation. Cotton, gingelly (sesame seed), and peanuts (groundnuts) are the chief cash crops. There are also high-quality cattle. Pop. (1981) town, 51,223.

dharmashastra, also spelled DHARMASASTRA, Sanskrit DHARMA-ŚĀSTRA ("righteousness science"), ancient Indian body of jurisprudence that is still fundamentally the family law of Hindus living in territories outside India (*e.g.,* Pakistan, Malaysia, East Africa) and is in force, subject to legislative modification, in India. Dharmashastra is not primarily concerned with legal administration, though courts and their procedures are dealt with comprehensively, but with the right course of conduct in every dilemma. Some basic principles of dharmashastra are known to most Hindus brought up in a traditional environment. These include the propositions that duties are more significant than rights, that women are under perpetual guardianship of their closest male relatives, and that the king (*i.e.,* the state) must protect the subjects (*i.e.,* the citizens) from all harm, moral as well as material. Dharmashastra penetrated into parts of Southeast Asia (*e.g.,* Myanmar [Burma], Thailand, Bali) in ancient times, where its literature slowly shed Indian characteristics to be replaced with local customs.

The dharmashastra literature, which is written in Sanskrit, exceeds 5,000 titles. It can be divided into three categories: (1) sutras (terse maxims); (2) smritis (shorter or longer treatises in stanzas); (3) *nibandhas* (digests of smriti verses from various quarters) and *vṛttis* (commentaries upon individual continuous smritis). The *nibandhas* and *vṛttis* are juridical works intended for legal advisers and exhibit considerable skill in harmonizing divergent sutras and smritis.

The techniques of the dharmashastra are mainly to state the ancient text, maxim, or stanza and to explain its meaning, where obscure, to reconcile divergent traditions, if necessary by use of the traditional science of interpretation (Mimamsa). Where possible, dharmashastra permits custom to be enforced, if it can be ascertained and if its terms are not repugnant to the principles of life as understood by Brahmans (those of the priestly class). Brahman ethics have given dharmashastra its colour and provided a test under which many customs of the Hindu peoples could be administered by Hindu kings.

Ancient Hindu jurisprudence was introduced to the West by Sir William Jones, 18th-century British Orientalist and jurist. Many who followed him—*e.g.,* Sir Henry Maine (1822–88)—believed dharmashastra was a kind of priestcraft, intended to keep the lowest castes, the Śūdras and the untouchables, under the control of the higher castes. The close study of dharmashastra sources by German and Italian scholars, principally G. Bühler, Julius Jolly, and Giuseppe Mazzarella, showed its psychological and sociological potential.

Dharmashastra is equal in age to Jewish law (or older, if its roots do indeed go back to the Vedas), but its sources are more accessible, more varied, and less codified. It differs from Roman law in these respects but especially in its greater continuity and longevity. The British colonial administration in India affected the system of Hindu law by applying the traditional rules in a hard-and-fast way and by introducing the concept of precedent. Rapid social change, following foreign rule, required many adjustments to India's body of Hindu law. There was, for example, no provision in the dharmashastra for the development of judicial divorce or the allotting of equal shares to daughters along with sons in their fathers' estate at his death. This would have necessitated inventing new texts, which was impossible. Hence, first piecemeal and later comprehensive legislation, in 1955–56, altered the system of Indian law administered in the courts. Gradually, as judges lost familiarity with Sanskrit, the ancient texts began to be replaced with contemporary, cosmopolitan juridical and social concepts.

dharmasutra, Sanskrit DHARMA-SŪTRA ("righteousness thread"), any of several manuals of human conduct that form the earliest source of Hindu law. They consist chiefly of strings (or "threads") of terse rules containing the essentials of law relating to man and his fellows and to man and the state. The maxims deal with the practical rules of caste and of human beings in their social, economic, and religious relations. Formulated in prose, they were intended to be committed to memory and expounded orally by teachers—thus forming, as it were, epitomes of class lectures. Eventually these rules came to be interspersed with stanzaic verses in various metres, each generally giving the substance of the rule immediately preceding it. The verses themselves became increasingly popular and ultimately led to the appearance of works entirely in verse. These metrical versions of previously existing dharmasutras came to be called dharmashastras, though in modern times the latter term more commonly is used collectively to denote the whole body of customary rules and observances governing Hindu religious and social life. *See also* dharmashastra.

Dharmavamsa, also spelled DHARMAWANGSJA, or DHARMAWANGSA (d. *c.* 1007, Java [now in Indonesia]), king of eastern Java from about 985 and the first historical Javanese whose life is known in any detail.

Dharmavamsa was a Saivite king whose reign is noted for its literary achievements, including a translation of the Hindu epic *Mahābhārata* into Javanese. A legal code that the king developed is still in use in Bali. Dharmavamsa established tributary relations with Bali and parts of the island of Borneo and attacked the powerful Sumatran kingdom of Śrivijaya, which retaliated with a military expedition that decimated eastern Java; Dharmavamsa himself was killed. His kingdom was subsequently restored under the leadership of his son-in-law Erlangga.

Dharmsāla, also spelled DHARAMSĀLA, city, western Himāchal Pradesh state, northwestern India, located on a lower slope of the Himalayas. Dharmsāla is a scenic health resort. Aerated water is bottled there, and slate is quarried nearby. The city was virtually destroyed by an earthquake in 1905, but it was then rebuilt. The Dalai Lama took up residence in Dharmsāla when he was forced into exile from Tibet in 1959. Pop. (1981) 14,522.

Dhārwār-Hubli, town, western Karnātaka (formerly Mysore) state, southwestern India. Fortified from the 16th century, Dhārwār was originally called Daravada (meaning "gateway town"). It is an educational and trading (cotton) centre lying along the Southern Railway and a national highway. The town is the seat of several institutions, including Karnātaka University (1917), many colleges (notably engineering and agricultural teachers' training), a detention home for juveniles, and a mental hospital. In 1961 Dhārwār was incorporated with industrial Hubli, 13 miles (21 km) southeast, to form one of the state's most populous urban areas.

Hubli, often called Hubballi, or Pubballi (meaning "old village"), developed around the 11th-century stone temple of Aharanishankar. Notable buildings include the Mahadi Mosque, the Bhavāni Shankar Temple, and the town hall. Hubli is a trading centre with cotton mills, ginning and pressing factories, and a large newspaper industry. A divisional headquarters of the Southern Railway, it has railway workshops and is also a major road junction. Its colleges of commerce, law, medicine, and engineering and technology are affiliated with Karnātaka University in Dhārwār.

The surrounding region, on the western edge of the Deccan Plateau, is drained by the Gangāvali and Malprabha rivers. Chief products are millets, pulses, cotton, and timber.

Stone Age tools have been collected from the Malprabha River basin. Buddhist relics have been discovered in the area, and Jainism flourished there during the first millennium AD, when local towns were centres of literature and art. Pop. (1981) town, 527,108.

Dhaulāgiri, mountain massif of the Himalayas in north-central Nepal, on the western side of the deep Kāli Gandak River gorge. Many of its snow- and glacier-covered peaks exceed 25,000 feet (7,620 m), including Dhaulāgiri I (26,795 feet), II, III, and IV. Dhaulāgiri I is one of the world's highest mountains. With a south wall 15,000 feet high, the peak's steep sides and bitter climate prevented an ascent to the top until May 13, 1960, when a Swiss expedition led by Max Eiselin reached the summit. The name of the peak is derived from two Sanskrit words meaning "white mountain."

Dhaun, Leopold Joseph, Graf von (count of): *see* Daun, Leopold Joseph, Graf von.

Dhebar Lake, large reservoir lake, in the southeastern Arāvalli Range, south-central Rājasthān state, northwestern India. The lake, approximately 20 square miles (50 square km) in area when full, was originally named Jai

Samand and was formed by a marble dam built across the Gomati River in the late 17th century. Canals carry water from the lake to villages in the western area. Small wooded islands dot the northern end of the lake, where fishing hamlets fringe the shore. Two palaces stand on the hills to the south.

Dhekélia, also spelled DEKÉLEIA, British military enclave in southeast Cyprus, retained as a "sovereign base area" by the United Kingdom under the 1959 London Agreement granting independence to Cyprus. It is located northeast of Larnaca on the northern shore of Larnaca Bay, and its northern boundary formed part of the border between the Republic of Cyprus (south) and the Turkish Cypriot administered area (north) established in 1974. It has a hospital and a small airfield. The base, together with Akrotiri sovereign base to the southwest (together totaling 99 square miles [256 square km]), is used as a British training and staging area and for support of the United Nations forces on Cyprus.

Dhenkānāl, town, east-central Orissa state, eastern India. Named for Dhenka, a medieval chieftain of the Savara (Saora, or Sora) tribe, Dhenkānāl is a marketplace for rice, oilseeds, and timber and is a centre of handloom weaving. It was formerly the capital of the princely state of Dhenkānāl, which was incorporated in 1949 into Orissa state. The raja's palace is on a hill encircled by moats. The town is the site of Dhenkānāl College (established 1959).

Rice and oilseeds are grown in the surrounding area, and forest products are important. Textiles, brass utensils, and other cottage industries are widespread. Pop. (1981) town, 35,653.

Dhībān (Jordan): *see* Dibon.

dhikr, also spelled ZIKR (Arabic: "reminding oneself," or "mention"), ritual prayer or litany practiced by Muslim mystics (Ṣūfīs) for the purpose of glorifying God and achieving spiritual perfection. Based on the Qur'ānic injunctions "Remind thyself [*udhkur*] of thy Lord when thou forgettest" (18:24) and "O ye who believe! Remember [*udhkurū*] Allāh with much remembrance" (33:41), the dhikr is essentially a "remembering" of God by the frequent repetition of his names. Originally a simple recitation of the Qur'ān and various religious writings among ascetics and mystics, the dhikr gradually became a formula (*e.g., lā ilāha illa 'llāh,* "there is no god but God"; *Allāhu akbar,* "God is greatest"; *al-ḥamdu li'llāh,* "praise be to God"; *astaghfiru 'llāh,* "I ask God's forgiveness"), repeated aloud or softly, accompanied by prescribed posture and breathing. As the Ṣūfī brotherhoods (*ṭarīqahs*) were established, each adopted a particular dhikr, to be recited in solitude (*e.g.,* following each of the five obligatory daily prayers) or as a community. The dhikr, like *fikr* (meditation), is a method the Ṣūfī may use in his striving to achieve oneness with God.

Dhiliyiánnis, Theódoros, Dhiliyiánnis also spelled DELIGIÁNNIS, or DILIYIÁNNIS (b. April 1826, Kalávrita, Greece—d. May 13 or June 13, 1905, Athens), politician who was prime minister of Greece five times (1885–86, 1890–92, 1895–97, 1902–03, 1904–05). He was a resolute advocate of aggressive and often irresponsible irredentism. His bitter rivalry with the reformist politician Kharílaos Trikoúpis dominated Greek politics for the last quarter of the 19th century.

Dhiliyiánnis, who studied law at the University of Athens, first became prominent as Greece's foreign minister in 1862. He was ambassador in Paris (1867–68), and, in 1877, as foreign minister in the government of Aléxandros Koumoundhoúros, he advocated Greek intervention in the Russo-Turkish War; the following year he was a delegate to the Congress of Berlin, which sought to solve the Eastern Question.

While his rival Trikoúpis advocated constitutional government and internal reform, Dhiliyiánnis, a supporter of the Great Idea (Megáli Idéa) that promised the liberation of all Greeks under Turkish rule and even the recovery of Constantinople (Istanbul), occupied himself primarily with an aggressive foreign policy and organized his followers into the conservative Nationalist Party, in opposition to Trikoúpis' Liberal Party. In 1885 Dhiliyiánnis formed his first government and, inspired by the Bulgarian declaration of complete independence from Turkey, prepared to invade Turkish Macedonia, an adventure that was stopped only when the great powers blockaded Greek ports.

Dhiliyiánnis became prime minister again in 1890 and 1895. Spurred on by the 1896 revolt on Crete against Turkish rule, he declared war on Turkey in April 1897, sending a fleet to the island and an army led by Crown Prince Constantine into Macedonia and Epirus. The army was defeated, and Greece was forced to yield 12 strategic points along its northern border to Turkey. Resigning as prime minister, Dhiliyiánnis kept his seat in the Chamber of Deputies, though he had lost much of his popular following. Nevertheless, he was prime minister again in 1902–03 and from December 1904 until his assassination by opponents of his strict measures against gambling syndicates.

Dhílos (Greece): *see* Delos.

Dhlomo, R(olfus) R(eginald) R(aymond) (b. 1901, Siyamu, Natal Province, S.Af.—d. 1971), African novelist, journalist, and editor who wrote in Zulu and English. His *An African Tragedy* (1928) was the first novel in English by a Zulu writer.

Dhlomo attended the Ohlange Institute in his hometown and then earned a teacher's certificate from Adams College at nearby Amanzimtoti. He contributed sketches and moral tales to *The Sjambok, Ilanga lase Natal,* and *The Bantu World* before becoming editor of *The Bantu World* (1942–43) and *Ilanga lase Natal* (1943–60), for which he wrote a leading feature in English and many articles in Zulu.

An African Tragedy, a novel about the corrosive effects of the city on a pair of lovers from the country, is a Christian fable of sin and forgiveness. Dhlomo's major novels in Zulu—*UNomalanga kaNdengezi* (1934; "Nomalanga, Daughter of Ndengezi") and *Indlela yababi* (1946; "The Way of the Wicked")—paint portraits of Zulu life in Natal and Johannesburg, respectively. Many of his other Zulu works are semibiographical accounts about members of the Zulu dynasty.

Dhodhekánisos (Greece): *see* Dodecanese.

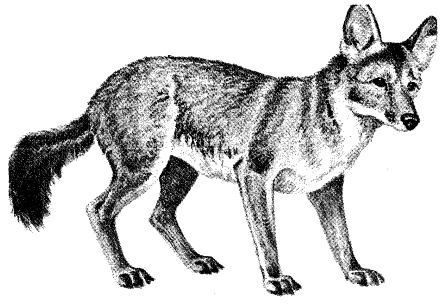
Dhofar, also spelled DHUFAR, Arabic ẒUFĀR, historical region in southern Oman, extending from Cape ash-Sharbatāt on the coast of the Arabian Sea southwestward to the Oman–Yemen (Aden) border. The region's northern boundary has never been defined, but generally included in the territory is the Wadi Mughshin, located about 150 miles (240 km) inland. To the northeast of Dhofar is a large desert of stony plains and sand dunes that contribute to the region's isolation from northern Oman. The Ṣalālah coastal plain (about 40 miles [64 km] long and ranging from 1 to 6 miles [1.5 to 9.5 km] wide), facing the Arabian Sea, is considered one of the most beautiful in Arabia, particularly in its southwestern part, because of its monsoon climate and temperate vegetation and bird life; the region has constantly flowing streams, making it Oman's most fertile area. About 10 miles (16 km) inland the rugged al-Qarā' Mountains rise to heights of between 3,000 and 4,000 feet (900 and 1,200 m). Farther north the al-Qarā' Mountains give way to a pebbly desert, beyond which lies the Rub' al-Khali (the Empty Quarter) of Saudi Arabia.

Dhofar is one of the locations suggested for the Ophir (*q.v.*) of the Bible; the earliest known settlement in the region dates back to the 12th century BC. By the close of the 12th century AD the region was ruled as a tributary of Oman by Aḥmad ibn-Moḥammad al-Manjawa. In the early 19th century it was governed by Moḥammad ibn-Agil al-Ajaibi. In 1965, Ohotari tribesmen, supported by neighbouring Yemen (Aden), rebelled against Sultan Sa'īd ibn Taymūr's restrictive policies; they were defeated in 1975.

Major crops in Dhofar include coconuts, alfalfa, sorghum, bananas, and vegetables. The region is the world's leading source of frankincense. Dhofar is Oman's cattle-raising area, primarily for milk. There are oil fields in the northeast. The coastal town of Ṣalālah, sprawled along a sandy beach, was the permanent residence of the former sultan of Oman. Other major towns, all situated on the plain, include Mirbāṭ, Ṭāqah, Raysūt, and Rakhyūt. A road from Ṣalālah crosses the al-Qarā' Mountains north to Thamril, where a graded road continues northward. The mountain sector is inhabited almost exclusively by the Qara, Sheva, and Mahra peoples; the majority of the peoples on the Ṣalālah plain are Najd and Kathier.

Dhok (Iraq): *see* Dahūk.

dhole, also called RED DOG (*Cuon alpinus*), wild Asian carnivore of the dog family (Canidae), found in central and southeastern wooded areas and distinguished structurally by the lack of one pair of lower molars. Its



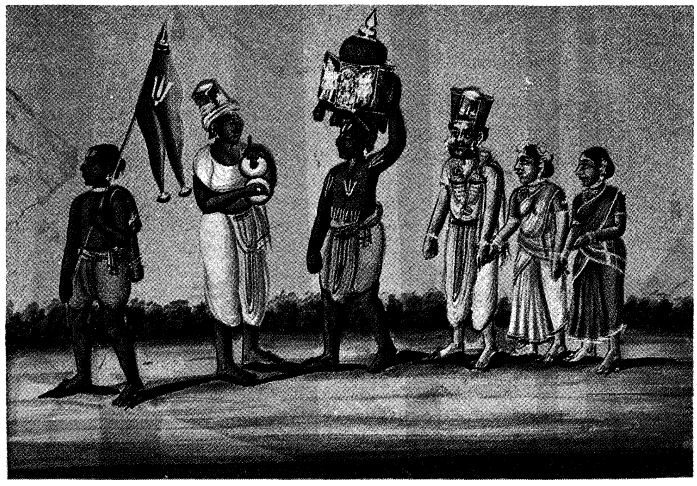
Dhole (*Cuon alpinus*)
Painting by Richard Ellis

length ranges between 76 and 100 cm (30 and 40 inches), exclusive of the 28–48-centimetre (11–19-inch) tail, and its weight is from 14 to 21 kg (30 to 46 pounds). Coloration varies from yellowish to reddish brown, often with lighter underparts. Dholes hunt various mammals, generally associating in packs of up to 30 individuals; they usually hunt such prey as deer and wild sheep but are reported to attack animals as large as tigers and bears. A litter usually contains two to six pups, born after a nine-week gestation period.

Dholpur, town, east-central Rājasthān state, northwestern India, situated just north of the Chambal River. The original town was founded by Raja Dholan Deo in the 11th century, when it was called Dhawalpur, a name since contracted to Dholpur. The present town was established just north of the original town to avoid encroachments by the Chambal River. It was the capital of the former princely state of Dholpur, which became part of the state of Rājasthān in 1949. Several temples surround nearby Machkund Lake, on the shores of which annual religious fairs are held. An agricultural distribution centre, Dholpur is connected by Grand Trunk Road with Āgra and Delhi to the north and with Gwalior to the south. The town has railway workshops, and industries include handloom carpet weav-

ing and glass manufacturing. Dholpur has a hospital and one college. Cattle and horse fairs are held annually. Pop. (1981) 44,375.

dhoti, long loincloth traditionally worn in southern Asia by Hindu men. Wrapped around the hips and thighs with one end brought between the legs and tucked into the waistband, the dhoti resembles baggy, knee-length trousers.



Men wearing dhotis, "Vaiṣṇava Procession," tale painting from India, mid-19th century; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

The lightweight cotton fabric, also called dhoti, that is used for the garment is usually white and is often bordered in brightly coloured stripes. It was originally called a *paridhana.* Sculptured reliefs dating from the 2nd century BC show the ancient dhoti as a garment worn by both sexes. Derivatives of the dhoti are the panung of Thailand, the comboy of Sri Lanka, and the sarong of Indonesia and Malaysia.

dhoum nut: *see* doum nut.

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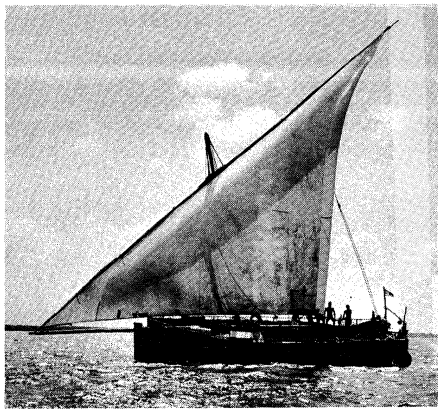
dhow, also spelled DOW, one- or two-masted Arab sailing vessel, usually with lateen rigging (slanting, triangular sails), common in the Red Sea and the Indian Ocean. On the larger types, called baggalas and booms, the mainsail is considerably bigger than the mizzensail. Bows are sharp, with a forward and upward



Dhow under sail off the coast of Zanzibar

Lynn McLaren—Rapho/Photo Researchers

thrust, and the sterns of the larger dhows may be windowed and decorated.

dhrupad, in Hindustani music, ancient vocal musical form in four parts preceded by extensive introductory improvisation (*ālāpa*) and expanded by rhythmic and melodic elaborations. It is related to the shorter, later *kayāl,* which has somewhat eclipsed the *dhrupad* in popularity.

The classical *dhrupad,* heavy and majestic in style, required great breath control. It was used in praise of heroes, gods, and kings.

Dhū al-faqār, in Islāmic mythology, the two-pointed magical sword that has come to represent ʿAlī, fourth caliph and son-in-law of Muḥammad. Originally owned by an unbeliever, al-ʿĀṣ ibn Munabbih, Dhū al-faqār came into Muḥammad's possession as booty from the Battle of Badr (624). He in turn passed it on to ʿAlī, and the sword, said to have borne an inscription ending in the words *lā yuqtal Muslim bi-kāfir* ("no Muslim shall be slain for [the murder of] an unbeliever"), eventually rested with the ʿAbbāsid caliphs.

As ʿAlī's legendary status grew, the importance of his association with Dhū al-faqār also increased. Particularly in legends surrounding the Battle of Ṣiffīn (657), Dhū al-faqār, the two points of which were useful for blinding an enemy, is credited with enabling ʿAlī to perform phenomenal military feats, decapitating or cutting in half more than 500 men.

In Muslim countries, fine swords have traditionally been engraved with the phrase *lā sayfa illā Dhū al-faqār* ("there is no sword but Dhū al-faqār"), often with the addition *wa lā fatā illā ʿAlī* ("and there is no hero but ʿAlī").

Dhū an-Nūnid DYNASTY, 11th-century Muslim Berber dynasty of Toledo that ruled central Spain from Guadalajara and Talavera to Murcia during the unruly period of the party kingdoms (*ṭāʾifahs*). As early as the mid-8th century the Banū Zannūn—their name was later Arabicized—had settled northeast of Toledo, where they became an influential family. In the civil war that broke up the Spanish Umayyad state (1008–31), ʿAbd ar-Raḥmān ibn Dhū an-Nūn, who had been invited by the Toledans to rule their city, and his son Ismāʿīl aẓ-Ẓāfir were the first local rulers to refuse to recognize the central authority of the Umayyad caliph of Córdoba. Aẓ-Ẓāfir established himself as an independent king in Toledo and, despite constant wars with the Christians, ruled until 1043. His son Yaḥyā al-Maʾmūn (reigned 1043–75) allied with Christians several times against his Muslim enemies and even entertained King Alfonso VI of Castile and Leon at his court (1072). In 1065 al-Maʾmūn seized the ʿĀmirid capital of Valencia and in 1074–75 was able to take Córdoba, the former seat of the Umayyads. But Yaḥyā al-Qādir (reigned 1075–92), al-Maʾmūn's grandson, soon lost both Valencia and Córdoba. An alliance with Alfonso VI hastened the end of the Dhū an-Nūnid kingdom: while al-Qādir was briefly restored to Toledo, he bargained away his capital to the Christians in return for Valencia (1085), where he was assassinated in 1092.

Dhubri, town, western Assam state, northeastern India. Situated on the Brahmaputra River just east of the Bangladesh border, it is a trade centre for rice, jute, fish, and other products. A match factory is the major industry. The town has road and rail connections with neighbouring districts, Calcutta, and Bangladesh. Pop. (1971) town, 45,589.

Dhūlia, also called DHULE, town, northwestern Mahārāshtra state, western India, on major road and rail routes. In early Muslim times it belonged to the Fārūquis, but later, in 1601, it became part of the Mughal Empire. Later conquered by Marāṭhās in the 18th century and ceded to the British in 1818, it joined Bombay Presidency in 1818. Formerly an agricultural commercial centre, Dhūlia has become a growing industrial town, with a cotton-textile mill and such small-scale industries as cotton ginning, cigarette making, and oil processing. It has 13 colleges affiliated with the University of Poona.

The large area around Dhūlia contains two main hill systems—the Sātpura (north) and Sātmāla (south) ranges—which are offshoots of the Western Ghāts. Between them the Tāpti River flows through a fertile valley that is part of the cotton-growing Khāndesh region. Other important crops are peanuts (groundnuts) and chilies; most of the agricultural produce is shipped to Bombay. The hills are forested and contain the resort town of Toranmal. Pop. (1981) town, 210,759.

Dhulip Singh: *see* Dalip Singh.

dhyāna, in Indian philosophy, a stage in the process of meditation leading to Nirvāṇa. *See* Buddhist meditation.

Dhyāni-Buddha, in Mahāyāna and Vajrayāna (Tantric) Buddhism, any of a group of five "self-born" Buddhas who have always existed from the beginning of time; the five are usually identified as Vairocana, Akṣobhya, Ratnasambhava, Amitābha, and Amoghasiddhi.

Scholars in recent years have pointed out that the term Dhyāni-Buddha does not appear in the original texts, but the nomenclature continues to be commonly used, particularly in describing groups of images composed of

A Dhyāni-Buddha on one of the *stūpa* terraces at Borobuḍur, Java, 8th century

By courtesy of the Royal Tropical Institute, Amsterdam

five meditating Buddhas—as in *maṇḍalas* (ritual meditation designs), on the four sides and top of votive *stūpas* (commemorative monuments), or on the terraces of the great monument at Borobudur in Indonesia.

The five are almost identically represented in art, all dressed in monastic garments, seated with folded legs, with the same hairdress and long-lobed ears, but are distinguished by characteristic colours, symbols, poses of hands, and the directions they face. The five eternal Buddhas are correlated to other groups of five, so that the entire cosmos is seen as divided between them and as emanating from them. Thus, each represents one of the five *skandhas*, or mental and physical aggregates which make up the whole of cosmic as well as individual existence.

According to the full exposition of this scheme, most of the other deities in the vast Buddhist pantheon are related to one of the five Buddhas as members of his "family"; reflect his distinguishing characteristics, such as colour, direction, and symbol; and when represented in art often carry an image of the "parent" Buddha in their crown. Each of the "self-born" Buddhas is also said to have manifested himself as an earthly Buddha and as a *bodhisattva* ("Buddha-to-be"). Each has his own consort, mount, sacred syllable, natural element, particular sense organ, special sense perception, and symbolic location in the human body.

In order to counter any tendency toward polytheism suggested by the fivefold scheme, some sects elevated one of the five, usually Vairocana, to a position of an Ādi-Buddha (first, or primal, Buddha). Sometimes a sixth deity is worshipped as the Ādi-Buddha. The Lamaist sects of Tibet identify the Ādi-Buddha as Vajradhara; some sects of Nepal give this position to Vajrasattva.

Di Penates (Roman deities): *see* Penates.

diabase, also called DOLERITE, fine- to medium-grained, dark-gray to black intrusive igneous rock. It is extremely hard and tough and is commonly quarried for crushed stone, under the name of trap. Although not popular, it makes an excellent monumental stone and is one of the dark-coloured rocks commercially known as black granite. Diabase is widespread and occurs in dikes (tabular bodies inserted in fissures), sills (tabular bodies inserted while molten between other rocks), and other relatively small, shallow bodies. Chemically and mineralogically, diabase closely resembles the volcanic rock basalt, but it is somewhat coarser and contains glass. With increase in grain size, diabase may pass into gabbro.

About one-third to two-thirds of the rock is calcium-rich plagioclase feldspar; the remainder is mostly pyroxene. In diabase, poorly formed pyroxene crystals wrap around or mold against long, rectangular plagioclase crystals to give it the characteristic texture known as diabasic or ophitic. The larger pyroxene grains may completely enclose plagioclase; but as the quantity of the latter increases, pyroxene appears more interstitial.

Certain flat tabular masses (thick sheets or sills) of diabase, such as that forming the Palisades along the Hudson River near New York City, show concentrations of heavy minerals (as olivine or pyroxene) in their lower portions. These concentrations are commonly believed to have developed by the settling of early formed crystals in molten diabase.

Diabase may show varying degrees of alteration: plagioclase is converted to sassurite; pyroxene to hornblende, actinolite, or chlorite; and olivine to serpentine and magnetite. In British usage, such altered rock is called diabase. Some diabase masses have been subdivided by systematic fractures into rectangular blocks. Subsequent alteration and weathering along these fractures have disintegrated and rounded off block corners and edges (spheroidal weathering), leaving regularly spaced, spherelike masses of fresh diabase enveloped by shells of progressively more altered and disintegrated material.

Diabelli, Anton (b. Sept. 6, 1781, Mattsee, near Salzburg, Archbishopric of Salzburg—d. April 7, 1858, Vienna), Austrian music publisher and composer best known for his waltz, or ländler, on which Beethoven wrote his 33 variations for piano (*Diabelli Variations*, Opus 120).

He intended to enter the priesthood and entered the monastery at Raichenhaslach, where his studies were supervised by Joseph Haydn's brother Michael. Diabelli left it in 1803, when the Bavarian monasteries were secularized, and went to Vienna, where he became known as a piano and guitar teacher. In 1818, with Peter Cappi, he founded a publishing firm, which he took over entirely in 1824. He published works of Schubert, Czerny, and Beethoven. In 1851 he issued the first thematic catalogue of Franz Schubert's works. Respected for his instincts as a publisher, he was called "Diabolus Diabelli" by Beethoven. His compositions include operettas, church music, and numerous light pieces for piano, flute, guitar, and other instruments.

diabetes insipidus, pathological endocrine condition characterized by extreme thirst and excessive production of very dilute urine. The patient may have a urine output of 4 to 5 litres per day and, in more severe cases, up to 15 litres. The essential feature of the disorder appears to be a lack of antidiuretic hormone (vasopressin) or a blocking of its action. This hormone, produced by the hypothalamus gland, regulates the kidney's conservation of water and production of urine.

Diabetes insipidus is to be differentiated from psychogenic thirst—*i.e.,* potomania, or a sensation of thirst unrelated to a shortage of water—in which the urine volumes are increased secondary to an increased water intake. Increased urine volumes mimicking diabetes insipidus may also occur in diabetes mellitus, in kidney disease, during discharge of excess body fluids, and in a number of other conditions.

The causes may be numerous: failure of osmoreceptors; tumours; inflammation of the hypothalamus or posterior pituitary by such diseases as syphilis or meningitis; granulomas; trauma, such as skull fracture or concussion; lesions; or failure of the tubules to respond to antidiuretic hormone.

Diabetes insipidus that results from injury to or destruction of the hypothalamic nucleus (where vasopressin is produced), the tract by which vasopressin is conveyed to the posterior pituitary gland, or the posterior pituitary (the neurohypophysis, where vasopressin is stored) is called supraoptic hypophyseal diabetes insipidus, or SHDI. These conditions can be congenital, familial, or acquired defects produced by brain tumours, injury, or disease. When the supplies of vasopressin are adequate but the kidney tubules are unresponsive—either genetically or because of potassium depletion, high levels of serum calcium, or other disorders—nephrogenic diabetes insipidus (NDI) results. The genetic type is familial and may be fully or partly developed; it may be present in newborn infants and, if untreated, results in mental retardation or death by dehydration.

SHDI can be corrected by injections of vasopressin-like molecules of animal or synthetic origin; such treatment, however, is ineffective in the nephrogenic form of the disorder. In both types, reduction of the solute load presented for excretion to the kidneys or the administration of certain antidiuretic drugs that influence salt and water excretion by the kidneys reduces the volume of urine.

diabetes mellitus, disorder of carbohydrate metabolism resulting from insufficient production of or reduced sensitivity to insulin. There are two varieties: juvenile type, for which insulin injection is required, and adult type, which may be controlled by dietary restriction. Despite the names, either type can occur at any age. Symptoms of diabetes include increased urinary volume and frequency, thirst, itching, hunger, weight loss, and weakness; high levels of glucose are characteristically found in the blood (hyperglycemia) and urine (glycosuria).

The exact cause of diabetes is unknown, and recovery without treatment almost never occurs. Before the isolation of insulin in the 1920s, most patients died within a short time after onset. Untreated diabetes leads to ketosis, the accumulation of ketones, products of fat breakdown, in the blood; this is followed by acidosis (accumulation of acid in the blood) with nausea and vomiting. As the toxic products of disordered carbohydrate and fat metabolism continue to build up, the patient goes into diabetic coma.

Treatment to control diabetes is highly successful. All patients are put on restrictive diets designed to help them reach and maintain normal body weight and to limit their intake of carbohydrates and fats. Diabetics who are unable to produce insulin in their bodies receive regular injections of the hormone. Medication, in the form of oral hypoglycemic (blood-sugar-lowering) agents, was once commonly used to control adult-type diabetes, but has fallen out of favour because of controversial reports of associated cardiovascular problems; such drugs are still used in a limited number of cases, however. The object of all forms of treatment is to keep the level of blood sugar within normal limits and thus reduce the complications, chiefly cardiovascular, that account for most diabetes-related deaths. Other serious complications include the condition known as diabetic retinopathy (retinal changes leading to blindness) and frequent infection.

Diable, Île du (French Guiana): *see* Devil's Island.

Diablo Range, segment of the Pacific Coast Ranges extending southeastward for about 180 mi (290 km) from the solitary Mt. Diablo (3,849 ft [1,173 m]) within Mt. Diablo State Park, about 20 mi east of Oakland, to northwest Kern County in west central California, U.S. It parallels the Pacific Ocean and forms part of the western wall of the Central Valley. Averaging 3,000 to 4,000 ft, the range is highest at San Benito Mountain (5,258 ft). The name Monte del Diablo (Devil's Woods) referred to an Indian rancheria near the ridge and was first recorded in 1824. Cattle grazing, petroleum, and agriculture are the region's main economic activities.

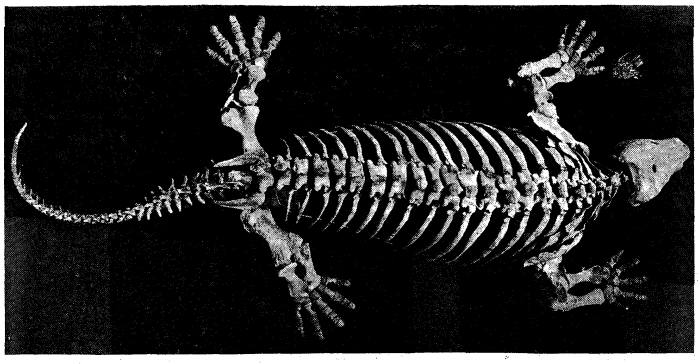
diacetylmorphine (drug): *see* heroin.

diachronic linguistics: *see* historical linguistics.

diaconate, the office of a deacon (*q.v.*), or a body or board of deacons.

Diaconus, Paulus (Lombard historian and poet): *see* Paul the Deacon.

Diadectes, extinct genus of amphibians found as fossils in Lower Permian rocks in North America (the Permian Period began 280,000,000 years ago and lasted 55,000,000 years). *Diadectes* had both reptile-like characteristics and primitive amphibian-like traits and is classified in the somewhat ambiguous order Seymouriamorpha. *Diadectes* grew to be about six feet (two metres) long. The skeleton was heavily constructed, with massive limbs, limb girdles, backbone, and ribs. The skull was relatively high and short. The teeth were blunt and peglike; *Diadectes* was probably one of the earliest terrestrial herbivores. The front



Diadectes skeleton
By courtesy of the American Museum of Natural History, New York

teeth were longer than the cheek teeth and probably served to nip off plant material. The cheek teeth probably served to grind the plant material. *See also* Seymouria.

Diadochus OF PHOTICE (fl. 5th century), theologian, mystic, and bishop of Photice, Epirus, who was a staunch defender of orthodox Christological doctrine as defined by the Council of Chalcedon (451). His treatises on the ascetic life have influenced Eastern Orthodox and Western spirituality.

The few details known of Diadochus' life derive from scant references made to him by Byzantine historians. In a 9th-century record of the Council of Chalcedon, Photius noted Diadochus' refutation of the heterodox Monophysite tenet positing a single, divine nature in Christ that excluded an integral humanity. Diadochus' advocacy of orthodox teaching, maintaining Christ's dual (human and divine) natures, is further evidenced in his letter to the Eastern Roman emperor Leo I in 457, subscribed by the Eastern bishops, disclosing the persecution of orthodox churchmen by the Alexandrian Monophysites. A late-5th-century chronicle, *Historia persecutionis Vandalorum* (1535; *The Memorable and Tragical History of the Persecution in Africke,* 1605) by Victor, bishop of Vita, commends Diadochus' catholic doctrine and indicates that he was abducted by marauding Vandals and taken to Carthage, the probable place of his death.

A student of Evagrius Ponticus, the chief 5th-century proponent of Christian mysticism, Diadochus authoritatively reflected the major movements of Greek and Egyptian asceticism in his principal work, *Hekaton Kephalaia Gnōstika* ("The Hundred Chapters, or Maxims, of Knowledge"). Major themes in the work include man's creation in the image of God, the restoration of fallen man by grace, free will, mastery of human passions, and mystical contemplation through love. "The Hundred Chapters" also constitutes a polemic against Messalianism, the pietistic movement (condemned at the Council of Ephesus in 431) that claimed that in consequence of primeval sin everyone has a demon within his soul that can be exorcised only by ceaseless prayers. Diadochus censured the Messalian corruption of ascetical *apatheia* ("impassiveness") into spiritual inertia. Rejecting extreme penitential practices, he optimistically submitted a tempered ascetical program as a means of achieving generosity of spirit. Christian doctrine, he proposed, must derive from contemplation and not be a function of legal preoccupation. He also held that Christian moral perfection can come only through martyrdom, but, with the passing of the age of bloody martyrdom, only the unbloody and spiritual martyrdom of the ascetical life would remain.

"The Hundred Chapters" deeply influenced Greek ascetical tradition and 16th-century Spanish mysticism; it also affected the *Philokalia,* or 18th-century Russian prayer anthologies. Diadochus' orthodoxy and vindication of mystical experience appeared also in his "Homily on the Ascension." He responded to the problem of pantheistic interpretation of Christian mysticism in his *Horasis* ("The Vision") and *Catechesis* ("Instruction"). The Greek text of the *Catechesis,* probably an 11th-century redaction of Diadochus' thought, was discovered and edited in 1952 by Édouard Des Places, who also produced a new critical edition of "The Hundred Chapters" (*Oeuvres spirituelles,* 1955).

diadochy, capability of an atom or ion (charged atom) to replace another in a particular crystal lattice. The replaceability may be complete or partial; the degree of substitution depends on the temperature of equilibration, the availability of substituting ion, and its radius, charge, and electronic structure relative to its diadochic partner. For example, in olivine structures the iron(II) ion may completely replace the magnesium ion.

diaeresis, also spelled DIERESIS (from Greek *diairein,* "to divide"), the resolution of one syllable into two, especially by separating the vowel elements of a diphthong and, by extension, two adjacent vowels, as in the word *coo*peration; it is also the mark placed over a vowel to indicate that it is pronounced as a separate syllable (*see* umlaut). In classical prosody, diaeresis refers to the end of a word coinciding with the completion of the metrical foot, in contrast to caesura, which refers to a word ending within a metrical foot.

diagenesis, sum of all processes, chiefly chemical, by which changes in a sediment are brought about after its deposition but before its final lithification (conversion to rock). Because most sediments contain mineral mixtures in which not all the minerals are in chemical equilibrium with each other, changes in interstitial water composition or changes in temperature or both will usually lead to chemical alteration of one or more of the minerals present. Diagenesis is considered a relatively low-pressure, low-temperature alteration process, whereas metamorphism is considered to be a rock-alteration process occurring at relatively higher pressures and temperatures. An example of diagenesis is the chemical alteration of a feldspar to form a distinctly new mineral in its place, a clay mineral.

Diaghilev, Sergey (Pavlovich) (b. March 31 [March 19, old style], 1872, Novgorod province, Russia—d. Aug. 19, 1929, Venice), Russian promoter of the arts who revitalized ballet by integrating the ideals of other art forms—music, painting, and drama—with those of the dance. From 1906 he lived in Paris, where, in 1909, he founded the Ballets Russes. Thereafter he toured Europe and the Americas with his ballet company, and he produced three ballet masterpieces by Igor Stravinsky: *The Firebird* (1910), *Petrushka* (1911), and *The Rite of Spring* (1913).

Diaghilev was the son of a major general and a noblewoman, who died in childbirth. Diaghilev was remarkable for his large, dreamy eyes acquired from his mother, and perhaps he also inherited from her his craving for luxury in both the personal and artistic spheres. He repeatedly made it clear that he followed a purely hedonistic philosophy. From his stepmother, Helen Valerianovna Panayeva, on the other hand, he acquired a sense of discipline and the instinct to dominate. Moreover, as a youth his artistic sensibilities were encouraged by her many musical connections. The piano lessons he took while still at school enabled him to play the Schumann concerto in public; as a child he also showed a gift for composition.

In 1890, while studying law at the University of St. Petersburg, he became associated with a group of friends interested in the social sciences, music, and painting—the first of a series of intellectual gatherings over which he presided throughout his life. Among his companions during this period were the painters Alexander Benois and Léon Bakst, both of whom were later to contribute brilliantly to his productions. His first experience of ballet was, curiously enough, a disappointment. The work was Peter Ilich Tchaikovsky's *Sleeping Beauty,* which he saw with little enthusiasm at the Mariinsky Theatre in St. Petersburg about 1890. (The work was later to become one of Diaghilev's most successful productions.)

Diaghilev, *c.* 1916
By courtesy of the Dance Collection, the New York Public Library at Lincoln Center, Aster, Lenox and Tilden Foundations

In 1893 he made his first journey abroad, visiting Germany, France, and Italy, where he met the distinguished French novelist Émile Zola and the opera composers Charles Gounod and Giuseppe Verdi. Even in his youth he sought out and was stimulated by the company of the great.

In 1896 Diaghilev graduated in law, but he was determined to follow a musical career. The composer Nikolay Rimsky-Korsakov, however, discouraged him from developing his talents as a composer, wisely no doubt, since a vocal work of Diaghilev that had been performed in public had left a poor impression. In Moscow he met the patron of the famed bass Fyodor Chaliapin and proposed revolutionary scenic ideas for productions of operas in which Chaliapin appeared. Although he was uncertain of his own artistic gifts, Diaghilev was convinced of his vocation: that of a great patron of the arts like the Roman Maecenas. His theatrical ventures in the sphere of opera and ballet and his literary projects, demanding huge investments, were hampered by the

fact that he embarked on this career with no private income. Moreover, in 19th-century Russia, his homosexuality was a serious handicap in the development of his career. He had personal charm and audacity, however, and he used them to advantage.

In 1899 he realized the first of these international ventures when he founded, as editor in chief, the review *Mir Iskusstva* ("World of Art"), which continued to appear until 1904. This was a counterpart of the London *Yellow Book,* reflecting the ideas of the graphic artist Aubrey Beardsley and the writer Oscar Wilde. In 1905 Diaghilev organized a historic portrait exhibition of Russian art treasures at the Tauride Palace in St. Petersburg.

The great turning point in his life came when he left Russia for Paris in 1906. It was there that he helped to found what was later referred to as the Franco-Russian artistic alliance. He organized an exhibition of Russian art and then, in 1907, a series of historic concerts devoted to the work of the Russian nationalist composers. In 1908 Modest Mussorgsky's opera *Boris Godunov* was produced in Russian by Diaghilev at the Paris Opéra with Fyodor Chaliapin in the title role.

The time had arrived for him to launch the venture that was to fulfill his ideal of a combination or interpenetration of the arts. Appointed in 1899 as assistant to Prince Sergey Volkonsky, director of the Imperial Theatre, Diaghilev had met the dancer Michel Fokine, whose creative activity was powerfully influenced by the American dancer Isadora Duncan. Influenced by the dance innovations of Isadora Duncan, the ideas of composer Richard Wagner, and the theories of the poet Charles Baudelaire, Diaghilev opened his season of Ballets Russes at the Théâtre du Châtelet in Paris in 1909. The dancers Anna Pavlova, Vaslav Nijinsky, and Michel Fokine were in his company.

Before long it became clear that conventional choreography was to have no place in Diaghilev's novel spectacles. Mime or action dances were the aim of the choreographers who, largely under the influence of Fokine and Léonide Massine, were creating an entirely new tradition. The composers chosen to transform the old art forms were themselves inspired by the fantasies of painters and choreographers. This was Diaghilev's lofty creation, an ideal of artistic synthesis, based on an innate sense of taste. Diaghilev's art reached its height in the three early ballets of the young Russian composer Igor Stravinsky: *The Firebird* (1910), *Petrushka* (1911), and *The Rite of Spring* (1913). In *Petrushka,* perhaps the greatest of the Diaghilev ballets, Stravinsky, at Diaghilev's insistance, transformed a conventionally conceived piano concerto (on which he had been working) into a mimed ballet, bringing into real life the fantasy dramas of puppets at a showman's fair. The incident is indicative of the extraordinary psychological influence Diaghilev was able to exert over his collaborators. In *The Rite of Spring* Stravinsky produced one of the most explosive orchestral scores of the 20th century, and the production created an uproar in the Paris theatre at its first performance. The scandalous dissonances and rhythmic brutality of the music provoked among the fashionable audience such protestations that the dancers were unable to hear the orchestra in the nearby pit. They carried on, nevertheless, encouraged by the choreographer Nijinsky, standing on a chair in the wings, shouting out and miming the rhythm.

Diaghilev left his native Russia and never returned. In Paris he collaborated with the French poet Jean Cocteau, among others. He toured with his ballet throughout Europe, in the United States, and in South America. Seasons of the Diaghilev ballet were given uninterruptedly from 1909 to 1929. During his later seasons he introduced the works of forward-looking composers and painters from France, Italy, Great Britain, and the United States. Among the composers represented in his repertory were Richard Strauss, Claude Debussy, Maurice Ravel, and Sergey Prokofiev.

Despite his influence, however, Diaghilev was a lonely and dissatisfied man, impecunious and personally unhappy. He was an idealist, never realizing perfection and yet sowing the seed of an exploratory spirit. Diaghilev had long suffered from diabetes, and by the end of his brilliant 1929 season at Covent Garden, London, his health had gravely deteriorated. He nevertheless left for a holiday in Venice, where, following an alarming rise in temperature, he sank into a coma from which he did not recover. He was buried in the island cemetery of San Michele. (E.L.)

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diagnosis, the process of identifying a disease or disorder by considering the patient's history, symptoms, and signs and by examining the patient in various other ways. The term diagnosis also refers to the identification reached by the physician or other examiner.

A brief treatment of diagnosis follows. For full treatment, *see* MACROPAEDIA: Diagnosis and Therapeutics.

Diagnostic methods include investigation of (1) the patient's past history and his environmental conditions, (2) the symptoms of which he complains, and (3) the physical signs determined through various forms of examination, with or without such instruments as X-ray machines, scanning devices, electrocardiographs, and various laboratory equipment.

The case history includes all the information about the patient that the physician thinks necessary to his successful treatment of the illness. It tells, for example, how and when the patient became sick and whether he has ever been previously afflicted with the same or a similar condition. It lists all the patient's past history of disease. It provides data about his personal habits, his home life, his family, and his occupation. In it the physician also maintains a complete record of every step he has taken in his treatment of the case.

A symptom is evidence of an abnormal body change of which the patient is himself aware. Examples of the most common symptoms are pain, fever, loss of weight, loss of appetite, shortness of breath, bleeding, weakness, and fatigue. Symptoms are clues that help the physician to determine what signs he should look for when he examines the patient.

A sign is evidence of an abnormal body change which the physician detects. He may observe a sign such as a rash by simple inspection. He may discover a tumour by palpation, or "feeling." He may detect a heart murmur by auscultation, or "listening." He may obtain an indication of infection in the body by a chemical analysis of such body emissions and fluids as blood, saliva, urine, feces, vaginal discharge, or semen.

After the physician has collected his data, he reviews the facts he has obtained and the suggested solutions; sugar in the urine, for example, would suggest a diagnosis of diabetes mellitus. Then he considers the implications of the evidence; thus, a diabetic patient, in addition to having sugar in the urine, should have an abnormal blood-sugar level and should have given the physician a history of excessive thirst, excessive urination, and loss of weight. The physician next compares the data with ideas that have occurred to him to see if certain solutions for the patient's condition match the data gained in the examinations. If further study shows the presence of all the aforementioned symptoms, for example, the data would agree with the suggested solution and the diagnosis would be diabetes.

This is the method pursued by the physician in making a diagnosis. While the task of collecting data on the patient—history, physical examination, special examinations, and laboratory tests—requires accurate observation, the process of correct reasoning is, in the last analysis, more important. False diagnoses often result not from false data but from faulty interpretation. To assemble the data, to make use of the relevant and to discard the irrelevant information, and to pass final judgment—all of which are important steps in making the diagnosis—often requires a mental ability of the highest order.

diagnostic imaging, also called MEDICAL IMAGING, the use of electromagnetic radiation to produce images of internal structures of the human body for the purpose of accurate diagnosis. Diagnostic imaging is roughly equivalent to radiology (*q.v.*), the branch of medicine that uses radiation to diagnose and treat diseases.

X rays were the first type of radiation used to provide images of the interior of the body; they have been used since 1895. X rays pass through bodily tissues and also have the property of darkening photographic film when they strike it. In penetrating tissues, the X rays are absorbed differentially, with harder objects such as bones absorbing more of the rays and thus preventing them from reaching the film. Soft tissues, on the other hand, absorb less of the rays; the result is that in an X-ray photograph of the interior of the body, bones show up as lighter areas and soft tissues show up as darker ones on the exposed film.

A limiting factor in X rays when used alone is their inability to distinguish between adjacent soft tissues of roughly the same density, with a resultant failure to produce contrasting tones between such objects on the exposed film. To obtain this contrast, a contrast medium (*q.v.*), *i.e.,* a liquid or gaseous substance that is comparatively opaque to X rays (radiopaque) or comparatively transparent to them, is injected into the body. Contrast-medium fluids can be injected into naturally occurring body cavities, injected into the bloodstream and lymphatic vessels, swallowed or introduced by enema for study of the digestive tract, or injected around organs to show their external contour. Different contrast media thus allow the X-ray imaging of particular types of soft internal structures, such as the arteries and veins in angiography (*q.v.*), the passage of blood through the heart in angiocardiography (*q.v.*), the gallbladder and biliary channels in cholecystography (*q.v.*), the spinal cord in myelography (*q.v.*), and the urinary tract in urography (*q.v.*). Virtually any part of the body can be examined for physiological disturbances of the normal structures by X-ray analysis. X-ray motion-picture films can record the body processes as the contrast media enter and leave parts of the body.

Other imaging techniques have been developed using X rays. In tomography (*q.v.*), X-ray images of deep internal structures can be obtained by focusing the rays on a specific plane within the body. A more complex variation of this technique is computerized axial tomography, known as a CAT scan.

The scanning of radioactive isotopes that have been injected into the tissues is a medical specialty called nuclear medicine (*q.v.*). Both isotope scanning and X-ray photography are used in brain scanning (*q.v.*). An imaging technique related to isotope scanning is positron emission tomography (*q.v.*). Another type of diagnostic imaging is nuclear magnetic

resonance (*q.v.*), which creates images of thin slices of the body using very-high-frequency radio waves. Ultrasound is a technique in which high-frequency sound waves are used for detecting abnormalities in internal organs. The varieties of radiation that are used in diagnostic imaging continues to expand, along with the techniques for using them.

Diaguita, Indian peoples of South America, formerly inhabiting northwestern Argentina and the Chilean provinces of Atacama and Coquimbo. The Calchaquí, a northwestern Argentine subgroup of the Diaguita, are the best-documented. Their language affiliation remains uncertain.

The Calchaquí were described as warlike, and their stone fortifications located at strategic places in their territory attest to this. They became effective cavalrymen who carried the attack to Spanish towns. They farmed terraced fields, sometimes built irrigation canals, and also kept herds of llama. Their technological skill extended to the loom weaving of llama-wool textiles, which they dyed; basket making; and a rather elaborate ceramic industry. Metallurgy was also known. Religious beliefs involved shamanistic practices for the cure of illness felt to be caused by witchcraft.

Diālā (Iraq): *see* Diyālā.

dialect, a variety of a language that is used by one group of persons and has features of vocabulary, grammar, or pronunciation distinguishing it from other varieties of the same language that are used by other groups. The two main types of dialects are the geographic dialect, spoken by people of the same area or locality, and the social dialect, used by people of the same social class, educational level, or occupational group.

A brief treatment of dialect follows. For full treatment, *see* MACROPAEDIA: Language.

The development of dialect variations clearly shows that language is continually evolving. Sometimes, when varieties of a language change to the point that they are mutually incomprehensible, the dialects become languages in their own right. This was the case with Latin, various dialects of which evolved into French, Spanish, Italian, Portuguese, Romanian, and their various dialects. In some cases, the label "language" or "dialect" is attached because of political or nationalistic considerations, not linguistic ones such as mutual comprehensibility. In China, for example, although there is a common written language, some spoken dialects are so distinct that, technically, they should be called languages. Yet, assigning one language to a country that has diverse populations is politically expedient in that it has a unifying effect. Thus, the distinction between a dialect and a language is often blurred. Generally, dialects develop as a result of barriers that exist between various groups of people who speak the same language. These barriers can be geographic, economic, political, or social.

Regional dialectology was of interest to the historical linguists of the 19th century and the structural linguists of the first half of the 20th century. Recent research, however, has focused on linguistic variation that is due to social-class differences. The term dialect sometimes has a negative connotation in everyday use. More often than not, in the minds of nonlinguists, it connotes a deviation from the "standard" language, which is commonly thought to be superior. This standard language is, from the linguist's point of view, just another dialect, but it has more prestige than the others because it is spoken by the highly educated, a social elite, or simply a majority.

dialectic, also called DIALECTICS, originally a form of logical argumentation but now a philosophical concept of evolution applied to diverse fields including thought, nature, and history.

Among the classical Greek thinkers, the meanings of dialectic ranged from a technique of refutation in debate, through a method for systematic evaluation of definitions, to the investigation and classification of the relationships between specific and general concepts. From the time of the Stoic philosophers until the end of the Middle Ages, dialectic was more or less closely identified with the discipline of formal logic. More recently, Kant denoted by the term "transcendental dialectic" the endeavour of exposing the illusion involved in attempting to use the categories and principles of the understanding beyond the bounds of phenomena and possible experience. Hegel identified dialectic as the tendency of a notion to pass over into its own negation as the result of conflict between its inherent contradictory aspects. Marx and Engels adopted Hegel's definition and applied it in their interpretations of social and economic processes. *See also* dialectical materialism.

dialectical materialism, a philosophical approach to reality derived from the teachings of Karl Marx and Friedrich Engels. For Marx and Engels, materialism meant that the material world, perceptible to the senses, has objective reality independent of mind or spirit. They did not deny the reality of mental or spiritual processes but affirmed that ideas could arise, therefore, only as products and reflections of material conditions. Marx and Engels understood materialism as the opposite of idealism, by which they meant any theory that treats matter as dependent on mind or spirit, or mind or spirit as capable of existing independently of matter. For them, the materialist and idealist views were irreconcilably opposed throughout the historical development of philosophy. They adopted a thoroughgoing materialist approach, holding that any attempt to combine or reconcile materialism with idealism must result in confusion and inconsistency.

Marx's and Engels' conception of dialectics owes much to Hegel. In opposition to the "metaphysical" mode of thought, which viewed things in abstraction, each by itself and as though endowed with fixed properties, Hegelian dialectics considers things in their movements and changes, interrelations and interactions. Everything is in continual process of becoming and ceasing to be, in which nothing is permanent but everything changes and is eventually superseded. All things contain contradictory sides or aspects, whose tension or conflict is the driving force of change and eventually transforms or dissolves them. But whereas Hegel saw change and development as the expression of the world spirit, or Idea, realizing itself in nature and in human society, for Marx and Engels it was inherent in the nature of the material world. They therefore held that one could not, as Hegel tried, deduce the actual course of events from any "principles of dialectics"; the principles must be inferred from the events.

The theory of knowledge of Marx and Engels started from the materialist premise that all knowledge is derived from the senses. But against the mechanist view that derives knowledge exclusively from given sense impressions, they stressed the dialectical development of human knowledge, socially acquired in the course of practical activity. Men can gain knowledge of things only through their practical interaction with those things, framing their ideas corresponding to their practice; and social practice alone provides the test of the correspondence of idea with reality—*i.e.*, of truth. This theory of knowledge is opposed equally to the subjective idealism according to which we can know only sensible appearances while things-in-themselves elude us, and to the objective idealism according to which we can know supersensible reality by pure intuition or thought, independent of sense.

The concept of dialectical materialism—which is a theoretical basis for a method of reasoning—should not be confused with "historical materialism," which is the Marxist interpretation of history in terms of the class struggle.

There exists no systematic exposition of dialectical materialism by Marx and Engels, who stated their philosophical views mainly in the course of polemics.

dialectology, the study of dialects (*see* dialect). Variation most commonly occurs as a result of relative geographic or social isolation and may affect vocabulary or features of grammar or pronunciation or both. Dialectology as a discipline began in the 19th century with the development in western Europe of dictionaries and grammars of regional dialects. Much of the work of dialectology has consisted of gathering information about the types of variation that occur in different dialects and the construction of linguistic atlases showing patterns of distribution for a series of varying features within a language. Such work on the geographical patterns of linguistic variation is also known as linguistic geography.

diallage, either of the two pyroxenes augite and diopside, which have well-developed, close-spaced, parallel partings commonly filled with magnetite or ilmenite. These filled partings are generally more pronounced than cleavage planes. Diallage is commonly dark green or bronze-coloured and often occurs as large crystals enclosing the silicate olivine in basic to ultrabasic rocks such as gabbro and peridotite. The term diallage is sometimes used in reference to a variety of diopside that has been altered by appreciable replacement by aluminum and other trivalent metal ions.

dialogue, in its widest sense, the recorded conversation of two or more persons, especially as an element of drama or fiction. As a literary form, it is a carefully organized exposition, by means of invented conversation, of contrasting philosophical or intellectual attitudes. The oldest known dialogues are the Sicilian mimes, written in rhythmic prose by Sophron of Syracuse in the early 5th century BC. Although none of these has survived, Plato knew and admired them. But the form of philosophic dialogue that he perfected by 400 BC was sufficiently original to be an independent literary creation. With due attention to characterization and the dramatic situation from which the discussion arises, it develops dialectically the main tenets of Platonic philosophy. To Lucian in the 2nd century AD the dialogue owes a new tone and function. His influential *Dialogues of the Dead,* with their coolly satirical tone, inspired innumerable imitations in England and France during the 17th and 18th centuries, *e.g.*, dialogues by the French writers Bernard de Fontenelle (1683) and François Fénelon (1700–12).

The revival of interest in Plato during the Renaissance encouraged numerous imitations and adaptations of the Platonic dialogue. In Spain, Juan de Valdés used it to discuss problems of patriotism and humanism (written 1533), and Vincenzo Carducci, theories of painting (1633). In Italy, dialogues on the Platonic model were written by Torquato Tasso (1580), Giordano Bruno (1584), and Galileo (1632). The Renaissance also adapted the dialogue form to uses unsuspected by either Plato or Lucian, such as the teaching of languages.

In the 16th and 17th centuries, dialogue lent itself easily and frequently to the presentation of controversial religious, political, and economic ideas. George Berkeley's *Three Dialogues Between Hylas and Philonous* (1713) are perhaps the best of the English imitations of Plato. The best-known 19th-century exam-

ples of the form are Walter Savage Landor's *Imaginary Conversations* (1824–29), sensitive re-creations of such historical personages as Dante and Beatrice. André Gide's *Interviews imaginaires* (1943), which explore the psychology of the supposed participants, and George Santayana's *Dialogues in Limbo* (1925) illustrate the survival of this ancient form in the 20th century.

Dialogue of the Ancients (Gaelic tale): *see* Interrogation of the Old Men, The.

dialysis, in chemistry, separation of suspended colloidal particles from dissolved ions or molecules of small dimensions (crystalloids) by means of their unequal rates of diffusion through the pores of semipermeable membranes. This process was first employed in 1861 by a British chemist, Thomas Graham. If such a mixture is placed in a sack made of parchment, collodion, or cellophane and suspended in water, the ions and small molecules pass through the membrane, leaving the colloidal particles in the sack. Separation by dialysis is a slow process, depending for its speed on the differences in particle size and diffusion rates between the colloidal and the crystalloidal constituents, and may be accelerated by heating or, if the crystalloids are charged, by applying an electric field (electrodialysis). For medical applications, *see also* artificial organ.

dialysis, also called HEMODIALYSIS, RENAL DIALYSIS, or KIDNEY DIALYSIS, in medicine, the process of removing blood from a patient whose kidney functioning is faulty, purifying that blood by dialysis, and returning it to the patient's bloodstream. The artificial kidney, or hemodialyzer, is a machine that provides a means for removing certain undesirable substances from the blood or of adding needed components to it. By these processes the apparatus can control the acid–base balance of the blood and its content of water and dissolved materials. Another known function of the natural kidney—secretion of hormones that influence the blood pressure—cannot be duplicated. Modern dialyzers rely on two physicochemical principles, dialysis and ultrafiltration.

In dialysis two liquids separated by a porous membrane exchange those components that exist as particles small enough to diffuse through the pores. When the blood is brought into contact with one side of such a membrane, dissolved substances (including urea and inorganic salts) pass through into a sterile solution placed on the other side of the membrane. The red and white cells, platelets, and proteins cannot penetrate the membrane because the particles are too large. To prevent or limit the loss of diffusible substances required by the body, such as sugars, amino acids, and necessary amounts of salts, those compounds are added to the sterile solution; thus their diffusion from the blood is offset by equal movement in the opposite direction. The lack of diffusible materials in the blood can be corrected by incorporating them in the solution, from which they enter the circulation.

Although water passes easily through the membrane, it is not removed by dialysis because its concentration in the blood is lower than in the solution; indeed, water tends to pass from the solution into the blood. The dilution of the blood that would result from this process is prevented by ultrafiltration, by which some of the water, along with some dissolved materials, is forced through the membrane by maintaining the blood at a higher pressure than the solution.

The membranes first used in dialysis were obtained from animals or prepared from collodion; cellophane has been found to be more suitable, and tubes or sheets of it are used in many dialyzers. In the late 1960s hollow filaments of cellulosic or synthetic materials were introduced for dialysis; bundles of such filaments provide a large membrane surface in a small volume, a combination advantageous in devising compact dialyzers.

Dialysis—which was first used to treat human patients in 1945—replaces or supplements the action of the kidneys in a person suffering from acute or chronic renal failure or from poisoning by diffusible substances, such as aspirin, bromides, or barbiturates. Blood is diverted from an artery, usually one in the wrist, into the dialyzer, where it flows—either by its own impetus or with the aid of a mechanical pump—along one surface of the membrane. Finally the blood passes through a trap that removes clots and bubbles and returns to a vein in the patient's forearm. In persons with chronic kidney failure, who require frequent dialysis, repeated surgical access to the blood vessels used in the treatments is obviated by provision of an external plastic shunt between them.

diamagnetism, kind of magnetism characteristic of materials that line up at right angles to a nonuniform magnetic field and that partly expel from their interior the magnetic field in which they are placed. First observed by S.J. Brugmans (1778) in bismuth and antimony, diamagnetism was named and studied by Michael Faraday (beginning in 1845). He and subsequent experimenters found that some elements and most compounds exhibit this "negative" magnetism. Indeed, all substances are diamagnetic: the strong external magnetic field speeds up or slows down the electrons orbiting in atoms in such a way as to oppose the action of the external field in accordance with Lenz's law.

The diamagnetism of some materials, however, is masked either by a weak magnetic attraction (paramagnetism) or a very strong attraction (ferromagnetism). Diamagnetism is observable in substances with symmetric electronic structure (as ionic crystals and rare gases) and no permanent magnetic moment. Diamagnetism is not affected by changes in temperature. For diamagnetic materials the value of the susceptibility (a measure of the relative amount of induced magnetism) is always negative and typically near negative one-millionth.

Diamantina, city, central Minas Gerais *estado* ("state"), southeastern Brazil. It lies in the mineral-laden Espinhaço Mountains at 4,140 feet (1,262 m) above sea level. Formerly called Tejuco, the city has some colonial buildings and a diamond museum. Textile mills, diamond-cutting and goldsmithing establishments, and ironworks contribute to the economy. Pop. (1980 prelim.) 20,197.

Diamantina River, intermittent river, east-central Australia, in the pastoral Channel Country (*q.v.*). It rises in Kirbys Nob, east of Selwyn, Queen., and flows (seasonally) for 500 miles (800 km) southwest past Birdsville to Goyder Lagoon in South Australia, draining a basin of 61,000 square miles (158,000 square km). In times of flood, the Diamantina River and the Georgina River (from the north) merge to drain along the channel of Warburton Creek southwestward to Lake Eyre. The Diamantina's principal tributaries are the Western and Mayne rivers. The Diamantina's average annual discharge at Birdsville is 890 cubic feet (25 cubic m) per second, ranging from 50,000 cubic feet (1,400 cubic m) per second in flood to nothing in dry years.

Diamir (Jammu and Kashmir): *see* Nānga Parbat.

diamond, a mineral composed of pure carbon. It is the hardest naturally occurring substance known; it is also the most popular gemstone. Because of their extreme hardness, diamonds have a number of important industrial applications.

The hardness, brilliance, and sparkle of diamonds make them unsurpassed as gems. In the symbolism of gemstones, the diamond represents steadfast love and is the birthstone for April. Diamond stones are weighed in carats (1 carat = 200 milligrams) and in points (1 point = 0.01 carat). In addition to gem-quality stones, several varieties of industrial diamonds occur, and synthetic diamonds have been produced on a commercial scale since 1960. *See also* industrial diamond; synthetic diamond.

Diamonds are found in three types of deposits: alluvial gravels, glacial tills, and kimberlite pipes. Only in kimberlite pipes, such as those at Kimberley, S.Af., are they present in the original rock in which they were formed, probably lying at depths of more than about 75 miles (120 km). Diamonds found in alluvial and glacial gravels must have been released by fluvial or glacial erosion of the kimberlite matrix and then redeposited in rivers or in glacial till.

Diamonds vary from colourless to black, and they may be transparent, translucent, or opaque. Most diamonds used as gems are transparent and colourless or nearly so. Colourless or pale blue stones are most valued, but these are rare; most gem diamonds are tinged with yellow. A "fancy" diamond has a distinct body colour; red, blue, and green are rarest, and orange, violet, yellow, and yellowish green more common. Most industrial diamonds are gray or brown and are translucent or opaque, but better-quality industrial stones grade imperceptibly into poor quality gems. The colour of diamonds may be changed by exposure to intense radiation (as released in a nuclear reactor or by a particle accelerator) or by heat treatment.

A very high refractive power gives the diamond its extraordinary brilliance. A properly cut diamond will return a greater amount of light to the eye of the observer than will a gem of lesser refractive power and will thus appear more brilliant. The high dispersion gives diamonds their fire, which is caused by the separation of white light into the colours of the spectrum as it passes through the stone.

The scratch hardness of diamond is assigned the value of 10 on the Mohs scale of hardness; corundum, the mineral next to diamond in hardness, is rated as 9. Actually, diamond is very much harder than corundum; if the Mohs scale were linear, diamond's value would be about 42. The hardness of a diamond varies significantly in different directions, causing cutting and polishing of some faces to be easier than others. For detailed physical properties, *see* native element (table).

In the atomic structure of diamond, as determined by X-ray diffraction techniques, each carbon atom is linked to four equidistant neighbours throughout the crystal. This close-knit, dense, strongly bonded crystal structure yields diamond properties that differ greatly from those of graphite, native carbon's other form.

Diamond, Cape, French CAP DIAMANT, promontory in Québec region, southern Quebec province, Canada. It is part of the city of Quebec and is located west of the confluence of the St. Charles and St. Lawrence rivers. It is the highest point in the headland (333 feet [102 m]) and is crowned by the Citadel, a former military fortress. Toward the St. Lawrence it presents a bold and precipitous front; on the landward side and toward the St. Charles the declivity is more gradual. The cape was named in 1608 by the French explorer Samuel de Champlain, who found quartz crystals resembling diamonds there. Considerable damage and loss of life was suffered in the Lower Town by rock falls from its heights in 1841, 1852, and 1889.

Diamond Area 1 (South West Africa/Namibia): *see* Sperrgebiet.

diamond cutting, separate and special branch of lapidary art involving five basic steps in fashioning a diamond: marking, cleaving, sawing, girdling, and faceting.

Marking. Marking is done after examining each rough diamond to decide how it should be cut to yield the greatest value. To make this decision, the shape of the rough diamond and the number and location of imperfections must be considered. Of utmost importance is the determination of the direction of the cleavage, or grain, in the diamond crystal (because of its atomic structure, diamond can be cleaved in four directions parallel to the octahedron crystal faces). Taking these factors into account, the planner decides how the diamond should be cut and marks it to indicate where the stone should be cleaved or sawed.

Cleaving. If the planner's decision is to cleave the stone, it then goes to the cleaver. Large diamonds are often preshaped by cleaving into pieces suitable for sawing. When the stone is very large and valuable, the cleaving is a most critical process, because a mistake by the planner or the cleaver can shatter the stone. The cleaver cuts a groove along the line showing where the stone is to be cleaved, using another diamond as a cutting tool. He mounts the diamond in a holder (dop) and inserts a steel wedge into the groove. He strikes the wedge sharply with a mallet and the diamond splits along its cleavage.

Sawing. The third step, or the second step if cleaving is unnecessary, in the diamond-cutting process is sawing. The saw is a paper-thin disk of phosphor bronze, rotated on a horizontal spindle at about 4,000 revolutions per minute. The sawyer mounts the diamond in a dop and clamps it so that it rests on top of the blade. The rim of the saw is charged with diamond dust, and, as the sawing progresses, the blade continues to recharge itself with diamond from the crystal being cut. The saw will cut through a 1-carat rough diamond in four to eight hours, unless it strikes a knot, in which case it may take much longer.

Girdling. The next step in cutting a round stone is called girdling (rounding; bruting). The diamond to be girdled is placed in the chuck of a lathe; while it spins, a second diamond mounted in a dop on the end of a long handle is held against it, and the diamond is slowly rounded into a cone shape. Some fancy-cut stones are girdled by mounting them off-centre in the lathe chuck.

Faceting. From the girdler the diamond goes to the lapper, or blocker, who specializes in placing the first 18 main facets on a brilliant-cut diamond. It then goes to the brillianteer, the workman who places and polishes the remaining 40 facets, if the stone is being cut in the standard 58-facet brilliant cut. Placing and polishing the facets is done by setting the stone either in a lead dop or a mechanical clamp and holding it down on a revolving cast-iron lap (horizontal, circular disk) that has been charged with diamond dust. Great skill is necessary at every stage, but especially during faceting, because the angles of the facets must be exact in order to yield maximum brilliancy, and their sizes must be accurately regulated to preserve symmetry.

The most popular style of cut is the brilliant cut, a round stone with 58 facets. A single cut is a simple form of cutting a round diamond with only 18 facets. Any style of diamond cutting other than the round brilliant or single cuts is called a fancy cut; important fancy cuts include the marquise, emerald, baguette, heart shape, pear shape, kite, and triangle. The term melee is used to describe smaller brilliant-cut diamonds as well as all small diamonds used in embellishing mountings for larger gems.

Diamond Harbour, town, Twenty-four Parganas district, West Bengal state, northeastern India, on both sides of Hajipur Creek, a tributary of the Hooghly River. It is an agricultural trade centre; rice milling is the chief industry. An important steamer stop, it contains the customhouse and harbour master for ships proceeding up the Hooghly to Calcutta. Just south lies the fort of Chingrikhali. Diamond Harbour has a college affiliated with the University of Calcutta. Pop. (1981) 20,299.

Diamond Head, cape and celebrated landmark, in Honolulu County, southeastern Oahu Island, Hawaii, U.S., at the southern edge of Waikiki. An extinct volcanic crater, it was used by the ancient Hawaiians as a burial ground. It became known as Diamond Head in the early 19th century when British sailors mistook some volcanic crystals for diamonds. Leahi Point, its highest spot (761 ft [232 m]), is on the western slope. The interior of the crater (diameter ½ mi, or 0.8 km), visible from Wilhelmina Rise or Maunalani Heights and accessible by road tunnel, is part of the Ft. Ruger military installation and is used for small-arms firing practice. There are exclusive residential areas on its eastern and western slopes.

Diamond Necklace, Affair of the, also called AFFAIR OF THE NECKLACE, scandal at the court of Louis XVI in 1785 that discredited the French monarchy on the eve of the Revolution. It began as an intrigue on the part of an adventuress, the Comtesse de La Motte, to procure, supposedly for Queen Marie-Antoinette but in reality for herself and her associates, a diamond necklace worth 1,600,000 livres.

The necklace was the property of the Parisian firm of jewellers Boehmer and Bassenge, who had tried unsuccessfully to sell it, first to Louis XV as a present for his mistress Madame du Barry, and later to Louis XVI for the Queen. The Comtesse's scheme involved the prestigious Cardinal de Rohan, bishop of Strasbourg, who as French ambassador to Vienna from 1772 to 1774 had aroused the dislike of the Queen's mother, the empress Maria Theresa, and who had subsequently incurred the hostility of Marie Antoinette herself; he was anxious to be restored to favour at the French court.

The Comtesse de La Motte suggested to the Cardinal that the Queen wished to acquire the necklace surreptitiously and would be prepared for a formal reconciliation at court if he would facilitate its purchase by negotiating with the jewellers. After reading forged letters supposedly from the Queen and after a brief nocturnal interview in the gardens of Versailles with a prostitute disguised as the Queen, the Cardinal entered into a contract with the jewellers to pledge his credit to pay for the necklace in installments. The imposture came to light, however, when the Cardinal failed to raise the first installment in full and the jewellers applied directly to the Queen. With the imposture exposed, it was discovered that the necklace that the Cardinal had supposed to be in the Queen's possession had been broken up and sold in London.

Instead of concealing the intrigue, Louis XVI had the Cardinal arrested and imprisoned in the Bastille. The Cardinal was tried, along with his alleged accomplices, before the Parlement of Paris. Though he was eventually acquitted of the charge of having fraudulently acquired the necklace (May 31, 1786), he was deprived of all his offices and exiled to the abbey of La Chaise-Dieu in Auvergne. The Comtesse de La Motte was sentenced to be flogged, branded, and imprisoned for life in the Salpêtrière prison in Paris. She later escaped to England and there published scandalous *Mémoires* vilifying the Queen.

Though Marie Antoinette was guiltless, the scandal confirmed the belief of contemporaries in her moral laxness and frivolity. The arbitrary arrest of the Cardinal, the pressure put on his judges, and his final disgrace deepened the impression of the King's weakness and the autocratic nature of his government. The incident was one of many factors leading to the dissolution of the ancien régime and thus to the French Revolution.

Diamond Sūtra, Sanskrit VAJRACCHEDIKĀ-SŪTRA ("Diamond Cutter Sūtra"), brief and very popular Mahāyāna Buddhist text, widely used in East Asia, and perhaps the best known of the 18 smaller "Wisdom" texts, which together with their commentaries are known as the *Prajñāpāramitā*. It takes the form of a dialogue in the presence of a company of monks and *bodhisattva*s ("Buddhas-to-be") between the Buddha as teacher and a disciple as questioner. The Chinese translation, *Chin-kang Ching* ("Diamond Sūtra"), appeared around 400.

The *Diamond Sūtra* expresses the *Prajñāpāramitā* emphasis upon the illusory nature of phenomena in these words: "Just as, in the vast ethereal sphere, stars and darkness, light and mirage, dew, foam, lightning, and clouds emerge, become visible, and vanish again, like the features of a dream—so everything endowed with an individual shape is to be regarded." As with most of the shorter (and later) *Prajñāpāramitā* texts, the ideas are not argued or explained but boldly stated, often in striking paradoxes, including frequent identification of things with their opposites. Thus, the form of presentation underlines the text's thesis that spiritual realization depends upon transcending rational categories. Partly for this reason the *Diamond Sūtra* is considered the Sanskrit work closest in spirit to the Zen approach.

diamondback moth (*Plutella maculipennis*), species of insect belonging to the family Plutellidae (order Lepidoptera). They resemble ermine moths, but diamondbacks hold their antennae forward when at rest. The adult moths have a wingspan of 15 millimetres (0.6 inch) and wavy yellow radial lines on the forewings, separating the brown anterior area from the cream-coloured hind edge. When the wings are folded these marks form a distinctive series of yellow diamond-shaped marks on top, for which the species is named. Larvae pupate in silk cocoons spun on the leaf surface of various food plants; they cause considerable destruction of cabbages and allied vegetables in all parts of the world.

diamondbird, also called PARDALOTE, any of several songbirds of the family Dicaeidae (order Passeriformes) with a simple tongue and a thickish, unserrated bill. Most of the seven or

Spotted diamondbird (*Pardalotus punctatus*)
Painting by Albert E. Gilbert

eight species, of the genus *Pardalotus,* which are confined to Australia, have gemlike white spangles on the dark upper parts; all are tiny and stub-tailed. Diamondbirds glean insects from leaves and bark. They nest in tree holes, in crannies of buildings, or in tunnels dug in sandbanks or level ground. The spotted diamondbird (*P. punctatus*), with yellow throat and rump, digs tunnels.

Diamper, Synod of, council that formally united the ancient Christian Church of the Malabar Coast (modern Kerala), India, with the Roman Catholic Church; it was convoked in 1599 by Aleixo de Meneses, archbishop of Goa. The synod renounced Nestorianism, the heresy that believed in two Persons rather than two natures in Christ, as the Indians were suspected of being heretics by the Portuguese missionaries. The Syrian Chaldean patriarch was then removed from jurisdiction in India and replaced by a Portuguese bishop; the Syrian liturgy of Addai and Mari was "purified from error"; and Latin vestments, rituals, and customs were introduced to replace the ancient Syrian traditions.

This forced Latinization and disregard for local tradition elicited a violent reaction from the Christians of St. Thomas, as the Indians called themselves. In 1653 most of them broke with Rome; and only when a Syrian bishop, John Sebastiani, was installed in 1661 did three-fourths of the schismatics return. The church, however, has remained Latinized. Those who stayed dissidents formed the Syrian Orthodox (Jacobite) Church.

Dian Chi (China): *see* Tien Lake.

Diana, in Roman religion, goddess of wild animals and the hunt, virtually indistinguishable from the Greek Artemis. Her name has the root *di* ("to shine") and probably means "Bright One." Like her Greek counterpart she

Diana with a torch, classical sculpture; in the Vatican Museum
Alinari—Art Resource/EB Inc.

was also a goddess of domestic animals. As a fertility deity she was invoked by women to aid conception and delivery.

Perhaps originally an indigenous woodland goddess, Diana was early identified with Artemis. She later absorbed Artemis' identification with both Selene (Luna) and Hecate (or Trivia), a chthonic (infernal) deity; hence the characterization *triformis* sometimes used in Latin literature.

The most famous place of worship for the Italian goddess was the grove of Diana Nemorensis (Diana of the Wood) on Lake Nemi near Aricia. It was a shrine common to the cities of the Latin League and hence of some political importance. Associated with Diana were Egeria, spirit of a nearby stream who shared with Diana (here called Diana Lucina) the guardianship of childbirth, and the hero Virbius (the Italian counterpart of Hippolytus), who was said to have been the first priest of Diana, *rex Nemorensis.* Custom dictated that the priest be a runaway slave and that he slay his predecessor in combat.

At Rome the most important temple of Diana was on the Aventine. It housed the foundation charter of the Latin League and was said to date back to King Servius Tullius (6th century BC). In her cult there Diana was also considered the protector of the lower classes, especially slaves; the Ides (13th) of August, her festival at Rome and Aricia, was a holiday for slaves. The Aventine Diana was the sister of Apollo, and they were worshipped together in the secular games. In Roman art she usually appears as a huntress with bow and quiver, accompanied by a hound or deer.

Diana, PRINCESS OF WALES, original name DIANA FRANCES SPENCER (b. July 1, 1961, Sandringham, Norfolk, Eng.), consort (from 1981) of Charles, prince of Wales, and mother of the heir second in line to the British throne, Prince William of Wales (born 1982).

Diana was born the Honourable Diana Spencer at Park House, the home that her parents rented on Queen Elizabeth II's estate at Sandringham and where her childhood playmates were the Queen's younger sons, Prince Andrew and Prince Edward. The third child and youngest daughter of Edward John Spencer, Viscount Althorp, heir to the 7th Earl Spencer, and his first wife, Frances Ruth Burke Roche (daughter of the 4th Baron Fermoy), she became Lady Diana Spencer when her father succeeded to the earldom in 1975. Riddlesworth Hall (near Thetford, Norfolk) and West Heath School (Sevenoaks, Kent) provided the young Diana's schooling, during which time she spent summer holidays with her mother in Scotland (her parents divorced in 1969). At the finishing school of Chateau d'Oex at Montreux, Switz., she perfected her French and became a competent skier. Upon her return to England she took up residence with three young women friends in an apartment in South Kensington, London, and became a kindergarten teacher at the fashionable Young England school in Pimlico.

She renewed her contacts with the royal family, and her friendship with Charles grew in 1980. On Feb. 24, 1981, their engagement was announced, and on July 29, 1981, they were married in St. Paul's Cathedral. Their first child, Prince William Arthur Philip Louis of Wales, was born on June 21, 1982, and their second, Prince Henry Charles Albert David, on Sept. 15, 1984.

diana monkey (*Cercopithecus diana*), arboreal guenon named for its crescent-shaped white browband that resembles the bow of the goddess Diana. The diana monkey is generally found well above the ground in West African rain forests. Its face and much of its fur is black and it has a white beard, chest, and throat; a white stripe along each thigh; a deep reddish patch on the back; and it is whitish, yellowish, or reddish on the inside of the thighs. The roloway monkey (*C. d. roloway*) has a longer beard and broader diadem (browband). The diana monkey is active, hardy, and readily tamed. It is engaging when young, but is less friendly when adult. *See also* guenon.

Diana monkey (*Cercopithecus diana*)
John Drysdale—Animals Animals

Diane DE FRANCE, DUCHESSE (duchess) DE MONTMORENCY ET ANGOULÊME (b. 1538, Paris—d. Jan. 11, 1619, Paris), natural daughter (legitimated) of King Henry II of France

Diane de France; detail from a portrait by an unknown artist, 1568; Louvre, Paris
H. Roger-Viollet

by a young Piedmontese, Filippa Duc. (Diane was often thought, however, to have been the illegitimate daughter of Diane de Poitiers.) She was known for her culture and intelligence as well as for her beauty and for the influence that she wielded during the reigns of Henry III and Henry IV.

Diane was legitimized in 1547. She married Orazio Farnese, duca di Castro, in 1553, but he was killed in battle the same year. In 1559 she married François de Montmorency, eldest son of Anne, constable of France. During Charles IX's reign she helped to make her husband a leader of the Politiques, a moderate Roman Catholic group working for peace within the realm.

Widowed a second time in 1579, Diane enjoyed even greater influence with Henry III and in 1582 received the duchy of Angoulême in appanage (life estate). She did much to influence the King's reconciliation with Henry of Navarre and was in great favour with the latter when he became king (as Henry IV). Further, she acted as mother to her niece Charlotte de Montmorency, later princesse de Condé, with whom Henry IV fell in love. Diane's letters have been saved, and they show her to have been a woman of great tolerance and courage.

Diane DE POITIERS, DUCHESSE (duchess) DE VALENTINOIS (b. Sept. 3, 1499—d. April 22, 1566, Anet, Fr.), mistress of Henry II of France. Throughout his reign she held court as queen of France in all but name, while the real queen, Catherine de Médicis, was forced to live in comparative obscurity. Diane seems to have concerned herself with augmenting her income and with making provisions for her family and protégés rather than with public affairs. A beautiful woman with a lively, cultivated mind, she was a friend and patron of poets, including Pierre de Ronsard, and of many artists. The great Renaissance architect Philibert Delorme built her château at Anet, and the Mannerist sculptor Jean Goujon adorned it with his works.

Diane came to court as a lady in waiting first to the mother of Francis I, Louise of Savoy, then to Queen Claude. Shortly after

Diane de Poitiers, detail of a drawing from the school of F. Clouet, *c.* 1565; in the Musée Condé, Chantilly, Fr.

Giraudon—Art Resource/EB Inc.

the death of her husband, Louis de Brézé, comte de Maulevrier, in 1531, the prince Henry, then duc d'Orléans and 20 years her junior, fell violently in love with her, and she became his mistress. Even in their own time legends grew up around them. On Henry's death (1559), his wife, Catherine, forced Diane to restore those of the crown jewels Henry had given her and to accept the fortress-like château of Chaumont in exchange for Chenonceaux. Diane retired to Anet. The *Lettres inédites de Diane de Poitiers* were published by G. Guiffrey (1866).

Dianthus, plant genus of the pink family. *See* pink.

diapason (from Greek *dia pasōn chordōn:* "through all the strings"), in medieval music, the interval, or distance between notes, encompassing all degrees of the scale—*i.e.,* the octave. In French, *diapason* indicates the range of a voice and is also the word for a tuning fork and for pitch.

On the organ, the open and stopped diapason are two basic stops, or ranks of pipes sounding a given tone colour. Open diapason pipes are also known as principals.

diapause, spontaneous interruption of the development of certain animals, marked by reduction of metabolic activity. It is typical of many insects and mites, a few crustaceans and snails, and perhaps certain other animal groups. This period of suspended development is an apparent response to the approach of adverse environmental conditions. It may occur during any life stage but is most common among pupae (*e.g.,* the cocoons of moths).

Diapause sets in when the bodily concentrations of growth and molting hormones decrease, which usually coincides with changes in day length, temperature, or abundance of food. Diapause is genetically determined but may be eliminated experimentally if the animals are raised under constant and favourable environmental conditions.

Diapensiales, order of dicotyledonous flowering plants comprising the family Diapensiaceae, with seven genera of small, evergreen shrubs and basally woody herbs found in Arctic and alpine (high elevation) habitats of Europe, Asia, and the eastern United States.

The plants are characterized by the presence of radially symmetrical, bisexual flowers with five free or fused sepals; five basally fused, overlapping petals, on the surfaces of which are situated five stamens (male pollen-producing structures) that are alternate in position with the petal lobes; and one pistil (female structure) composed of three carpels (ovule-bearing segments) and divided internally into three chambers that contain from few to many ovules each. Occasionally there are five sterile stamens, or staminodes, positioned opposite the petal lobes.

The order is related to the heath order (Ericales), and both orders are considered to have had an evolutionary ancestor in the tea order (Theales). The genera include *Shortia* (seven or eight species), *Diapensia* (three species), *Schizocodon* (two species), *Berneuxia* (two species), *Diplarche* (two species), *Pyxidanthera* (one or two species), and *Galax* (one species).

The wand-flower, beetleweed, or galax (*Galax urceolata*), native to the southeastern United States, is widely used in the florist trade in wreaths and decorations for its large, stiff, heart-shaped or rounded leaves, which are especially attractive in the autumn when they develop a rich bronze colour. The fringed

Arctic diapensia (*Diapensia lapponica*)

Kitty Kohout from Root Resources—EB Inc.

galax (*Shortia soldanelloides*), a small shrub only a few inches tall with nodding, one-inch (2.5-centimetre) flowers, is sometimes grown as a garden ornamental. Species of *Shortia, Diapensia,* and *Pyxidanthera* are sometimes grown in wildflower and rock gardens.

diaper, in architecture, surface decoration, carved or painted, generally composed of square or lozenge shapes but also of other simple figures, each of which contains a flower, a spray of leaves, or some such device. The pattern is repetitive and is usually based on a square grid. It was a common form of sculptural wall enrichment in Gothic art. An example is the 14th-century pulpitum, or choir screen, of Lincoln cathedral, Lincolnshire, England.

In Victorian England, attempts were made to reproduce diaper in brickwork, bricks of different colours being used to form bold patterns like pieces of polychrome cross-stitch work. The architect A.W.N. Pugin so embellished his own house, St. Marie's Grange, near Salisbury. This vogue was, in fact, a revival of brick diapering in Tudor times.

diaphragm, dome-shaped, muscular and membranous structure that separates the thoracic (chest) and abdominal cavities in mammals; it is the principal muscle of respiration.

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

The muscles of the diaphragm arise from the lower part of the sternum (breastbone), the lower six ribs, and the lumbar (loin) vertebrae of the spine and are attached to a central tendon. Contraction of the diaphragm increases the internal height of the thoracic cavity, thus lowering its internal pressure and causing inspiration of air. Relaxation of the diaphragm and the natural elasticity of lung tissue and the thoracic cage produce expiration. The diaphragm is also important in expulsive actions—*e.g.,* coughing, sneezing, vomiting, crying, and expelling feces, urine, and, in parturition, the fetus. The diaphragm is pierced by many structures, notably the esophagus, aorta, and inferior vena cava, and is occasionally subject to herniation (rupture). Spasmodic inspiratory movement of the diaphragm produces the characteristic sound known as hiccupping.

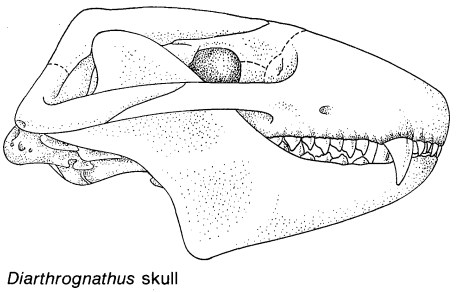
diapir (from Greek *diapeirein,* "to pierce"), geological structure consisting of mobile material that was forced into more brittle surrounding rocks, usually by the upward flow of material from a parent stratum. The flow may be produced by gravitational forces (heavy rocks causing underlying lighter rocks to rise), tectonic forces (mobile rocks being squeezed through less mobile rocks by lateral stress), or a combination of both. Diapirs may take the shape of domes, waves, mushrooms, teardrops, or dikes. Because salt flows quite readily, diapirs are often associated with salt domes or salt anticlines; in some cases the diapiric process is thought to be the mode of origin for a salt dome itself.

diarchy: *see* dyarchy.

Diarmaid MACMURCHADA: *see* Dermot MacMurrough.

diarrhea, also spelled DIARRHOEA, abnormally swift passage of waste material through the large intestine, with consequent discharge of loose feces from the anus. Diarrhea may be accompanied by cramping. The disorder may have a wide range of causes. It may, for example, result from dysentery, either amoebic or bacillary; from eating coarse or highly seasoned foods or drinking large quantities of alcoholic beverages; from poisons such as arsenic or mercury bichloride; or from drugs administered to reduce high blood pressure. It may be one consequence of a psychoneurosis. Thyrotoxicosis (exophthalmic goitre), deficiency of parathyroid hormones, and uremia—an excess of nitrogenous wastes in the blood—all may cause diarrhea.

Diarthrognathus, genus of extinct, advanced mammal-like reptiles found as fossils in Late Triassic terrestrial deposits in southern Africa (the Triassic Period began 225,000,000 years ago and lasted 35,000,000 years). *Diarthrognathus* was contemporaneous with a host of other mammal-like reptiles but is nearer than many of them to the line leading to the true mammals because of its unspecialized features



Diarthrognathus skull

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of skeletal anatomy and dentition. The articulation of the lower jaw with the skull shares reptilian and mammalian characteristics.

diary, form of autobiographical writing, a regularly kept record of the diarist's activities and reflections. Written primarily for the writer's use alone, the diary has a frankness that is unlike writing done for publication. Its ancient lineage is indicated by the existence of the term in Latin, *diarium,* itself derived from *dies* ("day").

The diary form began to flower in the late Renaissance, when the importance of the in-

dividual began to be stressed. In addition to their revelation of the diarist's personality, diaries have been of immense importance for the recording of social and political history. *Journal d'un bourgeois de Paris,* kept by an anonymous French priest from 1409 to 1431 and continued by another hand to 1449, for example, is invaluable to the historian of the reigns of Charles VI and Charles VII. The same kind of attention to historical events characterizes *Memorials of the English Affairs* by the lawyer and parliamentarian Bulstrode Whitelocke (1605–75) and the diary of the French Marquis de Dangeau (1638–1720), which spans the years 1684 to his death. The English diarist John Evelyn is surpassed only by the greatest diarist of all, Samuel Pepys, whose diary from Jan. 1, 1660 to May 31, 1669, gives both an astonishingly frank picture of his foibles and frailties and a stunning picture of life in London, at the court and the theatre, in his own household, and in his Navy office.

In the 18th century, a diary of extraordinary emotional interest was kept by Jonathan Swift and sent to Ireland as *The Journal to Stella* (written 1710–13; published 1766–68). This work is a surprising amalgam of ambition, affection, wit, and freakishness. The most notable English diary of the late 18th century was that of the novelist Fanny Burney (Madame d'Arblay); it was published in 1842–46. James Boswell's *Journal of a Tour to the Hebrides* (1785), a genuine diary though somewhat expanded, was one of the first to be published in its author's lifetime.

Interest in the diary increased greatly in the first part of the 19th century, in which period many of the great diaries, including Pepys's, were first published. Those of unusual literary interest include the *Journal* of Sir Walter Scott (published in 1890); the *Journals* of Dorothy Wordsworth (published after her death in 1855), which show her influence on her brother William; and the diary of Henry Crabb Robinson (1775–1867), published in 1869, with much biographical material on his literary acquaintances, including Goethe, Schiller, Wordsworth, and Coleridge. The posthumous publication of the diaries of the Russian artist Marie Bashkirtseff (1860–84) produced a great sensation in 1887, as did the publication of the diary of the Goncourt brothers, beginning in 1888.

In the 20th century, the *Journal of Katherine Mansfield* (1927), the two-volume *Journal* of André Gide (1939, 1954), and the five-volume *Diary of Virginia Woolf* (1977–84) are among the most notable examples.

Dias, Antônio Gonçalves (Brazilian writer): *see* Gonçalves Dias, Antônio.

Dias, Bartolomeu, Dias also spelled DIAZ (b. *c.* 1450—d. May 29, 1500, at sea, near Cape of Good Hope), Portuguese navigator and explorer who led the first European expedition to round the Cape of Good Hope (1488), opening the sea route to Asia via the Atlantic and Indian oceans. He is usually considered to be the greatest of the Portuguese pioneers who explored the Atlantic during the 15th century.

Almost nothing is known of Dias' early life. His supposed descent from one of Prince Henry the Navigator's pilots is unproved, and his rank was the comparatively modest one of squire of the royal household. The name Dias de Novais does not appear in contemporary documents but only in the deed of appointment of his grandson as governor of Angola in 1571.

In 1474, King Afonso V entrusted his son, Prince John (later John II), with the supervision of Portugal's trade with Guinea and the exploration of the western coast of Africa. John sought to close the area to foreign shipping and after his accession in 1481 ordered new voyages of discovery to ascertain the southern limit of the African continent. The navigators were given stone pillars (*padrões*) to stake the claims of the Portuguese crown. Thus one of them, Diogo Cão, reached the Congo and sailed down the coast of Angola to Cape Santa Maria at 13°26′ S, where he planted one of John's markers, supposing that he had attained the southernmost tip of Africa. Cão was ennobled and rewarded and sailed again: this time he left a marker at 15°40′ and another at Cape Cross, continuing to 22°10′ S. Royal hopes that he would reach the Indian Ocean were disappointed, and nothing more is heard of Cão. John II entrusted command of a new expedition to Dias. In 1486 rumour arose of a great ruler, the Ogané, far to the east, who was identified with the legendary Christian ruler Prester John. John II then sent Pêro da Covilhã (*q.v.*) and one Afonso Paiva overland to locate India and Abyssinia and ordered Dias to find the southern limit of Africa.

Dias' fleet consisted of three ships, his own "São Cristóvão," the "São Pantaleão" under his associate João Infante, and a supply ship under Dias' brother, whose name is variously given as Pêro or Diogo. The company included some of the leading pilots of the day, among them Pêro de Alenquer and João de Santiago, who earlier had sailed with Cão. A 16th-century historian, João de Barros, places Dias' departure in August 1486 and says that he was away 16 months and 17 days, but since two other contemporaries, Duarte Pacheco and Christopher Columbus, put his return in December 1488, it is now usually supposed that he left in August 1487.

Dias passed Cão's marker, reaching the "Land of St. Barbara" on December 4, Walvis Bay on December 8, and the Gulf of St. Stephen (Elizabeth Bay) on December 26. After Jan. 6, 1488, he was prevented by storms from proceeding along the coast and sailed south out of sight of land for several days. When he again turned to port, no land appeared, and it was only on sailing north that he sighted land on February 3. He had thus rounded the Cape without having seen it. He called the spot Angra de São Brás (Bay of St. Blaise, whose feast day it was) or the Bay of Cowherds, from the people he found there. Dias' Negro companions were unable to understand these people, who fled but later returned to attack the Portuguese. The expedition went on to Angra da Roca (present-day Algoa Bay). The crew was unwilling to continue, and Dias recorded the opinions of all his officers, who were unanimously in favour of returning. They agreed to go on for a few days, reaching Rio do Infante, named after the pilot of "São Pantaleão"; this is almost certainly the present Great Fish (Groot-Vis) River.

It was now clear that India could be reached by the Cape route, and Dias turned back. He sighted the Cape itself in May. Barros says that he named it Cape of Storms and that John II renamed it Cape of Good Hope. Duarte Pacheco, however, attributes the present name to Dias himself, and this is likely since Pacheco joined Dias at the island of Príncipe. Little is known of the return journey, except that Dias touched at Príncipe, the Rio do Resgate (in the present Liberia), and the fortified trading post of Mina. One of Dias' markers, at Padrão de São Gregório, was retrieved from False Island, about 30 miles short of the Great Fish River, in 1938. Another marker once stood at the western end of the Gulf of St. Christopher, since renamed Dias Point.

Nothing is known of Dias' reception by John II. Although plans are said to have been made for a voyage to India, none was attempted for nine years, perhaps pending news of Pêro da Covilhã. John's successor, Manuel I, authorized Vasco da Gama's celebrated voyage of 1497. Bartolomeu Dias accompanied that expedition as far as Mina.

On da Gama's return to Portugal, after successfully making contact with the seaports of western India, a further fleet was at once organized; it consisted of a dozen ships and was intended to impress the Indians and to open commerce on a large scale. The fleet was under the command of Pedro Álvares Cabral, and Dias was given one of the smaller ships. The fleet sailed far into the western Atlantic on its way to the Cape and sighted land at Espírito Santo in Brazil. Thought to be an island, it was named the Land of the True Cross. Dias thus participated in the discovery of Brazil. He was lost at sea when they reached the Cape, thus perishing in the very waters he had been the first to navigate.

No portrait of Dias is known. He had a son, Antônio, and his grandson, Paulo Dias de Novais, governed Angola and became the founder of the first European city in southern Africa, São Paulo de Luanda, in 1576.

(H.V.L.)

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Dias, Dinís (fl. 15th century), Portuguese navigator and explorer, one of the sea captains sent by Prince Henry the Navigator to open trade with countries of Africa, the Middle East, and India.

As captain of a caravel in 1445, Dias sailed past the outflooding mouth of the river of Senegal, later discovering Cape Verde, the westernmost point of Africa. Dias chose the name "Green Cape" because the headland had tall trees and fragrant vegetation. Dias and his crew were repulsed by natives when they tried to land and soon returned to Portugal.

In 1446 Prince Henry formed a fleet of caravels that were to show the Portuguese flag along the African coast and explore the river of Senegal, which the Portuguese believed was the western branch of the Nile. Dias commanded one of the vessels.

Diaspora (Greek: Dispersion), Hebrew GALUT (Exile), the dispersion of Jews among the Gentiles after the Babylonian Exile; or the aggregate of Jews or Jewish communities scattered "in exile" outside Palestine or present-day Israel. Although the term refers to the physical dispersal of Jews throughout the world, it also carries religious, philosophical, political, and eschatological connotations, inasmuch as the Jews perceive a special relationship between the land of Israel and themselves. Interpretations of this relationship range from the messianic hope of traditional Judaism for the eventual "ingathering of the exiles" to the view of Reform Judaism that the dispersal of the Jews was providentially arranged by God to foster pure monotheism throughout the world.

The first significant Jewish Diaspora was the result of the Babylonian Exile (*q.v.*) of 586 BC. After the Babylonians conquered the Kingdom of Judah, part of the Jewish population was deported into slavery. Although Cyrus the Great, the Persian conqueror of Babylonia, permitted the Jews to return to their homeland in 538 BC, part of the Jewish community voluntarily remained behind.

The largest, most significant, and culturally most creative Jewish Diaspora in early Jewish history flourished in Alexandria, where, in the 1st century BC, 40 percent of the population was Jewish. Around the 1st century AD, an estimated 5,000,000 Jews lived outside Palestine, about four-fifths of them within the Roman Empire, but they looked to Palestine as the centre of their religious and cultural life. Diaspora Jews thus far outnumbered the Jews in Palestine even before the destruction of Jerusalem in AD 70. Thereafter, the chief centres of Judaism shifted from

country to country (*e.g.*, Babylonia, Persia, Spain, France, Germany, Poland, Russia, and the United States), and Jewish communities gradually adopted distinctive languages, rituals, and cultures, some submerging themselves in non-Jewish environments more completely than others. While some lived in peace, others became victims of violent anti-Semitism.

Jews hold widely divergent views about the role of Diaspora Jewry and the desirability and significance of maintaining a national identity. While the vast majority of Orthodox Jews support the Zionist movement (the return of Jews to Israel), some Orthodox Jews go so far as to oppose the modern notion of Israel as a godless and secular state, defying God's will to send his Messiah at the time he has preordained.

According to the theory of *shelilat ha-galut* ("denial of the exile"), espoused by many Israelis, Jewish life and culture are doomed in the Diaspora because of assimilation and acculturation, and only those Jews who migrate to Israel have hope for continued existence as Jews. It should be noted that neither this position nor any other favourable to Israel holds that Israel is the fulfillment of the biblical prophecy regarding the coming of the messianic era.

Although Reform Jews still commonly maintain that the Diaspora in the United States and elsewhere is a valid expression of God's will, the Central Conference of American Rabbis in 1937 officially abrogated the Pittsburgh Platform of 1885, which declared that Jews should no longer look forward to a return to Israel. This new policy actively encouraged Jews to support the establishment of a Jewish homeland. On the other hand, the American Council for Judaism, founded in 1943 but now moribund, declared that Jews are Jews in a religious sense only and any support given to a Jewish homeland in Palestine would be an act of disloyalty to their countries of residence.

Support for a national state, often for purely humanitarian reasons, was notably greater after the wholesale annihilation of Jews during World War II. Of the estimated 14,500,000 Jews in the world today, about 3,100,000 reside in Israel, over 5,900,000 in the United States, and over 2,100,000 in the Soviet Union.

diaspore, white or grayish, hard, glassy aluminum oxide mineral ($HAlO_2$) that is associated with corundum in emery and is widespread in laterite, bauxite, and aluminous clays. It is abundant in Hungary, South Africa, France, Arkansas, and Missouri. Diaspore is dimorphous with boehmite (*i.e.*, it has the same chemical composition but different crystal structure); it does not contain a hydroxyl group (OH) but has cationic hydrogen (H^+) in twofold coordination with the oxygen atoms. For detailed physical properties, *see* oxide mineral (table).

diastereoisomer, also spelled DIASTEROMER, either member of a pair of substances that differ with respect to the configurations of their molecules (*i.e.*, stereoisomers) and that lack a mirror-image relationship (*i.e.*, are not enantiomorphs). An example is the pair consisting of either of the two optically active forms of tartaric acid (either the dextrorotatory or levorotatory form) and the optically inactive meso form of the same acid (mesotartaric acid). Unlike enantiomorphs, diastereoisomers need not have closely similar physical and chemical properties: they may differ as greatly as do structural isomers. For example, either of the optically active tartaric acids melts at 187° C, whereas mesotartaric acid melts at 143° C.

diastole, dilatation of the ventricles of the heart, accompanied by the filling of the chambers with venous blood, that occurs between two contractions (*see* systole). The period of diastole lasts 0.5 to 0.6 second, during which a period of rapid filling (as dammed-up blood rushes in from the atria) is followed by a brief atrial contraction. At the same time, there is a corresponding decrease in arterial blood pressure to its minimum (diastolic blood pressure), normally about 80 millimetres of mercury in man. Diastole may also refer to relaxation of contractile vacuoles in Protozoa. *See also* blood pressure.

diastrophism, also called TECTONISM, large-scale deformation of the Earth's crust by natural processes, which leads to the formation of continents and ocean basins, mountain systems and rift valleys, and other features by mechanisms such as continental drift, isostacy (equilibrium by displacement within the Earth's crust), sedimentary loading of the crust (as at a large river delta), faulting, folding, or disruption of rock strata. A brief treatment of diastrophism follows. For full treatment, *see* MACROPAEDIA: Geomorphic Processes.

The study of diastrophism, or tectonic processes, may now be considered as the central unifying movement in late 20th-century geology and geophysics. Tectonic processes chiefly comprise linear or torsional horizontal movements (such as continental drift) and vertical subsidence and uplift of the lithosphere (strain) in response to natural stresses on the Earth's surface such as the weight of mountains, lakes, and glaciers. Subsurface conditions also cause subsidence or uplift, known as epierogeny, over large areas of the Earth's surface without deforming rock strata; such changes include the thickening of the lithosphere by overthrusts of sedimentary strata, changes in rock density of the lithosphere caused by metamorphism or thermal expansion and contraction, increases in the volume of the asthenosphere (upper mantle supporting the lithosphere) caused by hydration of olivine, and orogenic or mountain building movements. These tectonic processes are believed to operate at a state of isostasy, or equilibrium, in which the asthenosphere alters its thickness in response to changes in the lithosphere's weight and movement.

Diatessaron, the four New Testament Gospels compiled as a single narrative by Tatian (*q.v.*) about AD 150. It was the standard Gospel text in the Syrian Near East until about AD 400, when it was replaced by the four separated Gospels. Quotations from the *Diatessaron* appear in ancient Syriac literature, but no ancient Syriac manuscript now exists. A 3rd-century Greek papyrus fragment was discovered in 1933 at Doura-Europus, northwest of Baghdad, Iraq. Whether the original writing was done in Greek or Syriac is unknown. There are also manuscripts in Arabian and Persian and translations into European languages made during the Middle Ages.

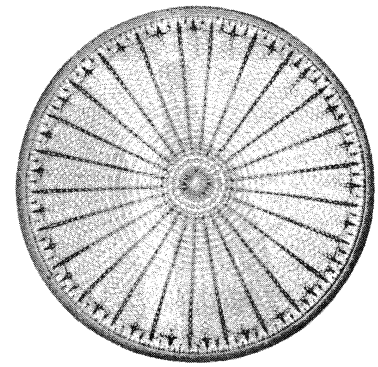
diathermy, form of physical therapy in which deep heating of tissues is accomplished by the use of high-frequency electrical current. U.S. engineer and inventor Nikola Tesla in 1891 first noted that heat resulted from irradiation of tissue with high-frequency alternating current (wavelengths somewhat longer than the longest radio waves) and pointed out its possible medical uses. K.F. Nagelschmidt, a German physician, in 1909 coined the term diathermy, meaning "heating through."

Three forms of diathermy are in wide use by physical therapists in hospitals and clinics: shortwave, ultrasound, and microwave. In shortwave diathermy, the part to be treated is placed between two condenser plates, and the highest temperature is concentrated in the subcutaneous tissues. Shortwave usually is prescribed as treatment for deep muscles and joints and is sometimes used to localize deep inflammatory disease. Ultrasound diathermy uses high-frequency acoustic vibrations; their heating effect increases circulation and metabolism and speeds up the rate of ion diffusion across cellular membranes. During treatment the apparatus is moved slowly across the surface of the area to be affected. Ultrasound is used to heat selected muscles that are too deep to be significantly affected by surface heating. Microwave diathermy uses radiation of very high frequency and short wavelength similar to that used in microwave ovens; all physiologic responses are due to its heating effect.

Depending on the amount of heat generated, diathermy can be used to merely warm or to destroy tissue. In the first instance, it is particularly beneficial in relieving muscle soreness and sprain. In the second, as an adjunct to surgery, diathermy is used to coagulate, prevent excessive bleeding, and seal off traumatized tissues. It is particularly effective in eye and neurosurgery. Diathermy therapy is also used effectively to treat back pain, to remove warts and moles, and to destroy or localize bacterial infection of tissues. *See also* physical therapy.

diatom, any member of the algal division or phylum Bacillariophyta (about 16,000 species) found floating in all the waters of the Earth. Diatoms may be either unicellular or colonial. The silicified cell wall forms a pillbox-like shell (frustule) composed of overlapping halves (epitheca and hypotheca) that contain intricate and delicate markings useful in testing the resolving power of microscope lenses. The beautiful symmetry and design of diatoms justify their title "jewel of the sea."

During reproduction, usually by cell division, the overlapping shell halves separate, and each



Diatom (highly magnified)
Eric Grave—Photo Researchers

secretes a smaller bottom half. Thus, individual diatoms formed from successive bottom halves show a progressive decrease in size with each division. In a few months there can be as much as a 60 percent decrease in size. Periodic spore formation serves to restore the diatom line to its original size.

Diatoms are divided into two orders on the basis of symmetry and shape: the round, nonmotile Centrales have radial markings; the elongated Pennales, which move with a gliding motion, have pinnate (featherlike) markings. Food is stored as oil droplets, and the golden-brown pigment fucoxanthin masks the chlorophyll and carotenoid pigments that are also present. Diatoms, among the most important and prolific sea organisms, serve directly or indirectly as food for many animals. Diatomaceous earth (*q.v.*), a substance composed of fossil diatoms, is used in filters, insulation, abrasives, paints, and varnishes.

diatomaceous earth, also called KIESELGUHR, light-coloured, porous, and friable sedimentary rock that is composed of the siliceous shells of diatoms, unicellular aquatic plants of microscopic size. It occurs in earthy beds that somewhat resemble chalk, but it is much

lighter than chalk and will not effervesce in acid. Under a high-powered microscope the form of the diatoms can be distinguished. When well hardened, it is called diatomite. Similar siliceous rocks, called radiolarian earth and radiolarite, are formed from the lattice-like opaline skeletons of Radiolaria.

Diatomaceous earth, formerly used principally as a filter in clarifying sugar and syrups, has been adapted to almost all industrial filtration applications, including the processing of oils, alcoholic and nonalcoholic beverages, antibiotics, solvents, and chemicals. A second major use is as a filler or extender in paper, paint, brick, tile, ceramics, linoleum, plastic, soap, detergent, and a large number of other products. It also is used in the insulation of boilers, blast furnaces, and other devices in which high temperatures are maintained; at temperatures higher than 525° C (about 1,000° F) diatomaceous earth is a more efficient insulator than asbestos or magnesia because it is more resistant to shrinkage and does not fail at red heat. Other uses include sound insulation and vehicles for herbicides and fungicides. The oldest and best known commercial use is as a very mild abrasive in metal polishes and toothpaste.

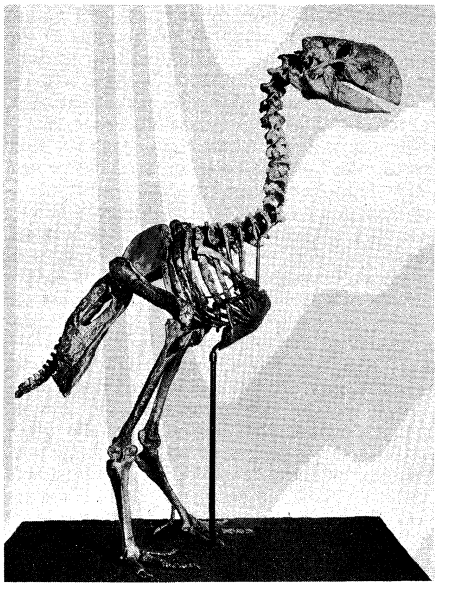
The largest deposit worked in the United States is in northern Santa Barbara County, California, where beds more than 300 metres (1,000 feet) thick extend over several square miles and vary from soft earth to hard, compact rock that can be sawed into blocks; other production has come from Nevada, Washington, and Oregon. Denmark, France, and the Soviet Union have well-developed diatomaceous earth industries, and numerous deposits exist in Algeria.

diatonic, in music, originally, one of the three tetrachords basic to ancient Greek theory; more generally, any stepwise arrangement of the seven "natural" pitches forming an octave devoid of chromatic alterations, in particular the major and minor scales that evolved from the medieval and Renaissance church modes in conjunction with the rise of diatonic harmony. The increasing irrelevance of the old modal system caused the 16th-century Humanist Glareanus to propose two additional modes, Aeolian and Ionian, based on A and C, respectively, and identical in every way with the modern major and natural minor.

The major scale consists of two identical disjunct tetrachords, each comprising two whole-tone steps topped by a semitone, while the minor scale in its natural form consists of one tetrachord with the semitone in the middle and another with the semitone at the bottom. Given the crucial importance of the so-called leading tone (the semitone between the seventh and eighth scalar steps) for diatonic harmony, however, natural minor in practice tends to yield to the need for chromatic alteration of the seventh step. The "harmonic" minor that results is, strictly speaking, no longer a diatonic scale, unlike "melodic" minor, which simply borrows its upper tetrachord from the parallel major, *i.e.*, the major scale beginning and ending on the same pitch.

Due to the close, indeed causal connections between diatonic harmony and the major and minor scales, diatonic scale degrees are often built on the corresponding pitches. Thus, the first step is often referred to as the tonic, the second as the supertonic, third as the mediant, fourth as the subdominant, fifth as the dominant, sixth as the submediant, and seventh as the leading tone. However, heptatonic (seven-note) diatonic scales occur also well beyond the confines of Western art music, including European and American folk monophony, as well as African and Asian music, and therefore, the theoretical value of such linguistic usage is questionable. It should be noted that the rapidly developing instrumental music of 18th- and 19th-century Europe, with its increasing emphasis on expressiveness, favoured chromatic intrusions to the extent that, by the time of Wagner, diatonicism became relegated primarily to the popular and semipopular realms of musical creativity.

Diatryma, extinct, giant flightless bird found as fossils in early Eocene rocks in North America and Europe (the Eocene Epoch began 54,000,000 years ago and lasted 16,000,000 years). *Diatryma* grew to a height of about 2¼ metres (7 feet). Its small wings were of little use for flight, but the legs were massively



Cast reconstruction of *Diatryma*
By courtesy of the American Museum of Natural History, New York

constructed; *Diatryma* was probably a strong and rapid runner. The head was large and supported a powerful beak; *Diatryma* was an active predator, probably feeding on the small mammals.

Diatryma is representative of the Diatrymiformes, a group of large, flightless, predaceous birds that inhabited North America and Europe. In South America a similarly adapted group is characterized by the genus *Phororhacos,* common during the Miocene Epoch (between 7,000,000 and 26,000,000 years ago). It was about 1½ metres (5 feet) in height and also had weakly developed wings, strong legs, a large head, and a powerful beak.

Diavolo, Fra, byname of MICHELE PEZZA (b. April 7, 1771, Itri, near Formia, Kingdom of the Two Sicilies—d. Nov. 11, 1806, Naples), Italian brigand chief who repeatedly fought against the French occupation of Naples; he is celebrated as a popular guerrilla leader in folk legends and in the novels of the French writer Alexandre Dumas *père.*

After committing various crimes, the young Pezza joined the mountain bandits then plundering the Italian countryside. His ferocity earned him the name Fra Diavolo, or Brother Devil, among the victimized peasants. In 1798 Cardinal Fabrizio Ruffo, chief adviser to King Ferdinand IV of Naples, pardoned Diavolo for two murders and hired him to fight the French. Diavolo's men disrupted the French communications but could not prevent the French capture of Naples (January 1799), which was declared the Parthenopean Republic.

Ruffo and Diavolo then went to Calabria, recruiting for their army while pillaging several towns. With the departure of the French, Ruffo, aided by Diavolo, recaptured Naples (June 1799). Encouraged by Queen Maria Carolina and the royal family's British ally Admiral Lord Nelson, Diavolo led the barbarous reprisals against collaborators with the French. Arrested for having sacked Albano Laziale, Diavolo was pardoned by Ferdinand, who made him a colonel. After receiving a generous pension and a fief from the Queen, he lived under court protection until 1806.

Diavolo then tried to organize resistance against Napoleon's troops, which had once again taken Naples (January 1806). When a price was put on his head, Diavolo was captured and hanged in the public marketplace.

Diaz, Armando (b. Dec. 5, 1861, Naples—d. Feb. 29, 1928, Rome), Italian general who became chief of staff during World War I.

A graduate of the military colleges of Naples and Turin, Diaz served with distinction in the Italo-Turkish War (1911–12). Appointed major general in 1914, he collaborated with Gen. Luigi Cadorna in the reorganization of the Italian Army in preparation for World War I. When Italy entered the war, he was chief of operations under Cadorna and contributed to the Italian victories at Carso and Gorizia (August 1916). Although he directed his armoured corps with skill, the Italians were overwhelmingly defeated by the Austrians at Caporetto (October 1917). He then replaced Cadorna as chief of staff and succeeded in sufficiently stabilizing the Italian Army to repel the Austrian offensive in June 1918 and to mount a strong counteroffensive. Diaz' decisive victory at Vittorio Veneto (Oct. 24–Nov. 3, 1918) signalled the defeat of the Austrian forces.

As a reward he was named *duca della vittoria* ("duke of victory") in 1921 and appointed marshal in 1924. He served as minister of war in the first Fascist Cabinet (1922–24). Poor health, however, forced him to resign and to retire to private life.

Diaz, Bartolomeu (Portuguese explorer): *see* Dias, Bartolomeu.

Díaz, Porfirio (b. Sept. 15, 1830, Oaxaca, Mex.—d. July 2, 1915, Paris), soldier and president of Mexico (1877–80, 1884–1911), who established a strong centralized state that he held under firm control for more than three decades.

A mestizo (part Indian), Díaz was of humble origin. He began training for the priesthood at 15, but upon the outbreak of war with the United States (1846–48) he joined the army. An illustrious military career followed, including service in the War of the Reform (1857–60) and the struggle against the French in 1861–67, when Maximilian became emperor. Earlier (1849), Díaz studied law with the encouragement of the Liberal Benito Juárez, who first became president in 1858.

Porfirio Díaz
By courtesy of the Library of Congress, Washington, D.C.

Díaz resigned his command and went back to Oaxaca when peace was restored but soon became dissatisfied with the Juárez administration. He led an unsuccessful protest against

the 1871 reelection of Juárez, who died the following year. Díaz continued his protests in an unsuccessful revolt against Pres. Sebastían Lerdo de Tejada in 1876, after which he fled to the United States. Six months later, however, he returned and defeated the government forces at the Battle of Tecoac (November 1876), and in May 1877 he was formally elected president.

During his first four years in office, Díaz began a slow process of consolidation of power and built up a strong political machine. His administration achieved a few public improvements but was more noted for its suppression of revolts. Having opposed Lerdo's reelection, he decided not to run for another term himself but handpicked his successor, Gen. Manuel González, who also soon dissatisfied him. Therefore, in 1884, Díaz ran for the presidency again and was elected.

Over the course of the next 26 years Díaz produced an orderly and systematic government with a military spirit. He succeeded in destroying local and regional leadership until the majority of public employees answered directly to him. Even the legislature was composed of his friends, and the press was muffled. He also maintained tight control over the courts.

Díaz secured his power by catering to the needs of separate groups and playing off one interest against another. He won the mestizos' support by supplying them with political jobs. The privileged Creole classes were cooperative in return for the government's non-interference in their haciendas and for positions of honour in the administration. The Roman Catholic Church maintained a policy of non-involvement in return for a certain degree of freedom. The Indians, who formed a full third of the population, were ignored.

When Díaz came to power, the Mexican government was in debt and had very little cash reserves; therefore, he enthusiastically encouraged investment by foreigners. Conditions were made so advantageous to the suppliers of capital that Mexican industries and workers alike suffered. Díaz was no economist, but his two principal advisers, Matías Romero and José Y. Limantour (after 1893), were responsible for the influx of foreigners to build railroads and bridges, to dig mines, and to irrigate fields. Mexico's new wealth, however, was not distributed throughout the country; most of the profits went abroad or stayed in the hands of a very few wealthy Mexicans. By 1910 the economy had declined and national revenues were shrinking, which necessitated borrowing. With wages decreasing, strikes were frequent. Agricultural workers were faced with extreme poverty and debt peonage.

On Feb. 17, 1908, in an interview with a reporter for *Pearson's Magazine*, Díaz announced his retirement. Immediately opposition and pro-government groups began to scramble to find suitable presidential candidates. Then, as plans were being formalized, Díaz decided not to retire but to allow Francisco Madero, an aristocratic but democratically inclined reformer, to run against him. Madero lost the election, as was expected; but when he resorted to a military revolution, the government proved surprisingly weak and collapsed. Díaz resigned office on May 25, 1911, and went into exile.

Diaz de La Peña, Narcisse-Virgile (b. 1808, Bordeaux, Fr.—d. Nov. 18, 1876, Menton), French painter and lithographer of the group of landscape painters known as the Barbizon school, who is distinguished for his numerous Romantic depictions of the forest of Fontainebleau and his landscape fantasies with mythological figures.

At 15 Diaz began working as a ceramic painter for the Sèvres porcelain factory. He studied for a time with the academic painter Alexandre Cabanel. Strongly influenced by Delacroix and the Romantics and attracted by medieval and Middle Eastern art, he often in his early career painted exotic subjects.

About 1840 Diaz began to paint landscapes in the forest of Fontainebleau near the village of Barbizon. These landscapes, which dominated his work for the rest of his career, characteristically have a pervasive sense of the shadowy seclusion of the forest; *e.g.*, "Forest Scene" (1867; St. Louis [Mo.] Art Museum). Dense, vividly coloured foliage is broken by spots of light or patches of sky shining through the branches. During the last 15 years of his life Diaz seldom exhibited publicly. He was helpful and sympathetic to the Impressionists, especially Renoir, whom he met in 1861 painting at Barbizon.

Díaz de Solís, Juan (b. 1470?, Seville, Spain—d. 1516, Río de la Plata, S.Am.), chief pilot of the Spanish navy and one of the first explorers to enter the Río de la Plata estuary in South America.

Solís had made a voyage to the Americas in 1508, before being commissioned to lead an expedition to an area 1,700 leagues (about 5,000 miles) south of the Isthmus of Panama and beyond. He led three vessels from Sanlúcar de Barrameda, Spain, on Oct. 8, 1515, with a crew of 70 men and provisions for 2½ years. In February 1516 he reached the estuary of Río de la Plata, which he called Mar Dulce (Fresh Sea). The first island he reached therein was named Martin Garcia, after one of his crewmen who had died. Sailing up the Uruguay River, he landed on the east bank (modern Uruguay) and was attacked by the Charrúa Indians of the region. He and the rest of the landing party, except for one man, Francisco del Puerto, were killed and eaten in sight of the remaining crewmen on shipboard. Puerto was made prisoner and later gave valuable information about the area to Sebastian Cabot, who arrived there in 1526.

Díaz de Vivar, Rodrigo, also called RUY DÍAZ DE VIVAR (Spanish hero): *see* Cid, the.

Díaz del Castillo, Bernal (b. *c.* 1492, Medina del Campo, Castile—d. 1581?, Guatemala), Spanish soldier and author, who took part in the conquest of Mexico.

In 1514 he visited Cuba and five years later accompanied Hernán Cortés to Mexico. In protest against the academic chronicles of sedentary historians he wrote his *Verdadera historia de la conquista de la Nueva España* (1632; "True History of the Conquest of New Spain"), insisting that, as actor and eyewitness, he was better situated to record the truth of the expeditions in their topographical and military details. This "true history," written in an unassuming, colloquial style, has historical and artistic value and is a source book of idiomatic 16th-century Spanish.

Díaz Ordaz, Gustavo (b. March 12, 1911, Ciudad Serdán, Mex.—d. July 15, 1979, Mexico City), president of Mexico from 1964 to 1970.

A descendant of José María Díaz Ordaz, associate of 19th-century Mexican leader Benito Juárez, Díaz Ordaz was trained as a lawyer and served as supreme court president in his native state of Puebla before being elected to the Mexican Senate in 1946. In 1958 he became federal interior minister and in July 1964 was elected to the presidency as the Partido Revolucionario Institucional candidate to succeed Adolfo López Mateos. Díaz Ordaz's administration emphasized economic development for Mexico. In 1977 he was ambassador to Spain.

diazepam, tranquillizing drug used orally or by injection for the treatment of anxiety and tension states and as an aid in preoperative and postoperative sedation. Diazepam also is used to treat skeletal muscle spasms. It belongs to a group of chemically related compounds (including chlordiazepoxide) called benzodiazepines, the first of which was synthesized in 1933. Diazepam, known by several trade names, including Valium, was introduced in 1963.

Side effects of diazepam include drowsiness and muscular incoordination. A degree of physical dependence can result after prolonged use.

Diazepam occurs as colourless crystals, and it is available for use in solution and in tablet form.

diazo compound, any of a class of organic substances that have as part of their molecular structure the characteristic atomic grouping

$$R_2C=\overset{+}{N}=\overset{-}{N},$$

in which R represents a hydrogen atom or any of a large number of organic groups.

The most common diazo compound is diazomethane, a toxic, explosive yellow gas usually prepared as a solution in ether and often used in laboratory procedures for converting carboxylic acids into their methyl esters or into their homologues.

diazonium salt, any of a class of organic compounds that have the molecular structure

$$R-\overset{+}{N}\equiv N,$$

in which R is an atomic grouping formed by removal of a hydrogen atom from an organic compound. Diazonium salts are usually prepared by the reaction (diazotization) of primary amines with nitrous acid; their most striking property is their instability. The aliphatic diazonium salts exist only as transient intermediates, quickly decomposing into a nitrogen molecule and a carbonium ion; certain aromatic diazonium salts are stable enough to be isolated but react readily either by loss of nitrogen or by formation of azo compounds.

Diazonium salts were first obtained from aromatic amines in 1858, and their utility in the preparation of azo compounds was soon recognized by the dye industry. By varying the chemical structures of the amines that are diazotized (the diazo components) and of the compounds with which they react (the coupling components), colours throughout the visible spectrum are imparted to dyes applicable to many types of fibres by several techniques.

The diazonium group can be replaced by numerous atoms or groups of atoms, often with the aid of copper or a copper salt; these reactions make possible the preparation of a wide variety of aromatic derivatives. Chemical reduction of aromatic diazonium salts leads to formation of hydrazine derivatives.

Dib, Mohammed (b. July 21, 1920, Tlemcen, Alg.), African novelist, poet, and playwright, known for his early trilogy on Algeria, *La Grande Maison* (1952), *L'Incendie* (1954), and *Le Métier à tisser* (1957), in which he described the Algerian populace awakening to a consciousness of self and to the impending struggle for independence that began in 1954. The trilogy recounts the years 1938–42.

Dib, who was at various times a teacher, accountant, rug maker, journalist, and drama critic, wrote of the poor Algerian worker and peasant in his early realistic novels. From the time of his exile from Algeria, in 1959, except for brief sojourns in that country, Dib lived in France.

His later novels, apart from *Un Été africain* (1959), which retains the realistic mode of expression in his description of a people in revolt, are marked by the use of symbol, myth, allegory, and fantasy to portray the French colonial repression of the Algerian people, the search for the authentic expression of an Al-

gerian personality, the war for independence and its effects, the new Algeria after independence and the struggle of the technocrats for control, and the plight of the Algerian emigrant worker in France. These novels—*La Danse du roi* (1960), *Qui se souvient de la mer* (1962), *Cours sur la rive sauvage* (1964), *Dieu en barbarie* (1970), *Le Maître de chasse* (1973), and *Habel* (1977)—like the early novels, express optimism in the brotherhood of mankind. Similarly, he wrote for those who are dispossessed through economic exploitation. Dib's use of the fantastic, the erotic, and the voyage metaphor are integral to his description of the search for truth and self.

Though he worked in a variety of genres, Dib viewed himself as essentially a poet. He wrote two collections of poetry, *Ombre gardienne* (1961) and *Formulaires* (1970), and he published two collections of novellas, *Au café* (1956) and *Le Talisman* (1966). Dib was also the author of a film scenario, *Les Fiancés du printemps*, and the play *Pour une paix durable*. His play *Mille Hourras pour une gueuse* was published in 1980.

Dībā al-Ḥiṣn, Dībā also spelled DIBBAH, or DABĀ, settlement and port town, on the eastern (Gulf of Oman) coast of the Oman Promontory of the Arabian Peninsula. It is situated on Dībā Bay and is surrounded by mountains. The town and its locality are part of two countries: the old port area and territory immediately south belong to the United Arab Emirates (Sharjah and Fujairah emirates), while the territory north of the bay lies in the Sultanate of Oman.

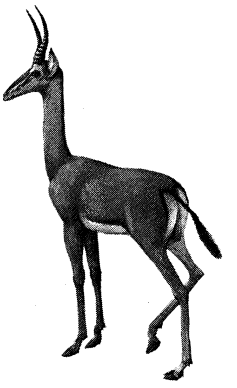
An important port of pre-Islāmic Arabia, Dībā al-Ḥiṣn was traditionally renowned as a copper-exporting centre for the interior of Oman. It was a prosperous town at the time of the emergence of Islām and was one of the last important places of resistance to the new religion in the Arabian Peninsula. It was razed by the Muslims in the 7th century. In the 19th century the Qawāsim pirate chieftain Sulṭān ibn Saqr gave the town as a fiefdom to one of his sons; his descendants, at various periods, claimed to be independent sheikhs.

Dībā al-Ḥiṣn, now a small fishing village with adjacent palm groves and vegetable plots, has a central electricity supply and a small hospital. Roads and trails link it with coastal settlements to the south and with the Ras al-Khaimah emirate, across the Oman Promontory. Pop. (latest census) 1,010.

Dibāng Valley, region, northeastern Arunāchal Pradesh state, eastern India. The region is located in the Great Himalayan Mountain Range, with its northern and eastern reaches fronting Tibet. The Mishmi Hills, a southward extension of the Himalayas, compose most of the northern part of the region. They have an average elevation of 15,000 feet (4,500 m) and are dotted with passes such as Yonggyap at 13,000 feet (3,950 m) and Kaya at 15,600 feet (4,750 m). The region derives its name from the Dibāng River. The Dibāng, together with the Ahui, Emra, Adzon, and Dri streams, flows southward to join the Brahmaputra River. Subtropical evergreen forests of oak, maple, juniper, and pine cover the hilly parts of the region.

The Mishmi, Miju, Idu (Chulikatta), Khampti, and Singpho ethnic groups inhabit the region and speak dialects of the Tibeto-Burman linguistic family. Rice, corn (maize), millet, potatoes, and cotton are grown on the terraced hill slopes and in the more level patches bordering the rivers. Barter markets are important to the regional economy; the Mishmi trade musk, beeswax, ginger, and chilies with the people of the Assam Plains to the south. Deposits of clay, graphite, limestone, and copper are worked. Cottage industries include caneworking, cloth weaving, silverworking, and blacksmithing. The system of roads in the Dibāng Valley region is largely undeveloped. Most distances are traveled over simple tracks, though there are a few all-weather roads. Anini is the chief settlement in the region. The Igu, a somber dance performed by the Idu Mishmi priests, is closely associated with the region.

dibatag, also called CLARK'S GAZELLE (*Ammodorcas clarkei*), slender north African antelope, family Bovidae (order Artiodactyla), that lives alone or in small groups in grass and thorn brush. The dibatag is a long-legged,



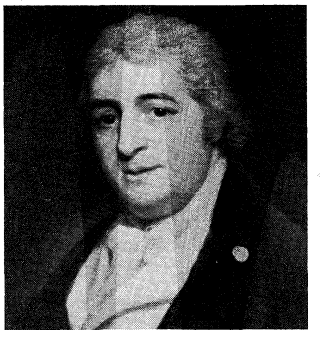
Dibatag (*Ammodorcas clarkei*)
Painting by Donald C. Meighan

long-necked animal with rounded ears, small hooves, and a long, thin black tail that it holds erect or tipped forward when alarmed or running. Shoulder height is 75–90 cm (30–35 inches). The coat is purplish brown with white on the underparts and buttocks and white and reddish brown markings on the face. The male has curved horns that hook forward at the ends. Like the gerenuk, which it resembles, the dibatag browses on foliage and sometimes stands on its hind legs to reach leaves.

dibbuk: *see* dybbuk.

Dibdin, Charles (baptized March 4, 1745, Southampton, Hampshire, Eng.—d. July 25, 1814, London), composer, author, actor, and theatrical manager whose sea songs and operas made him one of the most popular English composers of the late 18th century.

A chorister at Winchester Cathedral, Dibdin went to London at the age of 15, worked for a music publisher, and began his stage career at Richmond in 1762. He later acted in London, notably as Ralph in Samuel Arnold's *The Maid of the Mill*. His first operetta, *The Shepherd's Artifice*, was produced at Covent Garden in 1764. By 1778, when he became composer to Covent Garden, he had produced eight operas, among them *The Padlock* (1768), *The Waterman* (1774), and *The Quaker* (1775). He managed the Royal Circus, later the Surrey Theatre, during 1782–84 and in 1785 produced his ballad opera



Charles Dibdin, portrait by T. Phillips, 1799; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Liberty Hall. After the failure of a projected trip to India, he began about 1789 to produce his celebrated one-man "table entertainments," in which he acted as author, singer, and accompanist. Most of his sea songs were written for these entertainments, among them "Tom Bowling" (written in memory of his brother), "To Bachelors' Hall," "Poor Jack," and " 'Twas in the Good Ship Rover."

A self-taught musician, Dibdin wrote about 100 stage works, about 1,400 songs, often to his own words, and some instrumental works. He also wrote several novels. Restless and often irascible, he was a born melodist who excelled in writing for the voice.

Dibdin, Thomas Frognall (b. 1776, Calcutta—d. Nov. 18, 1847, London), English bibliographer who helped to stimulate interest in bibliography by his own enthusiastic though often inaccurate books, by his share in founding the first English private publishing society, and by his beautifully produced catalog of Lord Spencer's library (which collection later became the nucleus of the John Rylands Library, Manchester).

Educated at St. John's College, Oxford, Dibdin began a legal career but took orders in 1805. His *Introduction to the knowledge of rare and valuable editions of the Greek and Latin Classics* (1802) attracted the notice of Lord Spencer, through whose patronage Dibdin obtained a clerical appointment in London. His *Bibliotheca Spenceriana* (1814–15) became famous for the high quality of its printing. Dibdin traveled widely in search of books and manuscripts, and his *Bibliographical, Antiquarian and Picturesque Tour in France and Germany* (1821) is typical of his work in containing much lively anecdote, many factual errors, and some excellent engravings. His *Bibliomania* (1809) contributed to the public's interest in old and rare books.

Dibelius, Martin (b. Sept. 14, 1883, Dresden, Ger.—d. Nov. 11, 1947, Heidelberg, W.Ger.), German biblical scholar and pioneer of New Testament form criticism (the analysis of the Bible's literary forms).

Dibelius was educated at several German universities and taught from 1910 to 1915 at the University of Berlin before becoming professor of New Testament exegesis and criticism at Heidelberg, a post he held until his death. His major work, *Die Formgeschichte des Evangeliums* (1919; "Form Criticism of the Gospels"; Eng. trans., *From Tradition to Gospel*), presented an analysis of the Gospels in terms of oral traditions. The earliest form of the Gospels, he proposed, consisted of short sermons; the needs of the Christian community determined the development of written Gospels from these early preachings. His analysis of the Acts of the Apostles showed that the Gospel-writer Luke had access to written records of St. Paul and may have been Paul's companion.

Throughout his writings, Dibelius pursued the origins of ethical statements found in the New Testament and other early Christian writings. His approach was well-received in Germany, and all of his major works were translated into English.

dibenzazepine, any member of a class of chemical compounds (including the drugs imipramine and desipramine) introduced into medicine in the 1960s as antidepressant drugs. Imipramine was the first tricyclic (three-ringed) antidepressant introduced, and several other dibenzazepines and dibenzazepine derivatives (as amitriptyline, desipramine, nortriptyline, and protriptyline) followed. They are usually administered orally, also sometimes by injection. During the 1960s they became widely prescribed.

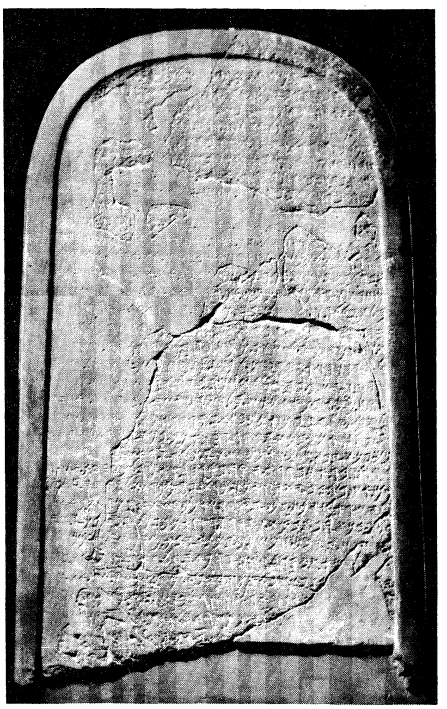
Dibich-Zabalkansky, Ivan Ivanovich: *see* Diebitsch, Johann (Karl Friedrich Anton), Graf.

Dibner, Bern (b. Aug. 18, 1897, Lisianka, Ukraine, Russian Empire—d. Jan. 6, 1988, Wilton, Conn., U.S.), American engineer and historian of science.

Dibner arrived in the United States in 1904. After graduating from the Polytechnic Institute of Brooklyn (now Polytechnic University), New York City, in 1921, he worked with the Electric Bond and Share Company (1923–25), where he participated in work leading to the electrification of Cuba. In 1924 he founded the Burndy Engineering Company (now Burndy Corporation) to manufacture solderless electrical connectors that he had invented. He retired in 1972.

Dibner was noted as a historian of science. He established two extensive book collections—the Dibner Library of the History of Science and Technology (1975), a 10,000-volume collection now located at the Smithsonian Institution's National Museum of American History in Washington, D.C., and the Burndy Library (1935), a 40,000-volume collection in Norwalk, Conn. In 1972 the Dibner Institute for the History of Science and Technology was established at Brandeis University in Waltham, Mass.

Dibon, modern DHĪBĀN, ancient capital of Moab, located north of the Arnon River in



Cast of the Moabite Stone, front view

By courtesy of the Oriental Institute, University of Chicago

west-central Jordan. Excavations conducted there since 1950 by the archaeologists affiliated with the American School of Oriental Research in Jerusalem have uncovered the remains of several city walls, a square tower, and numerous buildings. The pottery found on the site dates from Early Bronze (*c.* 3200–*c.* 2300 BC) to Early Arabic (*c.* 7th century AD), although pottery dating from the Middle and Late Bronze ages (*c.* 2300–*c.* 1550 BC; *c.* 1550–*c.* 1200 BC) is very rare, thus adding weight to the modern assumption that a great part of Transjordan reverted to nomadism during that time.

One of the most important finds at Dibon was the discovery in 1868 of the so-called Moabite Stone, bearing an inscription of Mesha, king of Moab, about the 9th century BC; its 34-line inscription commemorates a victory over the Israelites that reestablished the independence of Moab.

dibromoethane: *see* ethylene bromide.

Dibrugarh, town, northeastern Assam state, northeastern India. Dibrugarh is situated along the Brahmaputra River and is an important commercial centre, a port, and a rail terminus. Its industries include tea processing and rice and oilseed milling. The Assam Medical College, a law college, and other colleges are affiliated with Dibrugarh University. The town is served by Mohanbāri airfield, 12 miles (19 km) east. Dibrugarh suffered heavy damage from an earthquake in 1950.

North of Dibrugarh, the Dihāng River turns southwestward, where it is joined by the Dibāng and Luhit rivers; from this confluence the river is known as the Brahmaputra. East of Dibrugarh lie part of the Assam Himalayas. The area in which Dibrugarh is situated receives heavy rainfall and is often subject to flooding. Tea growing is among the most important agricultural activities. Petroleum production and coal mining are also carried on in the region on a modest scale. Pop. (1971) 80,348.

Consult the INDEX *first*

dibs (game): *see* jackstones.

Dibutades (Greek sculptor): *see* Butades of Sicyon.

Dicaearchus (fl. *c.* 320 BC), Greek Peripatetic philosopher of Messina in Sicily, a pupil of Aristotle and a scholar of wide learning who influenced such people as Cicero and Plutarch. He spent most of his life in Sparta. Neglecting systematic philosophy, he cultivated special branches of knowledge, including the history of literature and of music, biography, political science, and geography. He also wrote *Bios Hellados* ("Life of Greece"), a history of Greek civilization from its beginning.

Dicaeidae, songbird family, of the order Passeriformes, including the diamondbird and flowerpecker (*qq.v.*) groups.

dicastery, a judicial body in ancient Athens. Dicasteries were divisions of the Heliaea from the time of the democratic reforms of Cleisthenes (*c.* 508–507 BC), when the Heliaea was transformed from an appellate court to the court with original jurisdiction. Annually 6,000 citizens were chosen to sit on dicasteries, or court panels, and probably represented a cross section of the free population. Each group of about 500 dicasts (about 200 in matters of private law) constituted a court for the entire year. In more important cases, several dicasteries might be combined. The verdict was determined by majority vote; a tie vote acquitted.

Litigants usually spoke for themselves, though advocates could also speak on behalf of a defendant. Before *c.* 378 BC, evidence was presented orally; thereafter, a written brief was read before the court by its clerk. Once they had been determined, verdicts were not subject to appeal or revision. The presiding officer of the court supervised only procedural matters; the dicasts were judges of both law and fact and voted on the verdict without discussion among themselves.

The dicastery system has been defended on the grounds that the large number of dicasts provided solidarity against intimidation, lessened the chances of bribery, and made the administration of justice a more democratic process.

dice, singular DIE, small cubes used as implements for gambling and the playing of social games. Each side of a standard die is marked with from one to six small dots (spots). The spots are arranged in conventional patterns and placed so that together with the spots on the opposite sides they always total seven: one and six, two and five, three and four. The combinations of the six spots plus the number of dice in play determine the mathematical probabilities.

In most games played with dice, the dice are thrown (rolled, flipped, shot, tossed, or cast) from the hand or from a receptacle called a dice cup, in such a way that they will fall at random. The spots that face upward when the dice come to rest are the deciding spots. The combined number of the spots on the topmost surfaces of the dice decides, according to the rules of the game being played, whether the thrower (called the shooter) wins, loses, continues to throw, or loses possession of the dice to another shooter.

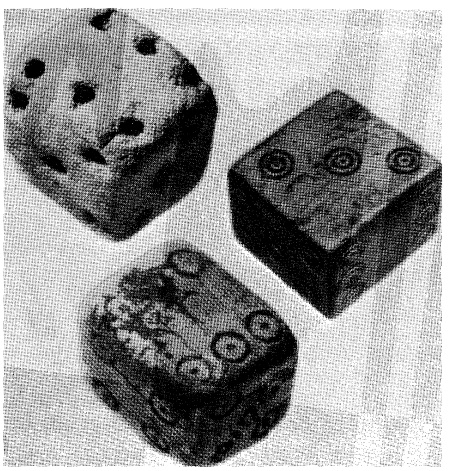
For individual dice games, *see* Craps; Bank Craps; Barbooth; Chuck-a-Luck; Grand Hazard; Hazard.

History. Sophocles reported that dice were invented by one Palamedes, a Greek, during the siege of Troy, while Herodotus maintained that they were invented by the Lydians in the days of King Atys. Both "inventions" have been discredited by numerous archaeological finds demonstrating that dice were used in many earlier societies. Dice were originally magical devices that primitive people used for the casting of lots to divine the future. The probable forerunners of dice were knucklebones (the anklebones of sheep) marked on four faces.

The people of many early cultures, including those of the North American Indian, the Aztec and Maya, the South Sea islander, the Eskimo, and the African, gambled with dice of many materials and curious shapes and markings. Dice have been made of plum and peach stones; seeds; buffalo, caribou, and moose bone; deer horn; pebbles; pottery; walnut shells; and beaver and woodchuck teeth. In later Greek and Roman times, although most dice were made of bone and ivory, others were of bronze, agate, rock crystal, onyx, jet, alabaster, marble, amber, porcelain, and other materials.

Cubical dice with markings practically equivalent to those of modern dice have been found in Chinese excavations from 600 BC and in Egyptian tombs dating from 2000 BC. In India, more than 2,000 years ago, the first written records of dice are found in the ancient Sanskrit epic the *Mahābhārata.* Pyramidal, pentahedral, and octahedral dice with a great variety of face designs also are and have been used.

Dice are the oldest gaming implements known to man, and countless games are and



(Top) Egyptian die, reputed to be from the tomb of Osiris, Abydos, Egypt; (right and bottom) Etruscan dice, *c.* 7th–6th century BC, from Chiusi, Italy

By courtesy of the Department of Anthropology, Smithsonian Institution, Washington D.C.

have been played with them. In Backgammon and hundreds of board games two or more dice are thrown to determine moves.

Manufacture. Modern dice are almost all made of a cellulose or other plastic material. There are two kinds, perfect, or casino dice made by hand and true to a tolerance of .0005 inch (.0013 centimetre), which are used mostly in gambling casinos to play Craps, and round-cornered, or imperfect, dice called drug-store or candystore dice, which are machine made and are generally used to play social and board games.

Cheating with dice. Dice specially made for cheating have been found in the tombs of ancient Egypt and the Orient and in prehistoric graves of North and South America. Any die that is not a perfect cube will not act according to correct mathematical odds and is called a shape. Shapes are cubes that have been shaved down on one or more sides so that they are slightly brick-shaped and will tend to settle down most often on their larger surfaces. Shapes are the most common of all crooked dice. Loaded dice when measured with calipers may prove to be perfect cubes, but extra weight just below the surface on some sides will make the opposite sides come up more often than they should.

Dice with one or more faces each duplicated on its opposite side and certain numbers omitted will produce some numbers in disproportionate frequency and never produce certain others; for example, two dice marked respectively with duplicates of 3–4–5, and 1–5–6 can never produce combinations totalling 2, 3, 7 or 12, which are the only combinations with which one can lose in the game of Craps. Such dice, called tops and bottoms, are used as a rule only by accomplished dice cheats, who introduce them into the game by sleight of hand. Since it is impossible to see more than three sides of a cube at any one time, tops and bottoms are unlikely to be detected by the inexperienced gambler.

Dicentra, genus of flowering plants of the fumitory family (Fumariaceae) including such popular wild garden representatives as bleeding heart, Dutchman's-breeches, and squirrel corn (*qq.v.*).

Dicey, Albert Venn (b. Feb. 4, 1835, near Lutterworth, Leicestershire, Eng.—d. April 7, 1922, Oxford), jurist whose work *Lectures Introductory to the Study of the Law of the Constitution* (1885) is itself considered part of the British constitution, which is an amalgam of several written and unwritten authorities. For this treatise he drew on his knowledge of constitutionalism in the United States as well as in Great Britain.

Dicey taught law at Oxford (1882–1909) and served as principal of the Working Men's College, London (1899–1912). Between 1886 and 1913 he wrote four books opposing Home Rule for Ireland. In 1905 he published his *Lectures on the Relation Between Law and Public Opinion in England During the Nineteenth Century.*

dichlorobenzene, any of three isomeric substances belonging to the family of organic halogen compounds, produced by the chlorination of benzene or chlorobenzene in the presence of iron(III) chloride; all three are colourless, denser than water, and insoluble in it.

The reaction of benzene with chlorine in the presence of iron(III) chloride replaces the hydrogen atoms by chlorine atoms. The first product is chlorobenzene (C_6H_5Cl); and continued treatment with chlorine leads to *ortho*- and *para*-dichlorobenzene ($C_6H_4Cl_2$), but very little of the *meta* isomer is formed. The *ortho* and *para* isomers can be separated by fractional freezing: upon cooling the mixture, the *para* isomer crystallizes while the *ortho* isomer remains liquid and drains away; *meta*-dichlorobenzene may be prepared from the other isomers by heating them under pressure with aluminum chloride. When the chlorination is conducted under strong illumination and without iron(III) chloride or a similar catalyst, the reaction yields benzene hexachloride (*q.v.*) instead of chlorobenzene or polychlorobenzenes.

Ortho- or 1,2-dichlorobenzene is a mobile liquid that is used as a solvent, as an insecticide, and in the manufacture of other chemicals, particularly dyestuff intermediates. *Meta-* or 1,3-dichlorobenzene also is a liquid. *Para-* or 1,4-dichlorobenzene is a crystalline solid that has a strong camphor-like odour and is widely used as a moth repellent. The most easily isolated of the dichlorobenzenes, it was first described in 1864; the *ortho* and *meta* isomers were not recognized until 1875.

dichlorodiphenyltrichloroethane: *see* DDT.

dichloromethane: *see* methylene chloride.

Dichondra, also called LAWN-LEAF, any of several species of low, creeping plants of the morning glory family (Convolvulaceae) that are used in warm climates as grass substitutes. The plants are from 2½ to 8 centimetres (1 to 3 inches) high and spread by runners.

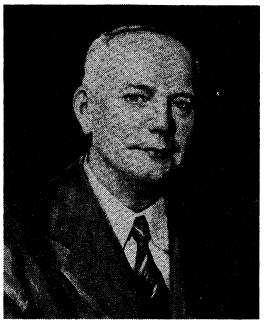
D. carolinensis, native to southeastern North America, is so similar to the Old World *D. repens* that it is sometimes given as *D. repens* variety *carolinensis.* Its round, bright-green leaves, indented where they join the long stalks, are 2 cm broad.

dichotomy (from Greek *dicha,* "apart," and *tomos,* "cutting"), a technical term for a form of logical division consisting in the separation of a class into two subclasses, one of which has and the other has not a certain quality or attribute. Men thus may be divided into professional men and men who are not professionals; each of these may be subdivided similarly. On the principle of contradiction this division is both exhaustive and exclusive; there can be no overlapping, and no members of the original genus or the lower groups are omitted. This method of classification, though formally accurate, has slight value in the exact sciences, partly because at every step one of the two groups is merely negatively characterized and is usually an artificial, motley class; but it sets forth clearly the gradual descent from the most inclusive genus (*summum genus*) through species to the lowest class (*infima species*), which is divisible only into individual persons or things.

In astronomy the term is used for the aspect of the Moon or of a planet when apparently half illuminated, so that the illuminated part of its disk has the form of a semicircle.

dichroite (mineral): *see* cordierite.

Dick, George Frederick (b. July 21, 1881, Fort Wayne, Ind., U.S.—d. Oct. 10, 1967, Palo Alto, Calif.), U.S. physician and pathologist who, with his wife, Gladys Henry Dick, discovered the cause of, and devised means of preventing, scarlet fever.



Dick, detail of a portrait by an unknown artist

By courtesy of the Department of Special Collections, the University of Chicago Library

Dick studied scarlet fever while serving in the Army Medical Corps in World War I. After the war he was professor of clinical medicine at Rush Medical College, Chicago (1918–33), and head of the department of medicine at the University of Chicago (1933–45).

In 1923 he and his wife isolated the hemolytic streptococcus that causes scarlet fever, prepared the toxin (Dick toxin) used for immunization, and devised the Dick method for prevention of the disease by toxin–antitoxin injection. In 1924 they developed the Dick skin test for susceptibility to scarlet fever.

dickcissel (*Spiza americana*), American bird usually placed in the subfamily Cardinalinae of the family Fringillidae (the Emberizidae of some authors). The male dickcissel—named for its song—is a streaky brown bird 16 centimetres (6½ inches) long, with a black bib on its yellow breast, looking somewhat like a miniature meadowlark. Dickcissels are

Dickcissel (*Spiza americana*)

Thase Daniel

seedeaters. They breed in weedy fields of the central United States and winter in northern South America; some stray to the U.S. Atlantic coast in winter.

Dicke, Robert H(enry) (b. May 6, 1916, St. Louis, Mo., U.S.), U.S. physicist noted for his theoretical work in cosmology and investigations centring on the general theory of relativity. He also made a number of significant contributions to radar technology and to the field of atomic physics.

During the early 1940s Dicke and other researchers at the Massachusetts Institute of Technology (MIT) played a key role in the development of microwave radar. He himself invented various microwave-circuit devices and radar systems, including mono-pulse radar and coherent pulse radar. In 1944 he developed a microwave radiometer that has become an integral component of most modern radio telescopes. For the next 10 years or so, Dicke devoted much attention to microwave atomic spectroscopy, conducting extensive research on fundamental radiation processes. His work led him to formulate what is often considered the first quantum theory of the emission of coherent radiation. (This type of radiation consists of electromagnetic waves, such as those in a beam of laser light, that are in phase).

By the 1960s Dicke had become actively interested in gravitation. He carried out a series of studies on the subject, the most notable of which was an experiment testing the principle of equivalence (*i.e.,* that the gravitational mass of a body is equal to its inertial mass) that forms the cornerstone of Einstein's concept of gravitation—the general theory of relativity. High-precision experiments with this objective had first been performed by the Hungarian physicist Roland von Eötvös, who confirmed

the principle to an accuracy of one part in 10^8. Dicke improved upon Eötvös' accuracy by another factor of 1,000. Together with Carl Brans he investigated the idea of a changing gravitational constant, which had first been proposed in 1937 by Paul Dirac. Dicke and Brans developed a theory of gravitation in which, as a result of the expansion of the universe, the gravitational constant is not actually a constant but decreases at a rate of two parts in 10^{11} per year.

In 1964 Dicke and several colleagues hypothesized that the entire universe is pervaded by a background radiation of microwave wavelengths—the remnant of the intense thermal radiation associated with the apparent explosive origin of the cosmos (*see* big-bang model). They were unaware that the existence of such residual radiation of the primordial fireball had been postulated some 16 years earlier by George Gamow, Ralph Alpher, and Robert Herman. Before Dicke attempted any observational work, Arno Penzias and Robert Wilson of Bell Telephone Laboratories discovered a faint glow of microwave radiation closely matching that predicted by theory.

Dicke received a bachelor's degree from Princeton University in 1939 and a doctorate from the University of Rochester in 1941. Later that same year he began work as a staff scientist at the radiation laboratory of MIT. In 1946 Dicke joined the Princeton faculty, and in 1975 he was appointed Albert Einstein Professor of Science.

Dickens, Charles (John Huffam) (b. Feb. 7, 1812, Portsmouth, Hampshire, Eng.—d. June 9, 1870, Gad's Hill, near Chatham, Kent), English novelist, generally considered the greatest of the Victorian era. His many volumes include such works as *The Old Curiosity Shop* (1841), *A Christmas Carol* (1843), *Martin Chuzzlewit* (1844), *A Tale of Two Cities* (1859), and *Great Expectations* (1861).

A brief account of the life and works of Charles Dickens follows; for a full biography, *see* MACROPAEDIA: Dickens.

The insecurity of Dickens' childhood, and in particular his labour in a squalid factory, permanently shaped his view of life and his writing. After serving as a solicitor's clerk, he worked as a reporter, successively, in the law courts, in Parliament, and on London newspapers. His career as a writer of fiction began in 1833 with short stories and essays in periodicals, and in 1837 his comic novel *The Pickwick Papers* (originally serialized in 20 monthly installments) made him the most popular author of his time in England. In *Oliver Twist, Nicholas Nickleby* (serialized 1837–39 and 1838–39, respectively), and subsequent novels in the 1840s his heightened concern with vulgarity and evil coexists with his basic optimism, which appears in perhaps its purest form in the semi-autobiographical *David Copperfield* (1850). Afterward, however, from *Bleak House* (1852–53) through *Our Mutual Friend* (1864–65), the inhuman aspect of Victorian industrial society becomes predominant, and the comic spirit, where it can be detected at all, is satirical. During this period he separated from his wife and began a protracted affair with a young actress. In 1858 he achieved great popularity for his public readings, in which his emotional involvement was intense.

Dickey, Bill, byname of WILLIAM MALCOLM DICKEY (b. June 6, 1907, Bastrop, La., U.S.), professional baseball catcher who played for the American League Yankees (1928–43, 1946), catching 100 games or more a season (1929–41), and competing in eight World Series, seven of which the Yankees won.

As a country boy, Dickey played sandlot ball, first as a pitcher. The Yankees signed him to a contract in 1925 and after three seasons of minor league play brought him up to the parent club in 1928. Dickey threw right-handed and batted left-handed and had a .313 lifetime batting average. As a catcher he was consistent and durable, at his best in big games—he caught every inning of his 38 World Series games; hit four for four in the 1938 series opener; and had a series average of .400 (.438 in the 1932 series). He had a fine knowledge of batters and could catch all kinds of pitches. He led American League catchers in fielding for six seasons. After retiring as a player he was player-manager (1946), catching coach (1949), and scout and coach (1959–60). In 1954 he was elected to the Baseball Hall of Fame. Later he sold securities in Little Rock, Ark.

Dickey, James (Lafayette) (b. Feb. 2, 1923, Atlanta, Ga., U.S.), U.S. poet, novelist, and critic best known for his poetry combining themes of nature mysticism, religion, and history and for his novel *Deliverance* (1970).

Dickey attended Clemson College, South Carolina, before serving as a fighter-bomber pilot in the U.S. Army Air Force during World War II. After the war he earned B.A. (1949) and M.A. (1950) degrees from Vanderbilt University. He reentered military service as an Air Force training officer during the Korean War.

By his own account, Dickey began writing poetry at the age of 24 with little awareness of formal poetics. After pursuing graduate studies and working for a time in advertising, he published his first book of poems, *Into the Stone,* in 1960. He travelled in Europe the following year on a Guggenheim Fellowship. He was a teacher and writer-in-residence at a number of U.S. schools, including Rice University (1950, 1952–54), Reed College (1963–64), the University of Wisconsin (1966–67), and the University of South Carolina (from 1968). From 1966 to 1968 he served as poetry consultant to the Library of Congress. In 1977 he read his poem "The Strength of Fields" at the inauguration ceremony of Pres. Jimmy Carter.

Dickey's other works include the poetry collections *Drowning with Others* (1962), *Helmets* (1964), *Buckdancer's Choice* (1965), *Poems 1957–1967* (1967), and *The Zodiac* (1976). Of his works of nonfiction prose, *Babel to Byzantium: Poets & Poetry Now* (1968), the autobiographical *Self-Interviews* (1970), and *Jericho: The South Beheld* (1974) are notable. A highly successful film version of his novel *Deliverance* was produced from Dickey's own screenplay in 1972.

His poetry is noted for its lyrical portrayal of a world in conflict—predator with prey, soldier with soldier, the self with itself.

Dickinson, city, seat (1884) of Stark County, western North Dakota, U.S., on the Heart River. Founded in 1880 on the Northern Pacific Railway and originally called Pleasant Valley Siding, it was renamed in 1883 for Wells S. Dickinson, a former New York state senator, railroad land agent, and local farmer. Early Russo-German settlers were attracted to the vicinity by a Catholic mission. Dickinson is the trading centre for a large agricultural area that produces livestock, wheat, and dairy products. Economic activities include livestock marketing and meat-packing, creameries, furniture manufacturing, an oil field, and a briquette-production plant (using lignite). Dickinson State College was opened in 1918 as a state normal school. Patterson Lake, impounded by the Dickinson Dam, a part of the reclamation plan for the Missouri River Valley, is just west. Inc. 1919. Pop. (1980) 15,924.

Dickinson, Emily (Elizabeth) (b. Dec. 10, 1830, Amherst, Mass., U.S.—d. May 15, 1886, Amherst), U.S. lyric poet who has been called "the New England mystic" and who experimented with poetic rhythms and rhymes. Almost all her poetry was published posthumously.

Emily Dickinson was the second of three children. The three remained close throughout their adult lives: her younger sister, Lavinia, stayed in the family home and did not marry, and her older brother, Austin, lived in the house next door after his marriage to a friend of Emily's. Her grandfather, Samuel Fowler Dickinson, had been one of the founders

Emily Dickinson, daguerreotype, *c.* 1847
By courtesy of The Harvard College Library

of Amherst College, and her father, Edward Dickinson, served as treasurer of the college from 1835 to 1872. A lawyer who served one term (1853–55) in Congress, Edward Dickinson was an austere and somewhat remote father, but not an unkind one. Emily's mother, too, was not close to her children.

Emily was educated at Amherst Academy and Mount Holyoke Female Seminary. Mount Holyoke, which she attended from 1847 to 1848, insisted on religious as well as intellectual growth, and Emily was under considerable pressure to become a professing Christian. She resisted, however, and although many of her poems deal with God, she remained all her life a skeptic. Despite her doubts, she was subject to strong religious feelings, a conflict that lent tension to her writings.

Emily began to write verse about 1850, apparently while under the spell of the poems of Ralph Waldo Emerson and Emily Brontë, and under the tutelage of Benjamin F. Newton, a young man studying law in her father's office. Only a handful of her poems can be dated before 1858, when she began to collect them into small, handsewn booklets. Her letters of the 1850s reveal a vivacious, humorous, somewhat shy young woman. In 1855 Emily went to Washington, D.C., with her sister to visit their father, who was serving in Congress. During the trip they stopped off at Philadelphia, where she heard the preaching of the noted clergyman, the Rev. Charles Wadsworth, who was to become her "dearest earthly friend." He was something of a romantic figure: a man said to have known great sorrow, whose eloquence in the pulpit contrasted with his solitary broodings. He and Emily exchanged letters on spiritual matters, his Calvinist orthodoxy perhaps serving as a useful foil for her own speculative reasoning. She may also have found in his stern, rigorous beliefs a welcome corrective to the easy assumption of a benign universe made by Emerson and the other Transcendentalists.

In the 1850s Emily began two of her significant correspondences—with Dr. and Mrs. Josiah G. Holland and with Samuel Bowles. The two men were editors of the *Springfield* (Massachusetts) *Republican,* a paper that took

an interest in literary matters and even published verse. The correspondence continued over the years, although in the case of the Hollands most of the letters after the 1850s went to Mrs. Holland, a woman intelligent enough to comprehend Emily's subtleties and witticisms. Emily tried to interest Bowles in her poetry, and it was a crushing blow to her that he, a man of quick mind but conventional literary tastes, failed to appreciate it.

By the late 1850s, when she was writing poems at a steadily increasing pace, Emily Dickinson loved a man whom she called "Master" in three drafts of letters. "Master" does not exactly resemble any of Emily's known friends but may have been Bowles or Wadsworth. This love shines forth in several lines from her poems: "I'm ceded—I've stopped being Theirs," "'Tis so much joy! 'Tis so much joy," and "Dare you see a Soul *at the White Heat?*" to name only a few. Other poems reveal the frustration of this love and its gradual sublimation into a love for Christ and a celestial marriage to him.

The poems of the 1850s are fairly conventional in sentiment and form, but beginning about 1860 they become experimental both in language and prosody, though they owe much to the metres of the English hymn writer Isaac Watts and to Shakespeare and the King James Version of the Bible. Emily's prevailing poetic form was the quatrain of three iambic feet, a type described in one of the books by Watts in the family library. She used many other forms as well, and to even the simpler hymnbook measures she gave complexity by constantly altering the metrical beat to fit her thought: now slow, now fast, now hesitant. She broke new ground in her wide use of off-rhymes, varying from the true in a variety of ways that also helped to convey her thought and its tensions. In striving for an epigrammatic conciseness, she stripped her language of superfluous words and saw to it that those that remained were vivid and exact. She tampered freely with syntax and liked to place a familiar word in an extraordinary context, shocking the reader to attention and discovery.

On April 15, 1862, Emily Dickinson wrote a letter, enclosing four poems, to a literary man, Thomas Wentworth Higginson, asking whether her poems were "alive." Higginson, although he advised Emily not to publish, recognized the originality of her poems and remained her "preceptor" for the rest of her life. After 1862 Emily Dickinson resisted all efforts by her friends to put her poems before the public. As a result, only seven poems were published during her lifetime, five of them in the *Springfield Republican.*

The years of Emily Dickinson's greatest poetic output, about 800 poems, coincide with the Civil War. Although she looked inward and not to the war for the substance of her poetry, the tense atmosphere of the war years may have contributed to the urgency of her writing. The year of greatest stress was 1862, when distance and danger threatened Emily's friends—Samuel Bowles, in Europe for his health; Charles Wadsworth, who had moved to a new pastorate at the Calvary Church in San Francisco; and T.W. Higginson, serving as an officer in the Union Army. Emily also had persistent eye trouble, which led her, in 1864 and 1865, to spend several months in Cambridge, Mass., for treatment. Once back in Amherst she never travelled again and after the late 1860s never left the boundaries of the family's property.

After the Civil War, Emily Dickinson's poetic tide ebbed, but she sought increasingly to regulate her life by the rules of art. Her letters, some of them equal in artistry to her poems, classicize daily experience in an epigrammatic style. For example, when a friend affronted Emily by sending a letter jointly to her and her sister, she replied: "A Mutual plum is not a plum. I was too respectful to take the pulp and do not like a stone." By 1870 Emily Dickinson dressed only in white and saw few of the callers who came to the homestead; her seclusion was fiercely guarded by her devoted sister. In August 1870 Higginson visited Amherst and described Emily as "a little plain woman" with reddish hair, dressed in white, bringing him flowers as her "introduction" and speaking in a "soft frightened breathless childlike voice."

Her later years were marked with sorrow at the deaths of many people she loved. The most prostrating of these were the deaths of her father in 1874 and her eight-year-old nephew Gilbert in 1883, which occasioned some of her finest letters. She also mourned the loss of Bowles in 1878, Holland in 1881, Charles Wadsworth and her mother in 1882, Otis P. Lord in 1884, and Helen Hunt Jackson in 1885. Lord, a judge from Salem, Mass., with whom Emily fell in love about 1878, had been the closest friend of Emily's father. Emily's drafts of letters to Lord reveal a tender, mature love, which Lord returned. Jackson, a poet and popular novelist, discerned the greatness of Emily's poetry and tried unsuccessfully to get her to publish it.

Soon after her death her sister Lavinia determined to have Emily's poems published. In 1890 *Poems by Emily Dickinson,* edited by T.W. Higginson and Mabel Loomis Todd, appeared. Other volumes of Dickinson poems, edited chiefly by Mabel Loomis Todd, Martha Dickinson Bianchi (Emily's niece), and Millicent Todd Bingham, were published between 1891 and 1957, and in 1955 Thomas H. Johnson edited all the surviving poems and their variant versions.

The subjects of Emily Dickinson's poems, expressed in intimate, domestic figures of speech, include love, death, and nature. The contrast between her quiet, secluded life in the house in which she was born and died, and the depth and intensity of her terse poems, has provoked much speculation about her personality and personal relationships. Her 1,775 poems and her letters, which survive in almost as great a number, reveal a passionate, witty woman and a scrupulous craftsman who made an art not only of her poetry but also of her correspondence and her life.

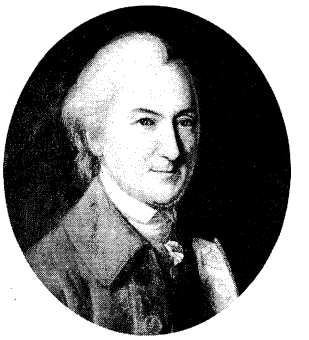
(D.J.M.H.)

MAJOR WORKS. No collection of poems by Emily Dickinson was published in her lifetime. The first selection, *Poems by Emily Dickinson* (1890), was followed by *Poems: Second Series* (1891), and *Poems: Third Series* (1896). Additional poems were included in *Letters of Emily Dickinson,* 2 vol. (1894). Later volumes of poems were: *The Single Hound: Poems of a Lifetime* (1914), *Further Poems of Emily Dickinson: Withheld from Publication by Her Sister Lavinia* (1929), *Unpublished Poems of Emily Dickinson* (1935), and *Bolts of Melody: New Poems of Emily Dickinson* (1945).

BIBLIOGRAPHY. S.T. Clendenning, *Emily Dickinson: A Bibliography, 1850–1966* (1968), is the most recent and most comprehensive bibliography. The great majority of Dickinson manuscripts, both poems and letters, are in the libraries of Harvard University and Amherst College. Emily Dickinson's home, the property of Amherst College, contains some memorabilia. The basic text of the poems is *The Poems of Emily Dickinson, Including Variant Readings Critically Compared with All Known Manuscripts,* 3 vol., ed. by T.H. Johnson (1955); *Final Harvest: Emily Dickinson's Poems* (1962), 2 vol. ed. by Johnson. *Acts of Light* (1980), a selection of poems with paintings by Ekholm Burket and an appreciation by Jane Langton, marked the Dickinson 150th anniversary. The most complete edition of the letters is *The Letters of Emily Dickinson,* 3 vol., ed. by T.H. Johnson and Theodora Ward (1958). There is as yet no definitive biography of Emily Dickinson. Biographical studies include: M.T. Bingham, *Emily Dickinson's Home: Letters of Edward Dickinson and His Family* (1955), the best account to date of Emily Dickinson's early years; T.H. Johnson, *Emily Dickinson: An Interpretive Biography* (1955), an extended critical biography; Jay Leyda, *The Years and Hours of Emily Dickinson,* 2 vol. (1960), a day-by-day guidebook to the life of Emily Dickinson; and Richard B. Sewall, *The Life of Emily Dickinson,* 2 vol. (1974), portrays the relation of her life and her work. Critical studies of the poems are C.R. Anderson, *Emily Dickinson's Poetry: Stairway of Surprise* (1960); G.F Whicher, *This Was a Poet* (1938), although no longer wholly reliable as biography, is critically excellent; Jean McClure Mudge, *Emily Dickinson and the Image of Home* (1975), combines criticism and biography.

Dickinson, John (b. Nov. 8, 1732, Talbot County, Md., U.S.—d. Feb. 14, 1808, Wilmington, Del.), American statesman often referred to as the "penman of the Revolution."

He studied law in London at the Middle Temple and practiced law in Philadelphia (1757–60) before entering public life. Dickinson represented Pennsylvania in the Stamp Act Congress (1765) and drafted its declaration of rights and grievances. He won fame in 1767–68 as the author of the *Letters from a Farmer in Pennsylvania, to the Inhabitants of the British Colonies,* which appeared in many colonial newspapers. The letters helped turn opinion against the Townshend Acts (1767), under which new duties were collected to pay the salaries of royal officials in the Colonies. He also denounced the establishing of the American Board of Customs Commissioners at Boston to enforce the acts.



John Dickinson, portrait by Charles Willson Peale, 1770; in Independence National Historical Park, Philadelphia

By courtesy of the Independence National Historical Park Collection, Philadelphia

Dickinson was a delegate from Pennsylvania in the Continental Congress (1774–76) and was the principal author of the "Declaration . . . Setting Forth the Causes and Necessity of Their Taking Up Arms." He helped prepare the first draft of the Articles of Confederation (1776–77) but voted against the Declaration of Independence (1776) because he still hoped for conciliation with the British. Although he was accused of being a Loyalist, he later served in the patriot militia.

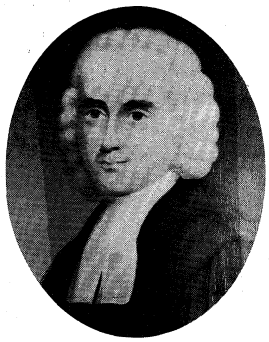
As a delegate from Delaware to the Federal Constitutional Convention (1787), he signed the U.S. Constitution and worked for its adoption. He later defended the document in a series of letters signed "Fabius."

Dickinson College at Carlisle, Pa., chartered in 1783, was named in his honour.

Dickinson, Jonathan (b. April 22, 1688, Hatfield, Mass., U.S.—d. Oct. 7, 1747, Elizabethtown, N.J.), prominent Presbyterian clergyman of the American colonial period and the first president of Princeton University.

Joining the newly founded Presbyterian body in the Middle Colonies in 1717, he soon became a leader in theological thought and debate. When in 1721–29 its synod deliberated over adoption of a constitution, it was largely through Dickinson's efforts that the undefined powers were given to the presbyteries rather

than to the synod, or central body. When the two factions, known as the Old Side and the New Side, differed over the extent to which ministers must accept creedal statements, he



Jonathan Dickinson, oil painting by Edward Ludlow Mooney; in Nassau Hall, Princeton University
By courtesy of Princeton University

proposed a compromise that proved unacceptable, and controversy ensued. The church was further plagued by differences of opinion on the Great Awakening revival of the 1730s and '40s; Dickinson, after some hesitation, gave his support to the group that approved the new movement. In 1746 the New Side founded the College of New Jersey (later Princeton University), and Dickinson served as its first president for the brief period before his death.

dickite, clay mineral, a form of kaolinite (*q.v.*).

Dickson, Carr, also called CARTER DICKSON (American author): *see* Carr, John Dickson.

Dickson, David (b. July 6, 1809, Hancock county, Ga., U.S.—d. Feb. 18, 1885, Hancock county), American farmer and writer on agriculture.

Dickson's father, Thomas, moved from Virginia to Georgia soon after the American Revolutionary War. As a young man, David Dickson received a patrimony, which he used to establish himself as a trader. He and a partner opened a store in Sparta, the seat of Hancock county, in 1835. Eleven years later he sold his business and purchased land, equipment, livestock, and slaves and began to farm. His emphasis on efficiency in organization and labour were remarkable, and some of his methods of farming were original; he was the first to introduce to the South the use of guano as a fertilizer. Dickson's private correspondence as well as his careful records and his letters to farming journals were a great influence on agricultural practices in the cotton-growing states. He wrote on a variety of subjects from seed selection to the advisability of mixed (rather than single-crop) farming.

After the American Civil War began, Dickson used his land to grow provisions for the Confederate Army. Though he lost much of his land in General William Tecumseh Sherman's "March to the Sea," Dickson prospered once more after the war. He is noted for having bred a variety of cotton called "Dickson's Select." In 1870 his writings were published as *A Practical Treatise on Agriculture: to Which is Added the Author's Published Letters.*

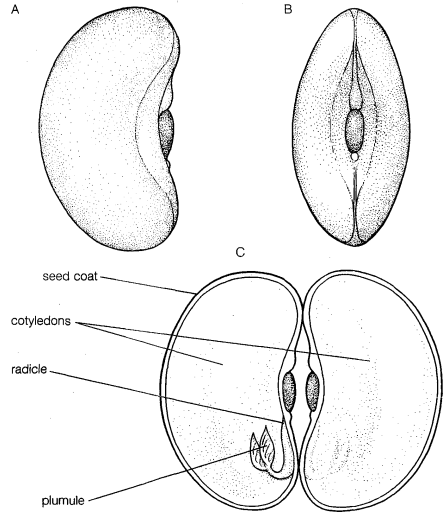
Dickson, John Robinson (b. Nov. 15, 1819, Dungannon, Northern Ireland—d. Nov. 23, 1882, Wolfe Island, near Kingston, Lower Canada [now Ontario, Can.]), medical doctor and educator who was instrumental in establishing organized medical training in Canada.

Dickson's family immigrated to Upper Canada in 1837, a move that interrupted his medical studies in Glasgow, Scot. He studied for one term at the University of New York, receiving his M.D. degree in 1842. He then returned to Canada and opened a practice in Kingston. Together with a group of colleagues, Dickson proposed a plan for the establishment of a faculty of medicine at Queens College in Kingston; in 1855 the faculty was organized, and Dickson was appointed to teach the principles and practice of surgery. Dickson and others left Queens in 1864 in a dispute with the trustees. Within two years they had established the Royal College of Physicians and Surgeons of Kingston. Dickson also served as the first president of the Council of Medical Education and Registration of Upper Canada. He retired in 1881.

Dickson, Leonard Eugene (b. Jan. 22, 1874, Independence, Iowa, U.S.—d. Jan. 17, 1954, Harlingen, Texas), American mathematician who made important contributions to the theory of numbers and the theory of groups.

Appointed associate professor of mathematics at the University of Texas at Austin in 1899, Dickson joined the staff of the University of Chicago in 1900, where he remained until 1939. A prolific mathematician, Dickson published the first extensive work on the theory of finite fields and expanded the Wedderburn and Cartan theories of linear associative algebras. One of his most-engrossing studies concerned the relationships between the theory of invariants and number theory. Using the analytic results of the Russian mathematician Ivan M. Vinogradov, he proved the ideal Waring theorem in his investigations of additive number theory. Of his 18 published books, the most monumental is *History of the Theory of Numbers,* 3 vol. (1919–23).

dicotyledon, byname DICOT, any plant of the class Magnoliopsida (magnoliatae, Dicotyledones), the larger of the two great groups (the smaller is the Liliopsida, or Monocotyledones) of flowering plants, or angiosperms. Most common garden plants, shrubs and trees, and broad-leafed flowering plants such as mag-



Dicotyledon bean seed
(A) side, (B) edge, (C) opened embryo

nolias, roses, geraniums, and hollyhocks are dicots. Most of them are characterized by the presence of a pair of seed leaves, or cotyledons, in the embryo contained in the seed.

Dicots typically also have flower parts (sepals, petals, stamens, etc.) based on a plan of four or five, or multiples thereof, although there are exceptions. The leaves are net-veined in most, which means the vessels that conduct water and food show a meshlike pattern. In the stems the vessels are usually arranged in a continuous ring near the stem surface. About 50 percent of all dicots are woody; they show an annual increase in stem diameter as a result of the production of new tissue by the cambium, a layer of cells that remain capable of division throughout the life of these plants. Branching of stems is common, as are taproots. The microscopic pores (stomates) on the leaf surfaces are usually scattered and are in various orientations. The pollen grains typically have three germinal furrows or pores (tricolpate condition), except in the more primitive families.

dictating machine, device for recording, storage (usually brief), and subsequent reproduction (usually by typewriter or word-processing system) of spoken messages. Dictating machines may be either mechanical or magnetic and may record the voice on wire, coated tape, or plastic disks or belts, which can be removed from the machine after dictation and forwarded to the point of transcription. The transcribing machine reproduces the dictated message in voice form. Early dictating machines were mechanical and, as in Thomas A. Edison's original invention, phonographically recorded the sound waves of the human voice on a wax cylinder; a similar device played the record back for transcription. Later adaptations used plastic disks and belts, and upon the development of magnetic wire and then tape recording, loops of wire and magnetic disks and belts were used to record. Microelectronic and solid-state developments have made possible significant reductions in size of both the dictating and playback equipment and the disks or cassettes used. The playback device used by the transcribing typist usually is operated by foot controls.

dictator, in the Roman Republic, a temporary magistrate with extraordinary powers, nominated by a consul on the recommendation of the Senate and confirmed by the Comitia Curiata (a popular assembly). The dictatorship was a permanent office among some of the Latin states of Italy, but at Rome it was resorted to only in times of military, and later internal, crises. The dictator's term was set at six months, although he customarily laid down his powers as soon as the crisis passed. The consuls and other magistrates continued in office during a dictatorship but were subject to the dictator's authority. By the 3rd century BC the limited term of a dictatorship rendered it impracticable in operations outside of Italy. Moreover, by 300 BC the people had secured the limitation of dictatorial powers by subjecting their use to the right of appeal. Dictators were then named for lesser functions such as the holding of elections in certain cases.

The Carthaginian invasion in the Second Punic War (218–201 BC) spurred a temporary revival of the office, but after 202 no dictators were chosen for any purpose. The dictatorships conferred upon Sulla and Julius Caesar in the last decades of the republic, in the 1st century BC, did not indicate a revival of the former office but the development of an extraconstitutional office with virtually unlimited powers. The term of office was lengthened until Caesar acquired dictatorial powers for 10 years in 46 and for life immediately before his assassination in 44 BC, when the office was abolished. *See also* tyrant.

dictatorship of the proletariat, in Marxist thought, rule by the proletariat (the economic and social class consisting of industrial workers who derive income solely from their labour) during the transitional phase between the abolition of the capitalist system and the establishment of Communism. During this transition the proletariat is to suppress bourgeois resistance to its socialist revolution, destroy the social relations of production underlying the class system, and create a classless society.

Originally conceived by Karl Marx as a dictatorship by the majority class, it became in Russia (after October 1917) a dictatorship of a political party that claimed to represent the proletariat.

diction, choice of words, especially with regard to correctness, clearness, or effectiveness.

Any of the four generally accepted levels of diction—formal, informal, colloquial, or slang—may be correct in a particular context but incorrect in another or when mixed unintentionally. Most ideas have a number of alternate words that the writer can select to suit his purposes. "Children," "kids," "youngsters," "youths," and "brats," for example, all have different evocative values.

The widest scope for literary style is offered at the level of word choice. Phrases such as "the little house," "the diminutive house," and "the petite house" have overlapping or synonymous meanings; but "little" may suggest endearment as well as size; "diminutive," good construction; and "petite," prettiness. Samuel Johnson, who believed that great thoughts were always general and that it was not the business of poets to "number the streaks of the tulips," habitually used general, abstract, non-emotive words: "This quality of looking forward into futurity seems the unavoidable condition of a being whose motions are gradual, and whose life is progressive" (*The Rambler,* 1750). Most modern writers, however, prefer particular, concrete, and emotive words and take advantage of the evocative values of technical, dialect, colloquial, or archaic terms when it suits their purpose. George Meredith used the archaic "damsel" to suggest the immaturity of a heroine; Ronald Firbank, in "Mrs. Henedge lived in a small house with killing stairs just off Chesham Place" (*Vainglory,* 1915), uses "killing" colloquially, in contrast to the standard words around it.

dictionary, reference book that lists words in order and gives their meanings. In dictionaries of Western languages, the words are given in alphabetic order. In addition to its basic function of defining words, a dictionary may provide information about their pronunciation, grammatical forms and functions, etymologies, syntactic peculiarities, variant spellings, conventional abbreviations, and synonyms and antonyms. A dictionary may also provide quotations illustrating a word's use, and these may be dated to show the earliest known uses of the word in specified senses. The word *dictionary* itself comes from the Latin *dictio,* "the act of speaking," and *dictionarius,* "a collection of words." It can be said that dictionaries define words while encyclopaedias define things, though there are many encyclopaedias that use the word *dictionary* in their name (*e.g.,* biographical dictionaries).

A brief treatment of dictionaries follows. For full treatment, *see* MACROPAEDIA: Encyclopaedias and Dictionaries.

The initial impetus for making dictionaries differed slightly from current principles. The early emphasis was less on making inventories of current word usage than on explaining changes or differences of meaning over centuries and among languages. Greeks in the first century AD made dictionaries to explain obsolete words from their rich literary past. Latin also was preserved in dictionaries, which were of considerable value because most scholarly work in Europe during the Middle Ages was done in Latin. So influential was one such dictionary, compiled by Ambrogio Calipino in 1502, that the name calepin was often substituted for the word dictionary.

The close juxtaposition of so many languages in Europe led to the appearance of many bilingual and polyglot (consisting of several languages) dictionaries from the early Middle Ages. Examples of certain words in the 7th and 8th centuries are the earliest records of English, and for a long while, bilingual dictionaries provided the best explanations of English words. In the 16th and 17th centuries, works appeared combining French, English, Italian, Latin, Spanish, and Welsh in assorted variations. These works reflect the interest in and traffic with continental cultures and the Renaissance enthusiasm for classical literature. One result was the influx into English of many Greek- and Latin-derived words.

The movement to produce an English dictionary was partly prompted by a desire for wider literacy, so that common people could read Scripture, and partly by a frustration of the educated that no regularity in spelling existed for the English language. Robert Cawdrey borrowed heavily from several earlier sources to make his *A Table Alphabetical* (1604), a 3,000-word list considered to be the first purely English dictionary. Other notable works of the period were John Bullokar's *An English Expositor* (1610) and Henry Cockeram's *The English Dictionarie* (1623), which was the first to actually use the word in its title. Subsequent English dictionaries built on their predecessors and added innovations such as the inclusion of cant and dialect (Coles, 1676); stressing of word origins, or etymology (Blount, 1656); an abridged dictionary (Kersey, 1708); and accents for pronunciation (Bailey, 1727). In general, English dictionaries were thought to be inferior to those on the Continent.

In 1746–47, with the backing of some prominent publishers, the poet and critic Samuel Johnson undertook the most ambitious English dictionary to that time and compiled a list of 43,500 words. The work was fastidious in discerning different senses for words and included 118,000 judiciously chosen illustrative quotations from the best literature of the language. Like many persons both before and after him, Johnson worried that changes in a language caused it to decay and hoped that a dictionary would check that decay. He realized as he worked that "language is the work of man, of a being from whom permanence and stability cannot be derived." The makers of dictionaries, lexicographers, can only describe current and past language; they cannot prescribe its use.

The spirit that recognized the changes and variations within language led to Noah Webster's dictionary of Americanisms in the early 19th century. Along the same lines was a dictionary of Scotland's language by John Jamieson that used as its source the everyday speech of common people. A further development in the 19th century was the work of philologists like Jacob Grimm and Franz Bopp, who found a systematic connection between most European languages and Sanskrit. The resulting discovery of the Indo-European family of languages changed the nature of etymology.

By the end of the 19th century the immense *Oxford English Dictionary* (*OED*), meant to be a definitive inventory of the English language, was underway. Between 1879 and 1928, when it was finally finished, 15,000 pages, using 1,827,306 illustrative quotations, were compiled. Similar works have been completed in France, Italy, and Germany. The monumental task posed by these immense inventories is updating them as the language changes.

The modern dictionary remains a difficult undertaking, beginning with the task of choosing a word list that will serve its readers well. In the field of science, words are continually coming into existence, and to name even all existing species of living creatures would be prohibitive (there are more than one million known insect species). Lexicographers have come to be regarded as the guardians of the language, which they are not. Language is, by nature, an ever-changing human phenomenon, but social and sometimes political pressures often force dictionary publishers to tailor word lists according to societal preferences. Pronunciation, for example, is enormously variable among speakers, but some guide is necessary because the phonetics of so many English words is variable. In general, the standard dictionary today will provide some uniformity in spelling, aid to pronunciation, a sense of a word's grammatical applications, sense meanings, illustrative quotations, a label that indicates a level of acceptibility (for example, regional dialect or vulgar usage), and a word's etymology.

There are various levels of dictionaries, general-purpose being most common. Scholarly dictionaries such as the *OED* are more thorough and include exhaustive etymologies as well as obsolete words. Specialized dictionaries cover narrow fields of knowledge, though their contents are still arranged by alphabetic order.

Dictionary of American English on Historical Principles, A (DAE), four-volume dictionary designed to define usage of words and phrases in American English as it differed from usage in England and other English-speaking countries, as well as to show how the cultural and natural history of the United States is reflected in its language. It was published from 1936 to 1944. Compiled under the editorship of Sir William A. Craigie, who had been a coeditor of *The Oxford English Dictionary,* and James R. Hulbert, an American professor of English, the dictionary includes American words and expressions from the period extending from the first English settlements until the end of the 19th century. It provides dated illustrative quotations for most entries.

Dictionary of Americanisms, A, two-volume dictionary of words and expressions that originated in the United States or that were first borrowed into the English language in the United States. Edited by the American scholar Mitford M. Mathews and published in 1951, the dictionary was based on historical principles and was designed to remedy the omissions and deficiencies of *The Oxford English Dictionary* and the *Dictionary of American English on Historical Principles.* Unlike the latter, which included many words of British origin, *A Dictionary of Americanisms* included only words and expressions of American origin. Sources and authorities were cited under each entry, and the pronunciations of many of the words were given.

Dictionary of the English Language, A, the famous dictionary of Samuel Johnson, published in London in 1755; its principles dominated English lexicography for more than a century. This two-volume work surpassed earlier dictionaries not in bulk but in precision of definition.

Its strength lay in two features: the original, carefully divided and ordered, elegantly formulated definitions of the main word stock of the language; and the copious citation of quotations from the entire range of English literature, which served in support and illustration and which exemplified the different shades of meaning of a particular word.

The dictionary included a history of the language, a grammar, and an extensive list of words representing basic general vocabulary, based on the best conversation of contemporary London and the normal usage of respected writers. The original was followed in 1756 by an abbreviated one-volume version that was widely used far into the 20th century.

Johnson's accomplishment was to provide for the English language a dictionary that incorporated with skill and intellectual power the prevailing ideals and resources and the best available techniques of European lexicography. It was the standard English dictionary until Noah Webster's (1828).

Dictionary of the Irish Language, authoritative dictionary of the Irish language that continues, starting with the letter D, the work of Kuno Meyer's *Contributions to Irish Lexicography* (1906–07), which covered A–C.

Based, according to its subtitle, on Old and

Middle Irish materials, it began publication in Dublin in 1913. The collection of the material, which is based on historic principles and will cover the language from its earliest period, has been administered by the Royal Irish Academy. Culled from books, manuscripts, and spoken language, entries describe the development of the meanings of words and their grammatical inflections.

In 1938 the academy began the irregular publication of fascicles continuing the work under the general heading *Contributions to a Dictionary of the Irish Language*. The academy's intent in issuing these fascicles was to make available immediately the enormous amount of material already collected and prepared for the final dictionary.

Dictionnaire alphabetique et analogique de la langue française (French: "Alphabetical and Analogical Dictionary of the French Language"), scholarly historical dictionary of the French language, which supplies for each entry etymology, definition, antonyms, synonyms, and cross-references.

Originally published in six volumes in Paris in 1951–64, the set was reissued with a supplement in 1970. In addition to containing all words accepted by the French Academy, it includes scientific and technical terms, commonly used colloquialisms, and archaic words that appear in classical French literature. Lengthy quotations from contemporary French writers demonstrate historical changes in the use of words and draw on modern-day examples to clarify usage. A one-volume abridgement was first produced in 1967 and revised and expanded in 1977.

Dictionnaire de la langue française (French: "Dictionary of the French Language"), also called DICTIONNAIRE LITTRÉ, or LITTRÉ, monumental French dictionary compiled by Maximilien-Paul-Émile Littré, a French lexicographer.

Begun in 1844 and published in four volumes from 1863 to 1873, with a supplement issued in 1877, it contained many quotations from works of literature written in the 16th–19th century, exhibiting historically the growth of the French language. In it, Littré attempted to classify precisely every sense in which a word could be used. In the arrangement of definitions, the first place is given to the most primitive meaning of the word instead of to the most common one; but other meanings follow in an order that is often logical rather than historical.

A reprint in modern format was published in 1956–58 in seven volumes, with the material from the original supplement incorporated into the alphabetization. This dictionary remains important for its history, etymology, and grammar. Other reissues appeared in 1978 (four volumes) and 1983 (four volumes and a supplement in one volume).

Dictyoclostus, genus of extinct brachiopods, or lamp shells, that were common invertebrate forms in the shallow seas of North America from the Carboniferous epoch to the Permian period (between 245 million and 360 million years ago). *Dictyoclostus* often grew to large size. Its distinctive shell is concavo-convex and is frequently highly ornamented with lines, grooves, and finely developed spines.

Dictyoclostus americanus, collected from Bennett, Neb.

By courtesy of the Buffalo Museum of Science, Buffalo, N.Y.

Dictys CRETENSIS, author of a pseudo-chronicle of the Trojan War. Dictys was supposed to have accompanied the Cretan leader Idomeneus from Knossos to the siege of Troy and to have written a pro-Greek account of the Trojan War. His manuscript was said to have been "discovered" during the 1st century AD and, by command of the Roman emperor Nero, to have been transliterated from Phoenician into Greek. Probably in the 4th century one Lucius Septimius put out a translation of Dictys' supposed eyewitness account (which in fact probably dates from the 2nd or 3rd century AD), and this fantastic work, the *Ephemeris belli Trojani,* together with a similar but pro-Trojan account by Dares Phrygius, was a major sourcebook for medieval handlings of the Trojan story.

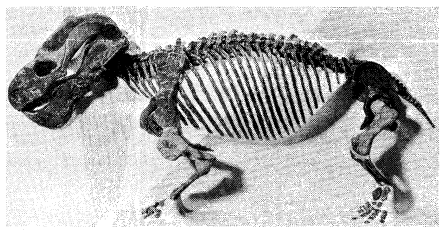
Dicuil (fl. 825, Ireland), monk, grammarian, and geographer whose work is important to the history of science and is a testament to Irish learning in the 9th century. Much of his astronomical knowledge was gained in calculating dates for religious festivals. Completed in 825, his *De mensura orbis terrae* ("Concerning the Measurement of the World") contains the earliest mention of Irish hermits having visited Iceland (795), where they marveled at the midnight sun.

The work also contains the most definite Western reference to a freshwater canal between the Nile and the Red Sea, obstructed in 767. Dicuil learned of the canal from one "Brother Fidelis," probably another Irish monk, who sailed along the "Nile" into the Red Sea—passing the "Barns of Joseph," or pyramids of Giza, which are well described. Dicuil quotes from, or refers to, 30 Greek and Latin writers as well as to the poet Sedulius, his Irish contemporary. The best edition of *De mensura* was made by G. Parthey in 1870.

dicyclopentadienyliron (chemistry): *see* ferrocene.

dicyemid, any of a class (Dicyemida) of multicellular wormlike parasites of various marine invertebrates. *See* mesozoan.

Dicynodon, extinct genus of therapsid reptiles, which once were dominant mammal-like



Dicynodon skeleton

By courtesy of the American Museum of Natural History, New York

land vertebrates, found in Middle and Late Permian deposits in southern Africa and Late Permian deposits in Europe and southern Asia (the Permian period began 286 million years ago and lasted 41 million years). The skull of *Dicynodon* was very long in the region behind the eye, with well-developed ridges that provided attachment for strongly developed jaw muscles. A toothless, beaklike structure was probably covered with a horny material that was also probably present in the remainder of the jaw. Small teeth occurred on some specimens, as did a pair of tusklike canine teeth, which may have been restricted to males. *Dicynodon,* probably herbivorous, had a massive body with strong limbs and limb girdles.

Didachē (Greek: "Teaching"), also called TEACHING OF THE TWELVE APOSTLES, the oldest surviving Christian church order, probably written in Egypt or Syria in the 2nd century. In 16 short chapters it deals with morals and ethics, church practice, and the eschatological hope (of the Second Coming of Christ at the end of time) and presents a general program for instruction and initiation into the primitive church.

Some early Christian writers considered the *Didachē* canonical, and Egyptian authors and compilers quoted it extensively in the 4th and 5th centuries. Eusebius of Caesarea quoted it in his *Ecclesiastical History* (early 4th century), and it formed the basis of chapter 7 of the 4th-century *Apostolic Constitutions,* a collection of early Christian ecclesiastical law. It was known only through such references in early Christian works until a Greek manuscript, written in 1056, was discovered in Istanbul in 1873 by the metropolitan Philotheos Bryennios. He published it in 1883. Two fragments of the work were later discovered, a 4th-century Greek papyrus in Oxyrhynchus, Egypt, and a 5th-century Coptic papyrus in the British Museum.

The *Didachē* is not a unified and coherent work but a compilation of regulations that had acquired the force of law by usage in scattered Christian communities. Evidently several pre-existing written sources were used and were compiled by an unknown editor.

Chapters 1–6 give ethical instruction concerning the two ways, of life and of death, and reflect an early Christian adaptation of a Jewish pattern of teaching in order to prepare catechumens (candidates for Christian baptism). Chapters 7–15 discuss baptism, fasting, prayer, the Eucharist, how to receive and test traveling apostles and prophets, and the appointment of bishops and deacons. Chapter 16 considers the signs of the Second Coming of the Lord.

Didelot, Charles (-Louis) (b. 1767, Stockholm—d. Nov. 7, 1837, Kiev), Swedish-born French dancer, choreographer, and teacher whose innovative work anticipated the Romantic ballet.

Following his debut in 1790 at the Paris Opera with the ballerina Madeleine Guimard, he later turned to choreography, creating several celebrated ballets, including *La Métamorphose, Flore et Zéphyre, Don Quixote,* and *Apollon et Daphné.* He is credited with important innovations, among them flying dancers via a wiring system, and with major changes in costume (supposedly introducing flesh-tinted tights for ballerinas).

From 1801 to 1811 he was ballet master and choreographer of the St. Petersburg Imperial School of Ballet (now the Soviet State School of Ballet in Leningrad). After working in London and Paris, he returned (1816) to St. Petersburg for the rest of his life, during which he produced more than 50 ballets that ventured into the Romantic milieu and applied the principles of his teacher, Jean-Georges Noverre. His own teaching method was considered revolutionary; his wife, Mme Rose (Colinette) Didelot, was also a dancer.

Diderot, Denis (b. Oct. 5, 1713, Langres, Fr.—d. July 31, 1784, Paris), French man of letters and philosopher who, from 1745 to 1772, served as chief editor of the *Encyclopédie,* one of the principal works of the Age of the Enlightenment.

Youth and marriage. Diderot was the son of a widely respected master cutler, whose worth he recognized in later life. He was tonsured in 1726, though he did not in fact enter the church, and was first educated by the Jesuits at Langres. From 1729 to 1732 he studied in Paris at the Collège d'Harcourt

or at the Lycée Louis-le-Grand or possibly at both these institutions, and he was awarded the degree of master of arts in the University of Paris on Sept. 2, 1732. He then studied law as an articled clerk in the office of Clément de Ris but was more interested in languages, literature, philosophy, and higher mathematics. Of the period 1734 to 1744 comparatively

Diderot, oil painting by Louis-Michel van Loo, 1767; in the Louvre, Paris

Giraudon—Art Resource/EB Inc.

little is known. He dropped an early ambition to enter the theatre and, instead, taught for a living, led a penurious existence as a publisher's hack, and wrote sermons for missionaries at 50 *écus* each. At one time he seems to have entertained the idea of taking up an ecclesiastical career, but it is most unlikely that he entered a seminary. Yet his work testifies to his having gone through a religious crisis, and he progressed relatively slowly from faith to deism and to atheism. That he led a disordered existence is made clear in his posthumously published novel, *Le Neveu de Rameau* ("Rameau's Nephew"). He frequented the coffeehouses, particularly the Régence and the Procope, where he met the philosopher Jean-Jacques Rousseau in 1741 and established a friendship with him that was to last for 15 years, until it was broken by a quarrel.

In 1741 he also met Antoinette Champion, daughter of a linendraper, and on Nov. 6, 1743, married her—secretly, because of his father's disapproval. The relationship, as surviving letters show, was based on romantic love, but the marriage was not a happy one owing to incompatible interests. The bond held, however, partly through a common affection for their daughter, Angélique, sole survivor of three children, who was born in 1753 and whom Diderot eventually married to Albert de Vandeul, a man of some standing at Langres. Diderot lavished care over her education, and she eventually wrote a short account of his life and classified his manuscripts. There is a bourgeois solidity about the pattern of his family life—he always kept himself informed of events at Langres, and he remained deeply attached to his sister Denise—which is in marked contrast with that of the aristocratic Voltaire and the plebeian Rousseau.

Mature career. In order to earn a living, he undertook translation work and in 1745 published a free translation of the *Inquiry concerning Virtue* by the 3rd Earl of Shaftesbury, whose fame and influence he spread in France. His *Pensées philosophiques* (1746; *Philosophic Thoughts,* 1916), an original work with new and explosive anti-Christian ideas couched in a vivid prose, contains many passages directly translated from or inspired by Shaftesbury. The proceeds of this publication, as of his allegedly indecent novel *Les Bijoux indiscrets,* were used to meet the demands of his mistress, Madeleine de Puisieux, with whom he broke a few years later during his detention at Vincennes. In 1755 he met Sophie Volland, with whom he formed an attachment that was to last more than 20 years. The liaison was founded on common interests, natural sympathy, and a deepening friendship. His correspondence with Sophie, together with his other letters, forms one of the most fascinating documents on Diderot's personality, enthusiasms, and ideas and on the intellectual society of Louise d'Épinay, F.M. Grimm, the Baron d'Holbach, Ferdinando Galiani, and other deistic writers and thinkers (Philosophes) with whom he felt most at home. Through Rousseau, Diderot met Condillac, the philosopher, and for a time the three friends dined together at the Panier Fleuri. Diderot, in his personal life, set great store by friendship as a basis for the establishment of moral values. This was brought out in his short story "Les Deux Amis de Bourbonne" ("The Two Friends of Bourbonne"), in which the Germans Goethe and Schiller were to become interested, and in the conclusion of "Ceci n'est pas un conte" ("This Is No Yarn").

The Encyclopédie. In 1745 the publisher André Le Breton approached Diderot with a view to bringing out a French translation of Ephraim Chambers' *Cyclopaedia,* after two other translators had withdrawn from the project. Diderot undertook the task with the distinguished mathematician Jean Le Rond d'Alembert as co-editor and profoundly changed the nature of the publication, broadening its scope and turning it into an important organ of radical and revolutionary opinion. He gathered around him a team of dedicated litterateurs, scientists, and even priests, many of whom, as yet unknown, were to make their mark in later life. All were fired with a common purpose: to further knowledge and, by so doing, strike a resounding blow against reactionary forces in church and state. As a *dictionnaire raisonné* ("rational dictionary"), the *Encyclopédie* was to bring out the essential principles and applications of every art and science. The underlying philosophy was rationalism and a qualified faith in the progress of the human mind. In 1749 he published the *Lettre sur les aveugles* (trans. *c.* 1750, *An Essay on Blindness*), remarkable for its proposal to teach the blind to read through the sense of touch, along lines that Louis Braille was to follow in the following century, and for the presentation of the first step in his evolutionary theory of survival by superior adaptation. This daring exposition of the doctrine of materialist atheism, with its emphasis on human dependence on sense impression, led to Diderot's arrest and incarceration in the prison of Vincennes for three months. His work on the *Encyclopédie,* however, was not interrupted for long, and in 1750 he published his *Prospectus,* which d'Alembert expanded into the momentous *Discours préliminaire* (1751). The history of the *Encyclopédie,* from the publication of the first volume in 1751 to the distribution of the final volumes of plates in 1772, was checkered, but ultimate success was never in doubt. A critical moment occurred in 1758, on the publication of the seventh volume, when d'Alembert resigned on receiving warning of trouble and after reading Rousseau's attack on his article "Genève." Another serious blow came when the philosopher Helvétius' book *De l'esprit* ("On the Mind"), said to be a summary of the *Encyclopédie,* was condemned to be burned by the Parlement of Paris; the work itself was suppressed. Untempted by Voltaire's offer to have the publication continued outside France, Diderot held on in Paris with great tenacity. His heart was nearly broken, however, by the discovery in 1764 that Le Breton had secretly removed compromising material from the corrected proof sheets of about 10 folio volumes. The censored passages, though of considerable interest, would not have made an appreciable difference on the impact of the work. To the 17 volumes of text and 11 volumes of plates (1751–72), Diderot contributed innumerable articles partly original, partly derived from varied sources, especially on the history of philosophy ("Eclectisme" ["Eclecticism"]), aesthetics ("Beau" ["The Beautiful"]), and the mechanical arts. He was an energetic general director and supervised the illustrations for 3,000 to 4,000 plates of exceptional quality, which are still prized by historians today. The completion of the *Encyclopédie* left Diderot without a source of income. To relieve him of financial worry, Catherine the Great of Russia first bought his library through an agent in Paris, requesting him to retain the books until she required them, and then appointed him librarian on an annual salary for the duration of his life. Diderot went to St. Petersburg in 1773 to thank her and was received with great honour and warmth. He wrote for her the *Plan d'une université pour le gouvernement de Russie* ("Plan of a University for the Government of Russia"). He stayed five months, long enough to become disillusioned with enlightened despotism as a solution to social ills and for his political ideas to harden, as evidenced in *Observations sur les instructions de Sa Majesté Impériale aux députés* ("Observations on Her Imperial Majesty's Instructions to Her Deputies"). It is now known that some of the most revolutionary passages in the writer and propagandist Guillaume Raynal's *Histoire des deux Indes* ("History of the Indies") actually came from Diderot's pen, as did arguments to legitimize revolution.

Philosophical and scientific works. In 1751 Diderot published *Lettre sur les sourds et muets* ("Letter on the Deaf and Dumb"), which studies the function of language and deals with points of aesthetics, and in 1754 he published the *Pensées sur l'interprétation de la nature* ("Thoughts on the Interpretation of Nature"), acclaimed as the method of philosophical inquiry of the 18th century; however, he published few other works in his lifetime. His writings, in manuscript form, were known only to his friends and the privileged correspondents of the *Correspondance littéraire,* a sort of private newspaper edited by Baron Grimm (1759–81) that was circulated in manuscript form. Among his philosophical works, special mention may be made of *L'Entretien entre d'Alembert et Diderot* ("Conversation Between d'Alembert and Diderot"), *Le Rêve de d'Alembert* ("D'Alembert's Dream"), and the *Eléments de physiologie.* In all these works, he developed his materialist philosophy, foreshadowing the evolutionary doctrine of Charles Darwin and evolving the first modern theory of the cellular structure of matter. Though his speculations in the field of science are of great interest, it is the dialectical brilliance of their presentation that is exceptional. His ideas, often propounded in the form of paradox, and invariably in dialogue, stem from a sense of reality and a profound understanding of the complexities and contradictions inherent in human nature. He developed a theory of dreams that was later to impress Freud.

Essays, novels, and plays. His essays, among them "Regrets sur ma vieille robe de chambre" ("Regrets over My Old Bathrobe") and "Entretien d'un père avec ses enfants" ("Conversation of a Father with His Children"), based on personal experience, have the qualities of form and style of his short stories and his novels: *La Religieuse* ("The Nun"), *Jacques le fataliste,* and *Le Neveu de Rameau. Jacques le fataliste* is in the tradition

of the picaresque novel and of the "philosophical tale." In spite of his scientific determinism, Diderot's philosophical standpoint is ambivalent, as is his ethical standpoint in *Le Neveu de Rameau,* which contains a satire of contemporary society by offering a vigorous dramatic sketch of a parasite and an eccentric amoralist. In the *Supplément au voyage de Bougainville* ("Supplement to Bougainville's Voyage"), Diderot presented his idea of a free society based on tolerance and sexual liberty.

His major plays, *Le Fils naturel* (trans. 1767, *Dorval; or, The Test of Virtue*) and *Le Père de famille* ("The Father of the Family"), make tedious reading today. His theories on drama, expounded in *Entretiens sur le fils naturel* ("Discussion on the Natural Son") and *Discours sur la poésie dramatique* ("Discourse on Dramatic Poetry"), were to exercise a determining influence on the German dramatist Gotthold Lessing, whose famous *Hamburgische Dramaturgie* ("Dramatic Notes from Hamburg") appeared in 1767–69. Diderot sought greater realism on the stage through the presentation of a serious bourgeois drama and a greater moral and social impact on the spectator by showing characters in their professions and milieu. He urged modifications in stagecraft and décor and hoped to move audiences through *tableaux vivants.* In his *Paradoxe sur le comédien,* Diderot argued that great actors, like great poets, are insensitive and must remain fabulous puppets. Although he wrote literary criticism, it is as the first great art critic, covering the salons, or annual art exhibitions, for the *Correspondance littéraire,* that he is best remembered. His analysis of art, artists, and the technique of painting, together with the excellence of his taste and his style, have won him posthumous fame; his *Essai sur la peinture* ("Essay on Painting"), especially, was admired by Goethe and later by the 19th-century poet and critic Charles Baudelaire.

Late life and works. In 1774 Diderot, now old and ill, worked on a refutation of Helvétius' work *De l'homme* (1772; "On Man"), which was an amplification of the destroyed *De l'esprit.* He wrote *Entretien d'un philosophe avec la Maréchale* ("Conversation with the Maréchale") and published in 1778 *Essai sur les règnes de Claude et de Néron* ("Essay on the Reigns of Claudius and Nero"). Usually known as *Essai sur la vie de Sénèque* ("Essay on the Life of Seneca"), the work may be regarded as an apologia of the Roman satirist and philosopher. Diderot's intimate circle was dwindling. Mme d'Épinay and d'Alembert died before him; only Grimm and Baron d'Holbach remained. Slowly Diderot retired into the shell of his own personal and family life. The death of Sophie Volland in February 1784 was a great grief to him; he survived her by a few months, dying of coronary thrombosis in the house in the rue de Richelieu that Catherine the Great had put at his disposal. Apocryphally, his last words were: "Le premier pas vers la philosophie, c'est l'incré" ("The first step toward philosophy is incredulity"). Through the intervention of his son-in-law, he was buried in consecrated ground at Saint-Roch. (Ro.N.)

MAJOR WORKS. *Philosophy and scholarship. Pensées philosophiques* (1746); *Lettre sur les aveugles* (1749); *Prospectus* (1750), to the *Encyclopédie; Lettre sur les sourds et muets* (1751); *Encyclopédie,* 17 vol. of text and 11 vol. of plates (1751–72), edited by Diderot and Jean d'Alembert and containing many articles by Diderot; *Pensées sur l'interprétation de la nature* (1754); *Le Rêve de d'Alembert* (written 1769, published 1830); *L'Entretien entre d'Alembert et Diderot* (written 1769, published 1830); *Eléments de physiologie* (1774–80).

Literary works. Novels: *Les Bijoux indiscrets* (1748); *La Religieuse* (written 1760, published 1796); *Jacques le fataliste* (written 1773, published 1796); *Le Neveu de Rameau* (written between 1761 and 1774, trans. into German by Goethe 1805, French edition 1821, authentic text 1891); *Supplément au voyage de Bougainville* (written 1772, published 1796). Short stories: "Les Deux Amis de Bourbonne" (1773); "Ceci n'est pas un conte" (written 1772, published 1798). Plays: *Le Fils naturel* (published 1757; performed 1771); *Le Père de famille* (1758; performed 1761); *Est-il bon? Est-il méchant?* (performed 1781, published 1834). Essays and treatises: *L'Histoire et le secret de la peinture en cire* (1755); *Entretiens sur le fils naturel* (1757); *Discours sur la poésie dramatique* (1758); *Éloge de Richardson* (1761); *Essai sur la peinture* (written 1765, published 1796); *Réflexions sur Térence* (1762); "Regrets sur ma vieille robe de chambre" (1772); *Entretien d'un père avec ses enfants* (1773); *Paradoxe sur le comédien* (written 1773–78, published 1830); *Plan d'une université pour le gouvernement de Russie* (published 1813–14), written for Catherine the Great; *Observations sur les instructions de Sa Majesté Impériale aux députés* (1774); *Réfutation de l'ouvrage d'Helvétius intitulé L'homme* (published 1875); *Essai sur les règnes de Claude et de Néron* (1778), usually called the *Essai sur la vie de Sénèque.*

Translations. Translations into English of a number of Diderot's individual works have been published but most of them so long ago as to be difficult to obtain. More recent translations include the following: *Denis Diderot: Selections,* ed. with introduction by E. Herriot (1953); *The Paradox of Acting,* trans. by W.H. Pollock (1957); *Diderot, Interpreter of Nature: Selected Writings,* trans. by Jean Stewart and Jonathan Kemp, and ed. with introduction by Jonathan Kemp, 2nd ed. (1963); Diderot's *Selected Writings,* trans. by Derek Coltman, and ed. with introduction and notes by Lester G. Crocker (1966); *The Nun,* trans. by Marianne Sinclair, with introduction and afterword by Richard Griffiths (1966), also trans. by L.W. Tancock (1972); *The Encyclopédie of Diderot and d'Alembert: Selected Articles,* ed. by J. Lough (1969).

BIBLIOGRAPHY. A.M. Wilson, *Diderot* (1972), is the standard and most scholarly biography. Lester G. Crocker, *Diderot, the Embattled Philosopher,* rev. ed. (1966), provides both a biographical and critical general study. John (Lord) Morley, *Diderot and the Encyclopaedists,* 2 vol. (1878, reprinted 1923), is still of value. The *Oeuvres complètes de Denis Diderot,* ed. by J. Assezat and M. Tourneux, 20 vol. (1875–77); and the selected *Oeuvres* in five volumes in the "Classiques Garnier" are adequate. Several volumes of a new critical, annotated edition, *Oeuvres complètes* (1975–), being prepared under the direction of H. Dieckmann, J. Proust, and J. Varloot, are available.

didgeridoo, also spelled DIDJERIDU, a drone-pipe (wind instrument), or straight wooden trumpet used by northwest Australian Aboriginals. It is made from bamboo or a hollow sapling and is about 5 feet (1.5 metres) long. Decorated ceremonial varieties, however, may be two or three times longer.

The didgeridoo has a wax mouthpiece covered with resin, and its end is sometimes placed in a tin can for resonance. It is used in such ritual ceremonies as those for sunsets, circumcisions, and funerals.

Consult the INDEX *first*

Didius Julianus, Marcus (b. *c.* 135—d. June 1, 193), wealthy Roman senator who became emperor (March 28 to June 1, 193) by being the highest bidder in an auction for the support of the Praetorian Guard.

A member of one of the most prominent families of Mediolanum (now Milan), Didius Julianus had a long and distinguished public career. After commanding the legion at Mogontiacum (now Mainz), *c.* 167, he governed northeastern Gaul, Dalmatia, the lower Rhine, Bithynia, and Africa.

During the political disturbances of Commodus' reign he was banished to Mediolanum. Commodus was murdered on the eve of Jan. 1, 193, however, and his successor, Pertinax, was assassinated by the imperial guard late in March. Backed by a group of senators who had Milanese connections, Julianus competed with the late emperor's father-in-law, T. Flavius Sulpicianus, in offering the guards

Didius Julianus, marble bust; in the Uffizi, Florence

Alinari—Art Resource/EB Inc.

a substantial donative (accession bounty). Julianus won the bidding and was escorted by the guards to the Senate, where he encountered angry demonstrators denouncing the auction and calling for the intervention of the army. Shortly thereafter the Danube legions invaded Italy, killed Julianus, and proclaimed their principal commander, Lucius Septimius Severus, emperor.

Dido, also called ELISSA, in Greek legend, the reputed founder of Carthage, daughter of the Tyrian king Mutto (or Belus), and wife of Sychaeus (or Acerbas). Her husband having been slain by her brother Pygmalion, Dido fled to the coast of Africa where she purchased from a local chieftain, Iarbas, a piece of land on which she founded Carthage. The city soon prospered, and Iarbas sought Dido's hand in marriage. To escape from him, Dido constructed a funeral pyre, on which she stabbed herself before the people. Virgil, however, made Dido a contemporary of Aeneas, whose descendants founded Rome. Dido fell in love with Aeneas after his landing in Africa, and Virgil attributes her suicide to her abandonment by him at the command of Jupiter. Dido was identified with the Virgo Caelestis; *i.e.,* Tanit, the tutelary goddess of Carthage.

Didot FAMILY, family of French printers, publishers, and typefounders who had a profound influence on the history of typography in France.

The founder of the family business was François Didot (1689–1757), who began business as a printer and bookseller in Paris in 1713. He was best known for publishing a 20-volume collection of the works of the Abbé Prévost. Didot's eldest son, François-Ambroise (1730–1804), altered the standard of type design by allowing greater contrast between thick and thin letters. He improved upon the Fournier standard of measurement for punch cutting and mold making; the Didot point system of 72 points to the French inch became the standard unit of type measurement. François-Ambroise also abandoned the use of classical names such as "parisienne" and "petit romain" for type size and instead distinguished types by their size as measured in points (*e.g.,* 12-point or 24-point type). In 1780 he introduced a highly finished wove paper, similar to the kind used by the English typefounder John Baskerville.

François-Ambroise had two sons, Pierre (called Pierre *l'aîné*; 1761–1853), who took over his father's printing office, and Firmin

(*c.* 1765–1836), who assumed responsibility for his father's typefoundry. Pierre published acclaimed editions of Virgil, Horace, La Fontaine, and Racine. Firmin designed the Didot typeface. He also invented stereotypes (plates cast from printing surfaces) and was thus able to publish low-priced editions of French, Italian, and English books. Napoleon appointed him director of the imperial foundry, a position he held until his death.

François Didot's younger son, Pierre-François (*c.* 1731–93), was a typefounder, publisher, and papermaker. His three sons also joined the family businesses: Henri (1765–1852) is remembered for his microscopic types. For producing type he invented the Polymatype, which consisted of a long bar of matrices into which hot metal was poured. As many as 200 pieces of type could be cast in one operation. Léger (1767–1829) invented a papermaking machine, and the third son, called Didot *le jeune*, followed Henri as a typemaker.

Firmin Didot's sons, Ambroise-Firmin (1790–1876) and Hyacinthe-Firmin (1794–1880), took over his business when he retired. Their most important publishing venture was an edition of the *Thesaurus graecae linguae* compiled by Henri Estienne (9 vol., 1855–59). Among the many other important works they published were the 200 volumes comprising the *Bibliothèque des auteurs grecs*, *Bibliothèque latine*, and *Bibliothèque française*.

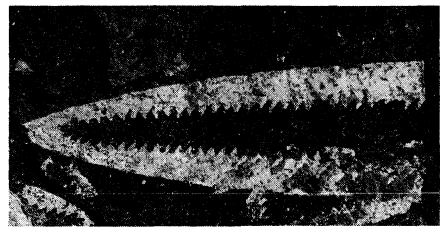
Didrikson, Babe: *see* Zaharias, Babe Didrikson.

Didyma, also called DIDYMI, or BRANCHIDAE, ancient sanctuary and seat of an oracle of Apollo, located south of Miletus in modern Turkey. Before being plundered and burned by the Persians (*c.* 494 BC), the sanctuary was in the charge of the Branchids, a priestly caste named after Branchus, a favourite youth of Apollo. After Alexander the Great conquered Miletus (334), the oracle was resanctified; the city administered the cult, annually electing a prophet. About 300 BC the Milesians began to build a new temple, intended to be the largest in the Greek world. The annual festival held there, the Didymeia, became Panhellenic in the beginning of the 2nd century BC. Excavations made between 1905 and 1930 revealed all of the uncompleted new temple and some carved pieces of the earlier temple and statues.

Didyme Insula (Italy): *see* Salina Island.

Didymelales, order of dicotyledonous flowering plants comprising the family Didymelaceae, with one genus (*Didymeles*) and two species, both of which are trees of Madagascar with very simple, primitive flowers. The plants are so distinctive that close relatives are nonexistent, as is reflected in the ordinal status given the group. The flowers are separately male and female, on different plants. The male flower consists of two anthers (pollen sacs) without stalks plus one or two small scales attached just below the anthers. The female flower consists of as many as four scales plus a single cylindrical carpel (ovule-bearing structure) with a large, obliquely situated pollen-receptive surface (stigma) and a single ovule. The fruit is a drupe, large, one-seeded, fleshy, and plumlike, with a lateral groove. In addition to the primitive flowers, the wood also exhibits many primitive features—among others, water-conducting cells with ladderlike sculpturings on the walls (scalariform pitting); and sclereids (fibre cells) with large, distinctly bordered pits in the wall.

Didymograptus, genus of graptolites (an extinct group of colonial animals related to primitive chordates) found as fossils in Lower and Middle Ordovician marine rocks (the



Didymograptus

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

Ordovician Period began 500,000,000 years ago and lasted 70,000,000 years). The several described species of *Didymograptus*, with their wide geographic distribution and relatively narrow time ranges, are guide fossils for correlation of Lower and Middle Ordovician rocks and time. The genus is characterized by its two-branched form, frequently suspended from a circular disk-shaped structure. *Didymograptus* includes some of the largest known graptolites.

Didymus CHALCENTERUS (fl. *c.* 80–10 BC, Alexandria), Greek scholar and grammarian, one of the chief links between ancient and modern classical scholarship. His industry, as the reputed author of 3,500 books, earned him the nickname of Chalcenterus (Brass Guts). His output included work on the text of Homer, exegetical commentaries on numerous Greek authors, lexicographical compilations, and grammatical and antiquarian treatises.

Didymus THE BLIND (b. *c.* 313, Alexandria, Egypt—d. *c.* 398, Alexandria), Eastern Church theologian who headed the influential catechetical school of Alexandria.

According to Palladius, the 5th-century bishop and historian, Didymus, despite having been blind since childhood and remaining a layman all his life, became one of the most learned ascetics of his time. Among those holding him in great esteem were Athanasius the Great, bishop of Alexandria, who made him head of the Alexandrian school, and Jerome, who acknowledged Didymus as his master. Jerome later retracted, however, when the works of Didymus, but not his person, were condemned by the Second Council of Constantinople (553) for teaching the doctrine of Origen (*q.v.*). Because of this condemnation, most of his works were not copied during the Middle Ages and thus were lost. He was a leading opponent of Arianism (*see* Arius).

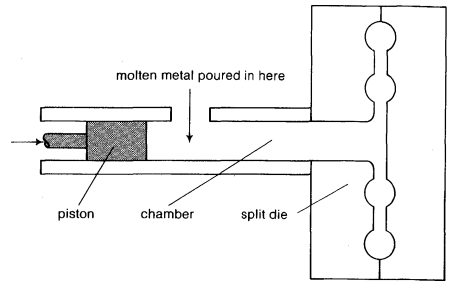
Didymus' biblical commentaries (supposedly on nearly all the books of the Bible) survive in fragments only, and those on the Catholic Letters are of dubious authenticity. He is probably the author of a treatise on the Holy Spirit that is extant in Latin translation. W.J. Gauche's *Didymus the Blind, an Educator of the 4th Century,* appeared in 1934.

die, tool or device for imparting a desired shape, form, or finish to a material. Examples include a perforated block through which metal or plastic is drawn or extruded, the hardened steel forms for producing the patterns on coins and medals by pressure, and the hollow molds into which metal or plastic is forced. *See also* diesinking.

die-casting, forming metal objects by injecting molten metal under pressure into dies, or molds. An early and important use of the technique was in the Mergenthaler Linotype machine (1884) to give line-long combinations of letters, but the appearance of the mass-production automobile assembly line gave die-casting its real impetus. Great precision is possible, and products range from tiny parts for sewing machines and automobile carburetors to aluminum engine-block castings.

The two major die-casting techniques differ only in how the molten metal is introduced: in the cold-chamber process, the metal is ladled into a chamber; a plunger impels the metal into the cold die cavity, in which it quickly hardens.

In the piston, or gooseneck, process the plunger and its cylinder are submerged in the molten metal, the metal being admitted through a hole in the top of the cylinder when the plunger is retracted; the advance of the plunger forces the metal into the die cavity as before. The die core is in position in the die cavity when the metal enters and fills the



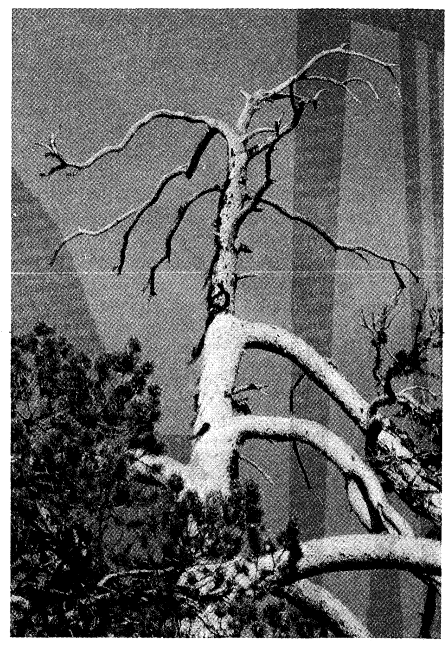
Cold-chamber die-casting machine

From *McGraw-Hill Encyclopedia of Science and Technology*, vol. 2, p. 568, Copyright (1971); used with permission of McGraw-Hill Book Co.

space around it; as soon as the metal hardens, the die core is retracted. The die is then opened, and the finished casting is ejected.

In modern die-casting the sequence is governed electronically.

dieback, common symptom or name of disease, especially of woody plants, characterized by progressive death of twigs, branches, shoots, or roots, starting at the tips. Staghead is a slow dieback of the upper branches of a tree; the dead, leafless limbs superficially resemble a stag's head. Dieback and staghead are caused by many fungi and a few bacteria that produce cankers, anthracnose, wilts, and stem or root rots. Nematodes, stem- or root-boring insects, mechanical damage, paving over roots, winter injury from cold or deicing salts, and a deficiency or excess of moisture or an essential element may cause dieback, directly



A pine tree afflicted with staghead dieback

Ingmar Holmasen

or indirectly. *See* anthracnose; blight; canker; fire blight; rot; wilt; witches'-broom.

Diebitsch, Johann (Karl Friedrich Anton), Graf (Count), Russian IVAN IVANOVICH DIBICH-ZABALKANSKY (b. May 13, 1785, Grossleipe, Silesia, Prussia—d. June 10, 1831,

Kleczewo, near Pułtusk, Pol.), military officer whose Balkan campaigns determined the Russian victory in the Russo-Turkish War of 1828–29.

Although he was of German parentage and was educated at the Berlin cadet school, Diebitsch joined the Russian Army in 1801, and, after fighting against Napoleon in the battles of Austerlitz, Eylau, Friedland, and Smolensk, he acquired the rank of major general. He continued to serve in various military and diplomatic capacities as the Russians continued the war in western Europe (1812–14). In 1815 he attended the Congress of Vienna, at which the allies, having defeated Napoleon, reorganized Europe. Subsequently, Diebitsch became adjutant general to the Russian emperor Alexander I, chief of the Russian general staff (1824), a participant in the suppression of the Decembrist uprising, and a member of a secret committee formed by the emperor Nicholas I to examine administrative and social reform programs (1826–32).

After the Russo-Turkish War broke out (1828) and Diebitsch was given command of the Russian forces in Europe (February 1829), he defeated the Turks at Silistra on the Danube River, at the Kamchyk River near Varna, and at Burgas (all in Bulgaria). Continuing his campaign, he advanced westward, inflicting another defeat upon the Turks at Sliven; he then turned south, forcing Adrianople (Edirne) to surrender and precipitating the conclusion of the Treaty of Edirne (Sept. 14, 1829), by which Turkey ceded the mouth of the Danube River and some territory in the Caucasus to Russia. For his victory Diebitsch was promoted to the rank of field marshal and given the name Zabalkansky to commemorate his march across the Balkans.

When the Poles staged an uprising against their Russian rulers (1830), Diebitsch led the Russian army that defeated the Poles at Grochów (Feb. 25, 1831) and at Ostroleka (May 20, 1831), but he died from cholera before the Poles capitulated.

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Diefenbaker, John G(eorge) (b. Sept. 18, 1895, Grey County, Ont., Can.—d. Aug. 16, 1979, Ottawa), leader of the Progressive Conservative Party who was prime minister of Canada in 1957–63, following 22 years of uninterrupted Liberal rule.

Diefenbaker
National Film Board of Canada Phototheque

After serving in World War I, Diefenbaker practiced law in Saskatchewan. He was made king's counsel in 1929. In 1936 he was chosen as leader of the Saskatchewan Conservative Party, serving at that post until 1940, when he was elected to the Canadian House of Commons for the constituency of Lake Centre. His quest for leadership of the Progressive Conservative Party in 1948 was unsuccessful, but he became party leader in 1956.

The general election of 1957 brought victory for the Conservatives, breaking the 22-year Liberal monopoly, and Diefenbaker succeeded Louis Saint Laurent as prime minister. In the 1958 election the Conservatives won an unprecedented 208 of the 265 House seats. In the next election, however, in 1962, the Conservatives lost their majority. A crisis over the proposed manufacture of nuclear weapons in Canada caused several ministerial resignations and forced Diefenbaker to call an election in 1963, when Lester B. Pearson, leading the Liberals, became prime minister. After struggling to retain party leadership, Diefenbaker resigned as party leader in 1967 and was succeeded by Robert Stanfield. Diefenbaker became chancellor of the University of Saskatchewan in 1969, at which post he served until his death.

Diego Garcia, coral atoll, largest and southernmost member of the Chagos Archipelago, in the southern Indian Ocean. Occupying an area of about 10.5 sq mi (27 sq km), it consists of a V-shaped, sand-fringed cay, about 15 mi (24 km) in length and having a maximum width of about 7 mi; the lagoon is open at the north end.

Discovered by the Portuguese in the early 16th century, it was for most of its history a dependency of Mauritius. In 1965 it was separated from Mauritius as part of the newly created British Indian Ocean Territory. The production of copra from coconut palms was the only economic activity until the early 1970s, when the last of the plantation workers and their families were moved to Mauritius to facilitate the development of U.S. military communications facilities established in accordance with a 1966 agreement between the United States and the United Kingdom. Development of this base for air and naval support in the late 1970s evoked strong opposition from littoral states of the Indian Ocean area, who wished to preserve a nonmilitarized status in the region.

Diégo-Suarez (Madagascar): *see* Antsiranana.

Diegueño, also called SAN DIEGUEÑO, a group of Yuman-speaking Indians who originally inhabited large areas extending on both sides of what is now the U.S.–Mexican border in California and Baja California. They were named after the mission of San Diego.

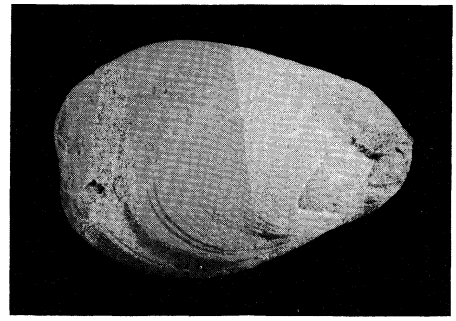
Diegueño culture reflected similarities with its neighbours the Luiseño to the north and other Yuman nations to the east, such as the Mojave (*see* Yuman Indians). Diegueño social organization was based upon lineage, each apparently associated with a particular location. The lineage chief led ceremonies. The diet staples of coastal Diegueño were fish and mollusks. Inland, some Diegueño engaged in agriculture. Their houses consisted of poles supporting a roof of brush and earth. They made baskets, pottery, and containers made of string substances.

Although many Diegueño religious practices paralleled those of the Luiseño, the world views of the two differed. Whereas the Luiseño were mystics, the Diegueño were more interested in the solid and visible in life.

Like most other California Indians with missions placed in their midst, the Diegueño resisted the Christianizing efforts of the Spanish Franciscans; they even attacked the San Diego mission. Conversions came slowly and were not extensive.

In the late 20th century about 700 Diegueño descendants remained in communities near San Diego. *See also* Mission Indians.

Dielasma, genus of extinct brachiopods, or lamp shells, that occur as fossils in rocks deposited in marine environments of Mississippian to Permian age (between 225,000,000 and 345,000,000 years old). The two small, rather smooth valves of the shell of *Dielasma* are slightly convex in profile, but the pedicle, or foot, valve is much larger than the brachial, or upper, valve. Growth lines are generally ap-



Dielasma
By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

parent. In some respects *Dielasma* is similar to *Composita,* a brachiopod with similar time range and habitat.

dieldrin, chlorine-containing organic compound used as an insecticide; *see* aldrin.

dielectric, insulating material or a very poor conductor of electric current. When dielectrics are placed in an electric field, practically no current flows in them because, unlike metals, they have no loosely bound, or free, electrons that may drift through the material. Instead, electric polarization occurs. The positive charges within the dielectric are displaced minutely in the direction of the electric field, and the negative charges are displaced minutely in the direction opposite to the electric field. This slight separation of charge, or polarization, reduces the electric field within the dielectric.

The presence of dielectric material affects other electrical phenomena. The force between two electric charges in a dielectric medium is less than it would be in a vacuum, while the quantity of energy stored in an electric field per unit volume of a dielectric medium is greater. The capacitance of a capacitor filled with a dielectric is greater than it would be in a vacuum. The effects of the dielectric on electrical phenomena are described on a large, or macroscopic scale by employing such concepts as dielectric constant, permittivity (*qq.v.*), and polarization (*see* polarization, electric).

dielectric constant, property of an electrical insulating material (a dielectric) equal to the ratio of the capacitance of a capacitor filled with the given material to the capacitance of an identical capacitor in a vacuum without the dielectric material. The insertion of a dielectric between the plates of, say, a parallel-plate capacitor always increases its capacitance, or ability to store opposite charges on each plate, compared with this ability when the plates are separated by a vacuum. If C is the value of the capacitance of a capacitor filled with a given dielectric and C_0 is the capacitance of an identical capacitor in a vacuum, the dielectric constant, symbolized by the Greek letter kappa, κ, is simply expressed as $\kappa = C/C_0$. Dielectric constant is a number without dimensions. It denotes a large-scale property of dielectrics without specifying the electrical behaviour on the atomic scale.

The value of the static dielectric constant of any material is always greater than one, its value for a vacuum. The value of the dielectric constant at room temperature (25° C, or 77° F) is 1.00059 for air, 2.25 for paraffin, 78.2 for water, and about 2,000 for barium titanate ($BaTiO_3$) when the electric field is applied perpendicularly to the principal axis of the crystal. Because the value of the dielectric

constant for air is nearly the same as that for a vacuum, for all practical purposes air does not increase the capacitance of a capacitor. Dielectric constants of liquids and solids may be determined by comparing the value of the capacitance when the dielectric is in place to its value when the capacitor is filled with air.

The dielectric constant is sometimes called relative permittivity or specific inductive capacity. In the centimetre–gram–second system the dielectric constant is identical to the permittivity (*q.v.*).

dielectric heating, also called CAPACITANCE HEATING, method by which the temperature of an electrically nonconducting (insulating) material can be raised by subjecting the material to a high-frequency electromagnetic field. The method is widely employed industrially for heating thermosetting glues, for drying lumber and other fibrous materials, for preheating plastics before molding, and for fast jelling and drying of foam rubber.

The material to be heated is placed between two metal plates, called electrodes, to which a source of high-frequency energy is connected. The resultant heating, in homogeneous materials, occurs throughout the material.

Diels, Otto Paul Hermann (b. Jan. 23, 1876, Hamburg—d. March 7, 1954, Kiel, W.Ger.), German organic chemist who with Kurt Alder was awarded the Nobel Prize for Chemistry in 1950 for their joint work in developing a method of preparing cyclic organic compounds.

He studied chemistry at the University of Berlin under Emil Fischer and after various appointments was made professor of chemistry at the University of Kiel (1916). He became emeritus in 1945.

In 1906 he discovered a highly reactive substance, carbon suboxide (malonic anhydride), and determined its properties and chemical composition. He also devised an easily controlled method of removing some of the hydrogen atoms from certain organic molecules by the use of metallic selenium.

His most important work concerned the diene synthesis, in which organic compounds with two carbon-to-carbon double bonds were used to effect syntheses of many cyclic organic substances under conditions that threw light on the molecular structure of the products obtained. This method was developed (1928) in collaboration with Kurt Alder, his student, and is known as the Diels–Alder reaction. Their work proved especially important in the production of synthetic rubber and plastics.

Diem, Ngo Dinh: *see* Ngo Dinh Diem.

Diemen, Anthony van (b. 1593, Culemborg, Neth.—d. April 19, 1645, Batavia, Dutch East Indies), colonial administrator who as governor general of the Dutch East Indian settlements (1636–45) consolidated the Dutch empire in the Far East.

After an unsuccessful business career in Amsterdam, van Diemen joined the Dutch East India Company, serving in Batavia from 1618 and becoming governor general in 1636. To strengthen the company's rule in the Moluccas, he signed a treaty with the Sultan of Ternate in 1638, which freed the Company for a war of conquest (1638–43) and resulted in a Dutch spice monopoly in the area. Also in 1638 van Diemen intensified the Dutch attack on the Portuguese empire in Asia with an invasion of Ceylon. By 1644 the Dutch had conquered Ceylon's cinnamon-producing areas and had established posts on India's Coromandel Coast.

Meanwhile van Diemen had succeeded in seizing the key Portuguese stronghold of Malacca (1641; now in Malaysia) on the trade route between India and China, and in 1642 the Dutch captured all of Formosa (Taiwan), driving out the Spaniards. Under his rule, advantageous treaties with the East Indian princes of Acheh (Atjeh) and Tidore were signed, and commercial relations with Tonkin (Vietnam) and Japan were established. By the end of van Diemen's administration, the United Provinces of the Netherlands had become the paramount commercial and political power in the East Indies.

Van Diemen completed the construction of Batavia in the Dutch pattern of his predecessor, Jan Pieterszoon Coen, including a Latin school, Protestant churches, an orphanage, and a hospital; he also introduced a legal code known as the Batavian statutes. Van Diemen initiated the exploring expeditions of Abel Tasman and Frans Visscher in 1642 and 1644 on which they discovered Tasmania (originally Van Diemen's Land), New Zealand, Tonga, Fiji, and the northern coast of Australia.

Diémer, Louis-Joseph (b. Feb. 14, 1843, Paris—d. Dec. 21, 1919, Paris), French pianist and teacher who was one of the first advocates of early keyboard music and instruments.

He was a student at the Paris Conservatoire from 1856 to 1861, and from 1863 he performed regularly, playing at the Alard, Pasdeloup, Colonne, Lamoureux, and Conservatoire concerts with great success; his repertoire included pieces written for him by Charles-Marie Widor, Camille Saint-Saëns, and Édouard Lalo. He was appointed professor of piano at the Conservatoire in 1887; in 1889 he gave a series of harpsichord recitals there whose favourable reception encouraged him to establish a Société des anciens instruments. He edited a collection of early French keyboard pieces (*Clavecinistes français,* 1928). Active also as a composer, he wrote both piano and orchestral works. Among his students were Alfred Cortot and Robert Casadesus.

Dien Bien Phu, Battle of, the decisive engagement in the first Indochina War (1946–54). It consisted of a struggle between French and Viet Minh (Vietnamese Communist and nationalist) forces for control of a small mountain outpost on the Vietnamese border near Laos. The Viet Minh victory in this battle effectively ended the eight-year-old war.

The battle was joined in late 1953 when French forces, who had been rapidly losing ground to the popularly supported Viet Minh, occupied the town of Dien Bien Phu in an attempt to cut the nationalist supply lines into Laos and to maintain a base for forays against enemy forces. Although the Vietnamese quickly cut all the roads into Dien Bien Phu, making it suppliable only by air, the French were confident of their position. They were thus taken by surprise when the Viet Minh Gen. Vo Nguyen Giap surrounded the base with 40,000 men and used heavy artillery to break the French lines. Despite heavy U.S. aid, the base was overrun on May 7, 1954.

With French forces in disarray after the battle, the French government sought an end to the fighting; an official settlement was negotiated at an international conference in Geneva. The French sense of national humiliation, particularly acute within the army, had lasting repercussions on French public opinion and contributed—along with later events in Algeria—to the downfall of the Fourth Republic in 1958.

Dienerian Stage, division of Triassic rocks and time (the Triassic Period began about 225,000,000 years ago and lasted about 35,000,000 years). Dienerian rocks, deposited in a marine environment, overlie those of the Griesbachian Stage and underlie rocks of the Smithian Stage. These stages, together with the Spathian Stage, comprise the Lower Triassic Series. Dienerian rocks are characterized by a distinctive fossil cephalopod fauna and have been correlated with rocks throughout the world, although regional names may sometimes be employed.

Dienné (Mali): *see* Djénné.

Dientzenhofer, Christoph and Kilian Ignaz (respectively b. July 7, 1655, Rosenheim, Bavaria—d. June 20, 1722, Prague; b. Sept. 1, 1689, Prague—d. Dec. 18, 1751, Prague), father and son, members of a large family of German architects, who were among the leading builders in Bohemian Baroque. Among their joint works are the Church of St. Nicholas (1703–11, 1732–52) and the Břevnov Monastery (1708–21), both in Prague. K.I. Dientzenhofer built the churches of St. Thomas (1725–31; a Gothic structure reworked into Baroque) and St. John on the Rock (1730–39; including the Vyšehrad Steps), both in Prague, and St. Mary Magdalene, Karlsbad (now Karlovy Vary; 1733–36); he also built the Villa Amerika (1712–20; afterward the Antonin Dvořák Museum), Prague.

Church of St. Nicholas in the Old City, Prague, by Christoph and Kilian Ignaz Dientzenhofer, 1703–11, 1732–52

Helga Schmidt-Glassner

Dieppe, town and seaport, northern France, Seine-Maritime *département,* Haute-Normandie region, on the English Channel, north of Rouen and northwest of Paris. It stands at the mouth of the Arques River in a valley bordered on each side by steep white cliffs.

In the old town many houses date back to the early 18th century. The castle, built in 1435, was damaged in 1944 but has been restored and now houses a museum. Much of the town was rebuilt after World War II. Dieppe is the seaside resort closest to Paris; the pebbly beach with its marine promenade became fashionable in the 19th century. A casino is nearby.

The name Dieppe probably comes from the Saxon word *deop* ("deep")—a reference to the depth of the estuary. The French kings, realizing the strategic importance of the town, granted it numerous privileges; when it was occupied by the English during the Hundred Years' War, the inhabitants expelled them at the first opportunity, in 1435. Dieppe, mainly Protestant, suffered greatly during the Wars of Religion, but its darkest period came in the second part of the 17th century. In 1668 almost 10,000 of its people died during a plague; in 1685 the Protestants of the town were persecuted after the revocation of the Edict of Nantes; and in 1694 the town was

almost completely destroyed by the English and Dutch fleets. The Allies landed in Dieppe in August 1942 and suffered serious losses in a test of German defenses near port facilities.

The port, cut in the bed of the Arques River, is one of the safest on the English Channel, but its shallowness hinders modern shipping. The passenger harbour has a regular service with Newhaven, Eng., except in winter. The fishing harbour is one of the main suppliers of the Paris market, and there is a well-equipped commercial port. The main industries include shipbuilding, oil refining, and the manufacture of rope, textiles, and (since the 15th century) articles in bone and ivory. More recent industries include telephone equipment, clocks and watches, chemicals, and automobiles. Pop. (1982) 35,659.

Dies, Martin, Jr. (b. Nov. 5, 1901, Colorado, Texas, U.S.—d. Nov. 14, 1972, Lufkin, Texas), American politician, the sponsor and first chairman (1938–45) of the House Committee on Un-American Activities.

A graduate of the University of Texas (1919) and the law school of National University in Washington, D.C. (1920), Dies opened a law practice in Texas but quickly turned his attention to politics. In 1931 he won a seat in the U.S. House of Representatives, where, following the election of Franklin Roosevelt, he supported the New Deal. By 1937, however, he had turned against Roosevelt and the liberal wing of the Democratic Party.

In 1938, after several unsuccessful attempts, Dies convinced the House to establish the Committee to Investigate Un-American Activities (later renamed the Committee on Un-American Activities, but always more popularly called the Dies Committee). As chairman, Dies rigorously pursued alleged subversives in New Deal agencies, labour unions, and other organizations. Although the committee was supposed to investigate fascist subversion as well, it quickly turned exclusively to supposed communist infiltration of American life.

As a result of the committee's well-publicized investigations, Dies gained a national reputation. Conservative groups applauded his zeal in exposing left-wing subversives, while liberals denounced his tactics of smearing reputations with unproven allegations. In his 1940 book, *The Trojan Horse of America,* Dies claimed to have surpassed the FBI in uncovering communist subversives in America.

Dies resigned his congressional seat in 1945 to resume his Texas law practice. But he returned to the House in 1953 and served until 1959, though he held no important positions during those years. After retiring once again from public life, he spent his final years in Texas practicing law.

Dies irae (Latin: "Day of Wrath"), the opening words of a Latin hymn on the Last Judgment, ascribed to Thomas of Celano (d. *c.* 1256) and forming part of the office for the dead and requiem mass.

The hymn ascribed to Thomas of Celano contains 18 rhymed stanzas (17 tercets, 1 quatrain), to which a later, anonymous writer added an unrhymed couplet, ending in "Amen." The impressive plainsong melody to which the hymn was sung was used by composers of religious works from the 16th century onward, either in its original form or as the basis of a polyphonic composition. Wolfgang Amadeus Mozart and Giuseppi Verdi were among the composers of religious works who wrote original music on the text of the hymn.

The original melody made a strong appeal during the Romantic period and was used, often in the form of a parody or to suggest the supernatural or the macabre, in many secular compositions by Hector Berlioz, Camille Saint-Saëns, Ralph Vaughan Williams, and other composers.

Diesel, Rudolf (Christian Karl) (b. March 18, 1858, Paris—d. Sept. 29, 1913, at sea in the English Channel), German thermal engineer who invented the internal-combustion engine that bears his name. He was also a distinguished connoisseur of the arts, a linguist, and a social theorist.

Diesel, the son of German-born parents, grew up in Paris until the family was deported to England in 1870 following the outbreak of the Franco-German War. From London Diesel was sent to Augsburg, his father's native town, to continue his schooling. There and later at the Technische Hochschule (Technical High School) in Munich he established a brilliant scholastic record in fields of engineering. At Munich he was a protégé of the refrigeration engineer Carl von Linde, whose Paris firm he joined in 1880.

Diesel devoted much of his time to the self-imposed task of developing an internal combustion engine that would approach the theoretical efficiency of the Carnot cycle. For a time he experimented with an expansion engine using ammonia. About 1890, in which year he moved to a new post with the Linde firm in Berlin, he conceived the idea for the diesel engine (*q.v.*). He obtained a German development patent in 1892 and the following year published a description of his engine under the title *Theorie und Konstruktion eines rationellen Wäremotors* (*Theory and Construction of a Rational Heat Motor*). With support from the Maschinenfabrik Augsburg and the Krupp firms, he produced a series of increasingly successful models, culminating in his demonstration in 1897 of a 25-horsepower, four-stroke, single vertical cylinder compression engine. The high efficiency of Diesel's engine, together with its comparative simplicity of design, made it an immediate commercial success, and royalty fees brought great wealth to its inventor.

Diesel, 1883

By courtesy of the Deutsches Museum, Munich

Diesel apparently fell from the deck of the mail steamer *Dresden* en route to London and drowned.

diesel engine, any internal-combustion engine in which air is compressed to a temperature sufficiently high to ignite fuel injected into the cylinder where combustion and expansion actuate a piston. It converts the chemical energy stored in the fuel into mechanical energy, which can be used to power freight trucks, large tractors, locomotives, and vessels. A limited number of automobiles also are diesel-powered, as are small electric-power generators.

A brief treatment of diesel engines follows. For full treatment, *see* MACROPAEDIA: Energy Conversion.

The diesel engine differs from other internal-combustion engines such as gasoline engines that induct and moderately compress an inflammable mixture of air and vaporized or gaseous fuel and then ignite it by an electric spark. It employs no ignition devices, and so is often called a compression-ignition engine. The possibility of compression ignition appears to have been first mentioned by the French physicist Sadi Carnot in 1824. The principle on which the modern automobile engine operates was conceived in 1862 by Alphonse Beau de Rochas, also of France; however, it was not applied to a practical engine until 1876, when the German engineer Nikolaus Otto built the first engine in which the charge (fuel–air mixture) was compressed in the cylinder before burning. This was the engine that Rudolf Diesel, a German engineer, undertook to improve when he started the experiments that led to the diesel engine.

After several years of studying the problems involved, Diesel applied for and was granted patents in 1892 and 1893. The processes described in these patents represented a cycle that differed from the theoretical or ideal cycle followed by existing engines only in the rate of combustion of the fuel–air charge. He proposed to burn the fuel during the first portion of the power stroke of the piston so slowly that no pressure rise would occur. As a means of slowing down combustion to avoid the almost instantaneous explosion of the spark-ignition engine, he suggested inducting air into the cylinder and compressing it so highly that it would attain a temperature above the ignition point of an appropriate fuel, which would be gradually sprayed into the combustion chamber during the descent of the piston. This method of igniting fuel requires that the air be compressed to a pressure of at least 3,450 kilopascals (500 pounds per square inch), which produces a temperature of approximately 540° C (1,000° F).

Diesel presumably thought that any fuel would be suitable for an engine operating in the manner he described. He attempted to build an engine that would burn powdered coal, the cheapest conceivable fuel. The coal-burning project, however, was soon abandoned, and an oil-burning version of the engine was completed in 1897.

The fuel economy of Diesel's engine proved to be better than that of any other existing power plant. The engine, however, was not rapidly adopted. Until his death in 1913, Diesel insisted that all engines manufactured under his licenses be made to operate with combustion at practically constant pressure, as described in his 1893 patent. This restriction meant that the engines had to run at a very low speed, and thus possible design improvements were delayed. The early diesel engines were so large and heavy in proportion to their power output that they had no application other than as stationary power plants.

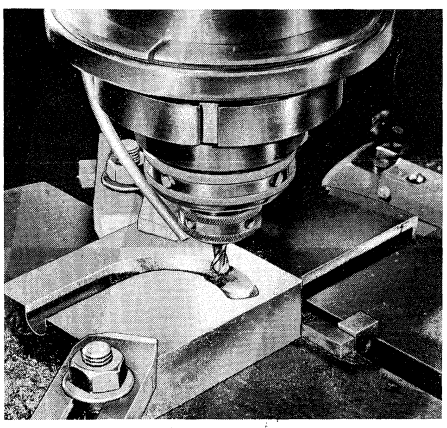
The first marine installation of a diesel engine was completed in 1910; the diesel engine became the primary power plant for submarines during World War I. The first diesel engine that was small and light enough for use in automobiles was built in 1922 in Germany, and it opened up numerous fields of application that had previously been closed to diesel engines because of their low specific power output. The higher-speed diesel engines do not follow the slow-burning cycle originated by Diesel. Fuel is injected into the cylinder near the end of the compression stroke and burned rapidly, with sharply rising pressure, while the piston is near its dead-centre position. Only the compression-ignition and fuel injection of Diesel's original engine are retained in the modern high-speed version.

Since the mid-1940s the diesel engine has become the predominant source of industrial power throughout the world for units up to roughly 5,000 horsepower, principally because it is capable of burning a low-grade fuel at a comparatively low rate of consumption per horsepower per hour. Relatively unrefined fuels can be burned by a diesel engine because of the nature of its fuel-injection system and

combustion process. Low fuel consumption results primarily from the higher compression ratio used. A greater fuel saving is effected at partial load than at full load since it is not necessary to throttle the inlet air, as in the case with spark ignition, to maintain an inflammable fuel–air mixture. (Only about two-thirds as much fuel is required.) Diesel engines do have some disadvantages, however. They are, for example, handicapped somewhat by their higher initial cost and greater weight per horsepower, by their emission of high levels of air pollutants (*e.g.*, nitric oxide and soot) and odour, and by their greater operating noise and vibration.

diesinking, process of machining a cavity in a steel block to be used for molding plastics, or for hot and cold forging, die-casting, and coining.

The die block is mounted on a table while a vertical-spindle milling machine with end cutters is used to shape the die. In most simple machines the movement of the cutter may be controlled by the manual operation of transverse, horizontal, and vertical feeds. Patterns of sheet metal or plastic may be used as guides. A pantograph (*q.v.*), four light rigid bars in a parallelogram, may be used to cause the cutter to follow a certain layout.



Diesinking on the Milwaukee rotary head, vertical milling machine

By courtesy of the Kearney and Trecker Corp.

Diesinking is done chiefly by automatic machines. The movement of the cutter against the die block is controlled by tracing a finger gauge the size and shape of the cutter in contact with a previously made model of soft metal, plaster of paris, or wood. The model, or template, is attached to the bed beside the die block. The movement of the finger over the template is transmitted to the cutter by hydraulic or electrical controls. The surface of the sunken die is finished to the desired size and surface quality by hand scrapers, files, small grinding wheels, and polishing cloth.

Diespiter (Roman god): *see* Jupiter.

Diet, Medieval Latin DIETA, German REICHSTAG, legislature of the German empire, or Holy Roman Empire, from the 12th century to 1806.

In the Carolingian empire, meetings of the nobility and higher clergy were held during the royal progresses, or court journeys, as occasion arose, to make decisions affecting the good of the state. After 1100, definitively, the emperor called the Diet to meet in an imperial or episcopal city within the imperial frontiers. The members of the Diet were originally the princes, including bishops of princely status, but counts and barons were included later. After 1250 the representatives of imperial and episcopal cities were recognized as members of the Diet, and at this time the electoral princes, whose duty it was to elect the emperor, began to meet separately, a division formally confirmed in the Golden Bull of Charles IV (1356), which established the number of the electoral princes as seven. (*See* elector.)

Beginning in the 12th century the power of the emperor gradually declined; by 1489 the Diet was divided into three colleges that met separately: (1) the electoral college of seven lay and ecclesiastical princes presided over by the imperial chancellor, the archbishop of Mainz; (2) the college of the princes with 33 ecclesiastical princes and 61 lay princes, presided over by the archbishop of Salzburg or the archduke of Austria; (3) the college of the cities presided over by the representative of the city in which the Diet met. The college of cities was separated eventually into the Rhine and Swabian divisions, the former having 14 towns and the latter 37.

The decisions taken separately by the three colleges were combined in an agreed statement the text of which was sent to the emperor as "the resolution of the empire" (*conclusum imperii*). All the decisions of the Diet forming the resolution were called the "recess of the empire" (*Reichsabschied*). The emperor could ratify part of the recess or the whole of it, but he could not modify the words of the recess. Until the 17th century the Diet possessed effective legal power, including the decision of war or peace, but the Peace of Westphalia (1648) spelled the final breakdown in the conception of a single German empire united by its members' common aims. The three-college Diet was replaced by an assembly of sovereign princes, usually represented by envoys, indifferent to the emperor's wishes and divided in religious and political aims. The Diet of Regensburg of 1663 prolonged itself indefinitely into permanent session and thereafter was called the Regensburg Diet, or the Everlasting Diet (Immerwährender Reichstag). The emperor was now represented by a prince of the empire as his commissioner; a jurist was appointed as subcommissioner; and the elector of Mainz, archchancellor of the empire, had charge of the business of the meetings of the Diet. This assembly of representatives without legislative power disappeared when the Holy Roman Empire collapsed under Napoleon's attack in 1806.

The name Reichstag was revived in 1871 for the legislature of the German Empire and retained by the Weimar Republic and the Third Reich; the name was abandoned in the two Germanies after World War II.

Diet, also called (1889–1947) IMPERIAL DIET, Japanese KOKKAI ("National Assembly"), or TEIKOKU GIKAI ("Imperial Assembly"), the national legislature of Japan.

Under the Meiji Constitution of 1889, the Imperial Diet was established on the basis of two houses with coequal powers. The upper house, the House of Peers (Kizokuin), was almost wholly appointive. Initially, its membership was slightly less than 300, but it was subsequently increased to approximately 400. The peers were intended to represent the top rank and quality of the nation and to serve as a check upon the lower house. The pre-World War II House of Representatives (Shūgiin) was originally composed of 300 members, all elected, but gradually this number was increased to 466. Its powers were in many respects largely negative. Without Diet approval, no bill could become law. The government did have the right to issue imperial ordinances in case of an emergency, but if these were to remain in effect the Diet had to approve them at its next session. There was one significant limitation upon the traditional legislative control over the purse strings. If the Diet did not pass the budget in a manner acceptable to the government, the government had the right to apply the budget for the previous year. This provision was borrowed from Prussian practice. The Diet did not initiate important legislation; this was chiefly the function of the executive.

Under the Constitution of 1947 the Diet, renamed Kokkai, was drastically altered both in structure and in powers. There remained two houses, the House of Representatives (Shūgiin) and the House of Councillors (Sangiin). The latter takes the place of the old House of Peers and has a membership of 250 consisting of two categories: 100 councillors elected from the nation at large with the remaining 152 elected as prefectural representatives. Every voter may cast a ballot for one candidate in each category, giving him a total of two votes. The members of the House of Councillors serve for six years, with one-half of the members standing for election every three years. The House of Councillors cannot be dissolved in case of conflict between it and the executive branch. The balance of power, though, lies in the lower house, where general agreement with executive policy must prevail. In case of a deadlock between the two houses over the selection of a prime minister, the vote of the lower house takes precedence. The budget must be submitted first to the lower house; if the two houses cannot agree, the position of the lower house prevails after 30 days. This same provision applies to treaties. With other legislation, if the councillors reject a bill or refuse to act upon it within 60 days, the House of Representatives can make it law by repassing it by a two-thirds majority of the members present.

The House of Representatives has 467 members elected from 118 electoral districts. Each district has from three to five representatives, but the voter casts only one ballot, with the candidates receiving the highest number of votes being elected. Lower-house members are elected for a term of four years, but the house can be dissolved at any time by the government, in which case elections must be held within 40 days.

As in the past, the Japanese Diet rarely initiates important legislation; such laws ordinarily come to the Diet under cabinet sponsorship. However, an individual member's bill can be introduced in the lower house if it has been signed by 20 or more members, and in the upper house with the signature of 10 or more members. Under Diet law, the committee system has been drastically altered to accord more with U.S. practice. Each house has slightly more than 20 standing committees dealing with such subjects as foreign affairs, finance, and education. Government legislation goes first to the appropriate committee, where it is examined and often vigorously debated. Membership on these committees is determined by the Diet in rough accordance with the party ratios in each house. A member normally retains his assignments as long as he sits in the Diet. Thus he develops some detailed knowledge and may provide a challenge to government policymakers of opposing parties or convictions.

Japanese politics in the second half of the 20th century has revolved around the Diet. That body is no longer on the periphery as it was under the Meiji Constitution. Moreover, with all adults over 21 eligible to vote, the Diet is more representative of the public will than it has been at any time in the past. Certain historic problems remain, however. Large-scale scandals are not lacking; the basic causes of corruption have not been eliminated. Even provided with constitutional support, the Diet has had some difficulty establishing itself as a respected body in the eyes of many of the Japanese people. Slowly, however, democratic procedures have acquired a tradition and an acceptance in Japan.

diethyl ether: *see* ethyl ether.

diethylcarbamazine citrate, synthetic anthelmintic drug (worming agent) effective

against most of the parasitic filarial worms, which are endemic throughout most of the subtropical and tropical regions of the world. These parasites infect the blood and lymph channels in human beings, causing the debilitating disease filariasis (*q.v.*). Diethylcarbamazine citrate is effective in treating filariasis caused by *Wuchereria bancrofti, Brugia malayi* (which infect the lymphatic system, causing diseases such as elephantiasis), and *Loa loa* (which infects the subcutaneous tissues). The drug is administered orally. Nausea, an allergic reaction, and a general malaise that may occur after taking diethylcarbamazine are attributed to the presence of dead and dying filarial parasites.

diethylstilbestrol (DES), nonsteroidal synthethic estrogen used as a drug and formerly used to promote growth of livestock. Unlike natural estrogens, DES remains active following oral administration. It is also administered as vaginal suppositories and by injection. DES breaks down more slowly in the body than do the natural estrogens.

DES is used therapeutically to replace estrogen during menopause, to relieve painful menstrual periods (dysmenorrhea), to stimulate the development of secondary sexual characteristics in women with nonfunctioning ovaries, to prevent conception following rape or incest, and to palliate advanced breast cancer in women and prostate cancer in men.

Beginning in the 1940s and continuing for more than 20 years, DES was frequently prescribed to pregnant women to prevent miscarriages. In 1971 investigators demonstrated statistically that DES daughters (*i.e.,* daughters born to women who had taken DES during their pregnancy) had abnormally high rates of an otherwise rare form of cervicovaginal cancer. The use of DES and other estrogens during pregnancy is now proscribed by the U.S. Food and Drug Administration.

Until the 1970s it was common practice to stimulate the fattening of beef cattle in the United States by mixing small amounts of DES into the cattle feed or by implanting pellets of DES under the skin in the ears of the cattle. Concern over trace amounts of the hormone in meat led to a ban on the use of DES as a livestock growth stimulant in the early 1970s; this ban was overturned but subsequently reinstated in 1979.

dieting, regulating one's food intake for the purpose of improving one's physical condition, especially for the purpose of reducing obesity, or what is conceived to be excess body fat. Dieting plans are based on the reduction of any of the macronutrients (fats, carbohydrates, and proteins) that constitute the major portions of food that a person eats (other than water) and that are necessary sources of energy. Energy deficits of 500–1,000 calories per day produce rather rapid initial weight loss owing to the early loss of body water, especially if carbohydrates are restricted. But, after the initial effects of dehydration, all the dieting plans produce a rate of fat loss that can only be proportional to the caloric deficit.

The following are some major approaches to dieting:

(1) Controlled dieting such as that directed by weight-control clubs (*e.g.,* Weight Watchers International, Inc.) and health spas involves programs that include education on nutrition, group reinforcement, specially constructed diets that provide adequate amounts of nutrients, and weight-maintenance regimens that are designed for long-term use. Although long-term success rates are difficult to determine, the dietary regimens are usually well-designed and can be counted on to provide proper nourishment even if weight loss is minimal.

(2) The so-called "prudent diet" is designed to control blood lipids and cholesterol for those persons at risk of coronary artery diseases. The prudent diet and its relatives stress a low-saturated and high-unsaturated fat content and limited amounts of sugar; they restrict red meat and stress poultry and nonoily fish.

(3) "Formula diets," such as Metrecal, Slender Now, and the Cambridge Diet plan, provide for the intake of a minimum of necessary nutrients—especially protein—in liquid form. Many such plans are packaged with liquids or powdered supplements, to be consumed variously from one to four times a day; modified versions call for two liquid meals and one meal of conventional food. The advantages of such formulas are ritual and reduced decision making, and the disadvantages are that dieters learn nothing about eating habits because choices are made for them and, also, that the more restrictive of these diets (down to 300 calories per day) can be quite dangerous to the health. Restrictive plans should be undertaken with medical supervision.

(4) The low-carbohydrate, high-fat, and high-protein diets, which became rather popular from the early 1970s on, restrict sugars and starches to a minimum by stressing meats, poultry, fish, and cheeses. The effect on the body is to produce ketosis and dehydration; thus initial weight loss may be marked. Although calories are not counted, the usual caloric intake is reduced because most human bodies are unable to adapt rapidly to the marked change in dietary composition. Weight is lost quickly but is returned as soon as normal eating habits are reestablished. The richness of the diet, in general, may produce dangerous effects related to the excretion of large amounts of uric acid and other nitrogenous end products and to the high saturated-fat content of the diet.

(5) High-carbohydrate, high-fibre diets promote the consumption of vegetables, fruits, nuts, and whole grains. Dietary fibre is a general term for indigestible carbohydrates that make up the cell walls of plants. Such fibres, as bulking agents, may make dieters feel satiated on fewer calories than normal. The best of the high-carbohydrate diets are moderate in protein and low in fat and promise slow weight loss with exercise and careful nutritional consideration. Some plans, however, are so low in calories or so low in protein or fat as to be nutritionally unsound.

(6) Fasting may consist of skipping a few meals or going a few days or weeks without food (other than water and, perhaps, vitamins and minerals). Fasting may serve the needs of those persons with just a few pounds to lose, but it is not effective for obese individuals or for anyone seeking long-term weight control. Fasting can be medically dangerous.

(7) Diet aids—such as amphetamines, phenylpropanolamine (PPA), starch blockers, benzocaine, diuretics, and thyroid hormones—come in pill form and are intended to suppress the appetite or reduce stomach space. Many such aids—such as amphetamines—have proved to be dangerous, whereas others are simply ineffective. Over-the-counter preparations such as PPA are ineffective in the dose provided (25 mg), though promotion for the product continues. The search continues for safe and effective appetite suppressants and for hormonal agents that may safely increase metabolic rate without inducing concomitant loss of lean body mass, including protein and bone.

Dietmar (historian): *see* Thietmar.

Dietrich, Marlene, original name MARIE MAGDALENE VON LOSCH (b. Dec. 27, 1901, Berlin), motion-picture actress whose aura of sophistication and languid sensuality made her one of the most glamorous of all film stars.

Born the daughter of a German police officer, she at first studied the violin and then studied acting under Max Reinhardt, the innovative theatrical director. She eventually joined Reinhardt's theatre company. Seven years after her first appearance in German films as an extra, her stardom was established by her role as Lola-Lola, a sultry and world-weary nightclub performer in Josef von Sternberg's *Der blaue Engel* (1930; *The Blue Angel*). Adapted from Heinrich Mann's novel *Professor Unrat,* the film was an international success. After its premiere, Von Sternberg brought her to the United States, where they collaborated on pictures such as *Morocco* (1930), *Dishonored* (1931), *Blonde Venus* (1932), *Shanghai Express* (1932), *The Scarlet Empress* (1934), and *The Devil Is a Woman* (1935). *Desire* (1936) and *Destry Rides Again* (1939) revealed her talent as a comedienne.

Marlene Dietrich
Pictorial Parade—EB Inc.

From 1943 to 1946 Dietrich made more than 500 personal appearances before Allied troops. After World War II she continued to make successful films such as *A Foreign Affair* (1948), *The Monte Carlo Story* (1956), *Witness for the Prosecution* (1957), *Touch of Evil* (1958), and *Judgment at Nuremberg* (1961). She was also a popular nightclub performer. In 1978, after a period of retirement from the screen, she appeared in the film *Just a Gigolo.*

Dietrich, Paul-Henri: *see* Holbach, Paul-Henri Dietrich, baron d'.

Dietrich von Bern, heroic figure of Germanic legend, apparently derived from Theodoric the Great, an Ostrogothic king of Italy who reigned 493–526.

Dietrich's exploits are related in a number of south German songs preserved in *Das Heldenbuch* (*see* Heldenbuch, Das)—including *Dietrichs Flucht* ("Dietrich's Flight"), *Die Rabenschlacht* ("The Battle of Ravenna"), *Alpharts Tod* ("Alphart's Death"), and a number of additional stories—and, more fully, in the 13th-century Icelandic prose *Thidriks saga.* This legend also has a connection with the Middle High German epic *Nibelungenlied.* References to Dietrich in Anglo-Saxon records are few and obscure.

Driven by Ermanaric from his kingdom of Berne (Verona), Dietrich lives for many years at Attila's court, until he returns with a Hunnish army to defeat Ermanaric at the Battle of Ravenna (Rabenschlacht). Attila's two sons fall in the fight, and Dietrich returns to Attila to answer for their deaths. Later he has his revenge by slaying Ermanaric. Dietrich's long stay with Attila represents Theodoric's youth spent at the Byzantine court. The exile is adorned with amazing exploits, most of which have no connection with the cycle.

Dietrich typifies the wise and just ruler as opposed to the tyrannical Ermanaric. Many of the incidents told about him have no basis in the story of Theodoric, although some

could be related to the experiences of Theodoric's father, Theudemir. The chief heroes of the Dietrich cycle are his weapons master, Hildebrand, with his nephews Alphart and Wolfhart; Wittich, Dietrich's traitorous vassal who slays Attila's sons; and Heime and Biterolf.

Dietz, Howard (b. Sept. 9, 1896, New York, N.Y., U.S.—d. July 30, 1983, New York City), American motion-picture executive and songwriter.

After graduating from Columbia University in 1917, Dietz joined the Philip Goodman Advertising Agency, where he was assigned to devise a trademark for Goldwyn Pictures. Dietz used Columbia's lion mascot as an inspiration for the Goldwyn studio's "roaring lion" trademark, which thereafter appeared at the beginning of each film, including those made after Goldwyn Pictures merged with two other studios in 1924 to become Metro-Goldwyn-Mayer (MGM) Corporation. Dietz also suggested the lion's accompanying Latin motto, "Ars Gratia Artis"—"Art for Art's Sake." Dietz himself joined Goldwyn Pictures in 1919 and soon became director of advertising and publicity, a post that he retained in MGM until his retirement in 1957.

Dietz wrote lyrics in his spare time and eventually wrote the words to more than 500 songs. He began this second career in 1923, but it was not until he teamed up with the song composer Arthur Schwartz in 1929 and the duo established their reputation with the musical revue *The Little Show* that his talents were recognized. The two men went on to collaborate in writing such popular Broadway musicals and revues as *Three's a Crowd* (1930), *The Band Wagon* (1931), *Flying Colors* (1932), *Revenge with Music* (1934), *At Home Abroad* (1935), *Inside U.S.A.* (1941), and *The Gay Life* (1961). Dietz also wrote an acclaimed English translation of Johann Strauss's operetta *Die Fledermaus* in 1950.

Dietz, Robert S(inclair) (b. Sept. 14, 1914, Westfield, N.J., U.S.), American geophysicist and oceanographer who set forth a theory of seafloor spreading in 1961.

Dietz was educated at the University of Illinois (B.S., 1937; M.S., 1939; Ph.D., 1941). After attaining the rank of lieutenant colonel as a pilot in the U.S. Army Air Force during World War II, he became a civilian scientist with the U.S. Navy. In this capacity, he supervised the oceanographic research on Admiral Richard E. Byrd's last Antarctic expedition (1946–47). He subsequently served as oceanographer with several organizations, including the U.S. Coast and Geodetic Survey (1958–65) and the Atlantic Oceanography and Meteorology Laboratories (1970–77). He became professor of geology at Arizona State University, Tempe, in 1977.

Dietz's discovery in 1952 of the first fracture zone in the Pacific, which he related to deformation of the Earth's crust, led him to hypothesize that new crustal material is formed at oceanic ridges and spreads outward at a rate of several centimetres per year. Subsequent work confirmed this suggestion. Dietz also became known for his work in the fields of selenography (study of the Moon's physical features) and meteoritics, particularly for his suggestion that certain shock effects in rocks are indicative of meteorite impact.

Dieudonné, Jean (-Alexandre-Eugène) (b. July 1, 1906, Lille, Fr.), French mathematician and educator known for his writings on abstract algebra, functional analysis, topology, and his theory of Lie groups.

Dieudonné was educated in Paris, receiving both his bachelor's degree (1927) and his doctorate (1931) from the École Normale Supérieure. After teaching at universities in Rennes and Nancy, Fr., and São Paulo, Braz., Dieudonné came to the United States in 1952 to accept a position as professor of mathematics at the University of Michigan. The following year he taught mathematics at Northwestern University, Ill., and remained as a professor until 1959, when he returned to Paris to teach at the Institute of Advanced Scientific Studies (1959–64). In 1964 he became professor of mathematics at the University of Nice; the following year he was named dean of the science faculty. In 1968 he was elected to the French Academy of Science. He was a founding member of the Nicolas Bourbaki (*q.v.*) group. His publications include *La Géométrie des groupes classiques* (1955), *Foundations of Modern Analysis* (1960), and *Algèbre linéaire et géométrie élémentaire* (1964; "Linear Algebra and Elementary Geometry").

Dieulafoy, Marcel-Auguste (b. Aug. 3, 1844, Toulouse, Fr.—d. Feb. 25, 1920, Paris), French archaeologist and civil engineer who excavated the palaces of the ancient Persian kings Darius I the Great and Artaxerxes II at Susa (modern Shūsh, Iran) in 1885 and gathered a large collection of archaeological fragments, which were placed in the Louvre. His published works include *L'Art antique de la Perse,* 5 vol. (1884–89; "The Ancient Art of Persia"), and *L'Acropole de Suse* (1890–92; "The Acropolis of Susa"). His wife, Jeanne Magre Dieulafoy (1851–1916), who accompanied him on the expedition, published *A Suse, journal des fouilles* (1888; "At Susa, Journal of Excavations"). She also discovered the ruins of the famed 12th-century mosque at Hasan, Mor., in 1912.

Dievs, also called DEBESTĒVS (Latvian), Lithuanian DIEVAS, Old Prussian DEIVAS, in Baltic religion, the sky god. Dievs and Laima, the goddess of human fate, determine man's destiny and world order. As pictured by the pre-Christian Balts, Dievs (Sky) is an Iron Age Baltic king who lives on a farmstead in the sky. Wearing a silver gown, pendants, and a sword, he occasionally rides down to earth, on horseback or in a horse-drawn chariot, to watch over farmers and protect their crops and households.

He is a wooer of Saule, the sun, and has two sons (Dieva dēli in Latvian; Dievo sūneliai in Lithuanian), the Heavenly Twins, sometimes considered the morning and evening star. Like their Greek (Dioscuri) and Vedic (Aśvins or Nāsatyas) counterparts, Dieva dēli are skilled horsemen. They associate with Saules meita, the daughter of the sun, and when she is sinking into the sea with only her crown still visible, Dieva dēli come to her rescue.

In name, Dievs is cognate with the Vedic Dyaus-Pitṛ, the Latin Dies-piter (Jupiter), and the Greek Zeus, denoting originally the bright, daylight sky.

The word *dievs* was also used by the ancient Balts to denote god in general and in modern usage refers to the Christian God.

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

Diez, Friedrich Christian (b. March 15, 1794, Giessen, Hesse-Darmstadt [Germany]—d. May 29, 1876, Bonn), language scholar who made the first major analysis of the Romance languages and thus founded an important branch of comparative linguistics.

As a student he acquired a deep interest in Italian poetry, but a visit to the great German poet J.W. von Goethe in 1818 directed his attention to exploring Provençal literature. As *Privatdozent,* or student-paid lecturer, at the University of Bonn from 1822, he published two important earlier works, one on Provençal troubadour poetry (1826) and the other on the lives and works of the troubadours (1829). After becoming professor of modern literature at Bonn in 1830, he turned increasingly to more general considerations of the Romance languages. Thus he came to produce his two great works, *Grammatik der romanischen Sprachen,* 3 vol. (1836–44; "Grammar of the Romance Languages"), and *Etymologisches Wörterbuch der romanischen Sprachen,* 2 vol. (1853; "Etymological Dictionary of the Romance Languages"). His work in the area of the Romance languages has been compared with the great achievement of Jacob Grimm in the field of Germanic languages.

Difaqane (African refugees): *see* Mfecane.

difference equation, mathematical equality involving the differences between successive values of a function of a discrete variable. A discrete variable is one that is defined or of interest only for values that differ by some finite amount, usually a constant and often 1; for example, the discrete variable x may have the values $x_0 = a$, $x_1 = a + 1$, $x_2 = a + 2, \ldots$, $x_n = a + n$. The function y has the corresponding values $y_0, y_1, y_2, \ldots, y_n$, from which the differences can be found:

$$\begin{aligned} \Delta y_0 &= y_1 - y_0 \\ \Delta y_1 &= y_2 - y_1 \\ &\cdots \\ \Delta y_n &= y_{n+1} - y_n. \end{aligned}$$

Any equation that relates the values of Δy_i to each other or to x_i is a difference equation. In general, such an equation takes the form

$$y_i - a_i y_{i-1} = b_i.$$

Systematic methods have been developed for the solution of these equations and for those in which, for example, second-order differences are involved. A second-order difference is defined as

$$\begin{aligned} \Delta^2 y_i &= \Delta(\Delta y_i) = \Delta y_{i+1} - \Delta y_i \\ &= (y_{i+2} - y_{i+1}) - (y_{i+1} - y_i) \\ &= y_{i+2} - 2y_{i+1} + y_i. \end{aligned}$$

differential, in mathematics, an expression based on the derivative (*q.v.*) of a function, useful for approximating certain values of the function. The derivative of a function at the point x_0, written as $f'(x_0)$, is defined as the limit as Δx approaches 0 of the quotient $\Delta y/\Delta x$, in which Δy is $f(x_0 + \Delta x) - f(x_0)$. Because the derivative is defined as the limit, the closer Δx is to 0, the closer will be the quotient to the derivative. Therefore, if Δx is small, $\Delta y \approx f'(x_0)\Delta x$ (the wavy lines mean "is approximately equal to"). For example, to calculate $\sqrt{17}$, the function involved is $f(x) = \sqrt{x}$, which has a derivative equal to $\frac{1}{2}x^{-\frac{1}{2}}$. If x_0 is 16, then $f'(x_0)$ is $\frac{1}{8}$ and Δx is 1, giving an approximate value of $\frac{1}{8}$ for Δy. Because $f(16)$ is 4, it follows that $f(17)$, or $\sqrt{17}$, is approximately 4.125, the actual value being 4.123 to three decimals.

differential analyzer, computing device for solving differential equations. Its principal components perform the mathematical operation of integration (*see also* integrator).

The American electrical engineer Vannevar Bush and others at the Massachusetts Institute of Technology invented the first continuous integraph, later called a differential analyzer, during the early 1930s. Its integrators consisted of replaceable shafts, gears, wheels, and disks and required much manual setting up. The analogue computer (*q.v.*) operates electronically and faster (although not always as accurately) and accomplishes the same operations with components that take up less space. The inherent lack of precision has been rectified in some cases by use of digital counting devices, giving rise to a subclass of these machines known as digital differential analyzers.

differential equation, mathematical statement containing one or more derivatives, that is, terms representing the relationships between the rates of change of continuously

varying quantities. Differential equations are very common in science and engineering, other fields of quantitative study. The solution of a differential equation is, in general, an algebraic equation expressing the functional dependence of one variable upon one or more others; it ordinarily contains constant terms that are not present in the original differential equation.

A brief treatment of differential equations follows. For full treatment, *see* MACROPAEDIA: Analysis (in Mathematics): *Differential Equations.*

Differential equations are classified into several broad categories, and these are in turn further divided into many subcategories. The most important categories are those of the so-called ordinary differential equations and the so-called partial differential equations. When the function involved in the equation depends upon only a single variable, its derivatives are ordinary derivatives and the differential equation is classed as an ordinary differential equation. If, on the other hand, the function depends upon several independent variables, so that its derivatives are partial derivatives, then the differential equation is classed as a partial differential equation. The following are examples of ordinary differential equations:

$$\frac{dy}{dt} = -ky,$$

$$m\frac{d^2y}{dt^2} = -k^2y,$$

$$\left[1+\left(\frac{dy}{dx}\right)^2\right]\frac{d^3y}{dx^3} - 3\frac{dy}{dx}\left(\frac{d^2y}{dx^2}\right)^2 = 0.$$

In these, y stands for the function, and either t or x is the independent variable. The symbols k and m are used here to stand for specific constants.

Whichever the type may be, a differential equation is said to be of the nth order if it involves a derivative of the nth order but no derivative of an order higher than this. The equation

$$\frac{\partial u}{\partial t} = k^2\left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right]$$

is an example of a partial differential equation of the second order. The theories of ordinary and partial differential equations are markedly different, and for this reason the two categories are treated separately.

Instead of a single differential equation, the object of study may be a simultaneous system of such equations. The formulation of the laws of dynamics frequently leads to such systems. In many cases, a single differential equation of the nth order is advantageously replaceable by a system of n simultaneous equations each of which is of the first order.

An ordinary differential equation in which, for example, the function and the independent variable are denoted by y and x is in effect an implicit summary of the essential characteristics of y as a function of x. These characteristics would presumably be more accessible to analysis if an explicit formula for y could be produced. Such a formula, or at least an equation in x and y (involving no derivatives) that is deducible from the differential equation, is called a solution of the differential equation. The process of deducing a solution from the equation by the applications of algebra and the calculus is called that of solving or integrating the equation. It should be noted, however, that the differential equations that can be integrated form but a small minority. The chances are large, in the instance of a differential equation selected at random, that the equation is itself the simplest mode of summarizing the characteristics of the function and that even theoretically no solving formula in the usual sense exists. In such instances, the function must be studied by indirect methods. Even its existence must be proved when there is no possibility of producing it for inspection.

differential equation, ordinary: *see* ordinary differential equation.

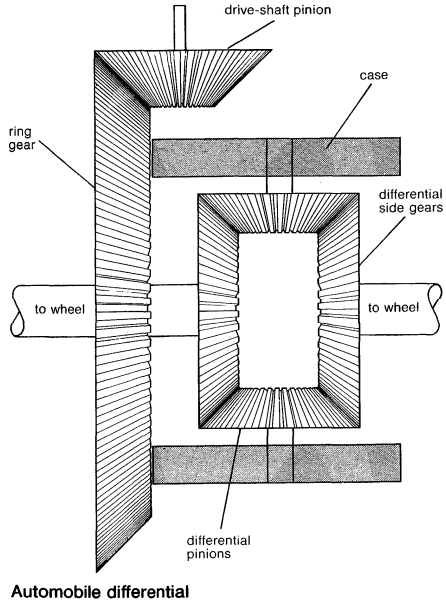
differential equation, partial: *see* partial differential equation.

differential gear, in automotive mechanics, gear arrangement that permits power from the engine to be transmitted to a pair of driving wheels, dividing the force equally between them but permitting them to follow paths of different lengths, as when turning a corner or traversing an uneven road. On a straight road the wheels rotate at the same speed; when turning a corner the outside wheel has farther to go and will turn faster than the inner wheel if unrestrained.

The conventional automobile differential was invented in 1827 by a Frenchman, Onésiphore Pecqueur. It was used first on steam-driven vehicles and was a well-known device when internal-combustion engines appeared at the end of the 19th century.

The elements of the Pecqueur differential are shown in the Figure. The power from the transmission is delivered to the bevel ring gear by the drive-shaft pinion, both of which are held in bearings (not shown) in the rear-axle housing. The case is an open boxlike structure that is bolted to the ring gear and contains bearings to support one or two pairs of diametrically opposite differential bevel pinions. Each wheel axle is attached to a differential side gear, which meshes with the differential pinions. On a straight road the wheels and the side gears rotate at the same speed, there is no relative motion between the differential side gears and pinions, and they all rotate as a unit with the case and ring gear. If the vehicle turns to the left, the right-hand wheel will be forced to rotate faster than the left-hand wheel, and the side gears and the pinions will rotate relative to one another. The ring gear rotates at a speed that is equal to the mean speed of the left and right wheels. If the wheels are jacked up with the transmission in neutral and one wheel is turned, the other wheel will turn in the opposite direction at the same speed.

The torque (turning moment) transmitted to the two wheels with the Pecqueur differential is the same. Consequently, if one wheel slips, as in ice or mud, the torque to the other wheel is reduced. This disadvantage can be overcome somewhat by the use of a limited-slip differential. In one version a clutch connects one of the axles and the ring gear. When one wheel encounters low traction, its tendency to spin is resisted by the clutch, thus providing greater torque for the other wheel.



Automobile differential

differential geometry, field of mathematics in which the calculus is applied to geometry. The type of this geometry called "local" deals mainly with properties in a limited domain around a point. It was thoroughly investigated in the 19th century after it was initiated in the 18th century by the European mathematicians Leonhard Euler and Gaspard Monge. With it are connected the names of Carl Friedrich Gauss, Pierre-Ossian Bonnet, Jean-Frédéric Frenet, and Eugenio Beltrami. Considerations of finite parts of surfaces, or surfaces (and curves) as a whole, are the concern of integral geometry, or global geometry, which has been further developed in the 20th century by Wilhelm Blaschke and others. This specialty includes, for example, theorems on closed geodesic lines on surfaces, especially ovaloids (egglike surfaces).

A brief treatment of differential geometry follows. For full treatment, *see* MACROPAEDIA: Geometry: *Differential geometry.*

A simple example of the techniques of differential geometry is the determination of the tangent to a plane curve at some chosen point on the curve. The procedure is equivalent to selecting—from all the lines passing through the chosen point—that line which has the same slope as the curve at that point. The methods of analytic geometry make it possible to write algebraic equations for the curve and for a line passing through the desired point and any nearby point on the curve; the methods of the calculus identify the line that has the required slope.

Similar operations may be extended to the calculation of the curvature and length of arc of curves and of analogous properties of surfaces in spaces of any number of dimensions.

differential psychology, branch of psychology that deals with individual and group differences in behaviour. Charles Darwin's studies of the survival capabilities of different species and Sir Francis Galton's researches on individual visual and auditory skills, as well as more recent experiments, have shown that both individual and group differences are quantitative rather than qualitative. Persons do not fall into sharply separated types, such as bright and dull, maladjusted and normal, introvert and extrovert. On the contrary, in all psychological characteristics, individuals vary by degree along a continuous scale. For most traits, the distribution approximates the bell-shaped normal probability curve, with the greatest clustering of cases near the centre of the range and a gradual decrease in numbers as the extremes are approached. Individual differences in behavioral characteristics are not limited to the human species; they occur throughout the animal scale. Investigations of animal behaviour, from unicellular organisms to anthropoid apes, reveal wide individual differences in learning, motivation, emotionality, and other traits. So large are these differences that the distributions overlap even when widely separated species are compared.

differential thermal analysis (DTA), in analytical chemistry, a technique for identifying and quantitatively analyzing the chemical composition of substances by observing the thermal behaviour of a sample as it is heated. The technique is based on the fact that as a substance is heated, it undergoes reactions and phase changes that involve absorption or emission of heat. In DTA the temperature of the test material is measured relative to that of an adjacent inert material. A thermocouple

imbedded in the test piece and another in the inert material are connected so that any differential temperatures generated during the heating cycle are graphically recorded as a series of peaks on a moving chart. The amount of heat involved and temperature at which these changes take place are characteristic of individual elements or compounds; identification of a substance, therefore, is accomplished by comparing DTA curves obtained from the unknown with those of known elements or compounds. Moreover, the amount of a substance present in a composite sample will be related to the area under the peaks in the graph, and this amount can be determined by comparing the area of a characteristic peak with areas from a series of standard samples analyzed under identical conditions. The DTA technique is widely used for identifying minerals and mineral mixtures.

differentiation, in mathematics, process of finding the derivative (*q.v.*), or rate of change, of a function. In contrast to the abstract nature of the theory behind it, the practical technique of differentiation can be carried out by purely algebraic manipulations, using three basic derivatives, four rules of operation, and a knowledge of how to manipulate functions.

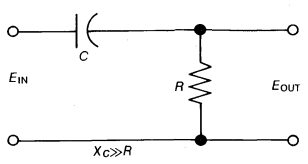
The three basic derivatives are: (1) for algebraic functions, $D(x^n) = nx^{n-1}$, in which n is any real number; (2) for trigonometric functions, $D(\sin x) = \cos x$; and (3) for exponential functions, $D(e^x) = e^x$.

For functions built up of combinations of these classes of functions, the theory provides the following basic rules for differentiating the sum, product, or quotient of any two functions $f(x)$ and $g(x)$ the derivatives of which are known: $D(af + bg) = aDf + bDg$ (sums); $D(fg) = fDg + gDf$ (products); and $D(f/g) = (gDf - fDg)/g^2$ (quotients).

The other basic rule, called the chain rule, provides a way to differentiate a composite function. If $f(x)$ and $g(x)$ are two functions, the composite function $f(g(x))$ is calculated for a value of x by first evaluating $g(x)$ and then evaluating the function f at this value of $g(x)$; for instance, if $f(x) = \sin x$ and $g(x) = x^2$, then $f(g(x)) = \sin x^2$, while $g(f(x)) = (\sin x)^2$. The chain rule states that the derivative of a composite function is given by a product, as $D(f(g(x))) = Df(g(x)) \cdot Dg(x)$. In words, the first factor on the right, $Df(g(x))$, indicates that the derivative of $Df(x)$ is first found as usual, and then x, wherever it occurs, is replaced by the function $g(x)$. In the example of $\sin x^2$, the rule gives the result $D(\sin x^2) = D\sin(x^2) \cdot D(x^2) = (\cos x^2) \cdot 2x$.

differentiator, a device or set of components for performing the mathematical operation of differentiation—*i.e.*, supplying an output proportional to the derivative of the input with respect to one or more variables. The many common examples of mechanical differentiators in which a displacement is differentiated with respect to time include speedometers and generators. In such devices, the derivative is frequently measured by deflections of spring-loaded elements.

There are also electronic differentiators, or electrical differentiating circuits. The Figure shows a differentiator based on an electrical analogue. For a time-varying input, if the capacitive reactance X_C shown in the schematic diagram is very large compared with the resistance R, the current, and hence output voltage E_{OUT} appearing across R, will lead the phase of the input voltage E_{IN} by almost 90°. Thus the output voltage E_{OUT} is the time derivative of the input voltage E_{IN}, $E_{OUT} = dE_{IN}/dt$.



Electrical differentiating circuit

From M.H. Weik, *Standard Dictionary of Computers and Information Processing*

diffraction, the spreading of waves around obstacles. Diffraction takes place with sound; with electromagnetic radiation, such as light, X-rays, and gamma rays; and with very small moving particles such as atoms, neutrons, and electrons, which show wavelike properties. One consequence of diffraction is that sharp shadows are not produced. The phenomenon is the result of interference (*i.e.*, when waves are superimposed, they may reinforce or cancel each other out) and is most pronounced when the wavelength of the radiation is comparable to the linear dimensions of the obstacle. When sound of various wavelengths or frequencies is emitted from a loudspeaker, the loudspeaker itself acts as an obstacle and casts a shadow to its rear so that only the longer bass notes are diffracted there. When a beam of light falls on the edge of an object, it will not continue in a straight line but will be slightly bent by the contact, causing a blur at the edge of the shadow of the object; the amount of bending will be proportional to the wavelength. When a stream of fast particles impinges on the atoms of a crystal, their paths are bent into a regular pattern, which can be recorded by directing the diffracted beam onto a photographic film.

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

diffraction grating, component of optical devices consisting of a surface ruled with close, equidistant, and parallel lines for the purpose of resolving light into spectra. A grating is said to be a transmission or reflection grating according to whether it is transparent or opaque—that is, whether it is ruled on glass or metal. Reflection gratings are further classified as plane or concave, the latter being a spherical surface ruled with lines that are the projection of equidistant and parallel lines on an imaginary plane surface. The advantage of a concave grating over a plane grating is its ability to produce sharp spectral lines without the aid of lenses. This makes it useful in the infrared and ultraviolet regions in which these radiations would otherwise be absorbed upon passage through a lens.

A diffraction grating is able to disperse a beam of various wavelengths into a spectrum of associated lines because of the principle of diffraction: in any particular direction, only those waves of a given wavelength will be conserved, all the rest being destroyed because of interference with one another. Gratings give exceptionally high resolutions of spectral lines. The resolving power (R) of an optical instrument represents the ability to separate closely spaced lines in a spectrum and is equal to the wavelength λ divided by the smallest difference ($\Delta\lambda$) in two wavelengths that can be detected; *i.e.*, $R = \lambda/\Delta\lambda$. Thus, for a grating 10 centimetres wide and ruled with 10,000 lines per centimetre, the resolution in the first diffraction order would be 100,000. For a wavelength emission in the ultraviolet, say $\lambda = 300$ nanometres (3×10^{-7} metre), a wavelength difference of $\Delta\lambda = 3 \times 10^{-12}$ metre (about $^1/_{100}$ the diameter of an atom) should be theoretically possible.

diffusion, process resulting from random motion of molecules by which there is a net flow of matter from a region of high concentration to a region of low concentration. A familiar example is the perfume of a flower that quickly permeates the still air of a room.

Heat conduction in fluids involves thermal energy transported, or diffused, from higher to lower temperature. Operation of a nuclear reactor involves the diffusion of neutrons through a medium that causes frequent scattering but only rare absorption of neutrons.

The rate of flow of the diffusing substance is found to be proportional to the concentration gradient. If j is the amount of substance passing through a reference surface of unit area per unit time, if the coordinate x is perpendicular to this reference area, if c is the concentration of the substance, and if the constant of proportionality is D, then $j = -D(dc/dx)$; dc/dx is the rate of change of concentration in the direction x, and the minus sign indicates the flow is from higher to lower concentration. D is called the diffusivity and governs the rate of diffusion.

diffusion chamber, simple form of cloud chamber, a device used for radiation detection (*see* cloud chamber).

Digambara (Sanskrit: "sky-clad"), in Jainism, one of the two principal sects, whose ascetics, shunning all property, wear no clothes. The ascetics of the other sect, the Śvetāmbara (*q.v.*; "white-robed"), wear only simple white loincloths or robes.

The schism that gave rise to the two sects is traditionally said to have taken place following a migration of Jaina monks southward from the Ganges or from Ujjain to Karṇāṭaka during a serious famine in the reign of Candragupta Maurya. Bhadrabāhu, the leader of the emigrants, insisted on the observance of nudity, thus following the example set by Mahāvīra, the last of the Jaina saviours. Sthūlabhadra, the leader of the monks who remained behind in the north, allowed the wearing of white garments, possibly as a concession to the hardships and confusion caused by the famine.

The philosophical doctrines of the two groups never significantly differed and their members have continued to intermarry. Since the northern and southern branches lived at a distance from one another, however, variations in their ritual, mythology, and literature did arise. The most serious issue, the question of whether it was possible for a monk who owned property (*e.g.*, wore clothes) to achieve *mokṣa* (spiritual release), led to the division into two sects in AD 80 (according to the Śvetāmbaras, AD 83).

Other points of difference held by the Digambara are (1) the belief that the perfect saint (*kevalin*) needs no food to stay alive; (2) the belief that Mahāvīra never married; (3) the view that no woman can reach *mokṣa* without being reborn as a man; and (4) the representation in their images of every Tīrthaṅkara (Jain saviour) as always naked, without ornaments, and with downcast eyes. Also, the Digambara do not recognize the Śvetāmbara canon of religious texts but maintain that the early literature was gradually forgotten and lost completely by the 2nd century AD.

The Digambara influence in southern India during the Middle Ages was considerable, but diminished in importance in that area as Hindu devotional Śaivism and Vaiṣṇavism grew. The sect continues mainly in southern Mahārāshtra and Karṇāṭaka.

Digboi, town, Dibrugarh district, northeastern Assam state, northeastern India, located 45 mi (72 km) east of Dibrugarh, the district headquarters. It is linked by road with Dibrugarh and with Shingbwiyeng, Burma, to the east. It is the site of extensive oil fields and refineries of the Assam Oil Company, producing a variety of petroleum products. Sulfuric acid is also manufactured. Pop. (1971) 16,538.

Digby, town, seat of Digby county, western Nova Scotia, Canada, on the isthmus of Digby Neck Peninsula, at the southern end of Annapolis Basin, an inlet of the Bay of Fundy.

The original settlement in 1766 by New

Englanders was destroyed by pirates, but in 1783 British admiral Robert Digby convoyed a group of United Empire Loyalists to resettle the site. Digby is now a popular summer resort and fishing port; it has a large scallop fishing fleet. Industries include lumbering, woodworking, and fish processing, especially of herring, known as "Digby chickens," and scallops. The town is also the southern terminus of a car ferry from Saint John, N.B., 45 mi (72 km) north-northwest. Inc. 1890. Pop. (1981) 2,558.

Digby, George: *see* Bristol, George Digby, 2nd earl of.

Digby, John: *see* Bristol, John Digby, 1st earl of.

Digby, Sir Kenelm (b. July 11, 1603, Gayhurst, Buckinghamshire, Eng.—d. June 11, 1665, London), English courtier, philosopher, diplomat, and scientist of the reign of Charles I.

The son of Sir Everard Digby, who was executed in 1606 for his part in the Gunpowder Plot (a conspiracy of a few Roman Catholics to destroy James I and the members of Parliament), Kenelm was brought up by his mother as a Roman Catholic. He left the University of Oxford in 1620 without taking a degree and was induced to go abroad by his mother, who opposed his love for Venetia, daughter of Sir Edward Stanley; she had been a childhood playmate and had become a woman of beauty and intellectual attainment. In 1623 in Madrid, Digby was appointed to the household of Prince Charles, who had just arrived there. Returning to England the same year, he was knighted by James I and appointed gentleman of the privy chamber to Charles. In 1625 he married Venetia Stanley.

In an attempt to win favour at court by some large action, Digby embarked as a privateer in December 1627 to attack for booty French ships that were anchored in the Venetian harbour of Scanderoon (now Iskenderun, Tur.). He returned to England in February 1628, in triumph, though the government felt called upon to disavow his actions because of threats of reprisals against English merchants. Lady Digby died in 1633, and he retired to Gresham College, where he occupied himself with chemical experiments for two years.

After 1635 Digby associated himself with Catholic queen Henrietta Maria's entourage at court and supported Charles I's expedition against the Presbyterian Scots in 1639–40; for this, Digby was summoned by Parliament as a Catholic recusant and appeared before the bar of the House of Commons in 1641. He then went to France, where in a duel he killed a French lord for insulting Charles I. Having returned to England, he was imprisoned by the Commons (1642–43). On his release he went to Paris, where he published his chief philosophical works, *Of the Nature of Bodies* and *Of the Nature of Mans Soule* (both 1644).

Upon his return to England, Henrietta Maria appointed Digby her chancellor; he was sent on two abortive missions to Pope Innocent X in Rome for aid in the Royalist cause in the English Civil War. Digby promised the conversion of King Charles and his chief aides. After banishment from England by a suspicious Parliament in 1649, he was allowed to return in 1654 and tried to obtain full toleration for Catholics from Oliver Cromwell. At the restoration of the monarchy, on May 8, 1660, he was confirmed as Henrietta's chancellor and was on the council of the Royal Society when its charter was granted in 1663. In January 1664 he was banished from court on grounds that he had interfered on behalf of a nobleman who had fallen into royal disfavour. Digby spent his remaining years in literary and scientific pursuits.

Digenis Akritas, also called DIGENIS AKRITAS BASILEIOS, Byzantine epic hero celebrated in folk ballads (Akritic ballads) and in an epic relating his parentage, boyhood adventures, manhood, and death. Based on a historical character who died *c.* 788, the epic, a blend of Greek, Byzantine, and Oriental motifs, originated in the 10th century and was popularized by itinerant folksingers; it was recorded in several versions from the 12th to the 17th century, the oldest of which is a linguistic mixture of popular and literary language.

Digenis Akritas, the ideal medieval Greek hero, is a bold warrior of the Euphrates frontier, the son of a Saracen amir converted to Christianity by the daughter of a Byzantine general; he was a proficient warrior by the age of three and spent the rest of his life valiantly defending the Byzantine Empire from frontier invaders. The feeling for nature and strong family affections that permeate the epic anticipate the great Cretan national romance, *Erotókritos* by Vitzéntzos Kornáros, and much modern Greek popular poetry.

Digest (in Roman law): *see* Pandects.

digestion, the process by which food is dissolved and chemically converted so that it can be absorbed by the cells of an organism and used to maintain vital body functions. In vertebrates, the main organs of the digestive track are the mouth, the stomach, and the small and large intestines. The liver and pancreas produce enzymes that contribute to the breakdown of food in the digestive tract. For a depiction of some of the structures that make up the human digestive system, see the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

A brief treatment of digestion and digestive systems follows. For full treatment, *see* MACROPAEDIA: Digestion and Digestive Systems.

Complex carbohydrates (polysaccharides and starches), fats, and proteins must be converted into simpler compounds before they can be assimilated into the body cells. During digestion, these organic compounds are reduced by hydrolytic enzymes, which split the long molecular chains by adding water molecules.

Vacuolar digestive systems, found mostly in unicellular organisms, are the simplest forms of digestion. Food is ingested and passed through a cell in bubble-like chambers called vacuoles. Enzyme organelles, or lysosomes, fuse with the vacuoles, and the enzymes convert the food into simpler compounds that can be assimilated into cellular material. After a vacuole has crossed the cell, it is expelled along with any undigested matter.

The simplest multicellular animals—the sponges— have slightly more elaborate digestive processes called channel-network systems. In these cases, whiplike structures called flagella direct water containing food along channels lined with cells that ingest and digest vacuolarly. In all other multicellular animals, special cells digest food for the entire organism. The bodies of hydra, for example, are composed of two cell layers: an outer layer (epithelium), which performs protective and sensory functions, and an inner layer (gastrodermis), responsible for digestion. The prey of a hydra is partly digested in a central cavity and is completely broken down within the vacuoles of the gastrodermal cells. Such systems are called saccular (*i.e.*, the digestive cavity is a sac with a single opening that serves as both a mouth and anus).

Most higher animals, including all vertebrates, have digestive tracts, or alimentary canals, through which food passes. Human digestion begins in the mouth. There the food is chewed and mixed with saliva, which adds moisture and contains an enzyme that begins to break down starches. The tongue kneads the food into a smooth-shaped chunk, or bolus, which is then swallowed. The bolus passes through the pharynx and esophagus and, propelled by peristaltic muscular contractions (about three per minute) is thoroughly mixed with gastric juices secreted into the stomach. Gastrin, a hormone produced by the stomach, stimulates the secretion of gastric juices. These gastric juices contain water, inorganic salts, hydrochloric acid, mucin, and several enzymes, the most abundant of which is pepsin. Pepsin breaks protein molecules into smaller molecules called polypeptides.

The food, now in a semiliquid state called chyme, passes from the stomach into the small intestine, where the greatest part of digestion takes place. Here, the chyme is subjected to the actions of a large number of enzymes, some secreted by the pancreas (which is connected to the small intestine by a duct) and some produced by glands in the intestinal wall. Each of these enzymes acts on specific food molecules. For example, amylase, maltase, lactase, and sucrase complete the digestion of carbohydrates; trypsin, chymotrypsin, carboxypeptidase, aminopeptidase, and dipeptidase, finish the breakdown of proteins; and lipase hydrolizes fat molecules. Bile, which is produced by the liver, also empties into the small intestine; this digestive secretion contains salts that break up fat globules, thereby exposing fat molecules to the enzymatic action of lipase. By the time this enzymatic attack has been completed, the carbohydrates have been broken down into simple sugars (monosaccharides), the proteins into amino acids, and the fats into glycerol and fatty acids. These simple molecules are then absorbed into the circulatory system through countless microscopic projections of the intestinal wall. These projections—called villi—give the small intestine an enormous absorptive surface.

Undigested food such as cellulose (fibre) is passed into the large intestines. There, water is again absorbed, and the remaining solid material is expelled through the anus. Common diseases of the human digestive system include infections, inflammations, ulcers, and cancers.

digestive nerve plexus, intricate layers of nervous tissue that control movements in the esophagus, stomach, and intestines. The mechanics of the nervous system's regulation of digestive functions is not fully known. Two major nerve centres are involved: the myenteric plexus (Auerbach's plexus) and the submucous plexus (Meissner's plexus). The myenteric plexus is situated between the circular muscle layer and the longitudinal muscle layer in the lower esophagus, stomach, and intestines. The submucous plexus, as its name implies, is located in the submucosal tissue, which connects the surface mucous membrane lining to the deeper muscle layers in the stomach and intestines.

The myenteric plexus receives its messages from the vagus nerve and responds by transmitting the message to muscle cells, which are thereby activated to contract. Control of nerve impulses is involuntary. The muscles of the stomach and intestines play an active role in digestion, as waves of muscle contractions (peristaltic waves) push food through the parts of the digestive tract. It is thought that the myenteric plexus stimulates the muscles to contract in peristaltic waves and that it helps keep muscle tone throughout the intestine walls, promotes secretions of intestinal juices, and allows muscular constrictions (sphincters) to open, thus permitting food to pass from one part of the digestive system to another.

The function of the submucous plexus is not as clearly defined. In the stomach its role may be partly inhibitory, working against the myenteric plexus to control the muscular contractions more finely. In the intestines it is generally believed to work in accord with the myenteric plexus in producing peristaltic waves and increasing digestive secretions.

Digger, any of a group of agrarian communists who flourished in England in 1649–50 and were led by Gerrard Winstanley (*q.v.*) and William Everard. In April 1649 about 20 poor men assembled at St. George's Hill, Surrey, and began to cultivate the common land. These Diggers held that the English Civil Wars had been fought against the king and the great landowners; now that Charles I had been executed, land should be made available for the very poor to cultivate. (Food prices had reached record heights in the late 1640s.) The numbers of the Diggers more than doubled during 1649. Their activities alarmed the Commonwealth government and roused the hostility of local landowners, who were rival claimants to the common lands. The Diggers were harassed by legal actions and mob violence, and by the end of March 1650 their colony was dispersed. The Diggers themselves abjured the use of force but hoped that their examples in seizing wastelands for communal cultivation would be followed elsewhere. Winstanley's pamphlets and the dispatch of emissaries from the colony won supporters in Kent, Buckinghamshire, Northamptonshire, and Essex. The Diggers also called themselves True Levelers, but their communism was denounced by the leaders of the Levelers.

digger bee: *see* mining bee.

digging wheel: *see* trenching machine.

Dighenis: *see* Grivas, Georgios.

digit, in anatomy, finger or toe of land vertebrates, the skeleton of which consists of phalanges. The tips of the digits are usually protected by keratinous structures, such as claws, nails, or hoofs, which may also be used for defense or manipulation. Digits are numbered one through five, beginning with the inside digit (thumb) when the palm (paw) is face downward.

In many species the number of digits has been reduced during the course of evolution. Amphibians and birds typically have four digits on each foot, amphibians having lost digit one (thumb) and birds digit five. Reptiles usually have five digits; in certain extinct dinosaurs with paddling feet, the number of phalanges was much-increased. Many phalanges have been lost from the bird's wing; the remainder are often elongated for support in flight. The number of digits in mammals varies greatly. In those with five digits (*e.g.,* primates, raccoons), the thumb has two phalanges; all other digits have three. In the horse only the third digit remains, covered at the tip by a single hoof. In cattle and other split-hoofed animals, digits three and four remain.

The number of phalanges may be multiplied in the fins of sea mammals. In bats the phalanges of digits two to five, and other arm bones, are elongated and support a fleshy wing; the thumb is short and free and carries a claw.

Primates have five digits, and most have developed fingernails and toenails in the place of claws and hoofs. These digits tend to be capable of much independent, manipulative action. The human foot is specialized for bipedal locomotion—the toes are shortened, relatively immovable, and nonmanipulative.

digit malformation, in human physiology, any of the isolated anomalies of the digits (fingers or toes) in an otherwise normal individual or as one symptom of a more generalized genetic abnormality. In polydactyly, having more than the normal number of digits, the extra digit is smaller than normal and usually at the outside of the hand or foot; it may be removed surgically. Polydactyly sometimes also occurs in various genetic syndromes, including the Ellis-van Crevald syndrome and chromosomal trisomy 13 (D_1-trisomy). In syndactyly the digits are fused or webbed, and it also is treated surgically. Syndactyly is a common finding in many genetic disorders. Brachydactyly, or abnormally short digits, may result from underdevelopment or absence of some of the phalanges or metacarpals and metatarsals. Long, spidery digits (arachnodactyly) are typical in Marfan's syndrome. The lobster-claw deformity occurs when the central digit is suppressed and the lateral digits are fused into two masses; it is more common in the feet than in the hands.

digital computer, any of a class of devices capable of solving problems by processing information in discrete form. It operates with numbers, letters, and symbols expressed directly as the two digits 0 and 1 of the binary code. By counting, comparing, and manipulating these digits or their combinations according to a set of instructions held in its memory, a digital computer can perform such tasks as to control industrial processes and regulate the operations of machines; analyze and organize vast amounts of business data; and simulate the behaviour of dynamic systems (*e.g.,* global weather patterns and complex chemical reactions) in scientific research.

A brief treatment of digital computers follows. For full treatment, *see* MACROPAEDIA: Computers.

Functional elements. A typical digital computer system has four basic functional elements: (1) input-output equipment, (2) main memory, (3) control unit, and (4) arithmetic-logic unit. Any of a number of devices is used to enter data and program instructions into a computer and to access the results of the processing operation. One of the most common is the video display terminal, which features an electronic keyboard and cathode-ray tube. This type of system permits both entry and retrieval of information. The information received by a computer from its input unit is stored in the main memory or, if not for immediate use, in an auxiliary storage device. The control unit selects and calls up instructions from the memory in appropriate sequence and relays the proper commands to the arithmetic-logic unit (ALU). It also synchronizes the varied operating speeds of the input and output devices to that of the ALU so as to ensure the proper movement of data through the entire computer system. The ALU performs the arithmetic and logic algorithms selected to process the incoming data at extremely high speeds—in many cases in nanoseconds (billionths of a second). The main memory, control unit, and ALU together make up the central processing unit of most digital computer systems, while the input-output devices and auxiliary storage units comprise peripheral equipment.

Development of the digital computer. Blaise Pascal of France and Gottfried Wilhelm Leibniz of Germany invented mechanical digital calculating machines during the 17th century. The English inventor Charles Babbage, however, is generally credited with having conceived the first true digital computer. During the 1830s Babbage devised his so-called Analytical Engine, a mechanical device designed to combine basic arithmetic operations with decisions based on its own computations. Babbage's plans embodied most of the fundamental elements of the modern digital computer. For example, they called for sequential control—*i.e.,* program control that included branching, looping, and both arithmetic and storage units with automatic printout. Babbage's device, however, was never completed and it was forgotten until his writings were rediscovered more than a century later.

Of greater importance in the evolution of the digital computer was the work of the English mathematician and logician George Boole. In various essays written during the mid-1800s, Boole pointed up the analogy between the symbols of algebra and those of logic as used to represent logical forms and syllogisms. His formalism, operating on only 0 and 1, became the basis of what is now called Boolean algebra (*q.v.*), on which computer switching theory and procedures are grounded.

In 1939 John V. Atanasoff, an American mathematician and physicist, constructed an experimental prototype of an electromechanical digital computer. In 1944 Howard Aiken and a group of engineers at International Business Machines Corporation completed work on the Harvard Mark I, a machine whose data-processing operations were controlled primarily by electric relays (switching devices).

Since the development of the Harvard Mark I, the digital computer has evolved at a rapid pace. The succession of advances in computer equipment, principally in logic circuitry, is often divided into generations, with each generation comprising a group of machines that share a common technology.

In 1946 J. Presper Eckert and John W. Mauchly, both of the University of Pennsylvania, constructed ENIAC (an acronym for *e*lectronic *n*umerical *i*ntegrator *a*nd *c*alculator), the first general-purpose, fully electronic digital computer. Like Atanasoff's machine, it included vacuum tubes instead of relays as its active logic elements, a feature that resulted in a significant increase in operating speed. In 1947 the Hungarian-born mathematician John von Neumann introduced the concept of a stored program computer. His idea of storing instruction codes as well as data in an electrically alterable memory was implemented in EDVAC (*e*lectronic *d*iscrete *v*ariable *a*utomatic *c*omputer).

The second computer generation began in the late 1950s, when digital machines utilizing transistors became commercially available. Although this type of semiconductor device had been invented in 1948, more than 10 years of developmental work was needed to render it a viable alternative to the vacuum tube. The small size of the transistor, its greater reliability, and its relatively low power consumption made it vastly superior to the tube. Its use in computer circuitry permitted the manufacture of digital systems that were considerably more efficient, smaller, and faster than their first-generation ancestors.

The late 1960s and 1970s witnessed further dramatic advances in computer hardware. The first notable breakthrough was the fabrication of the integrated circuit, a solid-state device containing hundreds of transistors, diodes, and resistors on a tiny silicon chip. This microcircuit made possible the production of mainframe (large-scale) computers of higher operating speeds, capacity, and reliability at significantly lower cost. Another type of third-generation computer that developed as a result of microelectronics was the minicomputer, a machine appreciably smaller than the standard mainframe but powerful enough to control the instruments of an entire scientific laboratory.

The development of large-scale integration (LSI) enabled hardware manufacturers to pack thousands of transistors and other related components on a single silicon chip about the size of a baby's fingernail. Such microcircuitry yielded two devices that revolutionized computer technology. The first of these was the microprocessor, which is an integrated circuit that contains all the arithmetic, logic, and control circuitry of a central processing unit. Its production resulted in the development of microcomputers, systems no larger than portable television sets yet with substantial computing power. The other important device to emerge from LSI circuitry was the semiconductor memory. Consisting of only a few chips, this compact storage device is well-suited for use in minicomputers and microcomputers. Moreover, it has found use in an increasing number of mainframes, particularly

those designed for high-speed applications, because of its fast-access speed and large storage capacity.

The digital computers of the 1980s are frequently referred to as fourth-generation systems. Most of their distinguishing features are attributable to very large-scale integration (VLSI). This new design and manufacturing technology has greatly increased the circuit density of microprocessor, memory, and support chips—*i.e.,* those that serve to interface microprocessors with input-output devices. A VLSI circuit typically contains hundreds of thousands of electronic components on a silicon chip that is less than 0.2 inch (5 mm) square. Many of the microcomputers produced during the early 1980s were equipped with a single chip on which circuits for processor, memory, and interface functions were integrated. Some of the most sophisticated of these devices, though only pocket-sized, were capable of controlling industrial machine tools and high-performance jet aircraft.

digital sound recording, method of preserving sound in which audio signals are transformed into a series of pulses that correspond to patterns of binary digits (*i.e.,* 0's and 1's) and are recorded as such on the surface of a magnetic tape or optical disc. A digital system samples a sound's wave form, or value, several thousand times a second and assigns numerical values in the form of binary digits to its amplitude at any given instant. A typical digital recording system is equipped with an analogue-to-digital converter that transforms two channels of continuous audio signals into digital information, which is then recorded by a high-speed tape or disc machine. The system uses a digital-to-analogue converter that reads the encoded information from the recording medium and changes it back into audio signals that can be used by the amplifier of a conventional stereo sound system.

Digital recording provides higher-fidelity sound reproduction than do ordinary recording methods, largely because audio signals converted into simple pulse patterns are virtually immune to the residual noise and distortion that are characteristic of analogue communication channels and sound recording media. In addition, many digital recording systems are designed to detect and eliminate interfering signals. In the 1980s digital compact disc recordings became available that were played by using a laser beam to optically scan digital information encoded on the disc's surface. In the late 1980s digital audio tape (DAT) recorders using magnetic tape cassettes became available for audio reproduction and recording. The digital recorder converts audio signals into digital data on a magnetic tape by means of a microprocessor and converts the data back into analogue audio signals that can be used by the amplifier of a conventional stereo sound system. *See also* sound recording.

digitalis, substance obtained from the seeds and leaves of the common foxglove (*Digitalis purpurea*) and used as a drug that strengthens contractions of the heart muscle and decreases the rate of the heartbeat. It is used to restore adequate circulation in patients suffering from congestive heart failure and to slow the rate of ventricular contraction in patients with atrial fibrillation or flutter.

The first physician to prescribe digitalis was the English physician and botanist William Withering (1741–99), who used it in the treatment of edema (dropsy). In *An Account of the Foxglove, and Some of Its Medical Uses* (1785), he summarized the results of his extensive clinical trials of the drug, described the symptoms of digitalis toxicity, and carefully outlined the method of its proper administration. The active principles in digitalis belong to a group of steroids called the cardiac glycosides. Their dosage must be determined with exceptional care because the lethal dose may be only three times the effective dose.

diglossia, the coexistence of two forms of the same language in a speech community. Often one form is the literary or prestige dialect, and the other is a common dialect spoken by most of the population. Such a situation exists in many speech communities throughout the world—*e.g.,* in Greece, where Katharevusa, heavily influenced by Classical Greek, is the prestige dialect and Demotic is the popular spoken language, and in Egypt, where there are two dialects of Arabic. Diglossia also denotes the speaking of two or more languages by the members of the same community, as, for example, in New York City, where many members of the Hispanic community speak both Spanish and English, switching from one to the other according to the social situation or the needs of the moment.

Digne, town, capital of Alpes-de-Haute-Provence *département,* Provence-Alpes-Côtes-d'Azur region, southeastern France. It lies 83 miles (134 km) northwest of Cannes by road. Situated on the scenic Route Napoléon, along which Napoleon traveled over the Alps on his return from Elba in 1815, it is a centre for tourism. It lies on the eastern bank of the Bléone River, a tributary of the Durance. The upper town stands on a mountain spur that is dominated by the present cathedral of Saint-Jérôme (late 15th century, largely restored). The majestic Romanesque cathedral of Notre-Dame du Bourg is disused. Digne has been an episcopal see since at least the 6th century. The local cultivation of lavender and fruits for preserving has made Digne known throughout France. Nearby Digne-les-Bains is a health resort for the treatment of rheumatic diseases. Pop. (1982) 12,540.

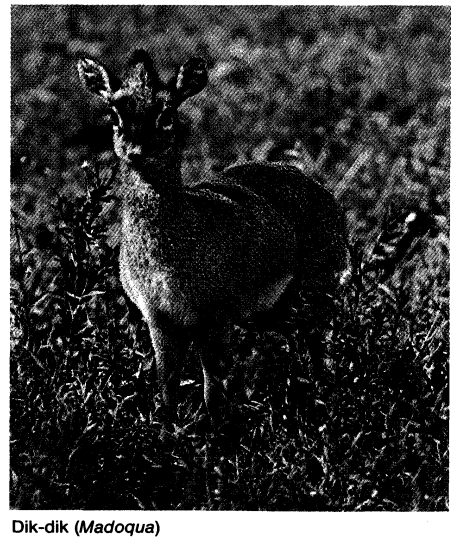
Digul River, Dutch DIGOEL RIVIER, river rising in the Sterren ("Star") Mountains in east-central Irian Jaya, Indonesia, on the island of New Guinea. The river flows 326 miles (525 km) south and west across a low region of extensive swamps (in the rainy season) to empty into the Arafura Sea immediately north of Dolak (Frederik Hendrik) Island. The river is navigable as far as Tanahmerah, the chief settlement along its course.

Dijon, city, capital of Côte d'Or *département* and of Bourgogne (Burgundy) region, east-central France. The city is 203 miles (326 km) southeast of Paris by road and lies at the confluence of the Ouche and Suzon rivers. Situated at the foot of the Côte d'Or hills and near a plain of fertile vineyards, the city has many outstanding old buildings, some dating back to the 15th century. It has always been a road centre and was known in the 9th century as Castrum Divionense. In 1015 Robert I, duke of Burgundy, chose it as the capital for his newly founded duchy, but only with the second ducal dynasty—that of Valois (1364–1477)—did the city flourish. Musicians, artists, and architects were attracted there by the patronage of the ducal court. The city retained its importance as a provincial capital after the duchy of Burgundy had been annexed by Louis XI in 1477, and the Burgundy Parliament sat there regularly. Dijon was most prosperous in the 18th century, when it was also an intellectual centre of France. The city declined after the French Revolution when its provincial institutions were suppressed, but the coming of the railways in 1851 brought it new wealth and population growth.

Dijon is still a major communications centre as well as a market and tourist town. A large number of industries, including foundries, automobile plants, and mechanical and electrical works have developed in the area. Celebrated Dijon food products are mustard, vinegar, and gingerbread; chocolate and liqueurs are also made. The Université de Dijon, founded in 1722, has faculties of law, science, and letters, as well as a medical school. The city has been a diocese since 1731.

The buildings of the palace of the dukes of Burgundy are located in the centre of the old city. The original medieval palace was largely rebuilt and extended in the 17th and 18th centuries. Only two towers—the guardroom and the kitchens—survive from the original 14th- and 15th-century building. The palace is now the *hôtel de ville* (town hall) and contains the Musée des Beaux Arts. The magnificent tombs of Philip the Bold (1342–1404) and John the Fearless (1371–1419), dukes of Burgundy, are found here; the museum's collection includes the painting of "The Nativity" by the unidentified 15th-century Master of Flémalle. A psychiatric hospital now stands on the site of the Chartreuse de Champmol, a Carthusian monastery founded by Philip the Bold in 1383, but the doorway of the chapel and other fine vestiges survive from the original building. In the west of the old city stands the cathedral of Saint-Bénigne, an example of pure Burgundian Gothic, built in the early 14th century to replace a Romanesque basilica of which the crypt still remains. The church of Saint-Philibert, close by, now deconsecrated, has a 12th-century nave. The Gothic church of Notre-Dame has an original facade with magnificent carvings around its triple doorway. The later Renaissance facade of the church of Saint-Michel also has a fine sculptured doorway. Pop. (1982) 139,188.

dik-dik (*Madoqua*), any of several small, delicate African antelopes, family Bovidae (order



Dik-dik (*Madoqua*)
Jack Cannon—Ostman Agency

Artiodactyla), named for the sound it makes when alarmed. The dik-dik stands 30–40 cm (12–16 inches) at the shoulder and weighs 3–5 kg (7–11 pounds). It has an elongated snout and a soft coat that is gray or brownish above, white below. The hair on the crown forms an upright tuft and may partially conceal the short, ringed horns of the male. The four species of dik-diks inhabit dry areas of dense brush in southern and eastern Africa. They feed chiefly on acacias and other shrubs.

dika nut, edible nut of the dika tree, also called the dika bread, or Gabon chocolate, tree (*Irvingia barteri*), native to West Africa. The nut is used principally for food and oil.

The fruit of the dika is a large edible drupe with thick, fibrous flesh. The kernels are taken from the stones and roasted like coffee beans, then pounded and poured into a mold before being added to boiling meat and vegetables. The kernels are also used to adulterate chocolate and ground to make flour. The fat is

extracted from the seeds for soap and candlemaking. A relish made from the dika nut is customarily eaten with plantain, a starchy fruit similar to the banana.

dike, in geology, tabular or sheetlike igneous body that is often oriented vertically or steeply inclined to the bedding of pre-existing intruded rocks; similar bodies oriented parallel to the bedding of the enclosing rocks are called sills. A dike set is composed of several parallel dikes; when the number of dikes is large, the term dike swarm is used. Although dikes may range in size from a fraction of an inch to dozens of feet in width, they average between 1 and 20 feet wide. The length of a dike usually depends upon how far it can be traced across the surface; dikes can be up to hundreds of miles long. Dikes have a wide range of rock compositions. They commonly have a porphyritic texture; *i.e.,* larger crystals within a finer grained groundmass, indicating two periods of crystallization.

Dikelocephalus, genus of trilobites (extinct arthropods) that is a useful guide fossil for the Upper Cambrian rocks of Europe and North America (the Cambrian Period began 570,000,000 years ago and ended 500,000,000 years ago). *Dikelocephalus* is distinguished by its broad head, its large and relatively well-developed tail, and its pair of short spines at the end of the tail. The eyes of *Dikelocephalus* are large and crescentic in shape.

Dikran II THE GREAT: *see* Tigranes II the Great.

dīkṣā, rite of consecration that preceded the Vedic sacrifice in ancient India; in later and modern Hinduism, the initiation of a layman by his guru (spiritual guide) into a religious sect.

In the soma sacrifices of the Vedic period, the lay sacrificer, after bathing, kept a daylong (in some cases up to a yearlong) silent vigil inside a special hut in front of a fire. He was dressed in garments of black antelope skin, which he also used to sit on, and at nightfall drank only cooked milk. The *tapas* (a mystical condition that was a basis of all Indian ascetic practices) produced was considered to be a sign, and a means, of passing from the realm of the profane to that of the sacred. Like similar rites observed throughout the world, *dīkṣā* also carried with it the meaning of a "rebirth," and the scriptures describing the ceremony made use of explicit symbolism, such as the "womb" of the hut.

At the end of the soma ritual, the sacrificer went through a reverse ceremony, the *avabhṛtha* ("concluding bath"), in which he again bathed, and his sacred garments, the ritual utensils, and the pressed shoots of the soma plant were all cast into the water.

In modern Hinduism, rites of consecration and initiation show many regional and sectarian variations. They are generally preceded by preparatory fasting, bathing, and dressing in new clothes and include in the act of initiation the placing of special marks on the body or forehead, taking on a new name, receiving from the preceptor a selected mantra (prayer formula), and worship.

Dikwa, also called DIKOA, town and traditional emirate, Borno State, Nigeria. The town lies near the Yedseram River, which flows into Lake Chad, and has road connections to Maiduguri, Bama, Ngala, and Kukawa. Precisely when the town was founded and when its walls (30 ft [9 m]) thick were built is unknown; but it had certainly become a major centre of the Bornu kingdom (*see* Kanem-Bornu) of the Kanuri people by the 1850s.

In 1893, after the Sudanese warrior Rābiḥ az-Zubayr (Rabah Zubayr) destroyed the Bornu capital at Kukawa (66 mi [106 km] north-northwest) and conquered almost all of Bornu, Dikwa was selected by Rābiḥ to be the new Bornu capital and seat of the *shehu* (sheikh). Although Rābiḥ was killed by the French at Kusseri (now Fort-Foureau, Cameroon, 72 mi east) in 1900, and the immediate region came under French control, Dikwa remained the *shehu*'s seat until 1902. After the British, the French, and the Germans divided Bornu in that year, Shehu Bukar Garbai fled from Dikwa to Nigeria, and the French moved their headquarters from Dikwa town to Kusseri. The Germans installed Sanda Mandarama at Dikwa (then recognized as the capital of Dikwa emirate in German Kamerun) as the *shehu* of German Bornu.

After the Cameroons campaign of 1914–16, Dikwa was occupied by the British; and, in 1922, when Dikwa emirate became part of the League of Nations mandate of British Cameroons, Emir Umar Sanda Kiarimi became known as the *shehu* of Dikwa. Kiarimi was selected *shehu* of Bornu (then Bornu province of Nigeria) in 1937; and his successor, Emir Abba Masta, dropped the title of *shehu* and became the first *mai* (in this case, "emir") of Dikwa. In 1942, however, the emirate headquarters was moved from Dikwa town (whose surrounding *firki* ["black cotton"] swamps had provided some protection against attack) to Bama, 40 mi south-southwest.

Although administered by Nigeria's Bornu province during British rule, the emirate became part of the United Nations Trust Territory of Northern Cameroons in 1946. After rejecting union with Nigeria in 1959, its peoples, mostly Kanuri and Shuwa Arab peoples, voted to join a new (later Sardauna) province in Northern Nigeria in the 1961 plebiscite. A year later, however, they were able to secede from Sardauna and unite with their kinsmen in Bornu Province. Dikwa was part of North-Eastern State from 1967 to 1976.

Most of the area's population is engaged in herding (especially cattle) and in farming (chiefly cotton, peanuts [groundnuts], millet, sorghum, corn [maize], and indigo). Fishing is important, both along the shores of Lake Chad and the Yedseram. Cotton weaving and dyeing are significant local activities, as is the tanning of leather. The Shuwa also use their cattle—a practice unusual in Nigeria—to transport goods and people.

Dikwa town has a government health office and a dispensary; but Bama, besides being the seat of the *mai Dikwa,* is larger, has more medical and educational facilities, and is a trade centre. Pop. (1982 est.) town, 10,860.

Dilas, Milovan: *see* Djilas, Milovan.

dilator muscle, any of the muscles that widen a body part— *e.g.,* in man, the dilator pupillae, fibres that extend radially through the iris of the eye and contract as available light decreases, thus dilating the pupil. There is also a dilator naris, which aids in widening the nostrils. *Compare* sphincter muscles.

dilemma, in syllogistic, or traditional, logic, any one of several forms of inference in which there are two major premises of hypothetical form and a disjunctive ("either . . . or") minor premise. For example:

If we increase the price, sales will slump.
If we decrease the quality, sales will slump.
Either we increase the price or
we decrease the quality.
Therefore, sales will slump.

In logic $\supset$ signifies "if . . . then"; $\vee$ signifies "either . . . or". Symbolically, therefore, a dilemma is an argument of the form $A \supset C$, $B \supset C$, $A \vee B$, therefore C.

It is not necessary that a dilemma should have an unwelcome conclusion; but from its use in rhetoric the word has come to mean a situation in which each of the alternative courses of action (presented as the only ones open) leads to some unsatisfactory consequence. To take a familiar example, a person who is asked, "Have you stopped beating your wife?" is presented with a rhetorical dilemma. In this more complicated version of the dilemma, however, two unwelcome results are presented instead of one (*C,* above). Thus, the conclusion itself becomes a disjunction:

Either you have been beating your wife or you are continuing to beat her.

dilemma tale, also called JUDGMENT TALE, typically African form of short story whose ending is either open to conjecture or is morally ambiguous, thus allowing the audience to comment or speculate upon the correct solution to the problem posed in the tale. Typical issues raised involve conflicts of loyalty, the necessity to choose a just response to a difficult situation, and the question of where to lay the blame when several parties seem equally guilty. An example is the story of a young boy who in a time of crisis must choose between loyalty to his own father, who is a cruel and unjust man, and loyalty to the kindly foster-father who brought him up.

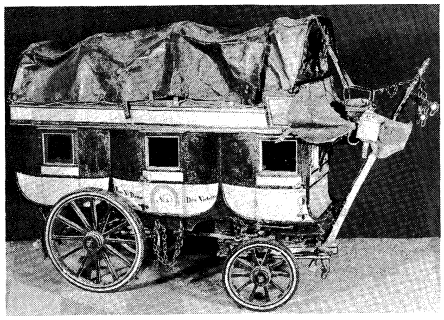
Another tale deals with a man who died while hunting an ox to feed his three wives. The first wife learns through a dream what has happened to him, the second leads her fellow wives to the place where he died, and the third restores him to life. Which of the three most deserves his praise?

A third tale has a tortoise as central character. Tortoise wishes to be thought of as equal in power and authority to Hippopotamus and Elephant. When his boastings reach their ears, however, they snub him by saying he is only a small being of no account. So Tortoise challenges both of them to a tug of war and through a trick pits them against each other, thus winning from each the grudging consent that he is their equal. The audience must decide exactly how equal the three of them are.

A final example is the tale of three brothers, all married to the same girl, who journey together to a strange land. One night the girl is murdered by a robber, and the eldest brother, with whom she is sleeping, is condemned to death on suspicion. He begs leave to visit his father before he dies. When he is late in returning, the second brother offers to die in his place, but as he is about to be executed, the third brother steps forward and "confesses" that he is the murderer. At that moment the eldest brother rides in, just in time to embrace his fate. Which of the brothers, the listeners are asked, is the most noble? As these four examples show, dilemma tales function both as instruction and entertainment, and they help to establish social norms for the audience.

Dili, also spelled DILLY, or DILLI, city, *kabupaten* (regency), and capital of Timor Timur *propinsi* (East Timor province), Timor island, Indonesia, located on the northern coast of the island on Selat (strait) Owbai. It was the capital, chief port, and commercial centre of the eastern half of Timor that was under Portuguese rule until 1975, except during Japanese occupation in World War II. The population is mostly Timorese and Atonese with minorities of Portuguese, Eurasians, and Arab Muslims. The city manufactures soap, perfume, pottery, and textiles; coffee is processed. Exports include cotton, coffee, rice, wheat, sandalwood, wool, copra, and processed hides. Crafts include plaiting, basketry, and ivory and sandalwood carving. Roads link Dili with Maubara and Atapupu to the west and with Manatuto and Tutuala to the east. It also has an airport. Pop. (1980) city, 60,150; regency, 67,039.

diligence, large, four-wheeled, closed French stagecoach employed for long journeys. It was also used in England and was popular in both countries in the 18th and 19th centuries.



Model of a diligence; in the Musée Carnavalet, Paris
J.E. Bulloz

Diligences, some of which held up to 16 people, were divided into two or three compartments. The driver rode on a seat directly above the front wheels, on the same level as, but unattached to, the coach body, on a seat on the body, or postilion. A famous diligence line operated between Paris and Lyon.

Dilke, Sir Charles Wentworth, 2ND BARONET (b. Sept. 4, 1843, London—d. Jan. 26, 1911, London), British statesman, Radical member of Parliament, who became a member of the Cabinet in W.E. Gladstone's second administration but was ruined at the height of his career when he was cited as co-respondent in a divorce suit.

After leaving Cambridge and making a world tour, he was elected to Parliament in 1868 and took an extreme left-wing position, delivering a series of speeches strongly critical of the monarchy. From 1874 on, however, with the Liberals in opposition, he moved closer to his official leaders. In Gladstone's second Liberal government, Dilke was finally promoted to the Cabinet as president of the Local Government Board in 1882.

Apart from his departmental activities, Dilke was eager, with Joseph Chamberlain, to press the general Radical point of view within the Cabinet. This eagerness led him to submit frequent resignations to Gladstone. It also led him to a position of great political promise. By the end of the government, in June 1885, Benjamin Disraeli's prophecy of 1879 that Dilke would be prime minister looked plausible.

The issue was never put to the test, for, a month later, Dilke was cited as co-respondent in a sensational divorce suit. Virginia Crawford, the 22-year-old wife of a Scottish Liberal lawyer, told her husband that she had been Dilke's mistress since 1882. Dilke strenuously denied the story, and, when the case was heard, in February 1886, there was adjudged to be no evidence against him, although Crawford got his divorce. A press campaign, in which the *Pall Mall Gazette* took the lead, made this an inadequate victory for Dilke. To try to clear his name he got the Queen's proctor to reopen the case, and a second hearing took place in July 1886. This went heavily against Dilke. One of his public difficulties was that, although he rebutted Mrs. Crawford's allegations, he was forced to admit to having been her mother's lover.

Six years later, Dilke returned to the House of Commons and held the seat until his death. He was active in the Commons as a military expert and as an exponent of advanced labour legislation. Much of his energy, however, was devoted to gathering evidence that might clear his name. The accumulated evidence showed decisively that much of Mrs. Crawford's story was a fabrication; whether there was a substratum of truth remains uncertain.

dill (*Anethum graveolens*), fennel-like annual or biennial herb of the parsley family (Apiaceae, or Umbelliferae) or its dried, ripe fruit, or seeds, and leafy tops used to season foods, particularly in eastern Europe and Scandinavia. Native to Mediterranean countries and the southern U.S.S.R., dill is widely cultivated in Europe, India, and North America. The entire plant is aromatic and the small stems and immature umbels are used for flavouring soups, salads, sauces, fish, sandwich fillings, and particularly pickles. Dill has a warm, slightly sharp flavour somewhat reminiscent of caraway. The whole seeds and the seed oil have carminative properties and have been used in treating flatulent colic.

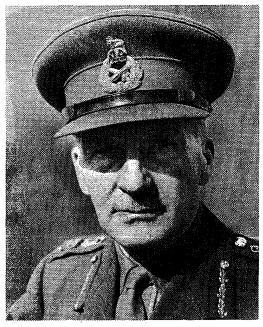
The fruit, or seed, is broadly oval in shape, about 0.14 inch (3.5 millimetres) long, with three longitudinal dorsal ridges and two

Dill (*Anethum graveolens*)
Ingmar Holmasen

wing-like lateral ridges. It is light brown in colour. The essential oil content is about 3 percent; its principal component is carvone.

Dill, Sir John Greer (b. Dec. 25, 1881, Lurgan, County Armagh, Ire.—d. Nov. 4, 1944, Washington, D.C.), British field marshal who became the British chief of staff during the early part of World War II and, from 1941 to 1944, headed the British joint staff mission to the United States.

After serving in the South African War (1899–1902) and in World War I, Dill advanced steadily, becoming director of military operations and intelligence at the War Office in 1934; he was knighted in 1937. Recognized as Britain's foremost strategist, he was head of a corps in France at the beginning of World



Dill
Camera Press

War II, becoming chief of the imperial general staff in May 1940. He was largely responsible for the decision to reinforce Egypt with 150 tanks in August in spite of the shortage at home and backed Britain's intervention in Greece (March 1941). His greatest service to the Allied war effort, however, was as chief British military representative to Washington, D.C. (1941–44), where he helped coordinate the military policies of the two major western Allies. His friendship with the U.S. chief of staff, George C. Marshall, did much to cement Anglo-U.S. solidarity.

Dilleniales, order of dicotyledonous flowering plants comprising two families (Dilleniaceae and Crossosomataceae), with 11 genera, most of which are trees, shrubs, or woody vines of the tropics and subtropics. The plants are characterized by radially symmetrical, usually bisexual flowers with three to many (but usually five) overlapping sepals; usually five overlapping petals; numerous stamens (the male pollen-producing structures); and several separate, ovule-bearing structures (pistils), each containing an indefinitely large number of ovules that develop into seeds with a fleshy appendage (aril) attached. Each pistil is topped by a slender pollen-receptive structure (the style). The flower has a characteristic appearance from the spreading of the styles.

The order is botanically significant as an evolutionary link between the more primitive magnolia order (Magnoliales) and several more advanced orders, the most immediately related of which are the tea or camellia order (Theales) and the violet order (Violales).

Economically the Dilleniaceae has a few tree species useful for their timber (*e.g., Dillenia indica, D. parviflora,* and *D. pentagyna*) and as a source of tannin. Several species of *Hibbertia* are grown as ornamentals, especially *H. scandens*, a woody vine with yellow, ill-smelling flowers, which is grown only in warm areas such as southern California or in greenhouses. *Dillenia indica* is also a greenhouse plant in temperate areas, where it is grown for its fragrant white flowers. It is a tree in its native area (Southeast Asia to Australia and Fiji), however, where it is valued for its lemon-flavoured fruits used in jellies and curries.

The largest genera of the family Dilleniaceae are *Hibbertia* (100 species), *Dillenia* (60 species), *Tetracera* (40 species), *Doliocarpus* (40 species), and *Davilla* (38 species).

The family Crossosomataceae contains only the genus *Crossosoma*, which has four species of small-leaved, sometimes spiny shrubs of the southwestern desert areas of North America. Being among the earliest plants to flower in spring and considered among the most attractive of desert shrubs, they are sometimes grown as ornamentals in dry areas.

Dillenius, Johann Jakob (b. 1687, Darmstadt, Ger.—d. April 2, 1747, Oxford), botanist who wrote several descriptive works on plants.

His *Catalogus Plantarum circa Gissam sponte nascentium* (1718; "Catalog of Plants Originating Naturally Around Giessen") treated 980 species of higher plants, 200 mosses and related forms, and 160 fungi found near Giessen, where he attended the university. In August 1721 he went to England, where in 1728 he became the first professor of botany at Oxford University. There he produced his most notable works, *Hortus Elthamensis* (2 vol., 1732), which contains descriptions and 417 drawings of plants in the Sherard Garden at Eltham, and *Historia Muscorum* (1741), which contains descriptions and illustrations of more than 600 species of "mosses," an assemblage of true mosses, liverworts, lycopods, algae, lichens, and other lower plants. The Swedish naturalist Linnaeus, who visited Dillenius in 1735, dedicated his own *Critica*

Dillenius, detail from an engraving by James Heath after an original portrait by an unknown artist
By courtesy of the Ashmolean Museum, Oxford

Botanica to him and later named the flowering-plant genus *Dillenia* in his honour.

Dilli (Indonesia): *see* Dili.

Dillinger, John (Herbert) (b. June 23, 1903, Indianapolis, Ind., U.S.—d. July 22, 1934, Chicago), most famous of all U.S. bank robbers, whose short career of robberies and escapes from June 1933 to July 1934 won media headlines.

Born in Indianapolis but spending his adolescence on a farm in nearby Mooresville, Dillinger joined the Navy in 1923, serving on the USS "Utah" but deserting after only a few months. In September 1924, caught in the foiled holdup of a Mooresville grocer, he served the next several years (1924–33) in Indiana state prisons. While in prison, he learned the craft of bank robbery from tough professionals and, upon parole on May 22, 1933, turned his knowledge to profit, taking (with one to four confederates) five Indiana and Ohio banks in four months and gaining his first notoriety as a daring, leaping, sharply dressed gunman.

Captured and jailed in Ohio in September, he was rescued by five former convict pals whose own escape from Indiana State Prison he had earlier financed and plotted. Dillinger and his gang next robbed banks in Indiana and Wisconsin and fled south to Florida and then to Tucson, Ariz., where they were discovered and arrested by local police. Dillinger was extradited to Indiana and lodged in the Crown Point, Ind., jail, where on March 3, 1934, he executed his most celebrated escape. With a razor and a piece of wood, he carved a fake pistol, blackened it with bootblack, and used it to force his way past a dozen guards to freedom, singing as he left, "I'm heading for the last roundup."

There followed more bank robberies with new confederates; Dillinger twice barely escaped FBI entrapments and shootouts in Minnesota and Wisconsin. His end came through a trap set up by the FBI, Indiana police, and one Anna Sage, a friend and brothel madam. This well-publicized "lady in red" drew Dillinger to the Biograph Theatre in Chicago, where, on emerging, he was shot to death.

Some researchers have claimed that another man, not Dillinger, was killed outside the Biograph and that Dillinger's allies accomplished a hoax on the FBI, leaving him free to disappear.

Dillon (eastern South Island, New Zealand): *see* Waiau River.

Dillon, city, seat of Beaverhead County, southwestern Montana, U.S., on the Beaverhead River (part of the Jefferson River system). It was founded as Terminus in 1880 with the arrival of the Utah and Northern Railroad and was renamed (1881) for Sidney Dillon, president of the Union Pacific, who directed completion of the line to Butte, 55 mi (89 km) north. The community (incorporated in 1885) developed as a wool-shipping point, and the founding there in 1893 of Montana's first normal school (later Western Montana College) sustained its growth. The city lies between divisions of the Beaverhead National Forest, for which it is headquarters, in an area of old mining camps (reflected in the Beaverhead County Museum). Nearby Bannack, now a ghost town and site of Montana's first major gold strike (1862), was once a bustling community of 8,000 and the first territorial capital. Dillon's economy now depends on ranching and farming (livestock, hay, and seed potatoes), mining, and tourism. Dude ranches dot the surrounding countryside. The Maverick Ski Area is to the northwest and, Clark Canyon Reservoir State Recreation Area is 20 mi south. Pop. (1980) 3,976.

Dillon, John (b. Sept. 4, 1851, Blackrock, County Dublin, Ire.—d. Aug. 4, 1927, London), a leader of the Irish Nationalist Party in the struggle to secure Home Rule by parliamentary means. Through the 1880s he was perhaps the most important ally of the greatest 19th-century Irish Nationalist, Charles Stewart Parnell; but after Parnell's involvement in a divorce case, Dillon repudiated him for reasons of political prudence.

John Dillon, 1890
By courtesy of Myles Dillon

The son of the Irish patriot John Blake Dillon (1816–66), John Dillon was a member of the British House of Commons, 1880–83 and 1885–1918. For his vigorous work in the Irish Land League, which sought fixed tenure, fair rents, and free sale of Irish land, he was imprisoned twice between May 1881 and May 1882 and was Parnell's fellow inmate of Kilmainham jail, Dublin, from October 1881. For six months in 1888 he was imprisoned for aiding William O'Brien, author of the "plan of campaign" against high rent charges by English absentee landlords in Irish farming districts.

When Parnell was named co-respondent in Capt. William Henry O'Shea's divorce suit in 1890, Dillon and O'Brien at first affirmed their support of him, but they finally decided that he would thenceforth be a liability as party leader. The party then split, the anti-Parnellite majority forming the Irish Nationalist Federation, of which Dillon served as chairman from 1896. In 1900, however, he agreed to join a reunited party under the Parnellite John Redmond.

During the prime ministry (1902–05) of Arthur James Balfour, Dillon came to believe that the British Conservative government intended to grant Irish reforms without independence, thereby "killing Home Rule by kindness." In 1905 he advised Irishmen to vote for Liberal Party candidates for Parliament, and, after the Liberals had taken office that year, he supported their reform program. Throughout World War I he vehemently opposed the extension of British military conscription to Ireland, both because that measure would strengthen the agitation by the more extreme nationalist Sinn Féin (We Ourselves) Party and because he never accepted the view that British imperial interests necessarily coincided with those of Ireland. After the Easter Rising in Dublin in 1916, Dillon protested against the harsh measures that ensued and, in the House of Commons, made a passionate speech in defense of the Irish rebels.

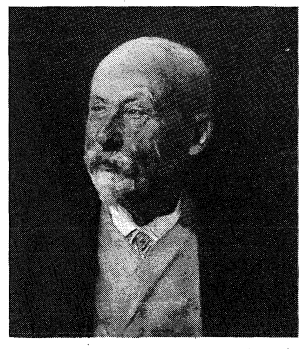
On Redmond's death (March 6, 1918), Dillon, who had broken with him over the Irish war effort, succeeded him as Nationalist Party leader. By that time, however, the party had been discredited, and in the election of December 1918 Sinn Féin won easily. On losing his House of Commons seat to Eamon De Valera (afterward president of the Republic of Ireland), Dillon retired from politics.

Dilly (Indonesia): *see* Dili.

Dilmun, Sumerian name of an ancient independent kingdom that flourished *c.* 2000 BC, plausibly identified with the island in the Persian Gulf now called al-Baḥrain. Dilmun is mentioned as a commercial centre in Sumerian economic texts of the 3rd millennium BC, when it was a transshipment point for goods between Sumer and the Indus Valley. Copper and a variety of other goods, including stone beads, precious stones, pearls, dates, and vegetables, were shipped to Sumer and Babylonia in return for agricultural products.

Bārbār, the remains of an ancient temple (largely built of limestone) situated on al-Baḥrain, and many thousands of burial mounds attest to the island's prominence. Qala'at (fort) al-Baḥrain, a large low tell covering about 45 ac (18 ha) on the northern coast of the island, is the largest site and consists of a city dating from about 2800 BC that had seven major building phases including, in its second phase (2300–1800 BC), city walls; other artifacts found dating to this phase are chert weights of the Indus Valley type, distinctive round steatite stamp seals, and quantities of copper. Related archaeological sites have been found on the northern coast of the Arabian Peninsula and on other offshore islands in the Persian Gulf.

Dilthey, Wilhelm (b. Nov. 19, 1833, Biebrich, near Wiesbaden, Nassau—d. Oct. 1, 1911, Seis am Schlern, near Bolzano, South Tirol, Austria-Hungary), German philosopher who made important contributions to a methodology of the humanities and other human sciences. He objected to the pervasive influence of the natural sciences and developed a philosophy of life that perceived man in his historical contingency and changeability. Dilthey established a comprehensive treatment of history from the cultural viewpoint that has been of great consequence, particularly to the study of literature.



Dilthey, detail of an oil painting by R. Lepsius, *c.* 1904; in a private collection
Archiv fur Kunst und Geschichte, West Berlin

Dilthey was the son of a Reformed Church theologian. After he finished grammar school in Wiesbaden, he began to study theology, first at Heidelberg, then at Berlin, where he soon transferred to philosophy. After completing exams in theology and philosophy, he taught for some time at secondary schools in Berlin but soon abandoned this to dedicate himself fully to scholarly endeavours.

During these years he was bursting with energy, and his investigations led him into diverse directions. In addition to extensive studies on the history of early Christianity and on the history of philosophy and literature, he had a strong interest in music, and he was eager to absorb everything that was being discovered in the unfolding empirical sciences of man: sociology and ethnology, psychology and physiology. Hundreds of reviews and essays testify to an almost inexhaustible productivity.

In 1864 he took his doctorate at Berlin and obtained the right to lecture. He was appointed to a chair at the University of Basel in 1866; appointments to Kiel, in 1868, and Breslau, in 1871, followed. In 1882 he succeeded R.H.

Lotze at the University of Berlin, where he spent the remainder of his life.

During these years Dilthey led the quiet life of a scholar, devoid of great external excitement and in total dedication to his work. He searched for the philosophical foundation of what he first and rather vaguely summarized as the "sciences of man, of society, and the state," which he later called *Geisteswissenschaften* ("human sciences")—a term that eventually gained general recognition. In 1883, as a result of these studies, the first volume of his *Einleitung in die Geisteswissenschaften* ("Introduction to Human Sciences") appeared. The second volume, on which he worked continually, never did appear. This introductory work yielded a series of important essays; one of these—his "Ideen über eine beschreibende und zergliedernde Psychologie" (1894; "Ideas Concerning a Descriptive and Analytical Psychology")—instigated the formation of a cognitive (*Verstehen*), or structural, psychology. During the last years of his life, Dilthey resumed this work on a new level in his treatise *Der Aufbau der geschichtlichen Welt in den Geisteswissenschaften* (1910; "The Structure of the Historical World in the Human Sciences"), which was also left unfinished.

Opposed to the trend in the historical sciences to approximate the methodological ideal of the natural sciences, Dilthey tried to establish the humanities as interpretative sciences in their own right. He considered as fundamental to this notion the interaction among personal experience (*Erleben*), its realization in creative expression, and the reflective understanding of this experience. He did not view the individual as isolated but always in the context of his environment. He emphasized that the essence of man cannot be grasped by introspection but only from a knowledge of all of history; this understanding, however, can never be final because history itself never is: "The prototype 'man' disintegrates during the process of history." For this reason, his philosophical works were closely connected to his historical studies. From these works later arose the encompassing scheme of his *Studien zur Geschichte des deutschen Geistes* ("Studies Concerning the History of the German Mind"); the notes for this work make up a complete coherent manuscript, but only parts have been published.

Dilthey did not have the ability for definitive formulation; he was suspicious of rationally constructed systems and preferred to leave questions unsettled, realizing that they involved complexity. For a long time, therefore, he was regarded primarily as a sensitive cultural historian who lacked the power of systematic thought. Only posthumously, through the editorial and interpretative work of his disciples, did the significance of the methodology of his historical philosophy of life emerge.

It is difficult to assess Dilthey the man. Even his more intimate disciples confessed to have known very little of his deeper feelings. Only the few invited to collaborate in his later years became somewhat familiar with him. They shared almost his entire day, reading to him, taking dictation, even drafting complete passages for him. They learned while being involved in various aspects of his work. And yet, each one perceived only one facet; nobody had full comprehension of the whole. Even to them, Dilthey remained the "strange mysterious old man." (O.F.B.)

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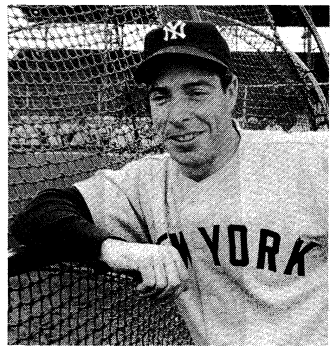
DiMaggio, Joe, byname of JOSEPH PAUL DiMAGGIO, also called JOLTIN' JOE, or THE YANKEE CLIPPER (b. Nov. 25, 1914, Martinez, Calif., U.S.), professional baseball player, an outstanding hitter, one of the greatest outfielders in the history of the game, and perhaps the best all-round baseball player in the 1940s. After minor league experience in San Francisco, he was acquired by the New York Yankees. Between 1936 and 1951, when he retired, he helped them to win 10 American League championships (he was in military service when they won the pennant in 1943) and nine World Series titles.



DiMaggio
EB Inc.

In 1939 and 1940 DiMaggio led the American League in batting, with averages of .381 and .352 (his career mark was .325). One of the most remarkable major league records is his feat of hitting safely in 56 consecutive games (May 15–July 16, 1941). He played the outfield with such languid expertise that some ill-informed fans thought he was lazy. DiMaggio received the Most Valuable Player Award for the American League in 1939, 1941, and 1947, and was elected to the Baseball Hall of Fame in 1955.

His brothers Vincent Paul and Dominic Paul DiMaggio also were major league outfielders. Joe DiMaggio's second wife was the motion-picture actress Marilyn Monroe. After his retirement he became a public relations executive and television performer.

Dimashq (Syria): *see* Damascus.

Dimashqī, ad- (Muslim scholar): *see* Ibn Abī ʿAṣrūn.

Dimbleby, Richard (Frederick) (b. May 25, 1913, Richmond, Surrey, Eng.—d. Dec. 22, 1965, London), pioneer radio news reporter and the first of Britain's great broadcast journalists. He was the first war correspondent for the British Broadcasting Corporation (BBC); his voice became familiar to most Britons via radio, and early in the television era his imposing visual presence became equally well known.

Dimbleby was the son of an editor and statesman, Frederick J.G. Dimbleby. Richard worked on the newspaper owned by his family, the *Richmond and Twickenham Times,* after graduating from secondary school. Five years later, after working for several other newspapers, he persuaded the BBC to engage him in its Topical Talks Department (1936). He was a self-assured, articulate young man, and he soon found his way into an assignment that only later acquired a name: radio news reporter. He was, in fact, one of the inventors of broadcast journalism, and as he felt his way in that new craft, he created traditions that would guide the future course of radio and, later, television reporting.

The BBC did not have a foreign correspondent until it sent Dimbleby to Spain to cover the Civil War. It created the title "war correspondent" for him at the outbreak of World War II, and he covered the war on the ground in Europe, Africa, and the Middle East, and in the air with the Royal Air Force over Germany.

By the end of the war, Dimbleby had become a trusted national figure. He was the quintessential anchorman for television coverage of the momentous events of state and politics. He was the focus of "Panorama," an influential BBC public-affairs weekly documentary program, and he was the natural choice to report and interpret the great rites and rituals of the realm, from the coronation of Queen Elizabeth II (1953) to the funeral of Sir Winston Churchill (1965).

During his coverage of World War II Dimbleby wrote several books; throughout his television heyday he contributed frequently to radio programs; and he never ceased a drumfire of correspondence in newspapers and journals—all the while maintaining an active involvement in the management of the family newspaper where his career had begun.

Two of Dimbleby's children, David and Jonathan, also became television journalists of distinction. Richard Dimbleby's memory is perpetuated by the Dimbleby Awards for distinguished contributions by broadcast journalists to their profession.

Dimbokro, town, administrative headquarters (since 1969) of Dimbokro *département,* south central Ivory Coast, on the Nzi River, a tributary of the Bandama River. A local trade centre (yams, bananas, and palm oil and kernels) among the Baule (Baoule) people, it has been a major entrepôt for coffee, yams, kola nuts, kapok, and cocoa since the completion of the government railway from Abidjan, 103 mi (166 km) south-southeast, in 1910. A textile factory was established in the 1970s. Pop. (1975) 30,986; (1979 est.) *département,* 474,629.

Dîmboviţa, *judeţ* (district), southern Romania, occupying an area of 1,443 sq mi (3,738 sq km). The Transylvanian Alps (Southern Carpathians) and the sub-Carpathians rise above settlement areas in intermontane valleys and lowlands. The district is drained by the Ialomiţa, Dîmboviţa, and Argeş rivers. Tîrgovişte (*q.v.*) is the district capital and was a capital of feudal Walachia. The city is located in the centre of an oil-producing area, with wells located at Bucşani, Hulubeşti, and Mislea. Machinery and metal products are manufactured in Tîrgovişte, Moreni, and Fieni, where building materials are also produced. Textiles are made in Pucioasa and Brănesti, and wood products in Găeşti. Lignite mines are worked near Mărgineanca and Sotînga towns, and hydroelectric plants operate on the Ialomiţa River near Moroeni and Fieni. Agricultural activities of the area include cereal growing and livestock raising in the lowlands and vineyard and orchard cultivation in hilly areas. Several notable 17th-century churches and museums are found in Tîrgovişte. Highway and railway connections extend through Tîrgovişte. Pop. (1982 est.) 548,877.

dimenhydrinate, antihistamine used as an anti-emetic (to combat nausea), chiefly in the treatment of motion sickness, also in the symptomatic treatment of vertigo, such as in Ménière's syndrome, a disease of the inner ear.

Dimenhydrinate, a synthetic chemical drug introduced into medicine in 1949, is administered orally in tablet or syrup form. Its duration of action is about four hours. The most common side effect is drowsiness.

dimensional analysis, technique used in the physical sciences and engineering to reduce physical properties such as acceleration, viscosity, energy, and others to their fundamental dimensions of length (L), mass (M), and time (T). This technique facilitates the study of interrelationships of systems (or models of systems) and their properties, and avoids the nuisance of incompatible units. Acceleration, for example, is expressed as L/T^2 in dimensional analysis because it is a distance (L, length) per unit of time (T) squared; whether the actual units of length are expressed in the English or metric system is immaterial. Dimensional analysis is often the basis of mathematical models of real situations. If model results are to be translatable in terms of the system being modelled then the model must be dimensionally faithful to the original. For an application in fluid mechanics, *see* pi theorem; *see also* mathematical model.

dimercaprol, also called BRITISH ANTILEWISITE (BAL), drug developed to combat the effects of the lethal war gas lewisite. By the end of World War II, dimercaprol had been found useful as an antidote against poisoning by many metals and semimetals—including antimony, arsenic, bismuth, cadmium, chromium, gold, lead, and mercury—that act by combining with cellular sulfhydryl groups. Dimercaprol is more effective if its use is begun within two hours after ingestion of the toxic metal. It is insoluble in water and is administered by intramuscular injection of a solution of it in peanut oil.

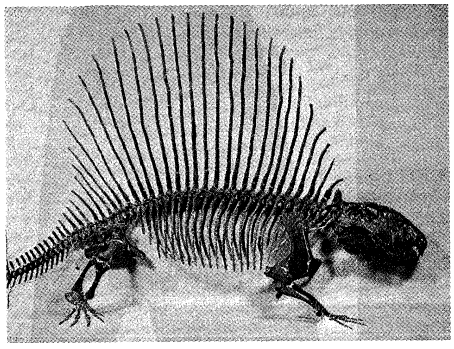
dimethoate, generic name for a systemic insecticide that acts by inhibiting cholinesterases, enzymes involved in transmitting nerve impulses. Chemically, it is an organophosphate. Like all organophosphates it is related to the nerve gases and among the most toxic of all pesticides to vertebrates, including humans. As a systemic, dimethoate is taken up into the roots of plants and translocated to aboveground parts, where it is toxic to any sucking insect feeding on the plant juices (*e.g.,* aphids, leafhoppers, and thrips). Caterpillars and other chewing pests are not killed by dimethoate because not enough juice-containing tissue is ingested to be effective.

dimethyl sulfoxide, simplest member of the sulfoxide family of organic compounds; *see* sulfoxide.

dimethylaminoethylbenzanilide: *see* phenbenzamine.

dimethyltryptamine, N,N- (hallucinogenic drug): *see* DMT.

Dimetrodon, extinct genus of primitive predatory reptiles found as fossils in Early and Middle Permian deposits of North America (the Permian Period began 280,000,000 years ago and lasted 55,000,000 years). *Dimetrodon,* which grew to be more than 3.5 metres (11 feet) long, had a large dorsal sail formed by elongated dorsal vertebrae connected by a membrane containing many blood vessels. The sail probably functioned as a temperature-regulating device. The skull was high and narrow; the region in front of the eyes was long. The many teeth were differentiated into types suited to grasping and holding, to piercing, and to dividing food material into smaller pieces. The body was slim, with a long tail and sprawling limbs not as awkwardly set as in other primitive reptiles; *Dimetrodon* probably could move more efficiently than its contemporaries, obviously an advantage to a predator. It is probable that the therapsids, the mammal-like reptiles that eventually gave rise to the mammals, were derived from *Dimetrodon* or a similar ancestor.



Dimetrodon, restored skeleton

By courtesy of the American Museum of Natural History, New York

diminished responsibility, legal doctrine that absolves an accused person of part of the liability for his criminal act if he suffers from such abnormality of mind as to substantially impair his responsibility in committing or being a party to an alleged violation. The doctrine of diminished responsibility provides a mitigating defense in cases in which the mental disease or defect is not of such magnitude as to exclude criminal responsibility altogether.

It is most frequently asserted in connection with murder cases requiring proof of a particular mental state on the part of the accused. If a judge or jury concludes that the accused is incapable of premeditation yet has the capacity to appreciate the wrongfulness of his conduct or to conform his behaviour to the requirements of the law, the court can bring a less serious penalty to bear. Generally, the defendant who successfully establishes his abnormal mental condition is found guilty of manslaughter instead of murder.

Few jurisdictions subscribe to the doctrine of diminished responsibility. Although long a part of Scottish homicide law, England and Wales did not adopt the defense until 1957. Most other countries recognize only mental disease or defect of sufficient degree to sustain a defense of insanity. *See also* insanity.

diminishing returns, law of, also called PRINCIPLE OF DIMINISHING MARGINAL PRODUCTIVITY, economic law stating that if one input in the production of a commodity is increased while all other inputs are held fixed, a point will eventually be reached at which additions of the input yield progressively smaller increases in output.

Early economists, neglecting the possibility of technical progress that would improve the means of production, used the law of diminishing returns to predict that as population expanded in the world, output per head would fall, to the point where the level of misery would keep the population from increasing further. In stagnant economies, where techniques of production have not changed for long periods, this effect is clearly seen. In progressive economies, on the other hand, technical advances have succeeded in more than offsetting this factor.

Dimitrijević, Dragutin, byname APIS (Holy Bull) (b. Aug. 17, 1876, Belgrade—d. June 27, 1917, Thessaloníki, Greece), Serbian army officer and conspirator, leader of the terrorist secret society Crna Ruka (Black Hand).

A young army officer and already a member of the Serbian general staff, in 1901 Dimitrijević initiated an officers' conspiracy to assassinate the unpopular king Alexander Obrenović. The plan was finally carried out in June 1903. Soon thereafter the conspirators succeeded in bringing the army under their control. As a professor of tactics at the military academy, Dimitrijević exerted considerable influence over his students, and he fostered Serbian nationalistic activity abroad. In 1913 he was appointed chief of general staff intelligence and in 1916 won promotion to colonel.

More significantly, Dimitrijević was also a founding member (1911) and inspirational leader of the nationalistic secret society Ujedinjenje ili Smrt (Union or Death), better known as the Black Hand, which sought to create a Greater Serbia through the use of violence. He is considered to have played an important role in plotting the assassination of the Austrian archduke Francis Ferdinand at Sarajevo (June 28, 1914), which touched off World War I. Later, however, his own secret group was marked for elimination by the Serbian premier Nikola Pašić, and in May 1917 he was sentenced to death with six other officers and was executed. He was exonerated of all charges at a staged retrial at Belgrade in 1953.

Articles are alphabetized word by word, not letter by letter

Dimitrios I, also spelled DEMETRIOS, original name DIMITRIOS PAPADOPOULOS (b. 1914, Istanbul), 269th ecumenical patriarch of the Eastern Orthodox Church.

After studying at the French *lycée* in the Galata district of Istanbul, Dimitrios Papadopoulos entered the Holy Trinity School of Theology on the island of Heybeli in the Sea of Marmara. He was ordained a priest in 1942, served for a few years as parish administrator in northern Greece, and was later appointed chaplain to the small Greek community in Tehrān. He was consecrated bishop in 1964 and on Feb. 15, 1972, was appointed metropolitan of Imroz Adasi and Bozca Ada, two Turkish islands in the Aegean Sea that were formerly Greek and that have Greek populations. On July 16, 1972, in Istanbul, the Holy Synod of the Eastern Orthodox Church elected Metropolitan Dimitrios patriarch of Constantinople (*i.e.,* ecumenical patriarch), succeeding Athenagoras I.

Dimitrov, Georgi Mikhailovich (b. June 18, 1882, Kovachevtsi, Bulg.—d. July 2, 1949, near Moscow), Bulgarian Communist leader, post-World War II prime minister of Bulgaria, who had won worldwide fame for his defense against Nazi accusations during the German Reichstag Fire trial of 1933.

A printer and trade union leader, Dimitrov led the Bulgarian Socialist parliamentary opposition to the voting of national war credits in 1915 and played a major role in the formation of the Bulgarian Communist Party (1919). Briefly imprisoned for sedition in 1918, he later journeyed to the Soviet Union, where he was elected to the executive committee of the Comintern (Communist International) in 1921. In 1923 he led a Communist uprising in Bulgaria that provoked ferocious government reprisals. Under sentence of death, he was forced to live abroad, from 1929 in Berlin as head of the central European section of the Comintern. After the Reichstag fire of Feb. 27, 1933, which provided Adolf Hitler, the newly appointed German chancellor, with an excuse for a decree outlawing his Communist opponents, Dimitrov was accused with other Communist leaders of plotting the fire.

At his trial Dimitrov thoroughly bested the Nazi prosecution and won acquittal. He settled in Moscow, and as secretary general of the Comintern's executive committee (1935–43) encouraged the formation of popular front movements against the Nazi menace, except when his patron Stalin and Hitler were cooperating. During 1944 he directed the resistance to Bulgaria's Axis satellite government, and in 1945 he returned to Bulgaria, where he was immediately appointed prime minister of a Communist-dominated Fatherland Front

government. Assuming dictatorial control of political affairs, he effected the Communist consolidation of power that culminated in the formation of a Bulgarian People's Republic in 1946.

Dimitrovgrad, town, south central Bulgaria, in the fertile lowlands of the Maritsa River Valley; it is a rail junction on the Belgrade–Sofia–Istanbul rail line. The new town, built in 1947 by Bulgarian youth, incorporated three existing villages—Rakovski, Marino, and Chernokonovo—and is named after the Bulgarian Communist leader Georgi Dimitrov. Industries include the manufacture of chemicals, cement, and asbestos; and food canning. The local state farms have a high yield of hothouse vegetables. The surrounding lignite-mining area, the Marbas coalfield, supplies the three Maritsa thermal-electric stations. Pop. (1975) 45,596.

Dimitrovgrad, formerly (until 1972) MELEKESS, city, Ulyanovsk *oblast* (administrative region), western Russian Soviet Federated Socialist Republic, at the confluence of the Melekes and Bolshoy (Great) Cheremshan rivers. Founded in 1714, it became a town in 1919 and is an agricultural processing centre, with sawmilling and metalworking industries. It also has an atomic research centre. A teacher-training college is located in the city. Pop. (1985 est.) 116,000.

Dimitrovo (Bulgaria): *see* Pernik.

Dimitry (personal name): *see under* Dmitry, or Demetrius.

dimity (from Greek *dimitos*, "of double thread"), lightweight, sheer cotton fabric with two or more warp threads thrown into relief, forming fine cords. Originally dimity was made of silk or wool, but since the 18th century it has been woven almost exclusively of cotton.

The name was applied to two types of corded cottons: a heavy material used for bedcovers, drapery, and the like, and a lightweight, almost sheer fabric either corded or made in check effects. Dimity now refers primarily to the latter.

Dimona, town of the Negev, southern Israel, on the main highway from Beersheba (Be'er Sheva') to Sedom (Sodom). It is named for the biblical city of Dimonah, mentioned (Joshua 15:21–22) as "belonging to . . . Judah in the extreme South."

Modern Dimona was established in 1955 as a residential centre for the workers of the Dead Sea Works at Sedom, 29 miles (47 km) east by road. The site was picked largely because of its elevation (about 1,968 feet [600 m] above sea level and almost 3,281 feet above the Dead Sea) and consequent cool nights. By the 1970s the population of Dimona had greatly exceeded the planned figure of about 5,000. In addition to the employees of the Dead Sea Works, many of whom later moved to 'Arad, several miles closer to Sedom, it houses the workers of the phosphate mines at Oron, 14 miles south. Dimona has textile mills, and porcelain articles are also manufactured. Nearby is the Negev Nuclear Research Center, with a 26-megawatt reactor. Dimona is connected to the national railway grid by a line from Beersheba. Inc. 1969. Pop. (1985 est.) 26,600.

Dimorphodon, genus of extinct flying reptiles found as fossils in Early Jurassic deposits of Europe. *Dimorphodon,* among the most primitive of the known pterosaurs (flying reptiles), was about 1 m (3 feet) long. The head was very large and deep, and the skull had several large openings. Two types of teeth are found in the jaws: several large pointed ones in the front and many smaller teeth in the back. The limbs were well developed; it is unclear whether the animal habitually walked on two legs. The wings consisted of thin membranes of skin that stretched from the enormously elongated fourth finger of each hand to the hind limbs. On the ground, the animal probably folded its wings, much as do modern bats. The three remaining fingers of each forelimb were well developed and probably able to support the animal on the ground; these fingers also were used for grasping and were clawed. The eyes were large.

Dimorphodon certainly was not as efficient a flier as the modern birds; it lacked the large keel to which the powerful flight muscles of birds are attached; gliding rather than wing beating was probably the normal mode of flight for the animal.

Dimyat (Egypt): *see* Damietta.

Dīn-i Ilāhī (Persian: "Divine Faith"), an elite eclectic religious movement, which never numbered more than 19 adherents, formulated by the Mughal emperor Akbar in the late 16th century AD.

The Dīn-i Ilāhī was essentially an ethical system, prohibiting such sins as lust, sensuality, slander, and pride and enjoining the virtues of piety, prudence, abstinence, and kindness. The soul was encouraged to purify itself through yearning for God (a tenet of Ṣūfism, Islāmic mysticism), celibacy was condoned (as in Catholicism), and the slaughter of animals was forbidden (as in Jainism). There were no sacred scriptures or a priestly hierarchy in the Dīn-i Ilāhī. In its ritual, it borrowed heavily from Zoroastrianism, making light (Sun and fire) an object of divine worship and reciting, as in Hinduism, the 1,000 Sanskrit names of the Sun.

In practice, however, the Dīn-i Ilāhī functioned as a personality cult contrived by Akbar around his own person. Members of the religion were handpicked by Akbar according to their devotion to him. Because the Emperor styled himself a reformer of Islām, arriving on Earth almost 1,000 years after the Prophet Muḥammad, there was some suggestion that he wished to be acknowledged as a prophet also. The ambiguous use of formula prayers (common among the Ṣūfīs) such as *Allāhu akbar,* "God is most great," or perhaps "God is Akbar," hinted at a divine association as well.

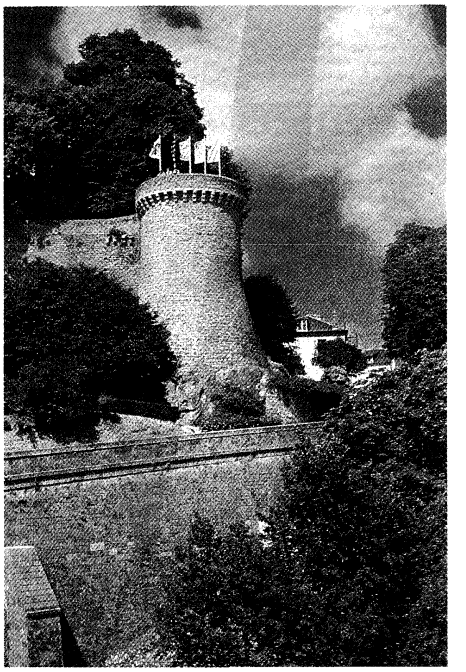
Akbar is recorded by various conflicting sources as having affirmed allegiance to Islām and as having broken with Islām. His religion was generally regarded by his contemporaries as a Muslim innovation or a heretical doctrine; only two sources from his own time—both hostile—accuse him of trying to found a new religion. The influence and appeal of the Dīn-i Ilāhī were limited and did not survive Akbar, but they did trigger a strong orthodox reaction in Indian Islām.

Dinah, also spelled DINA, in the Old Testament (Genesis 30:21; 34; 46:15), daughter of Jacob by Leah; Dinah was abducted and raped near the city of Shechem, by Shechem, son of Hamor the Hivite (the Hivites were a Canaanitish people). Because Shechem then wished to marry Dinah, Hamor suggested to Jacob that their two peoples initiate a policy of commercial and social intercourse. Dinah's brothers Simeon and Levi pretended to agree to the marriage and the covenant if Shechem and all the other males of the city of Shechem were circumcised. After the operations, while the men were still weakened, Simeon and Levi attacked the city, killed all the males, including Shechem and Hamor, and freed Dinah. They then joined in plundering the city. Jacob rebuked Simeon and Levi for arousing the enmity of neighbouring tribes and, on his deathbed, gave his blessing to their younger brother Judah, reproving Simeon and Levi for their cruelty.

Dināj̄pur, town, northwestern Bangladesh, just east of the Punarbhaba River. The old city and the former residence of the maharaja of Dināj̄pur are located in the northeastern quarter of the town. Dināj̄pur contains jute and rice mills, jute-seed farms, and a thermal power station. It houses two government colleges affiliated with the University of Rāj̄shāhi.

The area in which Dināj̄pur is located is a flat alluvial plain intersected by rivers and broken by the slightly elevated Bārind tract. It is an important rice, wheat, jute, and sugarcane growing area. Pāla remains (9th century AD) are scattered throughout the area. Pop. (1981 prelim.) city, 96,343.

Dinan, town, northwestern France, in Côtes-du-Nord *département,* Bretagne region, dominating the upper Rance Estuary. It stands on a height above the left bank of the river 14 miles (22 km) south of the coast at Dinard. It has preserved many medieval timbered houses, as well as its fine 18th-century granite buildings, its Gothic bridge, and its 15th-century belfry, the Tour de l'Horloge. The walls of the town, dating from the 11th century, survived two 14th-century attacks by the English. An imposing granite castle, known as the Château de la Duchesse Anne, was built by the dukes of Brittany in the 14th and 15th centuries. Dinan is a market town and a tourist centre; textiles are also manufactured. Pop. (1982) 12,104.



Section of the old walls of Dinan, Fr., with one of the 15 towers

J. Allan Cash Ltd.—EB Inc.

Dinan, SAINT: *see* Ninian, Saint.

dinanderie, type of late medieval brass ware made in and around Dinant, Belg.

Brass does not appear to have been used extensively in Europe until the 11th or 12th century, when a considerable industry was established in the Low Countries in the district near the River Meuse. By the 15th century its centre, Dinant, had become a prosperous town the name of which was synonymous with excellent brass ware. Included in the production were such domestic articles as ewers, fire irons, candlesticks, dishes, and basins and such ecclesiastical objects as censers, aquamaniles, fonts, and lecterns.

When the town was sacked in 1466 by Charles the Bold, son of Philippe III le Bon,

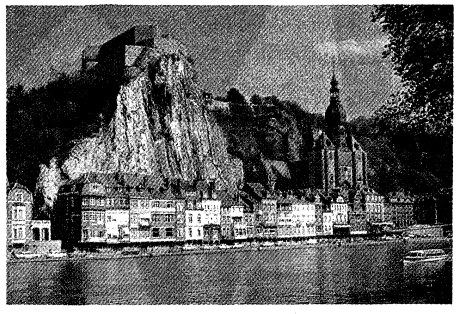
duke of Burgundy, the craftsmen dispersed, and the industry spread to other towns along the Meuse and to Brussels, Bruges, and Tournai, eventually establishing a new production centre in Aachen. Some of the fleeing "brass-

Dinanderie plate, brass, from Dinant or Malines, Belg., *c.* 1480; in the Irwin Untermyer Collection
By courtesy of Irwin Untermyer

beaters" may have gone as far as Nürnberg, which was already becoming famous for its metalworking and was soon to achieve the prominence of the old centres. In the late 15th and 16th centuries the "basin-beaters" of Nürnberg produced numerous embossed dishes and basins of a characteristic type, which were exported to most parts of Europe. These objects have also come to be known as dinanderie.

The earliest type of dinanderie, Gothic in feeling and outline, is generally small and deep and made of a golden-coloured brass. Pieces from the 16th century and later are flatter, larger, and of a darker colour. The embossed decoration, executed with large stamps, falls into two major categories: religious and allegorical subjects and stylized decorative patterns. Additional ornament was provided by punched bands of simple motifs repeated around the rim and encircling the main subject in the centre of the bowl. Many have a raised central boss in the form of an open rose with radiating petals, and some bear inscriptions in Gothic lettering or pseudo-Gothic-Islāmic script. They are quite often found in churches, where they have been used as alms dishes.

Dinant, municipality, Namur province, southern Belgium, on the Meuse River below steep limestone cliffs, south of Namur. Inhabited in Roman times, Dinant's name probably derives from Diana, Roman goddess of the hunt. A fortified burgh in Merovingian and Carolingian times, it was a dependency of the bishop of Tongres in the 7th century and a



Dinant, Belg., on the Meuse River, showing the citadel atop the cliff and the Church of Notre Dame (right)
Thomas Friedmann—Photo Researchers

fief of the bishops of Liège from 1070 to the French Revolution. It was famous for artistic metalwork (dinanderie) from the 13th century until it was sacked by Charles the Bold (1466). Dinant was occupied by the French for nearly 30 years after 1675 and again during the Napoleonic Wars. It was nearly destroyed by the Germans in 1914 and was damaged again during World War II.

A rail junction and tourist centre, it manufactures wool and textiles in addition to the traditional copper and brass ware and *couques de Dinant* (decorated biscuits). Landmarks include the 11th-century citadel 300 ft (90 m) above the river on top of a cliff; the Montfort Tower and the Church of Notre Dame (with its bulbous clock tower), both 13th century; and Rocher Bayard, the sentinel rock, 130 ft high. Prehistoric caverns and stalactite grottoes along the river and many ruined castles and châteaus attract tourists.

Near Dinant, at Hastière, is an 11th-century church in the Roman style with a Gothic choir. Also nearby is Fierfooz National Park containing Roman baths, reconstructed on original foundations, and other archaeological remains. Pop. (1983 est.) mun., 11,936.

Dinarchus, also spelled DEINARCHUS (b. *c.* 360 BC—d. after 292), professional speech writer at Athens whose work is generally thought to reflect the incipient decline of Attic oratory.

Dinarchus came to prominence in the scandal that followed the flight to Athens in 324 BC of Alexander the Great's treasurer, Harpalus, who brought with him considerable wealth derived from the spoils of Alexander's conquest of Asia. Dinarchus wrote the prosecution speeches against Demosthenes and other well-known politicians accused of misappropriating some of this money, and the three extant works generally ascribed to him are all concerned with these trials. The works are "Against Demosthenes," "Against Aristogiton," and "Against Philocles." Dionysius of Halicarnassus records the titles of 87 speeches ascribed to Dinarchus, 60 of which he considered genuine. Dionysius' low opinion of the orator is supported, in the extant speeches, by the lack of creative skill, use of violent abuse in place of reasoned judgment, and plagiarism from other orators.

Dinaric Alps, Serbo-Croatian DINARSKO GORJE, or DINARA PLANINA, southeastern division of the Eastern Alps, running parallel to the Dalmatian (Adriatic) coast of Yugoslavia south to Albania. Bounded by the Soča (Italian Isonzo) and Sava rivers (north), the Drina River (south), the Kolubara, Ibar, and Sitnica rivers (east), and the Adriatic Sea (west), the Alps rise to 8,274 ft (2,522 m) in Bobotov Kuk of Durmitor and occupy about one-third of Yugoslavia. The coast is indented with numerous natural harbours, but the limestone ranges prohibit any natural access to the agricultural hinterland. Interior basins of the range, though isolated, have both fertile soils and dense population.

Dīnawarī, al-, in full ABŪ ḤANĪFAH AḤMAD IBN DĀ'ŪD AL-DĪNAWARĪ (b. *c.* 815—d. *c.* 895/902), Persian astronomer, botanist, and historian, whose interest in Hellenism and the Arabic humanities has been compared with that of the Iraqi scholar al-Jaḥiẓ.

Al-Dīnawarī studied philology in the Iraqi cities of Basra and Kūfah. The systematic approach to learning that he acquired there is reflected in the preserved fragments of his *Kitāb an-nabāt* ("Book of Plants"), one of the most famous early Muslim works on botany. Of lexicographical character, it includes oral and written Arabic botanical traditions as well as much Persian material. Written in beautiful prose, it was the standard work in the field for generations. None of al-Dīnawarī's works on mathematics or the Qur'ān have been preserved. There are, however, fragments of his observations on astronomy, *Kitāb al-anwā'*. The only work that has survived in full is *al-akhbār aṭ-ṭiwāl* ("The Long Narratives"), a history of Persia written from the Persian, rather than the Arabic, viewpoint.

Dinbych (Wales): *see* Denbigh.

Dinder National Park, east central an-Nīl al-Azraq and southern Kassalā *mudīrīyāt* (provinces), The Sudan. The park lies in the clayish flood plain of the Nahr (river) ad-Dindar and Nahr ar-Rahad, at an elevation of 2,300 to 2,600 ft (700 to 800 m). Established in 1935, it covers an area of 2,750 sq mi (7,123 sq km). Vegetation in the park consists of thornbush savannah in the north and woodland in the south; along the riverbanks there are palm or gallery forests and swampy areas. Wildlife includes giraffe, hartebeest, reedbuck, roan antelope, bushbuck, oribi, waterbuck, greater kudu, gazelle, dik-dik, buffalo, lion, and ostrich. Black rhinoceros, leopard, cheetah, elephant, hyena, and jackal are also occasionally found. The park can be reached by road from Khartoum, a distance of 290 mi (470 km). Its headquarters are at Khartoum.

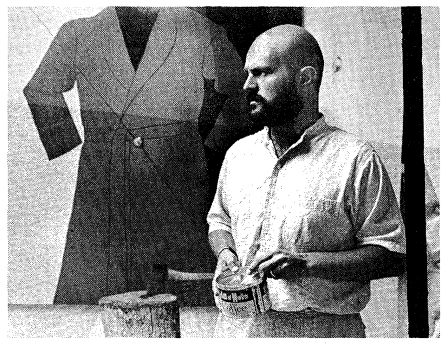
Dinder River, Arabic NAHR AD-DINDAR, tributary of the Blue Nile, rising in the Ethiopian highlands west of Lake Tana. It flows northwest past Dongur, descends into the Sudanese plain, and runs in numerous meanders to join the Blue Nile below Sannār, The Sudan. The river, 300 mi (480 km) long, is navigable for the lower one-third of its course during the flood season (June–September). Its middle course in The Sudan flows through Dinder National Park.

Dindigul, town, Madurai district, Tamil Nādu state, southeastern India. Situated between the Palni and Sirumalai hills, it is a road transport hub. Its name, derived from the words *tiṇṭu kal* ("pillow rock"), refers to the bare hill dominating the town. The fortress, built on the hill during the Vijayanagar era (1336–1565), was used in Hindu, Muslim, and British wars from the 17th to the 19th centuries. The contemporary town contains large-scale cotton spinning and weaving mills, as well as such handicraft industries as silk weaving and the manufacture of jewelry and cigars. Dindigul houses two liberal arts colleges, affiliated to Madurai-Kamaraj University. Pop. (1981) 164,103.

Dindings, also called DINDING: *see* Manjung.

d'Indy, (Paul-Marie-Théodore-)Vincent: *see* Indy, (Paul-Marie-Théodore-)Vincent d'.

Dine, Jim, byname of JAMES DINE (b. June 16, 1935, Cincinnati, Ohio, U.S.), American painter, graphic artist, sculptor, and poet who



Dine, photograph by Hans Namuth, 1964
Hans Namuth

emerged during the Pop Art period as an innovative creator of works that combine the painted canvas with ordinary objects of daily life.

Dine studied at the Boston Museum of Fine Arts School and at Ohio University. His early work consists primarily of images on canvas,

to which three-dimensional objects (*e.g.,* articles of clothing, garden tools) are attached. His "Shoes Walking on My Brain" (1960), for example, is a childlike painting of a face with a pair of leather shoes fixed to the forehead. His reputation was secured during the 1960s by his wittily incongruous painted images of tools, clothes, and other utilitarian and household objects. Dine's work of the 1970s pursued the same subject matter but showed a growing preoccupation with graphic media. His exploitation of nuances of line and texture is especially evident in his images of flowers and portraits of his wife done in the late 1970s. Dine also illustrated or coauthored several books.

Dinefwr, district, Dyfed county, southern Wales. Created in the administrative reorganization of 1974, it covers an area of 375 square miles (971 square km) and rises from an elevation of just over 100 feet (30 m) in the Tywi valley in central Dinefwr to heights of more than 2,000 feet (600 m) in the Black Mountains to the south. Dinefwr district is bordered by the districts of Ceredigion to the north, Brecknock to the east, Lliw Valley and Llanelli to the south, and Carmarthen to the west. The district's town of Llandovery was of strategic importance in Roman times, and the Church of Llanfair (restored 1915) nearby was built within the ramparts of a Roman fort. The ruins of the 13th-century Dynevor Castle are located just west of Llandeilo. Originally built in AD 876 by the Welsh nobleman Rhodri Mawr, the castle was taken by the English in the 13th century and rebuilt; the Welsh leader Owen Glendower tried to retake it in 1408 but failed.

Dinefwr is a rural district in which dairy farming is the main agricultural activity. Both Llandovery and Llandeilo are agricultural market towns, and Llandeilo is also the administrative seat for the district. Dinefwr's limited industry is located in Ammanford, a mining centre situated on an anthracite coalfield surrounded by scenic countryside. Many tourists visit the district as most of its eastern half lies within Brecon Beacons National Park. The County Agricultural College is in Llandeilo. A highway and a railway extend south from Llandovery through Llandeilo and Ammansford. Pop. (1986 est.) 37,200.

Dines, William Henry (b. Aug. 5, 1855, London, Eng.—d. Dec. 24, 1927, Benson, Oxfordshire), British meteorologist who invented instruments to measure atmospheric properties.

The son of a meteorologist, Dines was graduated from Corpus Christi College, Cambridge, with honours. He became interested in wind speed and invented a pressure-tube anemometer, the first device to measure both the velocity and direction of wind. Dines pioneered in the use of kites and balloons for upper-air measurement and designed a remarkable meteorograph for upper-air soundings weighing only about 2 ounces (60 g). This became for years the standard British instrument for upper-atmosphere soundings and provided many data on pressure, temperature, and humidity in heights well into the stratosphere. His analysis of these data revealed striking correlations between properties of the upper air and yielded valuable insights into the dynamics of cyclones and anticyclones. He also added to knowledge of terrestrial and solar radiation. Dines's collected scientific papers with a full bibliography were published in 1931 by the Royal Meteorological Society, of which he was president in 1901–02. In 1905 he was elected a fellow of the Royal Society.

Dinesen, Isak, pseudonym of KAREN CHRISTENCE DINESEN, BARONESS BLIXEN-FINECKE (b. April 17, 1885, Rungsted, Den.—d. Sept. 7, 1962, Rungsted), Danish writer whose finely crafted stories, set in the past and pervaded

Isak Dinesen, 1959
AP/Wide World

with an aura of supernaturalism, incorporate the themes of eros and dreams.

Educated privately and at the Academy of Fine Arts, Copenhagen, Dinesen married her cousin, Baron Bror Blixen-Finecke, in 1914, and went with him to Africa. There they owned and directed a coffee plantation in Kenya and became big-game hunters. After her divorce in 1921 she continued to operate the plantation for 10 years until mismanagement, drought, and the falling price of coffee forced her return to Denmark.

Her years in Kenya are recorded in a nonfiction book, *Out of Africa* (1937; *Den afrikanske farm*). These highly regarded memoirs of her years in Kenya reveal an almost mystical love of Africa and its people. The book is a poetic reminiscence of her triumphs and her sorrows on the loss of her farm, the death of her companion, the English hunter Denys Finch Hatton, and the disappearance of the simple African way of life she admired. In 1944 she produced her only novel *Gengældelsens veje* (*The Angelic Avengers*) under the pseudonym Pierre Andrézel. It is a melodramatic tale of innocents who defeat their apparently benevolent but actually evil captor, but Danish readers saw in it a clever satire of Nazi-occupied Denmark.

She initially wrote first in English and then rewrote her books in Danish, but her later books usually appeared simultaneously in both languages. Dinesen's characteristic writings were in the form of tales—highly polished narratives in the Romantic tradition. Collections include *Seven Gothic Tales* (1934; *Syv fantastiske fortællinger*), *Winter's Tales* (1942; *Vinter-eventyr*), and *Last Tales* (1957; *Sidste fortællinger*). *Carnival: Entertainments and Posthumous Tales* (1977) includes uncollected or hitherto unpublished stories. Her other posthumously published works include *Daguerreotypes, and Other Essays* (1979) and *Letters from Africa, 1914–31* (1981).

BIBLIOGRAPHY. Judith Thurman, *Isak Dinesen* (1982), is a fine biography utilizing Dinesen's private papers and letters.

ding (Chinese vessel): *see* ting.

Ding Ling, Wade–Giles romanization TING LING, pseudonym of CHIANG WEI-CHIH (b. 1904, Changde, Hunan province, China—d. March 4, 1986, Peking), one of China's most popular 20th-century authors. In her early career Ding Ling initially wrote highly successful short stories centring on young, unconventional Chinese women, and she began writing proletarian works in 1931.

Born into a declining gentry family, Ding Ling was supported by her mother after her father's death in 1911. After formal education in Hunan provincial schools, she journeyed in 1921 to Shanghai and then to Nanking, more to observe the intellectual life there than to study. In that period she developed an interest in anarchism. After a stint at Shanghai University, she went to Peking, where she met and fell in love with the leftist would-be poet Hu Yeh-p'in (1925). With him she moved to the Western Hills outside Peking.

Influenced by Flaubert's *Madame Bovary* and other European novels, Ding Ling began writing, partly autobiographic short stories in which she developed a new kind of Chinese heroine—daring, independent, and passionate, yet perplexed and emotionally unfulfilled in her search for the meaning of life. Ding Ling's chronicles of the aspirations and disappointments of modern Chinese women were an immediate success, but because Hu Yeh-p'in was making little progress in his literary career, the couple moved to Shanghai in 1928 to start a literary magazine as a vehicle to publish his work. The venture failed, and Hu Yeh-p'in turned his attention to politics, joining the League of Left-wing Writers. Ding Ling, however, devoted herself to writing, and by 1930 she had completed three collections of short stories and a novelette. Later that year she gave birth to a son. Hu Yeh-p'in joined the Chinese Communist Party and became even more involved in politics, only to be arrested by Nationalist authorities and executed in 1931. Ding Ling joined the Communist Party that same year and edited journals of the League of Left-wing Writers.

Ding Ling's conversion to Marxism channeled her writing into a new and initially fruitful direction. Her proletarian-oriented *Shui* (1931; "Flood") was acclaimed as a model of Socialist Realist fiction in China. She was abducted by agents of the Nationalist Party in 1933 and imprisoned until 1936, when, disguised as a soldier, she escaped and joined the Communists at Yenan. There she became friendly with Mao Zedong and was linked romantically with the general Peng Dehuai. She was not completely uncritical of the Communist movement, expressing her dissatisfactions openly through her stories and in journal articles, for which she was censured by Mao.

Ding Ling's officially successful proletarian novel *T'ai-yang chao tsai Sang-kan-ho shang* (1948; "The Sun Shines over the Sang-kan River") was the first Chinese novel to win the Soviet Union's Stalin Prize (1951). Yet despite her triumphs, she remained in political trouble for her open criticisms of the party, especially in regard to women's rights. She was officially censured and expelled from the party as a rightist in 1957 and was imprisoned for five years during the Cultural Revolution. In 1975 she was freed, and her membership in the Communist Party was restored in 1979. Her later publications include several critical essays, short stories, and longer fictional prose.

Dingane, also spelled DINGAAN (d. 1843), Zulu king of Natal (1828–40) who assumed power after taking part in the murder of his half brother Shaka in 1828. In November 1837 Dingane promised the Boer leader Piet Retief almost all of Natal in return for the recovery of a stolen herd of cattle. Despite their success, Retief and about 600 Boer immigrants were massacred by the Zulu in February 1838. These deaths were avenged by Andries Pretorius on Dec. 16, 1838 (Battle of Blood River), when 3,000 Zulu warriors were killed in battle. Dingane was finally overthrown by his brother Mpande in January 1840 and fled to Swaziland, where he was murdered in 1843.

Dingelstedt, Franz Ferdinand, Freiherr von (count of) (b. June 30, 1814, Halsdorf, Hesse-Kassel [Germany]—d. May 15, 1881, Vienna, Austria), German poet, playwright, and theatrical producer known for his biting political satires.

A member of the liberal Young Germany movement, Dingelstedt became a teacher. He also wrote political satires against the German princes, *Lieder eines Kosmopolitischen Nachtwächters* (1841; "Songs of a Cosmopolitan Nightwatchman"), one of which, *Die Neuen Argonauten* ("The New Argonauts"),

led to his dismissal. Between 1841 and 1843 he was a correspondent in Paris and London and underwent a political conversion that marked the beginning of his career as a state official. He was appointed manager of the court theatres at Munich and Weimar and, later, director of the opera and Hofburgtheater at Vienna, and he was ennobled by the king of Bavaria. He was responsible for splendid new productions of the German classics and of Shakespeare. He was also the founder of the German Shakespeare Society, and he translated many of Shakespeare's plays. Dingelstedt also wrote novels and an autobiographical sketch, *Münchener Bilderbogen* (1879; "Picture Sheet of Munich").

Dingelstedt, engraving by A. Weger after a photograph
Bavaria-Verlag

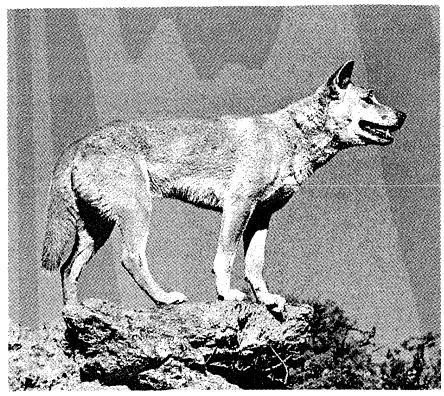
Dingiswayo (d. 1817), chieftain, from 1807, of the Mtetwa clan of the North (Natal) Nguni division of the Bantu people.

Dingiswayo became the paramount chief of about 30 peoples in Zululand (now northeastern Natal province, Republic of South Africa). His policy of conquering nearby Nguni peoples and absorbing them into a rudimentary centralized state was carried on by Shaka, the Zulu whom he chose as his successor. Dingiswayo initiated trade with the Portuguese in Mozambique. He was assassinated by Zwide, chief of the Ndwandwe clan, who rebelled against Dingiswayo's rule in Zululand.

Dingle, peninsula and bay in County Kerry, on the southwestern coast of Ireland. The peninsula begins south of Tralee as the Slieve Mish range, with elevations of more than 2,000 feet (highest point, Baurtregaum, 2,798 feet [853 m]); but in the west it becomes a mixture of hills and lowlands, with a north-trending line of hills near the town of Dingle. This ridge includes Brandon Mountain (3,127 feet [953 m]) and ends in some spectacular cliffs. The mountains are penetrated by heavily glaciated valleys. The extreme west of the peninsula comprises mainly lowlands, particularly around the harbours at Dingle, Ventry, and Smerwick. The peninsula terminates in the Blasket Islands. Dingle Bay separates the Dingle peninsula from the Iveragh peninsula to the south.

dingo (*Canis dingo*), also called WARRIGAL, Australian wild dog (family Canidae), one of the few nonmarsupial mammals in Australia. It was apparently introduced from Asia during the later immigrations of Aborigines in post-Pleistocene times (perhaps 5,000 to 8,000 years ago). Similar to the domestic dog in structure and habits, the dingo is stout with short, soft fur, a bushy tail, and erect, pointed ears. It is about 1.2 m (4 feet) long, including the 30-centimetre (12-inch) tail, and stands about 60 cm (24 inches) at the shoulder. Its colour varies between yellowish and reddish brown, often with white underparts, feet, and tail tip.

Dingoes hunt alone or in small groups; they



Dingo (*Canis dingo*)
G.R. Roberts

formerly preyed on kangaroos but now feed principally on rabbits and sometimes on livestock. Through competition they contributed to the extermination of the native Tasmanian wolf and Tasmanian devil (both marsupials) on the Australian mainland. With the European settlement of Australia, they preyed on sheep and poultry and were eliminated in most areas. Wild dingoes, although bold and suspicious, can be tamed, and those raised from puppies may become affectionate pets. The Aborigines sometimes use them as hunting dogs. Dingoes normally yelp and howl, but when domesticated they can imitate the bark of dogs. They usually bear litters of four to eight pups; the gestation period is about 63 days.

Dinguiraye, town, north-central Guinea, western Africa. It lies at the eastern edge of the Fouta Djallon plateau. The town was once the seat of the imamate (region ruled by a Muslim religious leader) of al-Hajj Umar, whose jihad (holy war) led to the creation of the Tukulor Empire (1850–93) in the Niger Valley. Dinguiraye is now connected by road with the towns of Siguiri and Dabola. It is the chief trading centre for rice, millet, peanuts (groundnuts), and cattle produced in the surrounding area by the Tukulor (Toucouleur), Fulani (Peul), and Dialonke (Djallonke) peoples. Alluvial gold is extracted from the upper reaches of the Tinkisso River (a tributary of the Niger) east of the town. Pop. (1983 prelim.) 32,065.

Dinh Bo Linh, reign title DINH TIEN HOANG (b. Hoa Lu, northern Vietnam—d. 979, northern Vietnam), emperor and founder of the second Vietnamese dynasty, who, after a decade of anarchy, reunified his country, winning official recognition of Vietnam as a state independent from China.

According to Vietnamese annals, Dinh Bo Linh, of peasant ancestry, was the adopted son of a feudal lord, the prefect of Hoa Lu. He was one of 12 chieftains among whom was divided Nam Viet, which consisted of northern Vietnam and three central Vietnamese provinces. Dinh Bo Linh defeated each of the other 11 lords and by 968 had gained control of all Nam Viet. Proclaiming himself emperor, he called the reunited country Dai Co Viet.

Dinh Tien Hoang eliminated the social and political anarchy that had characterized the divided kingdom. He filled administrative positions with Buddhist and Taoist monks, who were subordinate to government and imperial control, and he organized his state in a form adapted from the Chinese model that was familiar to the Viets, which stressed loyalty and individual performance of duties.

Dinh Tien Hoang sought peaceful relations with China. Exploiting the weakness of the newly installed Sung dynasty, he affirmed the subordinate status of his kingdom and agreed to pay tribute to the Chinese emperor in return for recognition of the sovereignty of Dai Co Viet and its ruler. He thus achieved permanent independence from China for the Vietnamese kingdom, although China sought unsuccessfully to reclaim the territory in centuries to come.

Dinh Tien Hoang was known as a courageous warrior and an able administrator and diplomat, but his authoritarian regime and his fondness for courtly pleasures made him many enemies, even within his family and his court. He and the crown prince were assassinated in 979 by a mystic seer who envisioned himself as the true emperor of Dai Co Viet. Because the emperor's heirs were too young to assert their position, the Dinh dynasty fell within a year of his death.

Dinichthys, also called DUNKLEOSTEUS, extinct genus of arthrodires, *i.e.,* primitive, armoured, fishlike animals that dominated ancient seas. *Dinichthys* lived during the Late Devonian Period, about 345,000,000 years ago, and is found fossilized in rocks of that age in Europe, northern Asia, and North America. *Dinichthys* grew to a length of about 9 m (30 feet), more than 3 m of which consisted of an armoured head shield that was hinged in the neck region, permitting the upper jaw to be raised in relation to the lower. *Dinichthys* was clearly the dominant marine predator of its time.

Dinichthys terrelli, reconstructed head
By courtesy of the Cleveland Museum of Natural History

Dinis, also spelled DINIZ, English DENIS (b. Oct. 9, 1261—d. Jan. 7, 1325), sixth king of Portugal (1279–1325), who strengthened the kingdom by improving the economy and reducing the power of the nobility and the church.

The son of Afonso III, he was educated at a court subject to both French and Castilian cultural influences and became a competent poet. He founded the first university in Portugal—in Lisbon—in 1290. A skilled negotiator, Dinis was able to establish with Castile a definitive frontier for Portugal. At home, he made the authority of the crown supreme, intervening in local government, reducing the power of the nobility, and combatting the supremacy of the clergy, particularly in regard to their territorial wealth (laws of disentail in 1286, 1291, and 1309). Concordats with the papacy (1289 and 1290) ended the struggle with the church.

Dinis took a special interest in the land, encouraging forestry plantation and the fuller development of the country's agricultural resources. He also showed great concern for shipbuilding and for the extension and protection of commerce. The last years of the reign were disturbed by a rebellion of his son, the future Afonso IV, who succeeded to the throne on his father's death. Dinis' wife would become Saint Elizabeth (Isabel) of Portugal.

Dinis, Júlio, pseudonym of JOAQUIM GUILHERME GOMES COELHO (b. Nov. 14, 1839, Porto, Port.—d. Sept. 12, 1871, Porto), poet, playwright, and novelist, the first great novelist of modern Portuguese middle-class society. His novels, extremely popular in his lifetime and still widely read in Portugal today, are

Dinis, detail of a watercolour by Alfredo Roque Gameiro, 19th century
By courtesy of the Secretaria de Estado da Informacao e Turismo, Lisbon

written in a simple and direct style accessible to a large public.

His first attacks of tuberculosis forced him to resign as deputy professor at the medical school of Porto. He had already published several tales of country life in the *Jornal do Porto*. Retiring to the coastal town of Ovar for his health, he wrote the novel for which he is best-known, *As Pupilas do Senhor Reitor* (1867; "The Pupils of the Dean"), depicting country life and scenery in a simple and appealing style. It was based on his own family situation and described the influence of the English on Portuguese culture. (His mother was English.) Encouraged by its immediate success, he published *Uma Família Inglesa* (1868; "An English Family"), a novel describing English society in Porto.

Dinis' poems and plays were published posthumously, but he is best-remembered for his novels. *As Pupilas do Senhor Reitor* had gone through 14 editions by 1900.

Dinka, also called JIENG, people who live in the savanna country surrounding the central swamps of the Nile basin in the south of The Sudan. Numbering about 2,960,000 in the late 20th century, the Dinka speak an Eastern Sudanic language of the Chari-Nile branch of the Nilo-Saharan family and are closely related to the Nuer. They form many independent

Dinka village on the Nile River in the southern Sudan
Henriette Grindat

groups of between 1,000 and 30,000 persons. These are grouped on a regional, linguistic, and cultural basis into clusters, of which the best-known are the Agar, Aliab, Bor, Rek, and Malual. The Dinka are primarily transhumant pastoralists, moving their herds of cattle to riverine pastures during the dry season (December to April) and back to permanent settlements in savanna forest during the rains, when their food crops, principally millet, are grown. Each group is internally segmented into smaller political units with a high degree of autonomy. Because of the vast geographical area they occupy, the Dinka exhibit great diversity of dialect, although they value intragroup unity in the face of enemies.

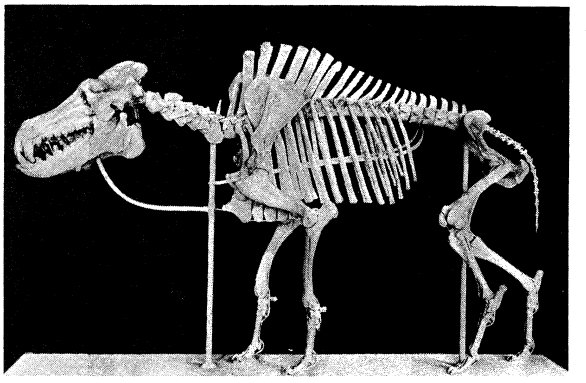
By tradition certain of their patrilineal clans provide priest-chiefs ("masters of the fishing spear"), whose position is validated by elaborate myths. Spiritual leadership and intervention are important to the Dinka, who are intensely religious and for whom God (Nhial) and many ancestral spirits play a central and intimate part in everyday life. Anything from a lie to a murder may be an occasion for sacrificial propitiation of the divine.

Proud, independent, and warlike, the Dinka ritualize the passage from boyhood to manhood through age-old ceremonies during which a number of boys of similar age undergo hardship together before abandoning forever the activity of milking cows, which had marked their status as children and servers of men.

Dinkelsbühl, city, Bavaria *Land* (state), southern Germany. It lies along the Wörnitz River, about 20 miles (32 km) southwest of Ansbach. Mentioned in 928, it was fortified in the 10th century and became a free imperial city in 1273. It flourished in the 14th and 15th centuries and successfully withstood eight sieges in the Thirty Years' War (events commemorated annually in a July festival) before it fell to Gustavus Adolphus of Sweden in 1632. The 10th-century walls, with a moat and 12th-century towers, still surround the city, thus preserving its medieval character. Notable landmarks include the late Gothic Church of St. George (1448–99; one of Germany's finest single-naved churches, with a Romanesque tower), the old castle of the Teutonic Order (rebuilt 1761–64), the fortified town mill (*c.* 1390), and the Deutsche Haus (a 14th–15th-century mansion, with a Renaissance facade). Gingerbread, furniture, textiles, clothing and leather, and beer are produced in the city. Pop. (1989 est.) 10,668.

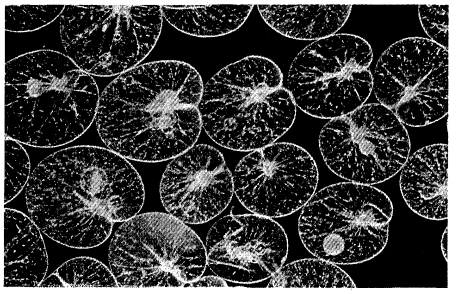
Dinnsheanchas (Gaelic: "Histories of Places"), studies in prose and verse of the etymology and history of place-names in Ireland—*e.g.,* of streams, raths (strongholds of ancient Irish chiefs), mounds, and rocks. These studies were preserved in variant forms in monastic manuscripts dating from as early as the 12th century. The *Dinnsheanchas* contain much pre-Christian mythology, especially stories of gods and fairies. The most famous study is the *Dinnsheanchas;* it describes more than 200 locations and is ascribed to Amergin mac Amhalgaidh, a poet to King Diarmaid in the 6th century. It was an important source for Irish poets, who were expected to be familiar with the lore of each area.

Dinocrates, also spelled DEINOCRATES (fl. 4th century BC), Greek architect who prospered under Alexander the Great. He tried to captivate the ambitious fancy of that king with a design for carving Mount Athos into a gigantic seated statue. The plan was not carried out, but Dinocrates designed for Alexander the plan of the new city of Alexandria (*c.* 330 BC) and constructed the vast funeral pyre of Hephaestion. Alexandria was, like Piraeus and Rhodes, built on a regular plan in contrast to the narrow and irregular streets of most earlier towns.



Dinohyus hollandi skeleton
By courtesy of the American Museum of Natural History, New York

dinoflagellate, any of numerous one-celled, aquatic organisms bearing two dissimilar flagellae and having characteristics of both plants and animals. Most are microscopic and marine. Botanists place them in the algal class Dinophyceae of the division Pyrrophyta, and zoologists claim them as members of the protozoan order Dinoflagellida. Dinoflagellates range in size from about 5 to 2,000 micrometres (0.0002 to 0.08 inch). Nutrition among dinoflagellates is plantlike, animal-like, or mixed; many species are parasitic or commensal. The group is an important component of phytoplankton in all but the colder seas and is



Dinoflagellate *Noctiluca scintillans* (magnified)
Douglas P. Wilson

an important link in the food chain. Dinoflagellates also produce part of the luminescence sometimes seen in the sea.

The dinoflagellate cell is banded by a median or coiled groove, the annulus, which contains a flagellum. A longitudinal groove, the sulcus, extends from the annulus posteriorly to the point at which a second flagellum is attached. Armoured dinoflagellates are covered with heavy, cellulose plates, which may have long, spiny extensions; some species lacking armour have a thin pellicle (protective layer). Dinoflagellates have yellowish or brownish plastids (pigment-containing bodies) and may store food in the form of starches, starchlike compounds, or oils.

Although sexual processes have been demonstrated in one genus, reproduction is largely by binary or multiple fission. Under favourable conditions dinoflagellate populations may reach 60,000,000 organisms per litre of water. Such rapid growths, called blooms, result in the red tides that discolour the sea and poison fish and other marine animals.

For additional information on specific dinoflagellate genera, *see* Ceratium; Gymnodinium. *See also* red tide.

Dinohyus, extinct genus of giant piglike mammals found as fossils in deposits of early

Miocene age in North America (the Miocene epoch occurred 23.7 to 5.3 million years ago). *Dinohyus* is the last and largest of a group of mammals called entelodonts, an early offshoot of the primitive swine stock. As large as a bison, it stood at least 2 m (6 feet) tall at the shoulder; the skull alone was about 1 m (more than 3 feet) long and had many bony flanges and protuberances. The braincase was extremely small. The teeth were very distinctive: the incisors were blunt, while the canines were stout and must have been effective weapons. The neck was short and thick, and the spines in the anterior elements of the backbone were very long and formed a pronounced hump at the shoulders of the animal. *Dinohyus* was probably a root eater.

Dinornis, genus of extinct giant flightless birds popularly known as moas (*see* moa).

dinosaur, any member of a great series of reptiles that were the dominant land animals during most of the Mesozoic era (from 245 to 66.4 million years ago) but became extinct at its close. The term, derived from the Greek, meaning "terrible lizard," refers to the gigantic proportions of some of these beasts. Dinosaurs belonged to two distinct but related orders—the Saurischia and the Ornithischia—that were distinguished from each other chiefly by differences in the structure of their pelvic girdles. The dinosaurs belonged to the Archosauromorpha infraclass of reptiles. Among the other archosaurs (Greek: "ruling reptiles") were the early crocodilians, extinct flying reptiles, and the ancestors of the modern birds. A considerable number of dinosaurs were flesh eaters, but many others abandoned this primitive reptilian mode of life for a plant diet. The early dinosaurs may have descended from archosaurs that were bipeds; many dinosaurs remained bipedal throughout the group's history. In both dinosaur orders, however, many of the herbivore types developed a four-footed mode of locomotion.

It is believed that the saurischian dinosaurs evolved from small, bipedal archosaurs called thecodonts. All of the early saurischians were similarly bipedal, as were the majority of the later members of the order. Of the three known suborders of Saurischia that evolved, the two main types were the theropods and the sauropods. The theropod coelurosaurs were slender-limbed, lightly built, fast-running carnivores that probably preyed upon smaller reptiles. They ranged from 2 to 8 feet (0.7 to 2.4 m) in length and had birdlike feet. The theropod carnosaurs were flesh eaters; they tended to reach a large size. Among the best-known types was *Tyrannosaurus,* which had tiny front limbs and a huge skull with many sharp teeth that were highly effective biting and tearing instruments. It reached a height of about 16 to 18 feet (5 m) and a length of about 50 feet (15 m). Such an animal was powerful enough to attack any of its dinosaur contemporaries, including the great sauropod plant eaters. Although the prosauropods, such as *Plateosaurus,* were generally smaller than the carnosaurs and were herbivorous in diet, they evolved into the largest of all dinosaurs, the sauropods. Among these huge, four-footed plant eaters were *Diplodocus,* which reached a length of 87 feet (26 m), and the heavier *Brachiosaurus,* which weighed as much as 80 tons. Sauropods had massive bodies, powerful limbs (to support their great weight), a long tail, a long neck, and a small head.

The ornithischian dinosaurs, like the saurischians, evolved from thecodonts. The ornithischians did not grow as large as some of the saurischians but were notable for their armour and other strange adaptations. They comprised four main groups. One group, the ornithopods, included the hadrosaurs, or duck-billed dinosaurs. These odd-looking creatures had ducklike mouths and several hundred teeth that they used to grind hard vegetable matter. The hadrosaurs were bipeds, but the other three ornithischian groups were mostly composed of quadrupeds. The stegosaurs had high-arched bodies and a row of large vertical bony plates running along their backs. The ankylosaurs were heavily armoured dinosaurs with extra bone plating over most of their bodies for defensive purposes. The ceratopsids, such as *Triceratops,* had a broad frill of bone protecting the head and neck and some type of long horn or horns projecting from the skull.

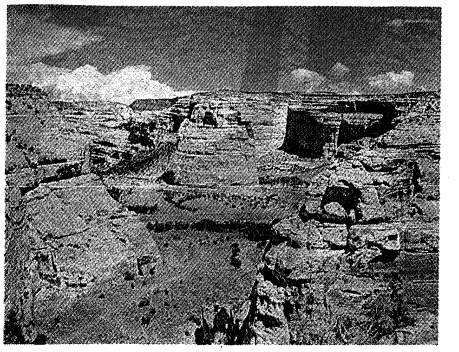
Most dinosaurs had long tails, but they held these tails straight out and off the ground for help in maintaining their balance, rather than dragging them along the ground as had been previously thought. Dinosaurs were also long thought to be cold-blooded, like all other reptiles, but recent consideration of their postures, rates of predation, and certain anatomical details has led many paleontologists to conclude that at least some dinosaurs were warm-blooded. This is a point of continuing controversy, but it is clear that, contrary to the traditional image of dinosaurs as sluggish, slow-moving beasts, many of them were swift-moving creatures with relatively high metabolic rates.

Most types of dinosaurs continued to flourish until the very latest phases of the Cretaceous period. Then, within the next million years, they disappeared completely from the geologic record, and succeeding rock strata show not the slightest trace of a dinosaur. The cause of this sudden demise is not at all clear. One widely accepted explanation for their mass extinction has been that a major geologic cycle of mountain building at the end of the Cretaceous period reduced the lowland areas in which dinosaurs flourished and also changed the world's climate, thus stimulating evolutionary changes in the plant life upon which dinosaurs fed. A more recent theory postulates an astronomical catastrophe as the cause: a collision between an asteroid and the Earth generated a huge dust cloud that caused a period of darkness lasting as long as three years. This blockage of sunlight made photosynthesis virtually impossible, and the resulting collapse of the food chain led to the worldwide extinction of the dinosaurs and many other life forms. Although this hypothesis has been partially substantiated by geologic evidence, the apparent survival of some types of dinosaurs for as long as 1 million years after the presumed asteroid impact raises doubts that this catastrophe was the primary cause of the dinosaurs' eventual disappearance. It is possible that both climatic change and an asteroid impact played a part in the extinction of dinosaurs.

Consult the INDEX *first*

Dinosaur National Monument, area in northwestern Colorado and northeastern Utah, U.S., set aside in 1915 to preserve rich fossil beds that include dinosaur remains. The monument was enlarged from 80 acres (32 hectares) to about 210,000 acres (85,000 hectares) in 1938 and to 211,142 acres (85,446 hectares) in 1978 to protect the scenic canyons of the Green and Yampa rivers. These cut through some 20 tilted and highly coloured geologic formations of the Uinta Plateau, representing 20,000 feet (6,000 m) of strata in deeply incised meanders. The rivers join near Steamboat Rock and flow westward as the Green.

The monument's wildlife includes deer, beaver, bighorn sheep, antelope, eagles, hawks,



Echo Park and Steamboat Rock, Dinosaur National Monument, Colorado

By courtesy of the National Park Service

and owls. The plant life features sagebrush and other dry-climate plants, trees in the moister areas, and wildflowers. The canyons contain evidence of prehistoric Indian life. The fossil quarry, visitor centre, a museum, nature trails, and campsites are provided for tourists.

Dinslaken, city, North Rhine-Westphalia *Land* (state), western Germany. It lies in the Ruhr region, about 22 miles (35 km) north of Düsseldorf. First mentioned in 1163 and chartered in 1273 by the count of Cleves (Kleve), it developed around a castle, the ruins of which now form a wing of the city's open-air theatre. Long-established as a district administrative centre, it sustained heavy damage during World War II but has been reconstructed as a modern residential city. Its varied industries include coal mining, sawmilling, and the manufacture of steel-rolling equipment, pipes, electrical equipment, nails, wire, and clothing and shoes. Pop. (1989 est.) 63,246.

Dinwiddie, Robert (b. 1693, Germiston, near Glasgow, Scot.—d. July 27, 1770, Clifton, Bristol, Eng.), British colonial administrator who as lieutenant governor of Virginia helped precipitate the French and Indian War.

After working as a merchant, Dinwiddie entered British government service in 1727 as collector of the customs for Bermuda. In 1739 he was appointed surveyor general (of revenues) for the southern part of America. In 1741 he became a member of the Governor's Council of Virginia.

Dinwiddie was appointed lieutenant governor of Virginia (in fact acting as governor, since the office of governor was a sinecure) and shortly thereafter became embroiled in a controversy with the House of Burgesses over his right to institute "pistole" fees, or taxes on land patents without the owners' consent. The Board of Trade decided the issue in favour of Virginia's lower house.

A more serious issue arose in 1753, when Dinwiddie, supporting land claims of the Ohio Company, sent George Washington to western Pennsylvania to advise the French to leave the Ohio country. Washington's mission led to a skirmish the next year that, in turn, marked the onset of the French and Indian War.

In 1755 the disastrous defeat of General Edward Braddock near Fort Duquesne in Pennsylvania left Dinwiddie with the difficult task of protecting Virginia's exposed frontier settlements. He raised ranger companies and a regiment under Washington and tried continuously and vigorously to obtain intercolonial cooperation for the war effort by corresponding with various colonial officials. In 1757 Dinwiddie requested leave to return to England. He departed from Virginia on Jan. 12, 1758, to spend his last years in virtual retirement in England.

Dio (India): *see* Diu.

Dio CHRYSOSTOMUS, also called DIO COCCEIANUS, or DIO PRUSAEUS (Greek rhetorician and philosopher): *see* Dion Chrysostom.

Dio Cassius, also spelled DION CASSIUS, in full CASSIUS DIO COCCEIANUS (b. *c.* 150, Nicaea, Bithynia—d. 235), Roman administrator and historian, the author of *Romaika,* a history of Rome, written in Greek, that is a most important authority for the last years of the republic and the early empire.

The son of Cassius Apronianus, governor of Dalmatia and Cilicia under Marcus Aurelius, and grandson of Dio Chrysostom, Dio Cassius went to Rome (180) after his father's death and became a member of the Senate. By Macrinus he was entrusted with the administration of Pergamum and Smyrna, and on his return to Rome he was made consul. After this he obtained the proconsulship of Africa and again on his return was sent as legate successively to Dalmatia and Pannonia. He was granted a second consulship by Alexander Severus, in 229, shortly before retirement. His history of Rome consisted of 80 books beginning with the landing of Aeneas in Italy and ending in the reign of Alexander Severus (222–235). Much of this work is preserved in later histories by Constantine VII Porphyrogenitus, John VIII Xiphilinus, and John Zonaras. Dio's industry was great, and the various offices he held gave him opportunities for historical investigation. His narratives show the hand of the practiced soldier and politician; the language is correct and free from affectation. Although, his work is far more than a mere compilation, it is not remarkable for impartiality, vigour of judgment, or critical historical faculty.

diocese, in some Christian churches, a territorial area administered by a bishop. The word originally referred to a governmental area in the Roman Empire, governed by an imperial vicar. The secular diocese was subdivided into provinces, each with its own governor; but, in the ecclesiastical adaptation of the system, the province became the larger territorial unit, administered by a metropolitan bishop and subdivided into dioceses.

The original unit of ecclesiastical administration was the parish, which in the Eastern Orthodox Church still remains the designation of the area administered by the bishop, whereas the diocese is the larger area administered by the patriarch. The use of these terms was still fluid in the West in the 9th century; but, by the 13th century, diocese meant the territory administered by a bishop.

In the Roman Catholic Church only the pope can divide or merge dioceses or create new ones. All dioceses are divided into parishes, each with its own church; dioceses are also sometimes divided into rural deaneries, which contain several parishes.

In the Church of England, during the 16th, 19th, and 20th centuries, new dioceses were created by statute by dividing existing ones. Each diocese is subdivided into parishes, which are grouped under rural deaneries and archdeaconries.

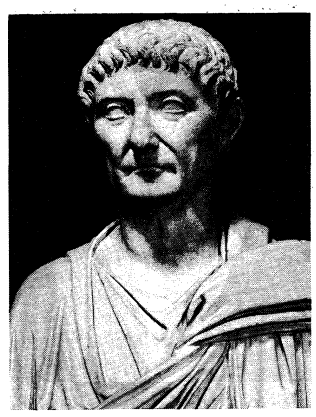
dioch (bird): *see* quelea.

Diocles (b. Carystus, Euboea, Greece; fl. 4th century BC), philosopher and pioneer in medicine, among Greek physicians second only to Hippocrates in reputation and ability, according to tradition.

A resident of Athens, he was the first to write medical treatises in Attic Greek rather than in the Ionic Greek customarily used for such writings; only fragments of his writings survive. Usually regarded as the chief representative of the dogmatic school, he wrote on animal anatomy, dietetics, physiology, embryology, and medical botany, among other subjects. His work on animal anatomy, prepared with the aid of his work in dissection, was the first systematic textbook on the subject.

Though it was once supposed that Diocles was a contemporary of Plato (428–348/47 BC), it has been shown that he must have been a contemporary of Aristotle (384–322 BC). His most probable dates are 375–300 BC. In doctrine, he shows a synthetic tendency, combining the influence of Hippocratic medicine and that of the Sicilian school, and his terminology and methodology suggest Aristotelian influences. Evidence exists that he had at his disposal a collection of Hippocratic writings, possibly one assembled by him. Diocles was, however, considerably more than a compiler and systematizer. Although his work in reorganizing medicine on the theoretical level was important, on the level of practical medicine he set out on original lines.

Diocletian, Latin in full GAIUS AURELIUS VALERIUS DIOCLETIANUS, original name DIOCLES (b. AD 245, Salonae?, Dalmatia—d. 316, Salonae), Roman emperor (285–305), who restored efficient government to the empire after the near anarchy of the 3rd century. His reorganization of the fiscal, administrative, and military machinery of the empire laid the foundation for the Byzantine Empire in the East and temporarily shored up the decaying empire in the West. His reign is also noted for the last great persecution of the Christians.



Diocletian, detail of a bust in the Capitoline Museum, Rome
Alinari—Art Resource/EB Inc.

Life. Diocletian's biography has been obscured by legends, rhetoric, the dubiousness of documents, and the hostility of his adversaries. Little is known of his origins. His father was a scribe or the emancipated slave of a senator called Anullinus. Diocletian's complete name, found in official inscriptions, is given as Gaius Aurelius Valerius Diocletianus. He received the name Diocles first, then the name Valerius, after the name of his daughter, Valeria, who married Galerius in 293. The gens name Aurelius did not appear until March 1, 286; that is, until after his accession. Nothing is known of his wife Prisca other than what the contemporary Latin Christian writer Lactantius Firmianus says in his *De mortibus persecutorum,* which is of debatable veracity. Diocles, having adopted the name Diocletianus, entered history like so many of those emperors who emerged from the shadows through force of arms, brought to power by the army. The little that is known of his appearance is based on coin effigies and on sculptures. From these it appears that he was tall and thin, with a large forehead, a short, strong nose, a hard mouth, and a determined chin.

Rise to power. Up to the time of his accession, Diocletian had lived most of his life in military camps. These may have been either in Gaul, as reported in the *Historia Augusta,* or in Moesia. Or he may have been a member of the Roman emperor Carinus' bodyguard. The only definite fact known about Diocletian during this period is that he was among those army chiefs whom Carinus gathered, together with the Illyrians, to fight against the Persians. In 284, during that campaign, Numerian, Carinus' brother and co-emperor, was found dead in his litter, and his adoptive father, the praetorian prefect Aper, was accused of having killed him in order to seize power. When Diocletian, acclaimed as emperor by his soldiers, appeared for the first time in public dressed in the imperial purple, he declared himself innocent of Numerian's murder. He designated Aper as the criminal and killed him personally. Here again, rhetoric has obscured the real events. Aper's guilt was accepted by contemporaries, but it was also true that a prediction had been made to Diocletian previously, telling him that he would become emperor on the day he killed a boar (Latin *aper*). And it was true, too, that he did not wish to wait much longer for the boar to come. In reality, Numerian had died either a natural death or from a stroke of lightning. By eliminating Aper, however, Diocletian rid himself of an eventual competitor and, retroactively, provided his act with sacred meaning.

Acclaimed emperor on Nov. 17, 284, Diocletian had real power only in those countries dominated by his army (*i.e.,* in Asia Minor and possibly Syria). The rest of the empire was obedient to Numerian's brother, Carinus. After having put down a revolt by Julianus, a troop commander in Pannonia, whom he attacked and killed near Verona, Carinus next attacked Diocletian. An indecisive battle near the confluence of the Margus (modern Morava) and Danube rivers, not far from present-day Belgrade, would have been a defeat for Diocletian had Carinus not been assassinated by a group of soldiers. Thus, in midsummer of 285, Diocletian became master of the empire.

Reorganization of the empire. At the beginning of 286 Diocletian was in Nicomedia. In the interim, he and his lieutenants had calmed the stirrings of revolt among Roman troops stationed on the frontiers. From that point on, he dedicated himself to restoring civil order to the empire by removing the army from politics.

Although he came from the army's ranks, Diocletian was not, properly speaking, a soldier. He had scarcely come to power when he made an unexpected decision—to share the throne with a colleague of his choice. The empire was too great for one man to administer; nearly every week, either in Africa, or somewhere on the frontier that extended from Britain to the Persian Gulf, along the Rhine, the Danube, the Pontus Euxinus (Black Sea), and the Euphrates, he was forced to suppress a revolt or stop an invasion. Diocletian, who was more attracted to administration, required a man who was both a soldier and a faithful companion to take responsibility for military defense. In 286 he chose Maximian, an Illyrian, the son of a peasant from the area around Sirmium. A little later, though still keeping Rome as the official capital, he chose two other residences. Maximian, who was responsible for the West, was installed at Milan in northern Italy, in order to prevent German invasions. Diocletian established himself at Nicomedia, in western Anatolia, and close to the Persian frontier, in order to keep watch on the East. Six years later, in 293, having taken the title of "Augustus" and given it to Maximian as well, he added two more colleagues: Galerius, a former herdsman, and Constantius I Chlorus, a Dardanian nobleman according to the legend of his house, but a rather rude countryman also. These additional collaborators were each given the title "Caesar" and attached to an Augustus, Constantius to Maximian (with a residence in Trier), and Galerius to Diocletian himself (with a residence in Sirmium).

Thus, while the empire remained a *patrimonium indivisum* (undivided inheritance), it was

nevertheless divided administratively: Diocletian, residing in Nicomedia, watched over Thrace, Asia, and Egypt; Galerius, residing in Sirmium, watched over Illyria, the Danubian provinces, and Achaea; Maximian, residing in Milan, over Italy, Sicily, and Africa; and Constantius I Chlorus, residing in Trier, over Gaul, Spain, and Britain. In order to strengthen the union of the colleagues, each Augustus adopted his Caesar. The relationships were further cemented when Galerius married Valeria, Diocletian's daughter, and Constantius I Chlorus repudiated his wife Helena, mother of the future emperor Constantine, in order to marry Theodora, Maximian's stepdaughter. The empire now had four masters, celebrated by the authors of the *Historia Augusta* (a collection of biographies of Roman emperors and caesars, published in the 17th century) as the *quattuor principes mundi* ("four princes of the world"), and Diocletian consecrated this human unity by forming a religious bond. Because he believed that he had come to power through divine will, as revealed by the "fateful" boar, he regarded himself and Maximian as "sons of gods and creators of gods." After 287, he called himself Jovius (Jove) and Maximian was named Herculius (Hercules), signifying that they had been chosen by the gods and predestined as participants in the divine nature. Thus, they were charged with distributing the benefits of Providence, Diocletian through divine wisdom, and Maximian through heroic energy. Later designated as *dominus et deus* on coins and inscriptions, Diocletian surrounded himself with pomp and ceremony and regularly manifested his autocratic will. Under Diocletian, the empire took on the aspects of a theocracy.

Diocletian's reforms were successful; they put an end to domestic anarchy, and elsewhere they allowed Maximian to defeat the revolt in Gaul of the Bagaudae, bands of peasants who found the tribute oppressive. Then, with peace scarcely restored after a campaign against the Germans, Maximian had to battle Carausius, who, having fought for the empire in Britain against the Frankish and Saxon pirates, revolted and named himself emperor in Britain in 287. Carausius reigned in Britain for nearly 10 years until Constantius I Chlorus succeeded in returning Britain to the empire in 296. Scarcely had troubles in Mauretania and in the Danubian regions been settled when Egypt declared itself independent under the usurper Achilleus. Diocletian reconquered the country in 296. Finally, in 297, he had to fight Narses, king of Persia, who had invaded Syria. Since he was still occupied in Egypt, he assigned this operation to Galerius, who, after a protracted campaign, finally won victory for the Romans. Tiridates, the king of Armenia and a protégé of the Romans, was able to return to his throne; the Tigris became the eastern border of the empire; and peace reigned in that part of the world until the reign of Constantine I (306–337).

Domestic reforms. Perhaps more important for the maintenance of the empire was Diocletian's program of domestic reform. He was not a complete innovator in this area, for his predecessors had made some tentative attempts in the same direction; the emperor Gallienus had excluded senators from the army and separated military from civil careers. The Senate had progressively been deprived of its privileges. Diocletian, however, systematized these arrangements in such a way that all his reforms led toward a kind of centralized and absolute monarchy that put effective means of action at his disposal. Thus, Diocletian designated the consuls; the senators no longer collaborated in the making of laws; the imperial counsellors (*consilia sacra*) were distributed among specialized offices, and their functions were strictly defined so that the power of the praetorian prefects (personal bodyguards to the emperor) was limited; the specialization of administrative work grew; and the number of bureaucrats increased. This was the beginning of the bureaucracy and technocracy that was eventually to overrun modern societies.

Such organization made it possible for administration to rely less on individual human beings and more on the application of legal texts. In fact, it was during Diocletian's reign that the Gregorian and Hermogenian codes, of which only fragments remain, were rewritten. But 1,200 extant rescripts show another aspect of the Emperor's personality. A conservative, Diocletian was concerned with the preservation of the ancient virtues: the obligation of children to feed their parents in old age; of parents to treat their children justly; of spouses to respect the laws of marriage; of sons not to bear witness against their fathers, or slaves against their masters; and of private property, creditor's rights, and contract clauses to be protected. He forbade the use of torture if truth could be discovered otherwise and encouraged governors to be as autonomous as possible.

The army was also reorganized and brought back to the old discipline. Sedentary troops (local troops) were sent to the frontiers, and the ready army (main movable army) was made domestic. Troop strength was increased by a fourth, not multiplied by four as Lactantius claims. Here again, Diocletian's reforms were infused with a sense of human realities; he exempted soldiers from duty after 20 years of service, and, if he limited the price of commodities so as to reduce the cost of living, it was mainly to make life easier for the troops. If one is to believe Lactantius, Diocletian divided the provinces "so as to make himself more feared," but in fact it was to bring the governors closer to those they administered and, by fragmenting their power, to diminish their territorial strength. He undertook to facilitate economic development through a recovery of agriculture and a program of building.

Such policies were expensive, as were wars and the legacy of an unstable financial situation. Diocletian's fiscal solutions are still debated; they constitute a very difficult problem. Two new taxes were instituted, the *jugum* and the *capitatio,* the former being the tax on a unit of cultivable land, the latter, a tax on individuals. Taxes were levied on a proportional basis, the amount of the contribution being determined by the productivity and type of cultivation. As a rule, it was a sort of socioeconomic taxation based on the linkage between man and land in terms of either ownership or productivity. Assessments were made every five years; later, the system was consolidated into a cycle of 15 years called an *indictio.* This census of taxable adults gave rise to violent criticisms but had the theoretical advantage of replacing the arbitrary levies of the previous era. To be sure, the financial system was subject to excesses; but Diocletian's purpose was to obtain funds, and he did not even spare Italy, which had until then been free of land taxation.

This reform was accompanied by a monetary reform, including restoration of a sound gold and silver coinage of fixed design, creation of a new bronze coin, circulation of small coins to facilitate daily financial exchange, decentralization of minting, and an increase in the number of mints from 8 to 15.

All of these measures tended to stave off financial crises. The renowned Edictum de Maximis Pretiis was issued in AD 301, fixing wages and establishing maximum prices, so as to prevent inflation, abusive profits, and the exploitation of buyers. About 1,000 articles were enumerated, and violation was punishable by death; severe penalties were exacted of black marketeers. But even so, this regulation of prices and wages was not enforceable, and the edict was later revoked.

Persecution of Christians. The end of the reign was darkened by the last major persecution of the Christians. The reasons for this persecution are uncertain, but various explanations have been advanced: the possible influence of Galerius, a fanatic follower of the traditional Roman religion; the desire to restore complete unity, without tolerance of a foreign cult that was seen as separatist and of men who were forming a kind of state within the state; the influence of anti-Christian philosophers such as Porphyry and governors such as Hierocles on the scholarly class and on the imperial court; the fear of an alienation of rebellious armies from emperor worship; or perhaps the disturbances provoked by the Christians themselves, who were agitated by doctrinal controversies. At any rate, some or all of these factors led Diocletian to publish the four edicts of 303–304, promising all the while that he would not spill blood. His vow went unheeded, however, and the persecutions spread through the empire with an extreme violence that did not succeed in annihilating Christianity but caused the faith of the martyrs to blaze forth instead.

Assessment. Diocletian had aged prematurely through illness. Perhaps he decided that, after 20 years of reign, his abdication was also "fateful." Of his own volition he decided to entrust the affairs of the empire to younger men and returned first to Nicomedia, then to the neighbourhood of Salonae, on the edge of the Adriatic, where he had a magnificent palace built (the modern town of Split, in Yugoslavia, occupies the site of its ruins). He abdicated May 1, 305, and his death occurred almost unnoticed.

Diocletian had reorganized the empire without political romanticism. His reforms had not proceeded from a premeditated plan but had imposed themselves out of historical necessity. He may be accused of several things: of having been cruel, but his harshness was not the act of deep-seated brutality; of being miserly, but this miserliness was inspired by the desire to obtain resources for the state; of cutting a slightly muddle-headed, visionary figure, but these were the traits that led him to reflect on better methods of governing an immense territory; of having paved the way to bureaucracy and technocracy, but this was done with greater efficiency in view. Personally, Diocletian was a religious man. No doubt he did not manifest any unusual piety, but he always thought that the gods of the emperors governed the world. He exercised an absolute, "divine right" monarchy, and he surrounded it with an almost Oriental majesty.

Partially he failed in his task, and one can rightly say that the state he created was not "the new house he intended to build, but rather an emergency shelter," which offered protection against storms with the help of the gods. The fact remains that he was, in his actions, his religion, and his time, *vir rei publicae necessarius,* "the man whom the State needed." (Je.C.)

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Diocletian, Palace of, ancient Roman palace built between AD 295 and 305 at Split (Spalato), Yugos., by the emperor Diocletian as his place of retirement (he renounced the imperial crown in 305 and then lived at Split until his death in 316). It was both an imperial city-palace and a sea fortress, as well as a country house of vast proportions and magnificence, covering an area of 9½ acres (four hectares). The north to south wall measured 705 feet (215 metres), with the walls being 7 ft thick and 72 ft high on the Adriatic side and 60 ft on the north. There were 16 towers and four gates: Porta Aurea (north), Porta Argentea (east), Porta Ferrea (west), and Porta Aenea (south). The rectangular ground plan was like a Roman camp; *i.e.,* with four arcaded avenues 36 ft wide meeting in the middle. The imperial apartments were in the two southern quadrants, along the width of which ran a 524-ft-long and 24-ft-wide arcaded grand gallery (probably for promenades and display of art) that was open to scenic views of the sea and the Dalmatian coast. The Temple of Jupiter and Diocletian's mausoleum (a cathedral after the 7th century) were located in courts of the imperial section. Guests and household officials were accommodated in the northern quadrants.

The Avars badly damaged the palace, but when their incursion was over (639) the inhabitants of the ruined city of Salona (Salonae; Diocletian's birthplace) took refuge within what remained of the palace and built their homes, incorporating the old walls, columns, and ornamentation in their new structures (this area is now the "Old Town" of Split).

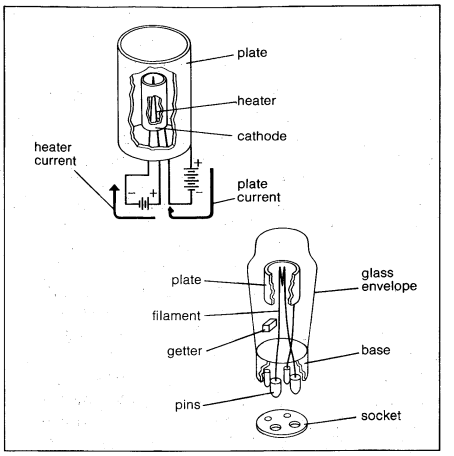
Diocletian window, window with a somewhat rounded top, or head, and bronze-framed panes of glass, named after those in the palace of the 3rd-century Roman emperor Diocletian at Spalato (Split, Yugos.) and in the Baths of Diocletian, Rome (now the church of Sta. Maria degli Angeli). The window was used again in the 16th century, especially by Andrea Palladio, and in the late 18th century by Robert Adam.

Diodati, Giovanni (b. June 6, 1576, Lucca, Italy—d. Nov. 3, 1649, Geneva), Swiss Calvinist pastor known for his translation of the Bible into Italian.

Born of a refugee Protestant family from Lucca, Diodati became a pastor at Geneva in 1608 and professor of theology in 1609. A leader of the Reformers, he was an eloquent, bold, and fearless preacher and a rigid Calvinist. He conducted a mission to France in 1614 and was appointed to record the proceedings of the Synod of Dort (1618–19). His Italian translation of the Bible was first published in 1603. He was also the author of a translation into French and of biblical annotations and polemical treatises.

diode, electron tube, evacuated glass or metal envelope containing two electrodes, a cathode and an anode. It is used as a rectifier and as a detector in electronic circuits such as radio and television receivers. When a positive voltage is applied to the anode (or plate), electrons emitted from the heated cathode flow to the plate and return to the cathode through an external load. If a negative voltage is applied to the plate, electrons cannot escape from the cathode and no plate current flows. Thus a diode permits electrons to flow from the cathode to the plate, but not from plate to cathode. If an alternating voltage is applied to the plate, current flows only during the time when the plate is positive. The alternating voltage is said to be rectified, or converted to dc (direct current).

In the indirectly heated cathode type of tube shown in the illustration, the electron emitter consists of a metallic cylinder, usually nickel, coated with an electron emitter, such as a mixture of barium and strontium oxides. The



Diode

heat is provided by a coil of wire (heater) located inside the sleeve but insulated from it. In the directly heated cathode (right), the heater wire itself serves as the source of electrons and is referred to as the filament.

Solid-state rectifiers, which have largely replaced the vacuum type, are also frequently referred to as diodes.

Diodorus CRONUS (b. Iasus, Caria, Anatolia; fl. 4th century BC), philosopher of the Megarian school, remembered for his innovations in logic. His surname Cronus, of uncertain meaning, was applied both to him and to his teacher, the philosopher Apollonius of Cyrene. Through Apollonius he is linked with Eubulides of Miletus, a 4th-century Greek thinker; together the three men formed the branch of the Megarian school that was especially strong in formal logic. The 3rd-century-AD historian Diogenes Laërtius reported that, at the court of Ptolemy Soter, Diodorus could not solve a logical problem propounded by Stilpon and died of shame at his failure (*c.* 307). None of Diodorus' writings are extant.

Diodorus Siculus (fl. 1st century BC, Agyrium, Sicily), Greek historian, the author of a universal history, *Bibliotheca historica.*

Diodorus lived in the time of Julius Caesar and Augustus, and his own statements make it clear that he travelled in Egypt during 60–57 BC and spent several years in Rome. The latest event mentioned by him belongs to the year 21 BC. His history consisted of 40 books and was divided into three parts. The first treats of the mythic history of the non-Hellenic and Hellenic tribes to the destruction of Troy; the second ends with Alexander's death; and the third continues the history as far as the beginning of Caesar's Gallic War. The *Bibliotheca,* invaluable where no other continuous historical source has survived, supplies to some extent the loss of the works of earlier authors, from which it was compiled. Diodorus does not always quote his authorities, but in the books that have survived his most important sources for Greek history were certainly Ephorus (for 480–340 BC) and Hieronymus of Cardia (for 323–302).

Diodotus I (fl. mid-3rd century BC), satrap (governor) of the Seleucid province of Bactria, who, with his son of the same name, founded the Greek kingdom of Bactria.

Diodotus I, coin, 3rd century BC

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

At first subject to the Seleucid king Antiochus I and later to Antiochus II, Diodotus rebelled in about 250 and took the title of king. Little is known of his reign, but, according to some scholars, the Seleucid king Seleucus II, in order to secure Diodotus' friendship, married one of his sisters to him during a time (246) when the Seleucid Empire was in chaos. Diodotus was succeeded by his son, Diodotus II, and after his death was called by the cult-name Soter (Saviour).

Diodotus II (fl. late 3rd century BC), king of Bactria, the son and successor of Diodotus I.

Although his father's freedom from Seleucid control is uncertain, Diodotus II unquestionably ruled as an independent king and issued coinage in his own name. He further proclaimed the independence of the kingdom of Bactria by entering into an alliance with the Parthians against Seleucus II, in contrast with his father's friendly policy toward the Seleucid Kingdom. At an uncertain date (perhaps *c.* 235), Diodotus II was overthrown by the usurper Euthydemus.

Consult the INDEX *first*

Diogenes (b. Sinope, Paphlygonia—d. *c.* 320 BC, probably at Corinth, Greece), archetype of the Cynics, a Greek philosophical sect that stressed stoic self-sufficiency and the rejection of luxury. He is credited by some with originating the Cynic way of life, but he himself acknowledges an indebtedness to Antisthenes, by whose numerous writings he was probably influenced. It was by personal example rather than any coherent system of thought that Diogenes conveyed the Cynic philosophy. His followers positioned themselves as watchdogs of morality.

Diogenes is the subject of numerous apocryphal stories, one of which depicts his behaviour upon being sold into slavery. He declared that his trade was that of governing men and was appointed tutor to his master's sons. Tradition ascribes to him the famous search for an honest man conducted in broad daylight with a lighted lantern. Almost certainly forced into exile from Sinope with his father, he had probably already adopted his life of asceticism (Greek *askesis,* "training") when he reached Athens. Referred to by Aristotle as a familiar figure there, Diogenes began practicing extreme anti-conventionalism. He made it his mission to "deface the currency," perhaps meaning "to put false coin out of circulation." That is, he sought to expose the falsity of most conventional standards and beliefs and to call men back to a simple, natural life.

For Diogenes the simple life meant not only disregard of luxury but also disregard of laws and customs of organized, and therefore "conventional," communities. The family was viewed as an unnatural institution to be replaced by a natural state in which men and women would be promiscuous and children would be the common concern of all. Though Diogenes himself lived in poverty, slept in public buildings, and begged his food, he did not insist that all men should live in the same way but merely intended to show that happiness and independence were possible even under reduced circumstances.

The program for life advocated by Diogenes began with self-sufficiency, or the ability to possess within oneself all that one needs for happiness. A second principle, "shameless-

ness," signified the necessary disregard for those conventions holding that actions harmless in themselves may not be performed in every situation. To these Diogenes added "outspokenness," an uncompromising zeal for exposing vice and conceit and stirring men to reform. Finally, moral excellence is to be obtained by methodical training, or asceticism.

Among Diogenes' lost writings are dialogues, plays, and the *Republic,* which described an anarchist utopia in which men lived "natural" lives. Diogenes' life and philosophy are studied in Ragner Höistad's *Cynic Hero and Cynic King* (1949).

Diogenes LAËRTIUS (fl. 3rd century), Greek author noted for his history of Greek philosophy, the most important existing secondary source of knowledge in the field. One of its traditional titles, *Peri biōn dogmatōn kai apophthegmatōn tōn en philosophia eudokimēsantōn* ("Lives, Teachings, and Sayings of Famous Philosophers"), indicates its great scope. The work is a compilation, the excerpts of which range from insignificant gossip to valuable biographical and bibliographical information, competent summaries of doctrines, and reproductions of significant documents such as wills or philosophical writings. Though he quoted hundreds of authorities, he knew most of them only by second hand; his true sources have not been ascertained except in a few cases. The work itself consists of an introductory book and nine others presenting Greek philosophy as divided into an Ionian and an Italic branch (books ii–vii; viii) with "successions," or schools, within each and with "stray" philosophers appended (books ix–x). In all extant manuscripts, the oldest of which belongs to the 12th century, part of book vii is missing.

Diogenes OF APOLLONIA (fl. 5th century BC), Greek philosopher remembered for his cosmology and for his efforts to synthesize ancient views and new discoveries.

It is uncertain whether Diogenes' birthplace, from which his name is derived, was the Apollonia of Crete or that of Phrygia (in modern Turkey). He lived most of his life in Athens, where his opinions were a source of danger to his life and were derided by the playwright Aristophanes in his *Nephelai* ("The Clouds"). Among numerous fragments of his works, written in Ionic Greek, is the important book *Peri physeōs* ("On Nature"). The treatises *Against the Sophists* and the *Nature of Man* may have been part of this work. Aristotle, in his *Historia animalium* ("The History of Animals"), quotes a long passage from Diogenes on veins. Because Diogenes sought to support his metaphysical position by painstaking observations in anatomy and physiology, he is sometimes considered to be one of the early Empiricists.

Diogenes, Lamp of (monument): *see* choragic monument.

Diognetus, Letter to, an early Christian apologetic work probably dating from the 2nd or 3rd century AD. It is often included with the works of the Apostolic Fathers, Greek Christian writers of the late 1st and early 2nd centuries, but it more accurately is associated with the early Apologists (primarily 1st century). Both the person addressed and the author of the work are unknown, although at one time the apologist Justin Martyr was erroneously considered the author. The work survived antiquity in one 13th–14th-century manuscript, which was destroyed by fire in Strasbourg, Fr., in 1870.

The first 10 chapters of the letter discuss pagan and Jewish religions, the life of a Christian as contrasted with the life of a non-Christian, and a review of the Christian faith as the unique revelation of God. The final two chapters, a sermon, were evidently written by a different author, also unknown.

Diomede Islands, Russian OSTROVA GVOZDEVA, two small islands in the Bering Strait, lying about 2½ mi (4 km) apart and separated by the U.S.–Soviet boundary, which coincides with the International Date Line. The larger island, Big Diomede (Russian Ostrov Ratmanova [Ratmanov Island]), has an area of 4 sq mi (10 sq km) and is part of the Chukchi autonomous okrug, in the Russian S.F.S.R. It has no permanent population but is the site of an important Soviet weather station. To the east lies Little Diomede Island, a part of Alaska, inhabited by Chukchi people who are skilled seamen. The islands' first European visitor was the Danish navigator Vitus Jonassen Bering on Aug. 16 (St. Diomede's Day), 1728. Pop. (1980) Little Diomede Island (Diomede city) 139.

Diomedes, in Greek legend, commander of 80 Argive ships and one of the most respected leaders in the Trojan War. His famous exploits include the wounding of Aphrodite, the slaughter of Rhesus and his Thracians, and seizure of the Trojan Palladium, the sacred image of the goddess Pallas Athena that protected Troy. After the war Diomedes returned home to find that his wife had been unfaithful (Aphrodite's punishment) and that his claim to the throne of Argos was disputed. Fleeing for his life, he sailed to Italy and founded Argyripa (later Arpi) in Apulia, eventually making peace with the Trojans. He was worshipped as a hero in Argos and Metapontum. According to Roman sources, his companions were turned into birds by Aphrodite, and, hostile to all but Greeks, they lived on the Isles of Diomedes off Apulia.

Dion (b. *c.* 408 BC—d. 354), brother-in-law of Dionysius the Elder, tyrant of Syracuse, in Sicily, and master of Syracuse intermittently between 357 and 354.

When the younger Dionysius, who was weak and inexperienced, succeeded in 367, Dion assumed control and persuaded Plato, whose friendship he had acquired, to train the new tyrant in the practical application of his philosophical principles. The experiment failed and Dion was banished, but in 357, assembling a force of 1,500 mercenaries at Zacynthus, he sailed to Sicily and was received with demonstrations of joy. After a short period of rule he was again banished and again recalled. In 354 he was assassinated. He was included by Plutarch in his *Lives.*

Dion CHRYSOSTOM, Greek DION CHRYSOSTOMOS ("golden-mouthed"), Latin DIO CHRYSOSTOMUS; also called DIO PRUSAEUS, or DIO COCCEIANUS (b. *c.* AD 40, Prusa, Bithynia—d. *c.* 112), Greek rhetorician and philosopher who won fame in Rome and throughout the empire for his writings and speeches.

Dion was banished in AD 82 for political reasons from both Bithynia and Italy. He wandered for 14 years through the lands near the Black Sea, adopting the life of poverty advocated by the Cynics. With the death of the emperor Domitian his exile ended, and he made a new career as a public speaker and philosopher.

A collection of 80 "orations" with fragments of others survives, but some are dialogues or moral essays, and two are spurious. Four are speeches addressed to Trajan. In *Olympicus* the sculptor Phidias explains the principles he followed in his famous statue of Zeus, one passage being supposed by some to have suggested the German dramatist Gotthold Lessing's *Laocoon.* In *On Aeschylus, Sophocles and Euripides,* Dion compares the treatment of the story of Philoctetes by each tragedian. Best known is the *Euboicus,* depicting country life on the island of Euboea, an important document for social and economic history. A patriotic Greek who accepted Roman rule, Dion typifies the revival of Greek self-confidence under the Roman Empire that marks the beginning of the new or second sophistic movement in the 2nd century AD.

Dione, in Greek mythology, a consort and, in one remote region, cult partner of Zeus, the king of the gods. Since the partner and wife of Zeus was normally the goddess Hera, it has been conjectured that Dione is an older figure than Hera. Dione was variously described. In the *Iliad* she is mentioned as the mother of the goddess Aphrodite by Zeus; in Hesiod's *Theogony,* however, she is simply identified as a daughter of Oceanus. Other writers have identified her as the mother of Dionysus.

Dione, one of the eight large, regular satellites of Saturn. It has a diameter of 1,120 kilometres (694 miles) and orbits Saturn in a prograde, nearly circular orbit at a mean distance of 377,400 km (233,990 mi). Like many objects in the Saturn system, Dione is involved in an orbital resonance—*i.e.,* its orbital period of about 66 hours is precisely twice that of Enceladus, another Saturn satellite. This phenomenon may be responsible for tidal heating in Enceladus.

As a result of tidal friction, Dione's rotation is commensurate with its orbital motion, so that it always keeps the same side toward Saturn. The surface of Dione shows great brightness contrasts, with the trailing hemisphere generally darker than the leading one. On the average, however, Dione's reflectivity is very high, as would be expected for a surface composed of large amounts of water ice. The satellite's low density, which is 1.4 times that of water, is consistent with a bulk composition of approximately 60 percent ice and 40 percent rock. Apparently a substantial amount of ice melting and crustal resurfacing has occurred because the surface in general shows a low crater population compared with other Saturn satellites. Most craters are found on the bright, preceding hemisphere. The dark, trailing hemisphere is broken by many bright linear features that form a polygonal network. Some of these are associated with linear troughs and ridges. The bright features are thought to have been caused by the recondensation of volatile material that escaped from Dione's interior along linear fractures. The remarkable asymmetry of the satellite's surface is not understood, although there is evidence of a major impact near the centre of the linear network on the trailing side.

Dionne QUINTUPLETS, the five daughters—Émilie, Yvonne, Cécile, Marie, and Annette—born prematurely on May 28, 1934, near Callander, Ont., Can., to Oliva and Elzire Dionne. The parents had 14 children, 9 by single births. The quintuplets became international celebrities during their early years—making three feature films for Twentieth-Century Fox, providing profitable endorsements for every kind of product from cod-liver oil to typewriters and automobiles, and attracting hordes of tourists to northern Ontario. The attending physician, Allan Roy Dafoe (d. 1941), also became a celebrity. In 1935 Ontario made them wards of the government, but their father regained control in 1941.

The "Quints" were remarkable in being the first medically and genetically documented set that survived; not one member of any other quintuplet set had previously lived more than a few days. The Dionne set had a sixth member that aborted during the third month of pregnancy. Much credit for the survival of the five premature infants was owing to the Hospital for Sick Children, Toronto, which quickly made available to Dafoe quantities of mother's milk and modern incubators and other equipment. The University of Toronto conducted biological, psychological, and dental studies of the quintuplets. The biological

study established that the set originated from one fertilized egg. The Dionne quintuplets arose through repeated twinning of the early single embryo; therefore, six embryos were produced, and the five infants surviving birth inherited the same genetic material.

Three of the sisters married: Annette had three sons; Marie had two daughters; and Cécile had four sons and one daughter. Only Cécile had a multiple birth: twin sons, one of whom died at the age of 15 months.

Émilie died of an epileptic seizure on Aug. 6, 1954, at Ste.-Agathe-des-Monts, Que.; Marie died in Montreal on Feb. 27, 1970.

Dionysia (Greco-Roman religion): *see* Bacchanalia.

Dionysian period, also called GREAT PASCHAL PERIOD, or VICTORIAN PERIOD, in calendars, a period of 532 years covering a complete cycle of New Moons (19 years between occurrences on the same date) and of dominical letters—*i.e.,* correspondences between days of the week and of the month, which recur every 28 years in the same order. The product of 19 and 28 is the interval in years (532) between recurrences of a given phase of the Moon on the same day of the week and month. This period is called Victorian for the astronomer Victorius of Aquitaine, its first calculator (*c.* AD 465); Dionysian for Dionysius Exiguus, who revised Victorius' figures in the 6th century; and Great Paschal because of its use in determining the date of Easter.

Dionysius BAR-SALIBI: *see* Bar-Salibi, Jacob.

Dionysius EXIGUUS, English DENIS THE LITTLE (b. *c.* 500, Scythia—d. *c.* 560, Rome?), celebrated 6th-century canonist who is considered the inventor of the Christian calendar, the use of which spread through the employment of his new Easter tables.

The 6th-century historian Cassiodorus calls him a monk, but tradition refers to him as an abbot. He arrived in Rome after the death (496) of Pope St. Gelasius I, who had summoned him to organize the pontifical archives. Thereafter, Dionysius flourished as a scholar at Rome. In 525, at the request of Pope St. John I, he prepared the chronology still current; it was a modified Alexandrian computation (95-year tables evolved by the patriarch Theophilus of Alexandria) based on Victorius of Aquitaine's 532-year cycle. He wrongly dated the birth of Christ according to the Roman system (*i.e.,* 754 years after the founding of Rome) as Dec. 25, 753.

Highly reputed as a theologian and as an accomplished mathematician and astronomer, Dionysius was well versed in the Holy Scriptures and in canon law. Credited to him are a collection of 401 ecclesiastical canons—including the apostolic canons and the decrees of the councils of Nicaea, Constantinople, Chalcedon, and Sardis—and a collection of the decretals of the popes from St. Siricius (384–399) to Anastasius II (496–498). Dionysius also translated many Greek works now lost, including a life of St. Pachomius and an instruction of St. Proclus of Constantinople.

Dionysius OF ALEXANDRIA, SAINT, also called SAINT DIONYSIUS THE GREAT (b. *c.* 200, Alexandria—d. *c.* 265, Alexandria; feast day November 17), bishop of Alexandria, then the most important Eastern see, and a chief opponent of Sabellianism (*q.v.*).

A Christian convert, Dionysius studied in Alexandria at the catechetical school headed by Origen, whom in 231/232 he was elected to succeed. In 247/248 he became bishop of Alexandria. During the persecution (250–251) of Christians by the Roman emperor Decius, he fled to the Libyan Desert, and he was again exiled in the Valerian persecution (257–260).

On his return to Alexandria in about 260, Dionysius favoured readmitting penitent apostates to the church in opposition to those who wanted to exclude them permanently. Engaged in the bitter controversy over baptism performed by heretics, Dionysius did not insist on rebaptizing converts who had received heretical baptism, but he recognized the right of communities to rebaptize if they preferred. He denied that the Book of Revelation was written by St. John the Evangelist and denounced the Millenarians, who, basing their argument on a literal reading of Revelation, believed that after 1,000 years Jesus Christ would return and establish his kingdom on Earth.

Dionysius was especially noted for his attacks on the Sabellians, who accused him of separating the persons of the Trinity (tritheism) and other heresies. Protests were sent to Pope St. Dionysius in Rome, who condemned those who denied any distinction between the persons of the Trinity and those who acknowledged three separate persons. Dionysius of Alexandria accepted the Pope's judgment and repudiated the Sabellians' charges, but he insisted that the Trinity consisted of three inseparable persons. His position has since been vindicated by the church.

Dionysius also wrote a treatise on nature against the atomism of the Greek philosopher Epicurus. Though highly esteemed and often cited by the leading Byzantine theologians, his works are known only from quotations, many of them extensive, preserved by Bishop Eusebius of Caesarea and other ecclesiastical writers. His letters and treatises appeared edited and with English translations by C. F. Felton in 1918. Philip S. Miller, *Studies in Dionysius the Great of Alexandria,* appeared in 1933.

Dionysius OF HALICARNASSUS (fl. *c.* 20 BC; b. Halicarnassus, Caria, Asia Minor), Greek historian and teacher of rhetoric whose history of Rome, from its origins to the First Punic War, written from a pro-Roman standpoint but carefully researched, is, with Livy's, the most valuable source for early Roman history.

Dionysius migrated to Rome in 30 BC, and his history, which sought to justify the Romans to the Greeks, began to appear in 7 BC. Of its 20 books, only the first 10 are extant. His literary and rhetorical theories are propounded in several extant treatises: *On Imitation* (containing assessments of individual authors), *Commentaries on the Ancient Orators,* and *On the Arrangement of Words,* the only surviving ancient study of the principles of word order and euphony.

Dionysius, SAINT (patron saint of France): *see* Denis, Saint.

Dionysius, SAINT (b. Greece?—d. Dec. 26, 268, Rome; feast day December 6), pope from July 22, 259, to Dec. 26, 268.

While a presbyter during the pontificate of Pope St. Stephen I (254–257), he took part in the controversy on rebaptism of converts and received an appeal from St. Dionysius, bishop of Alexandria, to avoid a break between Rome and the Asian churches.

Dionysius, who succeeded St. Sixtus II as pope, faced the urgent task of reorganizing the church. Sixtus had been martyred in the persecution of Christians under the emperor Valerian. The see of Rome had been vacant for almost a year. One of Dionysius' first acts was to send funds to the Christians in Cappadocia (in modern Turkey) suffering from a Persian invasion (259).

In response to charges of tritheism—*i.e.,* separating the members of the Trinity as three distinct deities—against Bishop Dionysius of Alexandria, the Pope convened a Roman synod (260) and demanded an explanation from Bishop Dionysius; this became known as "the affair of the two Dionysii." Semantics was at the root of the difficulty; Greek and Roman understandings of the same terms differed. The discussions at the synod helped to prepare the way for the theology of the Nicene Creed (325). The Bishop cleared himself in his *Refutation and Apology* and accepted the Pope's authority. Thus the Roman Church's claim to governing in matters of faith was strengthened by Dionysius' pontificate.

Dionysius TELMAHARENSIS, also called DIONYSIUS OF TELL MAHRE (d. Aug. 22, 845), patriarch of the Syrian Jacobite Church and author of an important source document on Eastern Christianity between the reigns of the Byzantine emperors Mauricius (582–602) and Theophilus (829–842).

After some years as a monk in Syria, Dionysius was chosen patriarch and ordained a priest in 818 in the Jacobite church, which took its name from Jacob Baradaeus (*see* Syrian Orthodox Church).

Although Dionysius' position was contested by a rival schismatic group during his entire reign, he succeeded in effectively governing the Syrian community. Through cordial relations with the Muslim rulers, Dionysius prevented violent suppression of the Syrian Christians and wholesale sacking of their property. The persecution, however, resumed toward the end of his life.

Dionysius' chronicles, although uncritical and only partly preserved in manuscript, retain their value as source data on life in the pre-medieval Syrian Church. They were included in subsequent Syriac annals and contributed a distinctive stage in the development of its literary culture.

Dionysius THE AREOPAGITE (fl. 1st century AD), biblical figure, converted by St. Paul at Athens (Acts 17:34), who acquired a notable posthumous reputation primarily through confusion with later Christians similarly named. In the 2nd century he was held to have been the first bishop of Athens, and in the 9th century he was identified with St. Denis of France. In about 500, probably in Syria, some writings were forged in his name by a Christian Neoplatonist with moderate Monophysite leanings. These writings, whose author is often referred to as Pseudo-Dionysius, became of decisive importance for the theology and spirituality of Eastern Orthodoxy and Western Catholicism. (*See also* Pseudo-Dionysius the Areopagite).

Dionysius THE AREOPAGITE, PSEUDO-: *see* Pseudo-Dionysius the Areopagite.

Dionysius THE CARTHUSIAN, Flemish DENYS VAN LEEUWEN, or DE LEEUWIS, also called DENYS RYCKEL, or VAN RIJKEL (b. 1402/1403, Rijkel, Lower Lorraine, Holy Roman Empire—d. March 12, 1471, Roermond, Lower Lorraine), theologian and mystic, one of the important contributors to, and propagators of, the influential school of Rhenish spirituality originating in the 14th century.

Educated at the University of Cologne, Dionysius entered the Carthusian order at the charterhouse of Roermond, in 1425. In 1451–52 he accompanied Nicholas of Cusa, papal legate to northern Germany and the Netherlands, on a mission for church reform in the Rhineland. In charge of the Carthusians at Hertogenbosch from 1465, he retired in 1469 because of poor health.

The school of Rhenish spirituality was influenced by Neoplatonism, the theology of St. Thomas Aquinas, and the teaching of Pseudo-Dionysius, whose works especially inspired late medieval mystics. Dionysius used Aquinas, Pseudo-Dionysius, and the Dutch mystic Jan van Ruysbroeck as principal authorities in writing his classic, *De contemplatione.* For Dionysius, mystical contemplation was an infusion of the gift of wisdom by the Holy Spirit, for which the soul could be prepared by the renunciation of all save God.

A prolific writer on dogmatic, ascetical, and mystical theology, he also sent letters to rulers calling for a crusade against the Turks, wrote treatises on church reformation, and compiled commentaries on Scripture and Pseudo-Dionysius, a compendium on Aquinas' *Summa,* and a handbook of philosophy. His commentaries and treatises were particularly popular in the 16th century. Dionysius' *Opera Omnia* were published (1896–1935) in 42 volumes.

Dionysius THE ELDER (b. *c.* 430 BC—d. 367), tyrant of Syracuse from 405 who, by his conquests in Sicily and southern Italy, made Syracuse the most powerful Greek city west of mainland Greece. Although he saved Greek Sicily from conquest by Carthage, his brutal military despotism harmed the cause of Hellenism.

After working as a clerk in a public office, Dionysius distinguished himself fighting in the war with Carthage that broke out in Sicily in 409. He took advantage of a crisis in the war to make himself tyrant in 405. Over the next eight years he ruthlessly consolidated and expanded his power. He built a wall around Syracuse and fortified Epipolae. The Greek citizens of Naxos, Catana, and Leontini were removed from their cities; many of them were enslaved and their homes were given to Sicilian and Italian mercenaries.

Dionysius was then ready to lead his vast army against Carthage, which had occupied western and southern Sicily. His first war with Carthage (397–396), during which the Greeks besieged Motya and the Carthaginians Syracuse, ended with a notable victory for Dionysius, who confined his enemy's power to an area of northwest Sicily. A second conflict ended in 392 with a treaty advantageous to Dionysius. After 390 he led an expedition against Rhegium and other Greek cities of southern Italy, and with the aid of the Lucanians he devastated the territories of Thurii, Croton, and Locri. By the time Rhegium fell (386), Dionysius had become the chief power in Greek Italy. He sent colonists to Illyria and possibly to northeast Italy. Although the Athenian writer Isocrates hailed him as a champion of Hellenism, the brutality of Dionysius' conquests made him unpopular in Greece, and his literary pretensions were deplored. When he sent a splendid embassy to the Olympic festival of 388, a crowd pillaged the tents of his envoys.

Dionysius' third war with Carthage (383–*c.* 375) proved disastrous; he suffered a crushing defeat at Cronium and was forced to pay an indemnity of 1,000 talents and cede the territory west of the Halycus River. Nevertheless, he was engaged in yet another conflict with the Carthaginians at the time of his death.

Dionysius THE GREAT, SAINT: *see* Dionysius of Alexandria.

Dionysius THE YOUNGER, ruler of Syracuse, in Sicily, 367–357 and 346–344 BC.

Dionysius was the son and successor of Dionysius the Elder, but he lacked the vigour to maintain the military autocracy he had inherited. Upon his accession in 367 he made peace with Carthage on the same unfavourable terms established after his father's defeat in the third war with Carthage (383–*c.* 375). Dion, a former minister, tried with Plato to make a philosopher-prince of Dionysius, but both counsellors were dismissed in 366. In 357 Dion drove Dionysius from his kingdom, and the deposed ruler fled to Locri. In 346, some eight years after the assassination of Dion, Dionysius regained control of Syracuse. On the arrival of the Greek general Timoleon from Corinth two years later, Dionysius was compelled to surrender and retire to Corinth.

Dionysius Longinus: *see* Longinus.

Dionysus, also called BACCHUS, or (in Rome) LIBER, in Greco-Roman religion, a nature god of fruitfulness and vegetation, especially known as a god of wine and ecstasy. Though introduced from Thrace and Phrygia, the strange legends of his birth and death and his marriage to Ariadne, in origin a Cretan god-

Dionysus, classical bas-relief sculpture; in the Museo Archeologico Nazionale, at Naples
Alinari—Art Resource/EB Inc.

dess, suggest that his cult represented a reversion to pre-Hellenic Minoan nature religion.

According to the most popular tradition, Dionysus was the son of Zeus and Semele, a daughter of Cadmus (king of Thebes), but in origin a Phrygian earth goddess. Hera, the wife of Zeus, out of jealousy persuaded Semele to prove her lover's divinity by requesting him to appear in his real person. Zeus complied, but his power was too great for the mortal Semele, who was blasted with thunderbolts. Zeus, however, saved his son by sewing him up in his thigh, keeping him there until he reached maturity, so that he was twice born. Dionysus was then conveyed by the god Hermes to be brought up by the Bacchants (Maenads, or Thyiads) of Nysa, a purely imaginary spot.

As Dionysus apparently represented the sap, juice, or lifeblood element in nature, lavish festal *orgia* (rites) in his honour were widely instituted. These Dionysia (Bacchanalia, *q.v.*) quickly won converts among the women in the post-Mycenaean world. The men, however, met it with hostility. According to tradition, Pentheus, king of Thebes, was torn to pieces by the Bacchants when he attempted to spy on their activities, while the Athenians were punished with impotence for dishonouring the god's cult. The women, nevertheless, abandoned their families and took to the hills, wearing fawn skins and crowns of ivy and shouting "Euoi!," the ritual cry. Forming *thyasi* (holy bands) and waving *thyrsoi* (fennel wands bound with vine leaves and tipped with ivy), they danced by torchlight to the rhythm of the flute and the *tympanon* (kettledrum). While they were under the god's inspiration, the Bacchants were believed to possess occult powers, the ability to charm snakes and suckle animals, as well as preternatural strength that enabled them to tear living victims to pieces before indulging in a ritual feast (*omophagia*). The Bacchants hailed the god by his titles of Bromios (Thunderer), Taurokeros (Bull-Horned), or Tauroprosopos (Bull-Faced), in the belief that he incarnated the sacrificial beast. The worship of Dionysus flourished long in Asia Minor, particularly in Phrygia and Lydia, and his cult was closely associated with that of numerous Asiatic deities.

Although Dionysus was believed to have descended to the underworld to bring back his mother Semele and was also associated with Persephone in southern Italy, any original connection between the god and the netherworld seems doubtful. Dionysus did, however, possess the gift of prophecy, and at Delphi he was received by the priesthood on almost equal terms with Apollo. He had an oracle in Thrace and was later patron of a healing shrine at Amphicleia in Phocis.

The followers of Dionysus included spirits of fertility, such as the satyrs, and in his ritual the phallus was prominent. He often took on a bestial shape and was associated with various animals. His personal attributes were an ivy wreath, the thyrsus, and the kantharos, a large two-handled goblet. In early art he was represented as a bearded man, but later he was portrayed as youthful and effeminate. Bacchic revels were a favourite subject with vase painters, though the private lodges of Bacchus were rigorously suppressed throughout Italy by senatorial edict in 186 BC.

Dionysus, Theatre of, prototype of Greek theatres, situated on the south side of the Acropolis in Athens, in which all extant classical Greek plays were first presented. Development on the site began with the creation of the orchestra, a circular floor of earth 60 feet in diameter with an altar at the centre. Placed adjacent to temples of nature and of the fertility god Dionysus, the orchestra was used for dramatic performances, which, together with a procession and sacrifice, composed the annual spring festival of the god. During the 5th century BC, the theatre served as the locus of the contests in which the plays of Sophocles, Euripides, Aeschylus, and Aristophanes (which developed from the Dionysian tradition) were first performed. At the time, the auditorium, perhaps with wooden benches, was set into the hillside, and the skene, or building serving as the background of the play, was built on the opposite side of the orchestra.

In the mid-4th century BC, raked tiers of stone seats capable of accommodating as many as 17,000 spectators were constructed, as well as an enhanced stone skene. Major revisions, probably including the introduction of a raised stage, were carried out in *c.* AD 61 under the Roman emperor Nero. After the 4th century the theatre fell into disuse and decay. It was rediscovered in 1765, and major archaeological restoration was undertaken in the late 1800s under archaeologist and Greek architectural authority Wilhelm Dörpfeld.

Dioon, a New World genus of ornamental cycads (plants of the family Cycadaceae). It

Dioon edule
Walter Dawn

is the most primitive American genus in the family and includes four or more species. The spiny-leaved, slow-growing giant dioon (*D. spinulosum*) may attain a height of 15 m (about 50 feet). It is a popular house plant. Starch like that of arrowroot is obtained from the seeds of *D. edule.*

Diop, Birago (b. Dec. 11, 1906, Dakar, French West Africa [now in Senegal]—d. Nov. 25, 1989, Dakar), African poet and recorder of traditional folktales and legends of the Wolof people.

Diop received his education in Dakar and Saint-Louis, Senegal, and then studied veterinary medicine at the University of Toulouse until 1933. This was followed by a series of tours as government veterinary surgeon in The Sudan, Côte d'Ivoire, Upper Volta (now Burkina Faso), and Mauritania. From 1961 to 1965 he served as newly independent Senegal's ambassador to Tunisia.

He is known for his small but beautifully composed output of lyric poetry. With his compatriot Léopold Senghor, Diop helped found the Negritude (*q.v.*) movement in the 1930s, which sought a return to African cultural values. Diop explored the mystique of African life in *Leurres et lueurs* ("Lures and Glimmerings"), a selection of his verse written between 1925 and 1960.

Diop received the Grand Prix Littéraire de l'Afrique Noire in 1964 for *Les Contes d'Amadou Koumba* (1947; *Tales of Amadou Koumba*) and *Les Nouveaux Contes d'Amadou Koumba* (1958), both reprinted in the 1960s, and for *Contes et lavanes* (1963). These books contained tales that were first told him by his family's *griot* (a storyteller whose role is to preserve the oral traditions of his tribe). Diop's skill in rendering the nuances of dialogue and gesture furthered the popularity of his books, selections from which were reprinted in a school-text edition in 1967. *Les Contes d'Aura* ("Tales of Awa") appeared in 1978.

Diop, David (b. July 9, 1927, Bordeaux, Fr.—d. 1960, Dakar, Senegal), one of the most talented of the younger French West African poets of the 1950s, whose tragic death in an airplane crash cut short a promising career.

Diop's works in *Coups de pilon* (1956; "Pounding"), his only surviving collection, are angry poems of protest against European cultural values, enumerating the sufferings of his people first under the slave trade and then under the domination of colonial rule and calling for revolution to lead to a glorious future for Africa. That he was the most extreme of the Negritude writers (who were reacting against the assumption underlying the French policy of "assimilation" that Africa was a deprived land possessing neither culture nor history) can be seen in his rejection of the idea that any good could have come to Africa through the colonial experience and in his belief that political freedom must precede a cultural and economic revival. He wrote during the period when the struggle for independence in many African countries was at its height.

Though he himself grew up in France, his strong opposition to European society was reinforced by visits to Senegal, Guinea, and Cameroon. The Martinique poet Aimé Césaire was a dominant influence on his verse, which first appeared in the journal *Présence Africaine* and in Léopold Senghor's *Anthologie de la nouvelle poésie nègre et malgache.*

Diophantine equation, equation involving only addition, multiplication, or taking powers in which all the constants are natural numbers or their negatives and the only solutions of interest are natural numbers or their negatives. Named in honour of the 3rd-century Greek mathematician Diophantus of Alexandria (*q.v.*), these equations were not systematically solved until the 7th century by the Hindus.

Diophantus OF ALEXANDRIA (fl. AD 250), Greek mathematician, famous for his work in algebra.

What little is known of Diophantus' life is inferred from a letter of the 11th-century Byzantine scholar Michael Psellus. The only other information, which is uncertain, comes from the solution of an arithmetic epigram, which says that Diophantus married at 33 and had a son who died at age 42, four years before Diophantus' death at 84.

The *Arithmetica,* the treatise on which Diophantus' fame rests, purports to be in 13 books, but none of the surviving Greek manuscripts consists of more than 6, though one has the same text in 7. The missing books were apparently lost early, for there is no evidence that the Arabs who translated or commented on Diophantus ever had access to more than is now extant.

A fragment of Diophantus' treatment of polygonal numbers is found in *Arithmetica.* In this treatise three lemmas are mentioned that are part of his work on porisms (corollaries to theorems). These lemmas are propositions concerning number theory. One of them states that the difference of the cubes of two rational numbers is equal to the sum of the cubes of two rational numbers ($a^3 - b^3 = c^3 + d^3$). The great variety of problems presented involves first-degree determinate equations with up to four variables, determinate quadratic equations, and first-degree indeterminate equations with one or more variables. The indeterminate equations are transformed into determinate equations by assuming an arbitrary value for one of the required numbers.

Diophantus was always satisfied with a rational result and did not require a whole-number solution. Most of the work consists of problems leading to second-degree indeterminate equations, and these universally take the form that one or two (never more) linear or quadratic functions of one variable x are to be made rational square numbers by finding a suitable value for x. A few problems lead to third- and fourth-degree indeterminate equations, and one is an easy sixth-degree indeterminate equation. The problem is to find two, three, or four numbers such that different expressions involving them in the first and second degree, and sometimes the third, are squares, cubes, partly squares and partly cubes, and so forth. Book VI contains problems of finding rational right triangles such that different functions of the parts (the sides and the area) are squares.

Before Diophantus, all algebra, including the problem, operations and logic, and solution, was expressed without symbolism; he was first to introduce symbolism into Greek algebra. For an unknown quantity he used only one symbol (called *arithmos*), which characterized an undefined number of units. To avoid confusion in problems having more than one unknown term, Diophantus expressed all unknowns in terms of one of them whenever possible. The only other algebraical symbol that he used was for subtraction, also used by Hero of Alexandria (fl. 1st century AD).

The *Arithmetica* is valuable also for the propositions in the theory of numbers, other than the porisms, stated or assumed in it. Thus, Diophantus knew that no number of the form $8n + 7$ (where n is a non-negative integer) can be the sum of three squares. He also states that, if $2n + 1$ is to be the sum of two squares, "n must not be odd" (*i.e.,* no number of the form $4n + 3$, or $4n - 1$, can be the sum of two squares), and goes on to add (for the most part the condition stated by the 17th-century French mathematician Pierre de Fermat) "and the double of it increased by one, *when divided by the greatest square which measures it,* must not be divisible by a prime number of the form $4n - 1$." Diophantus merely omitted the condition expressed in italics.

In the light of the discovery of highly developed algebraic methods employed in ancient Babylonia, Diophantus' work no longer appears to represent a late and degenerate form of Greek mathematics. On the contrary, it was doubtless influenced by traditions common to the Hellenistic and Roman world.

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diopside, common silicate mineral in the pyroxene family that occurs in metamorphosed siliceous limestones and dolomites and in skarns (contact-metamorphic rocks rich in iron); it is also found in small amounts in many chondrite meteorites. Clear specimens of good green colour are sometimes cut as gems.

Diopside is a calcium and magnesium silicate ($CaMgSi_2O_6$). It forms a complete chemical replacement series with hedenbergite in which

Diopside from De Kalb, N.Y.
Mary A. Root—EB Inc.

ferrous iron completely replaces magnesium in the molecular structure. Hedenbergite is common in limestone skarns, in thermally metamorphosed iron-rich sediments, and in some igneous rocks; sodium-rich varieties are found in many alkaline rocks. Intermediate members of the series are called salite and ferrosalite; they have properties between those of diopside and hedenbergite. *See also* augite. For detailed physical properties, *see* pyroxene (table).

diopter, in optics, unit of magnifying power of a lens or lens system. Because the power of a lens is proportional to unity (one) divided by the focal length (*see* lens), the power of a lens in diopters is numerically equal to 1 m divided by the focal length in metres. The algebraic sign of the magnifying power indicates whether the lens causes an incident pencil of parallel light rays to converge or to diverge. Thus, a diverging lens having a focal length of 1 m has a power of −1 diopter, and a converging lens of focal length 0.5 m has a power of two diopters. The power of a combination of two or more thin lenses in contact is equal to the sum of the powers of the individual lenses. For example, a lens of −10 diopters combined with a lens of 30 diopters gives a converging lens of 20 diopters (of 5 cm focal length).

Dior, Christian (b. Jan. 21, 1905, Granville, Fr.—d. Oct. 24, 1957, Montecatini, Italy), French fashion designer whose creations dominated world fashion in the decade following World War II.

Dior was born into a wealthy family and trained for the French diplomatic service, but in the midst of the financial crisis of the 1930s he went to work illustrating fashions for the weekly *Figaro Illustré.* In 1938 he became an assistant designer for the leading couturier of Paris, Robert Piguet, and four years later joined the house of designer Lucien Lelong (1889–1958).

In 1947, backed by a French textile manufacturer, Marcel Boussac, he introduced his revolutionary "New Look," spurring international controversy over the radically lowered hemline. The look featured small shoulders, a natural waistline, and a voluminous skirt, a drastic change from the World War II look of padded shoulders and short skirts.

Dior, 1957
Popperfoto

The overnight sensation of the "New Look" was followed by 10 years of outstanding success. In the 1950s the "Sack Look," or "H" line, was the characteristic silhouette of his designs. Dior was instrumental in commercializing Parisian fashion on a worldwide basis and in reestablishing the traditional superiority of Parisian over American designers.

diorama, three-dimensional exhibit, frequently housed in a cubicle and viewed through an aperture. It usually consists of a flat or curved back cloth on which a scenic painting or photograph is mounted. Flat or solid objects are placed in front of the back cloth, and coloured transparent gauze or plastic drop curtains are used to heighten the three-dimensional effect. A considerable improvement in perspective is achieved by the addition of stage borders or wings. The rigorous application of the laws of perspective is essential to the success of the exhibit. The skillful use of lighting also heightens the effect.

True dioramas, used for peep shows and the like, probably originated before the 19th century; but credit for the development of the diorama is usually given to Louis-Jacques-Mandé Daguerre, a French scenic painter, physicist, and inventor of the daguerreotype, who, with his coworker Charles-Marie Bouton, in 1822 opened an exhibition in Paris that he called the Diorama. Daguerre's techniques survive in present-day dioramas, which are widely employed, especially in museums, and may depict any subject on any scale.

The diorama is usually distinguished from the panorama, in which the background is considerably lengthened and usually viewed without restriction to an aperture, and the cyclorama, in which the background forms a complete circle around the viewer.

diorite, medium- to coarse-grained intrusive igneous rock that commonly is composed of about two-thirds plagioclase feldspar and one-third dark-coloured minerals, such as hornblende or biotite. The presence of sodium-rich feldspar, oligoclase or andesine, in contrast to calcium-rich plagioclase, labradorite or bytownite, is the main distinction between diorite and gabbro. The extrusive (volcanic) equivalent of diorite is andesite.

Diorite has about the same structural properties as granite but, perhaps because of its darker colour and more limited supply, is rarely used as an ornamental and building material. It is one of the dark gray stones that is sold commercially as black granite.

Some diorites are truly igneous; they have crystallized from molten material (magma). Others represent the products of reaction between magma and included fragments of foreign rock. Many have been chemically transformed in the solid state from some older rock, such as gabbro, by the loss of certain constituent atoms and the gain of others. Diorite occurs in small bodies such as sills (tabular bodies inserted while molten between other rocks), dikes (tabular bodies injected in fissures), stocks (bodies intruded upward), or as more irregular masses associated with gabbro and batholiths (huge bodies) of granodiorite and granite.

Dioscoreaceae, the yam family of the flowering plant order Liliales, consisting of 6 genera with more than 500 species of herbaceous or woody vines and shrubs, distributed throughout tropical and warm temperate regions. Members of the family have thick, sometimes woody roots or tuber-like underground stems and net-veined, often heart-shaped leaves that sometimes are lobed. The small green or white flowers of most species are borne in clusters in the leaf axils. The fruit is a winged capsule or a berry. Several species of yams (vines of the genus *Dioscorea*) are grown for their edible tuberous roots, such as Chinese yam, or cinnamon vine (*D. batatas*); air potato (*D. bulbifera*); and yampee, or cush-cush (*D. trifida*).

A few species are cultivated as ornamentals. Black bryony (*Tamus communis*) is a European perennial vine with yellow flowers, poisonous red berries, and poisonous blackish root tubers. *Dioscorea* is a principal raw material used in the manufacture of birth-control pills.

Dioscorides, Pedanius (b. *c.* AD 40, Anazarbus, Cilicia—d. *c.* 90), Greek physician and pharmacologist whose work *De materia medica* was the foremost classical source of modern botanical terminology and the leading pharmacological text for 16 centuries.

Dioscorides' travels as a surgeon with the armies of the Roman emperor Nero provided him an opportunity to study the features, distribution, and medicinal properties of many plants and minerals. Excellent descriptions of nearly 600 plants, including cannabis, colchicum, water hemlock, and peppermint, are contained in *De materia medica.* Written in five books around the year 77, this work deals with approximately 1,000 simple drugs.

The medicinal and dietetic value of animal derivatives such as milk and honey is described in the second book, and a synopsis of such chemical drugs as mercury (with directions for its preparation from cinnabar), arsenic (referred to as auripigmentum, the yellow arsenic sulfide), lead acetate, calcium hydrate, and copper oxide is found in the fifth book. He clearly refers to sleeping potions prepared from opium and mandragora as surgical anesthetics.

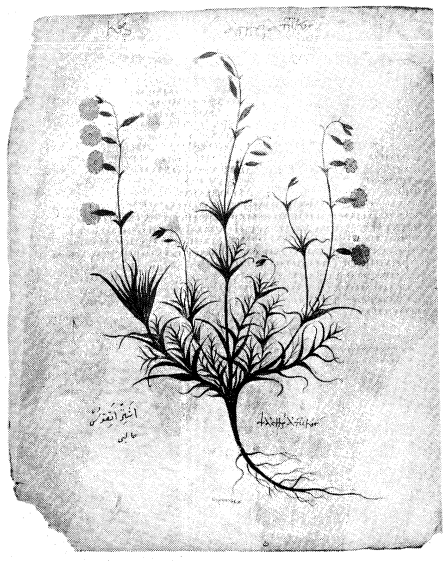


Illustration of an aster (*Silene linoides*) in the 6th-century codex of the *De materia medica* of Pedanius Dioscorides
Graphis Magazine, Graphis Press Corp., Zurich

Although the work may be considered little more than a drug collector's manual by modern standards, the original Greek manuscript, which was copied in at least seven other languages, describes most drugs used in medical practice until modern times and served as the primary text of pharmacology until the end of the 15th century. Authoritative editions have been published in Greek (1906–14) and in English (1934).

Dioscorus (b. Alexandria [Egypt]—d. Sept. 4, 454, Gangra, Galatia [now Cankiri, Tur.]), patriarch of Alexandria and Eastern prelate whose subscription to the unorthodox beliefs of the Monophysites caused him to be deposed and excommunicated by the Council of Chalcedon in 451. He was archdeacon at Alexandria when he succeeded St. Cyril as patriarch in 444.

He supported Eutyches, a monk of Constantinople and founder of Eutychianism (an extreme form of Monophysitism), who was condemned by a synod at Constantinople in 448. The following year Dioscorus presided over the Robber Synod of Ephesus. With the support of the Eastern Roman emperor Theodosius II, he reinstated Eutyches, excommunicated Pope Leo I the Great for censuring Eutychianism, and deposed Patriarch St. Flavian of Constantinople for opposing Monophysitism.

After Theodosius' death in 450, the Council of Chalcedon condemned all Monophysite doctrines and deposed Dioscorus, exiling him to Gangra. He was not, however, condemned as a heretic.

The Monophysite Christian churches (Coptic, Syrian, and Armenian) venerate Dioscorus as a saint.

Dioscorus (b. Alexandria [Egypt]—d. Oct. 14, 530, Rome), pope, or antipope, for 23 days in 530.

A deacon in the Alexandrian Church, he clashed with the Monophysites (Christians teaching that Christ has only one nature, rather than two—*i.e.,* human and divine) and went to Rome. Under Pope Symmachus he was papal legate at Ravenna to the Ostrogothic king Theodoric the Great.

In 519 Dioscorus led a legation dispatched by Pope Hormisdas to Constantinople, where, with the Byzantine emperor Justinian I the Great, they concluded the Pope's resolution of the Acacian Schism, thereby reuniting the Eastern and Western churches. Hormisdas then unsuccessfully tried to have Justinian make Dioscorus patriarch of Alexandria. Later, Dioscorus headed the Byzantine party at Rome during the reign of Pope Felix IV (III). To avoid a dispute over the succession between the Gothic and Byzantine factions, Felix appointed the archdeacon Boniface (II), who was of Gothic descent, as his successor.

On Felix's death on Sept. 22, 530, a marked majority (60 out of 67) of the Roman clergy, refusing to recognize the designation of Boniface, elected Dioscorus, and both popes were consecrated simultaneously. Dioscorus' sudden death, however, ended the schism; and his partisans then supported Boniface, who in the following December convoked a Roman synod that anathematized Dioscorus. This anathema was solemnly annulled by Pope Agapetus I in 535. According to contemporary canon law, Dioscorus' claim to the papal throne was probably legitimate.

Dioscuri (from Greek *Dioskouroi,* "Sons of Zeus"), also called CASTOR AND POLLUX, or

CASTOR AND POLYDEUCES, in Greek and Roman mythology, twin deities who succoured shipwrecked sailors and received sacrifices for favourable winds. They were the children of Leda and either Zeus, the king of the gods, or Tyndareus, Leda's husband. According to some versions, Castor was the son of Tyndareus and thus a mortal, while Pollux was the son of Zeus.

The twins were inseparable and became renowned for their athletic ability. A dispute between them, however, led to bloodshed; although the details are variously recorded, authorities agree that Castor, being mortal, was slain. After Pollux refused immortality in which Castor had no share, Zeus allowed them to remain together alternately in the heavens and the netherworld. Later he transformed them into the constellation Gemini.

The introduction of their cult at Rome goes back traditionally to 484 BC. The building of their temple in the Forum followed a vow of Aulus Postumius at the battle of Lake Regillus, where, according to legend, the Dioscuri fought on the side of the Romans and carried the news of victory to Rome. In art the twins are represented as two youths, usually horsemen, holding spears and wearing helmets; their image appeared on early Roman coins.

Diougou River (western Africa): *see* Cavalla River.

Dioula (people): *see* Dyula.

Diourbel, town, western Senegal, about 90 miles (145 km) east of Dakar. The market for a peanut-growing area, Diourbel produces peanut oil as well as beverages and perfume. The town is the site of a beautiful mosque. Pop. (1979 est.) 55,307.

dioxin, any of a group of chemical compounds that is an undesirable by-product in the manufacture of herbicides, disinfectants, and other agents. It is one of the most toxic of all man-made substances. (Popularly, dioxin has become a synonym for one specific dioxin, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin.)

In chemical structure, a dioxin (technically called dibenzo-*p*-dioxin) consists of two benzene rings connected by a pair of oxygen atoms. Each of the eight carbon atoms on the rings that are not bonded to oxygen can bind with hydrogen atoms or atoms of other elements. By convention these positions are assigned the numbers 1 through 4 and 6 through 9. The dioxins of greatest concern carry chlorine atoms at these positions. Theoretically, 75 possible combinations, called isomers, can be formed by adding one or more chlorine atoms.

There are 22 possible arrangements for dibenzo-*p*-dioxins (TCDDs). The most toxic dioxin is a member of this group, with chlorine atoms at the 2,3,7, and 8 positions. This isomer—2,3,7,8-TCDD—is extremely stable chemically. It is virtually insoluble in water and in most organic compounds but is soluble in oils. It is this combination of properties that allows this dioxin in soil to resist dilution with rainwater and causes it to avidly seek and enter fatty tissue in the body if it is absorbed.

Dioxin serves no useful purpose but is formed as an undesirable by-product during the synthesis of 2,4,5-trichlorophenol and some other useful compounds. For example, if the mixture of reactants used to synthesize 2,4,5-trichlorophenol exceeds 180° C (360° F), an exothermic (heat-generating) reaction occurs and some dioxin is formed. In fact, many accidental releases of dioxin have resulted from such overheating, producing a runaway explosive reaction. (A major industrial accident of this kind occurred in Seveso, Italy, in 1976, forcing the evacuation of 700 residents and the killing or contamination of animals and plants.) The chemical 2,4,5-trichlorophenol serves as a raw material for making the herbicides Silvex and 2,4,5-T (2,4,5-trichlorophenoxyacetic acid). The latter compound is a major active ingredient of Agent Orange (*q.v.*), a defoliant formerly used in Vietnam by the U.S. military and in the United States on railroad, highway, and power-line rights-of-way and in forested areas to kill unwanted vegetation. This 2,4,5-trichlorophenol is also used in the production of hexachlorophene, an antibacterial agent formerly used in deodorants and soaps.

The toxicity of dioxin renders it capable of killing some species of newborn mammals and fish at levels of 5 parts per 1,000,000,000,000 (or one ounce in 6,000,000 tons). Less than two millionths of an ounce will kill a mouse. Its toxic properties are enhanced by the fact that it can pass into the body through all major routes of entry, including the skin (by direct contact), the lungs (by inhaling dust, fumes, or vapours), or through the mouth. Entry through any of these routes contributes to the total body burden. Although its full toxic effects are still being investigated, it is known that dioxin can produce chronic skin diseases, muscular dysfunctions, various bodily inflammations, impotency, birth defects, genetic mutations, and disorders of the nervous system. It was also linked to various cancers.

Of rising concern is the recognition that houses, land sites, and entire communities have been contaminated by the improper disposal of chemical waste containing dioxin. In 1971 waste oil was sprayed in several horse arenas in eastern Missouri to keep down dust. Within weeks hundreds of rodents, insects, dogs, cats, and birds were found dead in and around the arenas. More than 80 horses that had stood or were ridden in the arenas became ill, and within 16 months most developed multiorgan disease, became paralyzed, suffered extraordinary wasting, and died. Children and adults also appeared to be affected. The oil was eventually recognized as the source of the problem, and several inches of topsoil were removed from the arenas. By the time dioxin was identified as the toxic agent (one arena showed a concentration of 33,000 parts per 1,000,000,000), some of the excavated soil had been used as landfill for homes in other areas of Missouri. Use of dioxin-contaminated oil on dusty roads in hundreds of other areas in Missouri eventually forced the permanent evacuation of whole communities.

Dīpaṅkara (Buddhist reformer): *see* Atīśa.

Dīpavaṃsa (Pāli: "History of the Island"), oldest extant historical record of Sri Lanka, compiled in the 4th century, considered to be one of the main sources drawn upon by the author of the later and more comprehensive historical chronicle the *Mahāvaṃsa.* In its emphasis on ecclesiastical (Buddhist) rather than political history and in the time span of its narrative, the *Dīpavaṃsa* is similar to the *Mahāvaṃsa.* Unlike the *Mahāvaṃsa,* however, the *Dīpavaṃsa* is a crude, unpolished work—perhaps the first attempt of the Sinhalese people to write in Pāli, the sacred language of Buddhism. Because of its lack of organization and a heterogeneity of style, it is generally considered the product of multiple authorship.

diphenhydramine, synthetic drug used to counteract the histamine reaction, as in allergies. Introduced into medicine in 1945 and marketed under several proprietary names, including Benadryl, it is administered orally or by intramuscular or intravenous injection in the form of its hydrochloride. It has been used to control the symptoms of hay fever, acute skin reactions (such as hives), and contact dermatitis (such as from poison ivy). The most common side effect is drowsiness.

Diphenhydrochloride occurs as white crystals, soluble in water. It is available in capsules and in solution for injection.

diphenyl (chemistry): *see* biphenyl.

diphtheria, acute infectious disease caused by the bacillus *Corynebacterium diphtheriae* and characterized by a primary lesion, usually in the upper respiratory tract, and more generalized symptoms resulting from the spread of bacterial toxin throughout the body. Diphtheria occurs in both tropical and temperate regions of the world, being more common during the colder months of the year and most often affecting children under the age of 10.

In most cases transmission is by direct contact through droplet infection from active cases or carriers. The most common portals of entry of the diphtheria bacillus are the tonsils, nose, and throat, where it usually remains and propagates, producing a toxin that is disseminated throughout the body by way of the blood and lymph vessels. The toxin is responsible for most of the symptoms. The primary lesion is characterized by a thick, leathery, bluish white membrane that is composed of bacteria, dead cells from the mucous membranes, and fibrin (the fibrous protein associated with blood clotting). This membrane, surrounded by a narrow zone of inflammation, firmly adheres to the underlying tissues. The more remote lesions caused by the circulating toxin primarily affect the heart muscle and peripheral nerve tissue, where inflammation and degeneration of the fatty tissue elements may occur; in more severe cases resulting heart failure and paralysis may lead to death. General symptoms of diphtheria include fever, sore throat, and a tired feeling.

There are several types of diphtheria, depending in large part on the anatomic location of the primary lesion. They include the following: (1) Anterior nasal diphtheria, in which the characteristic membrane appears inside the nostrils. Almost no toxin is absorbed from this site, so there is no danger to life and complications are rare. (2) Faucial, or tonsillar, diphtheria, the most common type, in which the infection is limited mostly to the tonsillar region. Most patients recover if properly treated with diphtheria antitoxin. (3) Nasopharyngeal diphtheria, the most fatal form, in which the tonsillar infection spreads to the nose and throat structures, sometimes completely covering them with the membrane; regional lymph glands and neck tissue may be swollen, and a marked degree of toxemia (general intoxication caused by absorption of the bacterial toxin) may be evident. (4) Laryngeal diphtheria, usually resulting from the spread of the infection downward from the nasopharynx, though the primary lesion may also be in the larynx itself; the airway may be blocked, and unless it is restored by inserting a tube or cutting an opening in the trachea, death by suffocation may ensue. If the airway obstruction is removed, the patient usually recovers, because there is not much absorption of the toxin from the trachea or the larynx. (5) Extra-respiratory diphtheria, consisting of those forms of the infection that affect parts of the body other than the respiratory tract, notably the skin, following a wound or sore.

In the treatment of diphtheria, the prompt administration of diphtheria antitoxin, obtained from the blood of animals that have been immunized against the infection, is the first and most important step. Active protection against the disease has become a routine measure in many countries through immunization with diphtheria toxoid, a form of the toxin that has been rendered nontoxic but that has retained its capacity to induce antibody formation once injected into the body. The diphtheria toxoid is usually first given during the first few months of life, with booster doses within one or two years and again within five or six years of age.

diphthong, in phonetics, a gliding vowel in the articulation of which there is a continuous transition from one position to another. Diphthongs are to be contrasted in this respect with so-called pure vowels—*i.e.,* unchanging, or steady state, vowels. Though they are single speech sounds, diphthongs are usually represented, in a phonetic transcription of speech, by means of a pair of characters indicating the initial and final configurations of the vocal tract. Many of the vowel sounds in most dialects of English are diphthongs: *e.g.,* the vowels of "out" and "ice," represented as [au] and [ai], respectively.

Diplodocus, genus of extinct giant sauropod dinosaurs found as fossils in Late Jurassic rocks of North America (the Late Jurassic epoch occurred 163 to 144 million years ago). *Diplodocus,* perhaps the most commonly displayed dinosaur and a relative of *Apatosaurus* (popularly *Brontosaurus*), was the longest land animal that ever lived; the longest known was 26.7 m (87.5 feet) long. The skull, unusually small, was elongate and rather light; it sat atop a very long neck. The brain was extremely small. Its relatively light body was well supported by limb girdles and pillarlike legs. While most of these dinosaurs weighed just over 10 tons, some members of the genus may have weighed as much as 80 tons. The tail was very long and probably extremely flexible. It is possible that the tail was a defensive weapon that could be lashed out at predators with great force; it is also possible that it was employed for propulsion in the water.

A mass of nervous tissue present at the base of the spine aided in the coordination of the movements of the hind limbs and tail. Because the great length of the animal would have made the transmission of nervous impulses from the tiny brain to the hindquarters a slow process, the spinal node, often mistakenly called a second brain, was developed to compensate for the time lag.

Some theories suggest that *Diplodocus* may have spent a good deal of time in the water with only its head sticking out. It is probable that *Diplodocus* could move about freely on dry land; the limbs were relatively slim and the feet broad, much like those of modern elephants. The character of the teeth—pencillike, dull-edged, and located on the anterior margins of the jaws—indicates that *Diplodocus* probably fed on soft vegetation.

Diplograptus, genus of graptolites, small, extinct colonial marine animals thought to be related to the primitive chordates and restricted to ancient marine environments. Forms or species of *Diplograptus* are useful index, or guide, fossils for the Ordovician period (which occurred from 505 to 438 million years ago) and thus allow the correlation of sometimes widely separated rock units. *Diplograptus* is characterized by a caplike float from which featherlike assemblages of graptolite organisms were suspended. It was relatively large for a graptolite; several kinds of individuals were present in a colony.

diplomacy, the established method of international discourse or art of managing international relations, chiefly by negotiation. In the past diplomacy referred to official relations between sovereign states, but in the 20th century it has expanded to cover summits and other international conferences and the activities of such entities as the United Nations, the Red Cross and Red Crescent, and the North Atlantic Treaty Organization (NATO).

A brief treatment of diplomacy follows. For full treatment, *see* MACROPAEDIA: Diplomacy.

Diplomacy is often confused with foreign policy, but it is instead the chief instrument through which the goals, strategies, and broad tactics—often politically determined—of foreign policy are implemented. Foreign policy is usually publicly stated; diplomacy, on the other hand, is generally conducted in secret, though its results are often made public.

Although traces exist that point to diplomacy in prehistoric societies, modern diplomacy originated in ancient Greece. Greek diplomacy first employed heralds as inviolable messengers between warring states; later, envoys chosen for their oratorical skills were sent on diplomatic missions. A special class, the proxeni, or consular agents, were distinguished from envoys by their resident missions and by the commercial tasks in which they specialized.

Roman and medieval European contributions were primarily legal: the application of civil law to treaties and the beginnings of a formal international law. In the late Middle Ages papal diplomacy played a leading role; papal legates and nuncii were the models from which secular rulers fashioned their own agents. From the 12th century these agents were called ambassadors. Italy, particularly Venice, conducted the most extensive diplomacy and influenced its development in other European states.

By the 16th century resident embassies were common throughout Europe. The presence of a number of ambassadors, each representing the dignity of his sovereign, in the various capitals led to issues of precedence among the diplomatic corps, and much diplomatic protocol descends from solutions fashioned in this period. In the 17th century the focus of diplomacy began to shift from representing the sovereign to representing the national interest; to coordinate and direct this service, in 1626 Cardinal Richelieu instituted in France the first modern foreign ministry. This trend accelerated in the 19th century as power shifted from royal courts to cabinets. Also at this time the pattern of European diplomacy began to be adopted by other nations; by the end of the century the Western diplomatic system was in evidence throughout the world.

Advances in communication and transportation in the 19th and 20th centuries changed the conduct of diplomacy. Ambassadors communicated more frequently with political leaders in the capital, and politicians themselves took an increasingly active role in diplomatic negotiations. Heads of state had attended major diplomatic conferences (such as the Congress of Vienna of 1814–15) in the past, but in the late 20th century summitry and other international conferences brought further involvement from politicians in the diplomatic process.

Diplomatic venues multiplied as well. The League of Nations and its successor, the United Nations (UN), were the most prominent international platforms, but bodies such as the European Communities, the Organization of Petroleum Exporting Countries, and the Organization of African Unity also received envoys from interested states.

As diplomacy became more public it became more hazardous. Despite extraterritoriality (*q.v.*) and other protections of diplomatic immunity, diplomats became a target of terrorists and other disaffected groups, and kidnappings and assassinations were not uncommon in the late 20th century.

The Vienna Convention on Diplomatic Relations, adopted in 1961 by the UN Conference on Diplomatic Intercourse and Immunities, recognized types of diplomatic agents and the agreed protocols from which they operate. It specified three classes of heads of missions: ambassadors or nuncios; envoys, ministers, or internuncios; and chargés d'affaires. The first two are accredited to heads of state, the third to ministers of foreign affairs. These representatives, along with members of their staffs and the consular corps, constitute a country's foreign service (*q.v.*). Their primary functions include representing the sending state in the host state, protecting the interests of the sending state, negotiating on its behalf, gathering information on conditions and developments in the host country, and promoting friendly relations between the two countries.

Diplomatic tasks have broadened to include economic, cultural, disarmament, and other negotiations, usually conducted by or with the support of negotiators who are specialists in the field. Diplomats themselves have become more specialized in training and education, though some countries, especially small ones, continue to favour generalists in staffing their diplomatic corps.

diplomatic immunity: *see* extraterritoriality.

diplomatic service: *see* foreign service.

diplomatics, the study of documents, including documents of legal and administrative import, and public records. The major task of diplomatics is to distinguish between genuine and false documents; diplomatic studies have been applied in particular to Western documents of the Middle Ages.

A brief treatment of diplomatics follows. For full treatment, *see* MACROPAEDIA: History, The Study of.

Diplomatics originated during the Middle Ages in response to the large numbers of forgeries resulting from the loss of records during wartime and the new need for written substantiation of previously unwritten "customary" law. It was not until the 17th century, however, that attempts to detect forgeries began to adhere to strict, scientific methodology. Jean Mabillon, a Benedictine monk, published *De Re Diplomatic Libri VI* in 1681, in which he set out the fundamental principles of verifying documents. His work was extended by René-Prosper Tassin and Charles-François Toustain in *Nouveau traité de diplomatique* (1750–65), and in 1821, the École des Chartes was founded in Paris for the training of archivists. In Germany and Austria, scholars furthered the science of diplomatics by differentiating between *actum* and *datum* (*i.e.,* between verbal legal procedure and its formal documentation) and by developing a technique to authenticate the writing of individual notaries or scribes.

Today, documents are classified in various ways, including public and private, and evidentiary and dispositive. A document may be either original (drawn up on the order of the sender or donor and designated as evidence of the transaction) or a copy (made before or after the deed was actually sealed; copies made before are technically rough drafts). Certification of a copy by a notary can provide it with the same legal value as an original.

To gauge the authenticity of a document, the diplomatic scholar studies the ink used and material on which it was written, the language and abbreviations used therein, its script style, its form and content, its date, and finally the material composition of its seal.

Throughout history, documents were written on, and with, a variety of materials. Stone, metal, wax, papyrus, and parchment held the writings of antiquity; in the Middle Ages, parchment and papyrus were common, although paper was sometimes available in the 12th and 13th centuries, after which it became the material of choice. All documents were written with ink, but the colour varied from region to region.

The language used in documents throughout the Roman Empire was primarily Latin; toward the end of the 6th century AD it was superseded in the East by Greek, which remained in force in the Byzantine Empire through 1453. With few exceptions, Latin was the primary language used in Western documents until the 15th century, when the vernacular also became acceptable. In addition to the language used, the particular characteristics of the abbreviations in a document

also contribute to a correct assessment of its probable date and provenance.

Script styles provide telling evidence as to the authenticity of a document, since certain styles were dominant in some eras and disused in others. Thus, the knowledge of paleography, different styles of ancient writing, is a skill essential to diplomatics.

The form and content of documents, especially in comparison to model texts used by chanceries (letter offices of rulers and popes) provide valuable insight into their authenticity. In the case of common documents, notaries copied from books in which text formulas had been collected, adding the pertinent individual information. Official documents were normally divided into three parts: the introduction, the main text, and the concluding formula. Each of these parts contained certain standard subject matter, such as an invocation to the deity; documents which fail to adhere to standards of format and content may be of questionable validity.

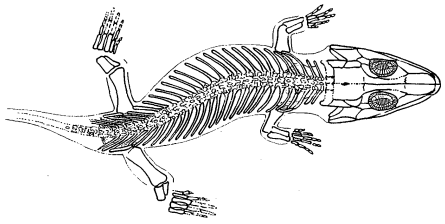
The date on a document is also a clue to its validity. The date may be that of legal enactment (*actum*) or that of the issue of the document recording the (already performed) legal enactment. Dates varied depending on what calendar system was used, so the form in which the date is given is exceedingly useful in determining provenance and authenticity.

Finally, authenticity of a document can be judged by analyzing the appropriateness of the seal. Byzantine emperors, for instance, used gold seals, whereas ecclesiastics and officials of the realm used lead and silver.

Most formal documents were drawn up in chanceries throughout the Roman and Byzantine empires, in a tradition that continued through the Middle Ages and into the 17th century, at which time departmentalization obviated the need for a central letter office. Documents issued through chanceries included laws, edicts, decrees, foreign letters, administration, writs, charters, privileges, and others. For the most part, diplomatic studies have been applied mainly to Western documents, usually medieval or earlier in issue, because the validation of more recent documents requires less specialized training.

diplopia: *see* double vision.

Diplovertebron, genus of extinct amphibians of North America and Europe known from fossils in Late Carboniferous rocks (from 320



Dorsal view of *Diplovertebron* skeleton

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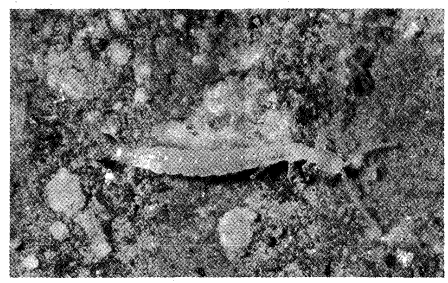
to 286 million years ago). *Diplovertebron* represents a late surviving form of the anthracosaurs, a group of primitive amphibians that probably included the ancestors of the more advanced reptiles. *Diplovertebron* and other anthracosaurs are characterized by a distinctively constructed vertebral column and skull pattern and five-toed feet.

dipluran, also called APTERAN, or ENTOTROPHIAN, group of small primitive wingless insects (about 400 species) of the subclass Apterygota. Some entomologists consider many of their features similar to those associated with ancestral insects. Diplurans are blind, pale insects that live in soil and feed on decaying vegetation and plant tissues; thus they often damage growing plants.

The order is divided into three families. Typically the members of the campodeid family have two long, slender abdominal cerci (sensory appendages) that are sensitive to vibra-



Dipluran (Japygidae)

William E. Ferguson

tions; these insects are commonly known as twintails. The cerci of the japygid family are modified into hard pincers that are used to catch prey. Members of the third family, the projapygids, also have cerci.

Dipnoi, order or subclass of fishes that includes living species of the lungfish (*q.v.*), as well as a number of extinct forms.

Dipo Negoro, Pangeran (Prince), also called RADEN MAS ONTOWIRJO (b. *c.* 1785, Jogjakarta, Java [Indonesia]—d. Jan. 8, 1855, Makasar, Celebes), Javanese leader in the 19th-century conflict known to the West as the Java War and to Indonesians as Dipo Negoro's War (1825–30). During those five years Dipo Negoro's military accomplishments severely crippled the Dutch and earned for him a prominent place in the Indonesian nationalist pantheon of heroes.

The sultanate of Jogjakarta was created Feb. 13, 1755, by a Dutch treaty that dismembered the once-powerful Javanese kingdom of Mataram. Although Dipo Negoro was the eldest son of the third ruler of Jogjakarta, Sultan Amangku Buwono III, he was passed over for the succession in 1814 on the death of his father in favor of a son whose mother was of higher rank, but he was promised the throne should his half brother predecease him. He was a deeply religious person who throughout that period lived in meditative seclusion, and historians disagree on whether he wanted the throne or whether he spurned it in favour of a contemplative life.

There is no doubt, however, that during the 1820s Dipo Negoro came into conflict with Dutch officials and by 1825 emerged as the leader of disaffected aristocrats in the Jogjakarta region. The Java War itself was triggered by a series of draconian land reforms that undercut the economic position of the Javanese aristocrats.

There were mystical overtones to the conflict as well, drawn from traditional Javanese and from Muslim sources. Dipo Negoro clearly was cast in the role of the Javanese *ratu adil* ("just prince") come to save his people, but the struggle was also seen as a Muslim *jihād* ("holy war") against the infidel Dutch. The outbreak of the war was accompanied by reports of revelations and prophecies and miraculous events.

Dipo Negoro had a strong following in the Jogjakarta region and launched a guerrilla war that was quite successful for nearly three years. In late 1828, however, Dutch forces won a major victory that proved the turning point in the war. Under General H. Merkus de Kock, the Dutch proceeded to develop a system of small, mutually protecting outposts linked by good roads that enabled them to quell the natives' guerrilla warfare. In 1830 Dipo Negoro agreed to meet with Dutch representatives for peace negotiations, but during the meeting he was arrested. He died in exile.

dipolar hypothesis, theory that the Earth's magnetic field is produced or is best represented by a magnetic dipole, a body having poles of opposite sign, that is, positive and negative. In the first quantitative study made of the Earth's magnetic field, William Gilbert observed that it resembled the magnetic field of a uniformly magnetized sphere. This field is the same as that of a magnetic dipole, and early theories of the origin of the geomagnetic field postulated some sort of lodestone or gigantic iron bar magnet within the Earth that gave rise to this dipolar field. Measurements and projections of pressure and temperature led to the conclusion that the Curie point (temperature at which magnetic properties are lost) of all known magnetic compounds is exceeded 10 to 40 km (6 to 25 miles) below the surface; this conclusion left the lodestone and bar-magnetic theories untenable.

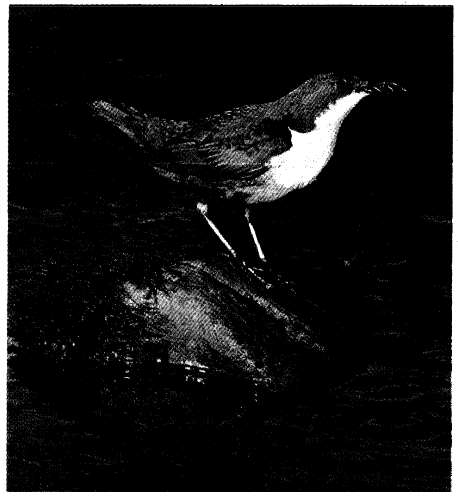
Current theories postulate a self-sustaining dynamo in the Earth's core, giving rise to the magnetic dipolar field. Detailed study of the Earth's magnetic field shows the dipolar field to be the main component, although there are, in addition, irregularities caused by the superposition of a non-dipolar field, which is weaker than the dipolar field and is thought to arise in the Earth's outer core.

dipole, electric: *see* electric dipole.

dipole, magnetic: *see* magnetic dipole.

Dipolog, city, western Mindanao, Philippines. Dipolog is a fishing and interisland shipping port. There is also a commercial airport. Its city status dates from 1969; it had been a municipality since 1913 and, before that, had been considered an outer adjunct of the port of Dapitan on Dapitan Bay, some 10 miles (16 km) to the northeast. Dipolog long since outstripped the other town in size and importance, however. The city is connected with the main part of Mindanao island via the eastern Zamboanga Peninsula's scanty road system. Inc. city, 1969. Pop. (1989 est.) 78,168.

dipper, also called WATER OUZEL, any of four species of songbirds of the Cinclidae family (order Passeriformes) noted for insect hunting by walking underwater in rushing streams and named for their frequent body bobbing.



Eurasian dipper (*Cinclus cinclus*)

H.M. Barnfather—Bruce Coleman Inc.

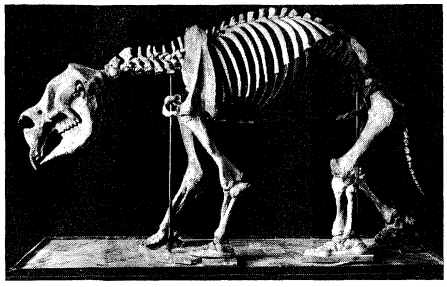
Among the best-known species are the Eurasian, or white-bellied, dipper (*Cinclus cinclus*), blackish brown with a white breast, found from northern Africa and Europe to Manchuria, and the North American dipper (*C. mexicanus*), dull gray in colour, found from Alaska to Panama, east to the foothills of the Rockies. Two other species are found in mountainous areas of South America and

Asia; there is also an Asiatic species, the brown dipper (*C. pallasii*), found from the Himalayas to China, Korea, and Japan.

Dippers are plump, stub-tailed birds, about 18 cm (7 inches) long, with thrushlike bills and legs. The nest is a dome of moss built in a crevice, often behind a waterfall.

dipping duck: *see* dabbling duck.

Diprotodontidae, family of extinct marsupial mammals that existed from the Late Oligocene epoch into the Pleistocene epoch (from 30 million to roughly 10,000 years ago) in Australia. It included *Diprotodon,* which was the largest known marsupial (3.5 m [11 feet] long). *Diprotodon* was characterized by a wombat-like body the size of a large rhinoceros. Its limbs and skeleton were massively constructed to support its imposing bulk. The incisor teeth were well developed and resemble those of gnawing animals. The Diprotodontidae also included *Palorchestes,* of the Pleistocene, a large kangaroo-like marsupial. All members of the family were presumably herbivorous. They are perhaps distantly related to kangaroos and wombats.



Diprotodon (cast), mounted skeleton
By courtesy of the American Museum of Natural History, New York

Dipsacales, the teasel order of flowering plants, belonging to the class known as dicotyledon (*q.v.*; characterized by two seed leaves). It comprises 40 genera and about 1,100 species in four families and is distributed throughout the world, but is centred mainly in the Northern Hemisphere. The order is best known for its ornamental plants, such as the honeysuckle, the arrowwood, the wayfaring tree, the guelder rose, and the scabious.

The diversity of habitat found in Dipsacales is illustrated by the species of *Viburnum* (Caprifoliaceae family) growing naturally in eastern North America. *V. edule,* the red-fruited squashberry, inhabits moist woods from Labrador to Alaska, southward into Pennsylvania, Michigan, and Minnesota, and as far west as Colorado and Oregon. A variety of arrowwood, *V. dentatum,* thrives not only in moist woods but also in swamps. Possum haw (*V. nudum*) is largely limited to swamps of the eastern and southern coastal plain. In contrast, *V. rufidulum* (southern black haw) and *V. molle* prefer dry, rocky woods or hills.

Thirteen of the 18 genera of the honeysuckle family (Caprifoliaceae) are under cultivation. Many genera consist of relatively few species. *Viburnum,* however, has about 225 species, including the guelder rose (*V. opulus* variety *opulus*), the arrowwood (*V. dentatum*), and the Chinese snowball (*V. macrocephalum* variety *sterile*). Other significant genera of the Caprifoliaceae are *Lonicera, Sambucus* (elderberry), *Symphoricarpos,* and *Weigelia.*

The valerian family (*Valerianaceae*) comprises 10 genera and 400 species of herbs distributed chiefly in the Northern Hemisphere. Its members are characterized by the rank odour of their stems and leaves when dried. *Valeriana officinalis,* the garden heliotrope, is a perennial herb prized for its spicy, fragrant flowers; it is native in Europe and western Asia. Its dried rhizome yields valerian, a natural sedative. Another member of the Valerianaceae, the spikenard (*Nardostachys jatamansi*), is a perennial herb of the Himalayas and produces an essential oil in its woody rhizomes.

The Dipsacaceae is a natural family comprising herbs placed in 8 to 12 genera and 300 species. *Dipsacus sativus* is noted for its compact head of flowers in which elongate, stiff bracts (leaflike scales) accompany each flower. The ripened heads were used even in Roman times to raise the nap of woolen cloth, a process known as fulling. (Fuller's teasel has since been replaced by mechanical methods.) Another important genus of Dipsacaceae is *Scabiosa,* the pin-cushion flower genus, 21 species of which are ornamentals. Many other members of the family are cultivated as ornamentals. Himalayan whorlflower (*Morina longifolia*), sometimes placed in a family of its own, has thistlelike leaves and produces spikes of tubular flowers about 90 cm (3 feet) tall that open white and turn scarlet. *Pterocephalus parnassi,* from mountains of southeastern Europe, is a low, perennial plant with purplish flowers. *Cephalaria transylvanica,* a tall annual, produces large, stiff, globe-shaped, white to bluish flower heads and has divided leaves. Devil's bit scabious (*Succisa pratensis*), a blue-flowered perennial, grows wild in European meadows. Its leaves are entire or slightly lobed and oval to narrow in shape.

The fourth family, Adoxaceae, consists of *Adoxa moschatellina,* the muskroot, widely distributed in northern regions. It is a low-growing, perennial herb composed of a basal cluster of leaves and a single stem. It has a musky odour (as its name implies), and its use is limited to rock gardens.

The American elderberry and the bush honeysuckle produce rhizomes that send up new shoots to propagate the species vegetatively. Such plants often form dense colonies. Seeds, however, are produced in abundance by all members of the Dipsacales growing naturally.

Inflorescences in this order range from paired flowers in the twinflower (*Linnaea*) to the showy, compactly branched, flat-topped inflorescences (cymes) produced by the American elderberry. Several other types of inflorescences are produced in certain species.

A model flower of this group of plants has four to five units in each whorl of sepals, petals, and stamens (male). Sepals may be undiverged to form a funnel-shaped calyx; petals are always fused to form an often bell-shaped corolla. Stamens are attached basally to the petals.

The pistil (female) is composed of two or more carpels in which the basal, swollen ovary is topped by a slender style that ends in the pollen-receptive stigma. Stigmas are the same in number as the chambers of the ovary, and each chamber produces one ovule. A distinctive feature of the teasel order is the departure of all floral parts from the top of the ovary; it is inferior in position.

Pollination is generally effected by insects, but in some species of honeysuckle of the western United States, hummingbirds pollinate the flowers. Following pollination and fertilization, the ovule becomes the seed and the ovary the fruit. Several types of fruits are found in the Dipsacales. Those that mature fleshy are berries, or, if the layer next to the seed is hard, drupes. Many species produce dry fruits that either split (capsules) or remain closed (achenes).

Fleshy fruits and their seeds are dispersed by birds. Some species in the teasel family produce spiny fruits or inflorescences that cling to passing animals and are scattered widely.

Features shared by most families in the Dipsacales include opposite leaves, inflorescences in cymes (oldest flowers at top), united petals, anthers separate from each other, and an inferior ovary. In most genera, petals are alike in shape, but some members of the order develop two-lipped flowers in which one half of the flower is the mirror image of the other half (bilateral symmetry).

dipteran, a member of the insect order Diptera, the two-winged or "true" flies. This order contains over 85,000 species divided into three suborders: the Nematocera (midges, gnats, mosquitoes, crane flies), the Brachycera (horse flies, bee flies, robber flies), and the Cyclorrhapha (house flies, fruit flies, leafminers, blow flies). Many other insects are commonly called flies (such as dragonflies, caddisflies, and mayflies), but their wing structures serve to distinguish them from the true flies. Dipterans occur in all habitats throughout the world; one or two species of midges (*e.g., Pontomyia natans*) are even marine-dwelling.

A brief treatment of dipterans follows. For full treatment, *see* MACROPAEDIA: Insects.

The smallest dipterans are midges only 1 mm (0.04 inch) in length, and the largest are the robber flies (Asilidae), which can attain a length of nearly 8 cm (3 inches). The chief diagnostic feature of the group is wing structure. The anterior wings are functional for flight, while the posterior wings have evolved into halteres, which serve as balancing organs during flight. The earliest dipterans in the fossil record date from the beginning of the Jurassic period (about 208 million years ago).

Within the order there is great variation in the relative size of the thorax, abdomen, and legs. While some flies are bright and metallic in appearance, most are covered with a fine coating of dust (tomentum). In many species the ovipositor is a telescoping organ composed of the last few segments of the abdomen; its structure allows the fly to lay her eggs within various organic matter. Dipterans' compound eyes are large—in the house fly (*Musca domestica*) there are 4,000 facets in each eye. Antennae vary greatly in structure but are present in all species of dipterans. In flies the mouthparts have evolved for sucking. In various species of primitive flies, such as mosquitoes, the mandibles of the female are adapted to piercing the skin of vertebrates to obtain blood. Some advanced flies with this habit (tsetse flies and robber flies) have evolutionarily lost the mandibles but have evolved other structures for the purpose.

Like many other insects, flies undergo a complete metamorphosis from the egg through larva and pupa to the adult. In the more advanced flies, fewer molt stages, or larval instars, occur. In tsetse flies (*Glossina*) and three families of parasitic flies (Hippoboscidae, Nycteribiidae, and Strebelidae) only one egg is produced, and it hatches internally. The larva is nourished within the female and when mature is expelled and immediately pupates; these flies lack any free larval stage. By contrast, in many midge species the larvae lead complex, active lives, while the adult lives just long enough to mate and assure a new generation of larvae.

Most flies lay eggs. The typical number in a batch of eggs varies among species from one to 250. The site of egg deposition is chosen to place the larvae where food will be readily accessible. Fruit flies (Trypetidae, Drosophilidae) lay their eggs within rotting fruits, while blow flies (Calliphoridae) deposit their eggs in rotting meat or open wounds on living animals. Various other fly larvae, including the frit flies (Chloropidae), leafminers (Agromyzidae), and the gall midges (Cecidomyiidae), develop while feeding on plant tissues. Still other larval species are predatory. Larvae may be found in microhabitats ranging from plant and animal tissue to dung (the beetle flies, Celyphidae), underwater (the mosquitoes, Culicidae, and the black flies, Simuliidae), or in pools of petroleum seepage (the carnivorous petroleum fly [*Psilopa petrolei*]).

The larvae of primitive flies have well-developed heads, chewing mouthparts, and pseudopods or prolegs ("false legs," similar to those that support the abdomen of a caterpillar). No fly larvae have true jointed thoracic legs. In the larvae of advanced forms, known as maggots, the head is simple and the mouthparts consist only of a pair of hooks that move vertically. Two spiracles (air holes) are located at the posterior end of the maggot; prolegs are lacking.

Fly larvae frequently pupate within either a cocoon or a puparium (a case formed as the larval skin hardens). The adult emerges from the pupa soft, wrinkled, and lacking colour. It swallows air to expand the body and get its blood flowing.

Dipterans are ecologically quite important, especially in the function maggots perform in the breakdown and redistribution of organic materials. Flies are also an important link in numerous food chains. Aquatic larvae are an important food for small fish, while all the developmental stages are taken by various other vertebrates including frogs, toads, small mammals, lizards, swallows, swifts, and other species of birds.

While some flies are beneficial to man as parasites of insect pests or as scavengers, and many others are important as pollinators of various plants, flies are more familiar for their negative aspects. Many are annoying blood-sucking insects—mosquitoes (Culicidae), deer flies (*Chrysops*), and stable flies (*Stomoxys*), for example—while swarms of sweat flies and face flies are a nuisance as they gather to suck up sweat and other bodily secretions. In almost all species which take blood, it is done only by the female, who needs nutrients from blood in order to develop a clutch of eggs. Many dipterans are vectors of disease, and because they move from one organism to another they transmit diseases readily. House flies are known agents in the transmission of diseases such as cholera, typhoid, and dysentery. Mosquitoes transmit malaria, yellow fever, and various viral diseases. Deer flies may transmit tularemia. The tsetse flies carry trypanosomes, which cause sleeping sickness in tropical Africa. Fruit flies and frit flies can cause great damage to agricultural crops, as can gall midges and leafminers when they invade ornamental plants.

Dipterocarpaceae, family of South Asian and African timber trees, in the tea order (Theales), comprising 22 genera. Most of the species are lofty trees with leathery, evergreen leaves and aromatic resins. Their clustered, fragrant flowers have five twisted, leathery petals. *Dipterocarpus* species provide a variety of products in addition to useful timber. *Dipterocarpus glandulosa* yields gurjun balsam, used in medicines. Many species in the genus *Shorea,* such as sal (*Shorea robusta*), also are valuable timber trees and produce useful resins. *Dryobalanops aromatica* produces Borneo camphor, used in East Asia for medicines, varnishes, and embalming. From *Vateria indica* comes a gum resin known as Indian copal; a similar resin comes from the larger *V. acuminata.* Other genera with useful timbers are *Vatica, Hopea,* and two African genera, *Marquesa* and *Monotes. See also* Shorea.

Dipterus, genus of very primitive lungfish, among the earliest known, found as fossils in European and North American Devonian rocks (between 345,000,000 and 395,000,000 years old). Very similar to the crossopterygians, the lobe-finned fishes that gave rise to the first amphibians, *Dipterus* retained many archaic features, including two dorsal fins and a tail that resembled a lobe-finned tail. Functional lungs were probably present in *Dipterus,* and a freshwater habitat is indicated. The skull bones of *Dipterus,* though still primitive, consist of a mosaic of small bones; *Dipterus* had already initiated the unusual bone pattern seen in more advanced lungfish. Similarly, *Dipterus* evidences the beginnings of the lungfish trend toward extreme deossification of skeletal elements. *Dipterus* was probably the direct ancestor of the modern Australian lungfish, the genus *Neoceratodus.*

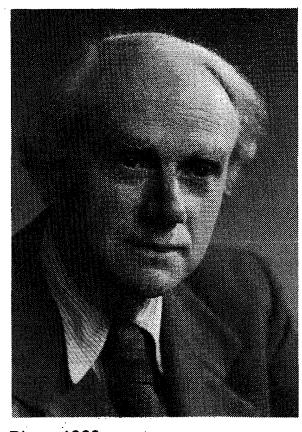
dipyre, variety of the mineral scapolite (*q.v.*).

Dīr, town and district of Malākand division, North-West Frontier Province, Pakistan. The town, the district headquarters, lies just north of the Dīr River, an affluent of the Panjkora, and is connected by road with Malākand, 70 mi (110 km) south. Mullā Ilyās, a 17th-century holy man, is said to have been the founder. Cottage industry includes the making of clothing and footwear. There is also a wood-processing plant.

The district, a former princely state of the Akhūnd Khēl royal house, occupies an area of 2,039 sq mi (5,281 sq km), drained by the Panjkora and its affluents. The upper portion of the Panjkora Valley as far as its confluence with the Dīr River is called Panjkora Kohistān. The Dīr Valley is also known as Kashkar. The population is mainly confined to the Panjkora and its fertile lateral valleys, which produce abundant fruit. Forests on the mountain slopes yield timber, the main source of income. Yūsufzay Pashtun are the predominant ethnic group. Pop. (1972) city, 3,540; (1981 prelim.) district, 769,000.

Dirac, P(aul) A(drien) M(aurice) (b. Aug. 8, 1902, Bristol, Gloucestershire, Eng.—d. Oct. 20, 1984, Tallahassee, Fla., U.S.), English theoretical physicist known for his work in quantum mechanics and for his theory of the spinning electron. In 1933 he shared the Nobel Prize for Physics with the Austrian physicist Erwin Schrödinger.

Dirac's mathematical ability showed itself at an early age. At the school he attended in Bristol he was given rather advanced books on mathematics to study independently. His father, a Swiss by birth who was the French master at the same school, encouraged his son to develop his mathematical ability. He wished



Dirac, 1960
Ramsey & Muspratt Ltd., Cambridge

him also to become fluent in French, to the extent that, according to the son's report, the elder Dirac refused to speak to him unless he was addressed in the French language. This may have fostered Dirac's pronounced tendency to speak seldom and choose his words with utmost care. He avoided company, preferring to work alone. His chief pastime was solitary walks.

Toward the practical end of earning a living, Dirac studied engineering at the University of Bristol. The use of approximations that he learned in this study had a strong influence on his later work; it strengthened his confidence in the intuitive approach to problem solving. He came to believe that a theory expressing fundamental laws of nature could be constructed solely on the basis of approximations, guided by intuition rather than exact knowledge of the actualities. He declared that the actual phenomena were too complex ever to be pinned down in a precise way; a physicist must be satisfied to work only with approximate knowledge of reality.

Dirac's study of theoretical physics began only after he had received a degree in electrical engineering, had failed to find work in this field, and, aided by a grant, had entered St. John's College, Cambridge. From R.H. Fowler, his faculty supervisor, who had collaborated with Niels Bohr in his pioneering work in atomic physics, Dirac learned the current state of that science.

In 1926, while still a graduate student, he made his first major contribution to physics by devising a form of quantum mechanics, the laws of motion that govern atomic particles. Other physicists (Max Born, Pascual Jordan) working in Germany anticipated Dirac in this achievement by only a few months. Dirac's version of quantum mechanics was distinguished, however, by its generality and logical simplicity.

With the object of formulating atomic laws in the most elegant mathematical language, Dirac applied to quantum mechanics the ideas of Einstein's special theory of relativity. He had the revolutionary idea that the electron could be described by four wave functions, satisfying four simultaneous differential equations. It followed from these equations that the electron must rotate on its axis, an idea that had been developed by other physicists, and also that there must be states of negative energy. The latter conclusion did not seem to correspond to physical reality. In a later paper, however, Dirac suggested that a deficiency of an electron in one of these states would be equivalent to a short-lived positively charged particle. This idea was confirmed when Carl David Anderson obtained cloud chamber photographs showing the existence of positrons—*i.e.,* particles equal to the electron in mass but positively charged. In the experimental confirmation of this phenomenon, an apparent difficulty of Dirac's theory was turned into a triumph.

In his book *The Principles of Quantum Mechanics* (4th ed., 1958), Dirac developed the so-called transformation theory of quantum mechanics that furnished a machinery for calculating the statistical distribution of certain variables when others are specified. He also stated his philosophical position with respect to theoretical physics. The fundamental laws of nature, he wrote, "control a substratum of which we cannot form a mental picture without introducing irrelevancies." In his own work Dirac avoided using any pictorial model or mental picture of the phenomena described by his mathematical symbols.

In addition to refining mathematical descriptions of matter on the atomic scale, Dirac introduced a quantum theory of radiation. He was co-inventor of the Fermi–Dirac statistics. In 1933 he was awarded the Nobel Prize for Physics and in 1939 the medal of the Royal Society. Dirac taught at Cambridge after receiving his doctorate there, and in 1932 he was appointed Lucasian Professor of Mathematics, the chair once held by Isaac Newton. He served in that capacity until 1968, shortly after which he moved to the United States. In 1971 he was made professor emeritus at Florida State University, Tallahassee, Fla.

Dirac's other published works include *Lectures on Quantum Mechanics* (1966), *The Development of Quantum Theory* (1971), *Spinors in Hilbert Space* (1974), and *General Theory of Relativity* (1975). (B.L.C.)

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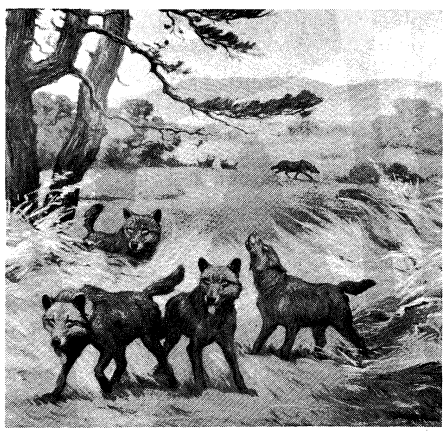
Dire Dawa, town, east-central Ethiopia, located in the Great Rift Valley, 30 miles (48 km) northwest of Harer. It lies at the intersection of roads from Addis Ababa, Harer, and Djibouti and has an airport. Dire Dawa, for long a caravan centre, developed as the

Mosque in the old quarter of Dire Dawa, Eth.
Victor Englebert—De Wys Inc.

chief outlet for Harer trade after 1904, when it became the terminus of the railroad from the port of Djibouti (since extended to Addis Ababa). The Dachatu River, whose bed can be crossed on foot during the dry season, divides the town into modern and old quarters. The former, built by the French, contains a Coptic church and a royal palace. Within the old quarter are a mosque and a large Muslim cemetery. Grain is imported from the highlands to the south because the dry fields around Dire Dawa (which means "empty plain") yield little to cultivation. The town has railway workshops, textile and cement factories, and coffee- and meat-canning plants and trades in coffee and hides. Most of its inhabitants are Oromo (Galla) or Somali people. Nearby are caves decorated with prehistoric paintings. Pop. (1982 est.) 91,629.

dire wolf, species (*Canis dirus*) of wolf that existed during the Pleistocene Epoch (2,500,000–10,000 BP). It is probably the most common mammalian species found preserved in the Rancho La Brea tar pits in southern California. The dire wolf differed from the modern wolf in several ways: it was larger, had a more massive skull, a smaller brain, and relatively light limbs. It is probable that *Canis dirus* was less intelligent than modern wolves. The species was very widespread, and skeletal remains have been found in Florida, the Mississippi Valley, and the Valley of Mexico.



Dire wolf (*Canis dirus*) from Rancho La Brea, California, detail of a mural by Charles R. Knight, 1922
By courtesy of the American Museum of Natural History, New York

Direct Action, French ACTION DIRECTE, French clandestine terrorist group that emerged in 1979 and is believed to have been an amalgam of earlier extremist groups. Among its founders are thought to be Jean-Marc Rouillan, Nathalie Menigon, Régis Schleicher, and André Oliver, all arrested in 1986–87. Direct Action's Communist ideology is described as anarchist or Maoist, with strong sympathies for Third World aspirations, and the group has been compared with the older Italian Red Brigades and the West German Red Army Faction.

Over the years Direct Action attacked by bomb or gunfire various "capitalist" targets, such as employers' association offices and factories, and various public targets, such as police stations, magistrate courts, and military sites. It assassinated such public figures as Georges Besse, chairman of the Renault automobile company (1986), and René Audran, an official of the French Defense Minstry (1985). It engaged in a number of anti-Jewish raids, including a machine-gun and grenade attack against a Jewish restaurant, Chez Jo Goldenberg, in Paris in 1982, killing 6 people and wounding 22. The French government put Direct Action under official ban in 1982.

direct current, abbreviation DC, flow of electric charge that does not change direction. Direct current is produced by batteries, fuel cells, rectifiers, and generators with commutators. Direct current was supplanted by alternating current (AC) for common commercial power in the late 1880s because it was then uneconomical to transform it to the high voltages needed for long-distance transmission. From the 1960s, however, new techniques overcame this obstacle, and direct current is now transmitted over very long distances, even though it must ordinarily be converted to alternating current for final distribution. For some uses, such as electroplating, direct current is essential. *See also* electric current.

direct dye, also called SUBSTANTIVE DYE, any of a class of coloured, water-soluble compounds that have an affinity for fibre and are taken up directly, such as the benzidine derivatives. Direct dyes are usually cheap and easily applied, and they can yield bright colours. Washfastness is poor but may be improved by aftertreatment. Most packaged dyes sold for home use are direct dyes. *See also* mordant dye; reactive dye.

direct-mail marketing: *see* mail-order business.

directing, the art of coordinating and controlling all the elements in the staging of a play, opera, motion picture, television program, or radio script. The responsibility for this control is usually delegated to one person, called the director.

A brief treatment of directing follows. For full treatment, *see* MACROPAEDIA: Theatre, The Art of the; Motion Pictures.

The director did not become a dominant force in the theatre until the mid-19th century. Before then it was not uncommon for an experienced actor to advise the other members of a troupe, but with the rise of modern realistic drama came the need for someone to coordinate all the elements of a production from a perspective broader than that of a member of the cast.

Madame Vestris in England and George II, duke of Saxe-Meiningen, in Germany directed plays in which they did not act, abandoning artificial, stagy costumes and insisting on authentic sets and speech. On a tour of Russia in 1890, Meiningen caught the attention of Konstantin Stanislavsky, whose reforms of the crafts of directing and acting remained influential long after his death in 1938. His name is inextricably linked to the psychological dramas of Anton Chekhov and to the actor's training technique known as the Stanislavsky method (*q.v.*).

The theatrical elements available to the director are the script and the acting of the players, as well as the decor, costuming, lighting, visual and sound effects, incidental music, and—in a musical play—choreography. Using all these elements, the director shapes the overall production in order to leave the audience with an imaginative interpretation of what the playwright has written.

Since the actors usually constitute the most important and the most variable theatrical element, an understanding of acting and of human nature are indispensable in a director. In most cases, the director does not tell the actors every detail of what he expects of them, nor does he control their actual performance. Rather, he stimulates their imaginations and gives them confidence in their own creativity, with the idea that they will begin by knowing less than he does about their roles and end by knowing more. Casting—choosing the actor to fit the role—is a crucial responsibility of the director, since a single miscast role can ruin an entire production.

In the rehearsal the director's skills as manager as well as craftsman become important. The actors must be integrated into the set and their physical movements "blocked," or arranged. The director must compose a "stage picture" that gives the desired emphasis to the spoken word. He must also oversee the designers, stage technicians, and sometimes the choreographer and orchestra conductor.

The direction of these disparate—and often competing—elements requires a broad and unifying vision that subordinates the parts of the production to the play as a whole.

Modern film directors oversee the same elements that theatre directors do, as well as such technical factors as cinematography, editing, and sound recording. The first motion-picture directors did not realize the artistic control that these technical elements allowed; they simply filmed short vaudeville or circus acts and brief action-filled views of real life from start to finish without moving the camera. Soon, however, film directors learned to use camera placement and movement to focus viewer attention on a particular area or person, and they discovered that they could use editing to create narrative or dramatic effects. Later developments in motion-picture technology, such as the introduction of sound and colour, inspired further innovations in film-directing technique.

Two techniques that are sometimes used to describe motion-picture directing styles are montage and mise-en-scène. Montage directors are primarily concerned with editing and the relationships of individual shots to one another. D.W. Griffith was one of the first directors to use montage expressively, as in his *Birth of a Nation* (1915). Theories of montage were further developed by Soviet filmmakers of the 1920s, especially Sergey Eisenstein and Vsevolod Pudovkin. Mise-en-scène directors concentrate on the relationships between the elements within a shot and on the processes that precede the editing stage, such as camera movement, pictorial composition, lighting, and design. Directors known for their use of mise-en-scène include Orson Welles, Max Ophuls, Jean Renoir, and Mizoguchi Kenji. In most traditional Hollywood feature films, which are characterized by their fast pace and "invisible" editing style, both montage and mise-en-scène techniques are used, but montage usually dominates.

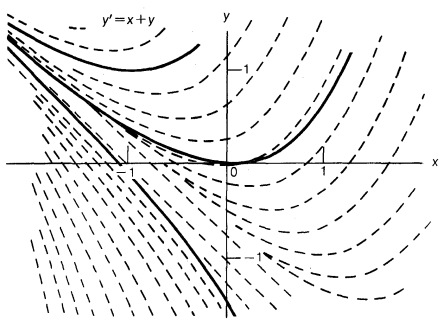
Directing television programs for live broadcast presents a situation similar to that of working on the stage. The performance is

continuous and cannot be stopped to correct mistakes. The director must edit from the control room as the program is being broadcast, making split-second decisions about when to cut from one camera shot to another.

Television directors working on programs for future broadcast have the same basic functions as motion-picture directors, although they usually have less artistic control.

The radio director's responsibilities, like those of the television director, differ for live and recorded material. In general, however, the director of a radio play needs an acutely sensitive ear to ensure that the actors' inflections and vocal rhythms produce expressive speech and that the total play with all its music and sound effects can be visualized clearly in a listener's mind.

direction field, way of graphically representing the solutions of a first-order differential equation without actually solving the equation. The equation $y' = f(x, y)$ gives a direction, y', associated with each point (x, y) in the plane that must be satisfied by any solution curve passing through that point. The direction field is defined as the collection of small line segments passing through various



Direction field

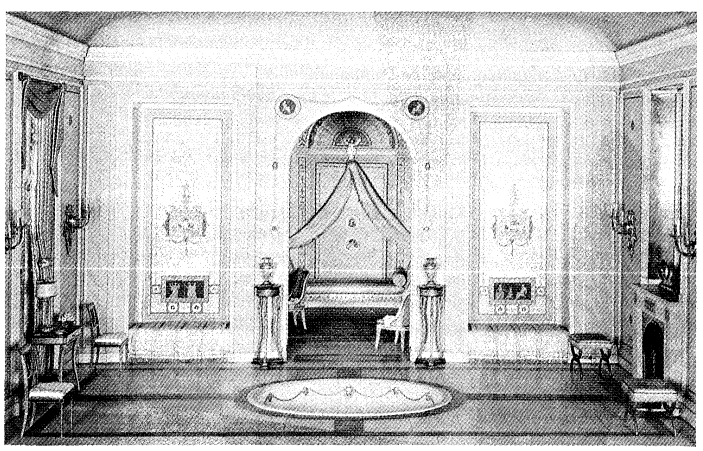
points having a slope that will satisfy the given differential equation (*see* Graph) at that point. The actual family of curves (solutions of the differential equation) must have a direction at each point that agrees with that of the line segment of the direction field at that point, so that this method is valuable for gaining some feeling for the behaviour of the solutions in cases in which the equation is difficult to solve or in which the solution is a complicated function. Often it is helpful when drawing the direction field to determine the lines or curves, called isoclines, on which the slope of the direction field segments is constant. For example, in the equation $y' = x + y$ the slope will have the constant value k when $k = x + y$, or when $y = -x + k$; that is, the isoclines are straight lines with a slope of -1. These lines can then be sketched in lightly to aid in constructing the direction field (*see* Graph). The actual family of solutions in this case is $y = ae^x - x - 1$ for any constant a, as found by methods of differential equations.

direction finder, radio receiver and antenna system for determining the direction of the source of a signal. A direction finder may be a ground station that takes bearings on ships or aircraft, a device used for military or investigative purposes, or an airborne or shipborne navigational device, also called a radio compass.

The directional property of a radio antenna that is formed into a coil or loop was familiar to the earliest experimenters. As a loop is rotated horizontally its energy output, derived from the interception of a radio wave, passes through a sharp minimum that corresponds to the direction of the radio transmitter. Soon after ships were first equipped with radio, shore direction-finding (DF) stations were placed at strategic points along navigational routes and near harbour approaches. Upon receiving a request by radio from a ship, two or more shore stations determined the directions from which the ship's signal arrived by means of their loop antennas and transmitted this information back to the vessel. However, this service was limited to one vessel at a time, a serious drawback in bad weather, when demands were heavy. By reversing the process—placing the transmitter ashore and the direction finder on the ship—the system became nonsaturable and the navigator was given two further advantages: he was able to take continuous or frequent bearings on any shore beacon, and he could take bearings of any receivable signal, such as transmissions from broadcasting stations and from other vessels. This change in the system was roughly coincident with the initial growth of aviation, and the airborne direction finder immediately became a valuable aid to air navigation.

Crossed-loop direction finders, used when it is not convenient to rotate the loop, consist of two loops mounted at right angles to each other with their terminals connected by cable to two crossed fixed coils of a goniometer; a rotatable coil in the goniometer simulates the rotation of the ordinary loop antenna. Other types of DF antennas include the Adcock (using spaced dipoles or monopoles) and spaced-loop types that have been employed ashore as navigational aids in the high-frequency and very-high-frequency bands, where greater efficiency and accuracy is obtained than with the simple loop. Loops incorporating ferromagnetic cores are largely used in portable direction finders, produced principally for aircraft and small boats.

Directoire style, style of dress, furniture, and ornament popular in France during the period of the Directory (1795–99). Dress for men, mixing ancient and contemporary elements, featured trousers and high boots, vests, long, open coats, and top hats. Women dressed in chemises that had long sleeves and V necklines, and they wore ruffled caps gathered around the ears, as in Jacques Louis David's portraits of Madame and Monsieur de Sériziat (1795; Louvre, Paris).


Model of a Directoire bathroom and boudoir in the Pompeiian style adapted from designs by the architect François-Joseph Bélanger (1745–1818); in the Art Institute of Chicago

By courtesy of Thorne Rooms in Miniature, the Art Institute of Chicago

Furniture and ornaments stressed elongated, simple shapes with clear lines; the Directoire style's sparse detail and ornamentation were based mostly on ancient Roman objects recently recovered from excavations at Pompeii. Directoire furniture was the last phase of the Louis XVI style.

Directory, French DIRECTOIRE, the French Revolutionary government set up by the Constitution of the Year III, which lasted four years, from November 1795 to November 1799. It included a bicameral legislature known as the Corps Législatif. The lower house, or Council of Five Hundred (Conseil de Cinq-Cents), consisted of 500 delegates, 30 years of age or over, who proposed legislation; the Council of Ancients (Conseil des Anciens), consisted of 250 delegates, 40 years of age or over, who held the power to accept or veto the proposed legislation. The Ancients also picked the executive—the five Directors (Directeurs)—from lists drawn up by the Five Hundred. A Director had to be at least 40 years old and to have formerly served as a deputy or minister; a new one was chosen each year, on rotation. The Directors chose governmental ministers, ambassadors, army generals, tax collectors, and other officials. However, though nominally inheriting many of the centralized powers of the former Committee of Public Safety (*see* Public Safety, Committee of), they had no funds to finance their projects or courts to enforce their will. The Directory was a fatal experiment in weak executive powers; it was created in reaction to the puritanical dictatorship that had existed under the Reign of Terror of 1793–94, and it would end up yielding to the more disciplined dictatorship of Napoleon Bonaparte.

The Directory was perhaps the most corrupt regime that France has ever known. Its policies were aimed, first, at protecting and increasing the profits of those in political and economic power and, second, at preventing the return of the Bourbons or the establishment of any other regime that might endanger those in power by such means as the redistribution of national property. The period was also noted for extravagant fashions in dress, excesses in entertainment, and a loose morality.

Diriamba, city, southwestern Nicaragua. It lies in the Diriamba Highlands at an elevation of 1,891 feet (576 m). Diriamba is a major commercial and manufacturing centre; its hinterland is known primarily for its coffee, but lumbering is also significant. Limestone quarries and saltworks are located in the vicinity, and the city contains several processing plants. It lies on the Pan-American Highway south of Managua and just west of Jinotepe. A branch of the Pacific Railway terminates in Diriamba. It was a scene of heavy fighting between Sandinista guerrillas and government troops in 1978–79, with serious damage to property. Pop. (1985 est.) 19,728.

Dirichlet, Peter Gustav Lejeune (b. Feb. 13, 1805, Düren, French Empire [now in Germany]—d. May 5, 1859, Göttingen, Hanover), German mathematician who made valuable contributions to number theory, analysis, and mechanics. He taught at the universities of Breslau (1827) and

Berlin (1828–55) and in 1855 succeeded Carl Friedrich Gauss at the University of Göttingen.

Dirichlet made notable contributions still associated with his name in many fields of mathematics. In number theory he proved the

Dirichlet

By courtesy of the University Library, Gottingen, W.Ger.

existence of an infinite number of primes in any arithmetic series $a+b$, $2a+b$, $3a+b$, . . . , $na+b$, in which a and b are not divisible by one another. He developed the general theory of units in algebraic number theory. His *Vorlesungen über Zahlentheorie* (1863; "Lectures Concerning Number Theory"), with later addenda, contains some material important to the theory of ideals.

In 1837 Dirichlet proposed the modern concept of a function $y=f(x)$ in which for every x, there is associated with it a unique y. In mechanics he investigated the equilibrium of systems and potential theory, which led him to the Dirichlet problem concerning harmonic functions with prescribed boundary values. His *Gesammelte Werke* (1889, 1897; "Collected Works") was published in two volumes.

Dirichlet problem, in mathematics, the problem of formulating and solving certain partial differential equations that arise in studies of the flow of heat, electricity, and fluids. Initially, the problem was that of determining the equilibrium temperature distribution on a disk from measurements taken along the boundary. The temperature at points inside the disk must satisfy a partial differential equation called the Laplace equation corresponding to the physical condition that the total heat energy contained in the disk shall be a minimum. A slight variation of this problem occurs when there are points inside the disk at which heat is added (sources) or removed (sinks) as long as the temperature still remains constant at each point (stationary flow), in which case Poisson's equation is satisfied. The Dirichlet problem can also be solved for any simply connected region—*i.e.*, containing no holes—if the temperature varies gradually along the boundary.

In the related Neumann problem, heat is supplied and removed across the boundary in such a way as to maintain a stationary temperature distribution. In Robin's problem, heat is merely allowed to be lost through radiation across the boundary at a rate proportional to the temperature drop across it, resulting in the eventual stabilization of the temperature distribution. Aside from heat flow, there are other phenomena that result in similar mathematical formulations, as in electrical charge distribution and steady fluid flow. These are special cases of the more general boundary-value problems of the class of second-order partial differential equations called elliptic equations.

Dirichlet's theorem, statement that there are an infinite number of prime numbers (those not divisible by an integer larger than one except themselves) contained in the collection of all numbers of the form $(a \times n)+b$, in which the constants a and b are natural numbers or their negatives, that have no common divisors except the number 1 and themselves, and the variable n is any natural number. Conjectured by the 18th–19th-century German mathematician Carl Friedrich Gauss, the statement was first proved in 1826 by the French mathematician Peter Gustav Lejeune Dirichlet.

dirigible: *see* airship.

Dir'īyah, Battle of ad- (1818), major defeat dealt the Wahhābīs, fanatical and puritanical Muslim reformers of Najd, central Arabia, by the forces of the Egyptian ruler Muḥammad 'Alī Pasha; the Wahhābī empire was destroyed, and the Sa'ūdī family that created it was virtually wiped out.

Wahhābī attacks on pilgrim caravans crossing Arabia concerned the Ottoman Turkish government at the end of the 18th century (the Ottoman sultan was protector of Mecca, Islām's chief holy city). When the Ottomans attempted to invade al-Ḥasā', eastern Arabia, the Wahhābīs responded by seizing the holy city of Karbalā' in Turkish Iraq (1801), then capturing Mecca itself (1802). Preoccupied in other directions, the Sultan did not send another force into Arabia until 1811, when he consigned to Muḥammad 'Alī Pasha, the virtually independent viceroy of Egypt, the task of crushing the "heretics." For the next four years, the balance of power shifted back and forth between Muḥammad 'Alī and Sa'ūd.

In 1815 Sa'ūd's successor, 'Abd Allāh I, sued for peace, and the Egyptians withdrew from Najd. The following year, however, Ibrāhīm Pasha, one of the Viceroy's sons, took command of the Egyptian forces. Gaining the support of the volatile Arabian tribes by skillful diplomacy and lavish gifts, he advanced into central Arabia to occupy the towns of 'Unayzah, Buraydah, and Shaqrā'. Joined now by most of the principal tribes—Ḥarb, 'Unayzah, Muṭayr, Banū Khālid—he appeared before the Wahhābī capital ad-Dir'īyah in April 1818. After six months of intermittent and desperate fighting, 'Abd Allāh surrendered (Sept. 9, 1818) and was sent to Constantinople, where he was beheaded. Ad-Dir'īyah was razed to the ground, and Egyptian garrisons were posted to the principal towns. Several members of the Sa'ūdī family managed to escape before the surrender; the rest were sent to Egypt to prison.

Consult the INDEX *first*

Dirk Hartog Island, Australian island in the Indian Ocean, just north of Edel Land Peninsula, Western Australia. Naturaliste Channel passes north to enter Denham Sound (which washes the eastern shore), and Shark Bay lies to the northeast. The island was named after a Dutch navigator who arrived in 1616 and nailed an inscribed pewter plate to a post at its northern extremity (Cape Inscription), which is now the site of a lighthouse. The island, the state's largest, measures 48 mi (77 km) by 3–7 mi (5–11km), has an area of 239 sq mi (620 sq km), and supports a sheep station. From overhanging limestone cliffs, which rise above 600 ft (180 m) along its seaward (western) edge, it descends to sand dunes along the east. The island's West Point marks Australia's westernmost point.

Dirks, Rudolph (b. Feb. 26, 1877, Heide, Ger.—d. April 20, 1968, New York City), U.S. cartoonist who created the comic strip "Katzenjammer Kids."

At the age of 7 Dirks moved with his family to Chicago, and at 17 he went to New York City, where he worked as staff artist for William Randolph Hearst's *New York Journal.* There, inspired by Wilhelm Busch's *Max und Moritz*, a picture story that Hearst had seen in Germany, Dirks, in 1897, created the "Katzenjammer Kids." When he joined the *New York World* in 1912, he lost his right to the name "Katzenjammer Kids," and so he renamed the strip for the mischievous Katzenjammer brothers, Hans and Fritz, later retitling it "The Captain and the Kids" because of World War I anti-German sentiment. The "Katzenjammer Kids" continued, but as the work of another artist, H.H. Knerr. Toward the end of his life, Dirks, who was a self-taught artist, devoted most of his time to marine and landscape painting, leaving the work of the strip to his son John, who continued it after his father's death.

Dirksen, Everett McKinley (b. Jan. 4, 1896, Pekin, Ill., U.S.—d. Sept. 7, 1969, Washington, D.C.), U.S. politician, leader of the Senate Republicans during the Kennedy and Johnson administrations.

Dirksen attended the University of Minnesota, left before graduating to serve in World War I, and, after his discharge, returned to Pekin, where he pursued a number of business interests. In 1926, with his election to the office of city finance commissioner in Pekin, Dirksen began what was to become a lifelong career in public service. Defeated in 1930 in his bid for a congressional seat, he ran again in 1932 and won. A conservative Republican, Dirksen voted against most New Deal measures—except Social Security. He also opposed Roosevelt's foreign policy, adhering to an isolationist stance. In a foreshadowing of his later moderation and flexibility, however, Dirksen switched to bipartisan support of presidential foreign policy with U.S. entry into World War II.

A severe eye ailment forced Dirksen to resign his House seat in 1948. He returned to Pekin to practice law, having completed his legal education and gained admittance to the bar while in Congress. By 1950 his health was fully restored, and he ran successfully for a seat in the Senate. Throughout the 1950s, Dirksen belonged to the so-called old guard conservative wing of the Republican Party. He backed Sen. Robert A. Taft for the 1952 presidential nomination, and he supported the anti-Communist crusade of Joseph A. McCarthy until the Wisconsin senator was discredited in the middle of the decade.

Elected minority leader of the Senate in 1959, Dirksen continued to voice support for several conservative policies, including the permitting of prayer in public schools. But he played a crucial role in securing passage of major pieces of liberal legislation in the 1960s: the Nuclear Test Ban Treaty, the Civil Rights Act of 1964, and the Voting Rights Act of 1965.

In his constituency, in the Senate, and through the medium of television, Dirksen became something of a folk hero for his rich bass voice and imposing oratorical style, attributes for which his critics dubbed him "the wizard of ooze." He won his last election in 1968 and served in the Senate until his death the following year.

dirty sandstone: *see* graywacke.

Dis Pater (Latin: Rich Father), in Roman religion, god of the infernal regions, the equivalent of the Greek Hades (*q.v.*), or Pluto (Rich One). Also known to the Romans as Orcus, he was believed to be the brother of Jupiter and was greatly feared. His wife, Proserpina (a Roman corruption of the Greek Persephone [*q.v.*]), was identified with vegetation, being regarded as a goddess of death during her annual sojourn in the underworld and of abundance during her term in the upper regions.

Disa, genus of orchids, family Orchidaceae, containing as many as 200 species of plants. They grow in marshes and grasslands in southeastern Africa, Madagascar, and on nearby islands.

Most species bear flowers ranging in colour from white to purple and in diameter from about 0.5 to 10 centimetres (about 0.2 to 4

inches). The upper sepal of each flower usually has a spur and stands upright, forming a hood. Red disa (*Disa uniflora*), a South African species, bears pink and scarlet flowers.

disaccharide, also called DOUBLE SUGAR, any substance that is composed of two molecules of simple sugars (monosaccharides) linked to each other. Sucrose, which is formed following photosynthesis in green plants, consists of one molecule of glucose and one of fructose; lactose (milk sugar), found in the milk of all mammals, consists of glucose and galactose; and maltose, a product of the breakdown of starches during digestion, consists of two molecules of glucose. Another important disaccharide, trehalose, which is found in the circulating fluid of many insects, also consists of two molecules of glucose, but they are linked in a way such that trehalose differs from maltose.

disarmament, in international relations, any of four distinct conceptions: (1) the penal destruction or reduction of the armament of a country defeated in war (the provision under the Versailles Treaty [1919] for the disarmament of Germany and its allies is an example of this conception of disarmament); (2) bilateral disarmament agreements applying to specific geographic areas (naval disarmament in this sense is represented by the Rush–Bagot Agreement between the United States and Great Britain, which, since 1817, has kept the Great Lakes disarmed); (3) the complete abolition of all armaments, as advocated by utopian thinkers and occasionally by governments; and (4) the reduction and limitation of national armament by general international agreement through such international forums as the League of Nations, in the past, and the United Nations, in the present. This last is the most frequent current use of the term.

Disarmament has become a more urgent and complicated issue with the rapid development of nuclear weapons capable of mass destruction. Since the explosion of the first atomic bombs in 1945, the previous contention that armaments races were economically inexpedient and led inevitably to war was replaced by the argument that the future use of nuclear weapons in quantity threatened the continued existence of civilization itself. During the post-World War II period, there were discussions at several levels with a view to the limitation and control of armaments. Efforts ranged from continuous talks at the United Nations to such discussions among nuclear powers as the Strategic Arms Limitation Talks (SALT) of the 1970s and the Strategic Arms Reduction Talks (START) of the 1980s. *See also* arms control.

disbarment, the process whereby an attorney is deprived of his license or privileges for failure to carry out his practice in accordance with established standards. Temporary suspension may be employed if some lesser punishment is warranted.

Grounds for disbarment vary considerably from country to country, but, in general, conviction of an attorney for a major crime or a felony or his inability to account for a client's funds entrusted to him constitute the major reasons.

The procedures for disbarment also vary from country to country. In some countries the bar association upon receipt of a complaint will hold a hearing. If the committee decides that the evidence is sufficient for disbarment or other punishment, it will make such a recommendation to the appropriate court. This court will then hear the evidence and the committee's recommendations and make its decision. In some countries—Israel and the Soviet Union, for example—the bar organizations are themselves empowered to deal with these matters in their totality. In England the Inns of Court (the governing body of barristers) and the Law Society (the governing body of solicitors) both have the power to remove the attorneys within their respective organizations from the rolls.

Disbrowe, John (English soldier): *see* Desborough, John.

disc jockey, also spelled DISK JOCKEY, person who conducts a program of recorded music on radio, on television, or at discotheques or other dance halls. Disc jockey programs became the economic base of many radio stations in the United States after World War II. The format generally involves one person, the disc jockey, introducing and playing phonograph records and chatting informally and usually extemporaneously in the intervals.

The idea of the program originated in the 1930s, but its development was hampered by a Federal Communications Commission rule that required stations to identify recorded music frequently—so frequently, as it turned out, that the message tended to irritate and alienate the listener. The disc jockey was also restricted by musicians and artists whose phonograph labels bore the warning "Not Licensed for Radio Broadcast." But the show's potential was revealed when Martin Block broadcast his *Make Believe Ballroom* on station WNEW in New York City as filler between news coverage of the closely followed trial of the kidnapper of the Charles A. Lindbergh baby. Upon the request of thousands of listeners, the makeshift show was retained by the station after the kidnap trial. In 1940 the Federal Communications Commission relaxed its rules, requiring that recorded material be identified only twice in an hour, and in the same year the courts ruled that the warning on record labels had no legal significance. From that time disc jockey shows became increasingly popular.

The radio disc jockey's future was clouded again during World War II by industry wage disputes with the American Society of Composers, Authors, and Publishers (ASCAP) and the American Federation of Musicians. At issue was the declining demand for live appearances of artists because of the popularity of disc jockeys and recorded music. In 1944 the disputes were settled, and wartime controls on vinylite and shellac, the materials from which phonograph records were made, were eased.

By the 1950s listener loyalty to disc jockeys was so firmly established that the success of any record depended on the preferences of the disc jockey. To solicit their favour, record companies began to shower the disc jockeys with money, stocks, or gifts (commonly known as payola). This widespread practice of commercial bribery was given national exposure by a federal investigation in 1959. As a result, payola faded for a while, but in the mid-1980s new exposés revealed that the practice continued to exist in many quarters.

The disc jockey format was never as popular on television as on radio, with the exception of a few dance shows.

discharge printing, also called EXTRACT PRINTING, method of applying a design to dyed fabric by printing a colour-destroying agent, such as chlorine or hydrosulfite, to bleach out a white or light pattern on the darker coloured ground. In colour-discharge printing, a dye impervious to the bleaching agent is combined with it, producing a coloured design instead of white on the dyed ground. *See also* resist printing; roller printing.

Disciples of Christ, group of Protestant churches that originated in the religious revival movements of the American frontier in the early 19th century. The three major bodies are the Churches of Christ, the Christian Church (Disciples of Christ), and the Undenominational Fellowship of Christian Churches and Churches of Christ. Related churches exist outside the United States. All have attempted to restore what they have interpreted to be the "ancient order" of the church and have repudiated "human creeds."

A brief treatment of the Disciples of Christ churches follows. For full treatment, *see* MACROPAEDIA: Protestantism: *Disciples of Christ*.

The Great Western Revival (1801) produced a variety of religious movements dedicated to overcoming the barriers of denominationalism through a return to primitive Christianity. Two of these movements, located on the trans-Appalachian frontier and associated with the names of Thomas and Alexander Campbell and Barton W. Stone, merged in 1832 to become the Disciples of Christ. The new denomination grew rapidly with the frontier.

Despite the merger, the essential program of the Disciples—the unity of all Christians on the basis of New Testament faith and practice—failed to unite a divided Protestantism, and, in fact, proved to be divisive even within the movement as it struggled to define more precisely that common platform. (It must be noted that these controversies were reinforced by a series of historic, geographic, and cultural factors.) For the segment of Disciples that was to become the Churches of Christ, that platform meant that every aspect of faith, organization, and worship had to conform to New Testament prescription or precedent. Hence when societies for missions and for the publication of tracts appeared around 1849, and when churches began using reed organs to accompany congregational singing during worship, charges of unscriptural innovation were raised. A division over these issues emerged during and after the American Civil War and was formally ratified by a request from the conservatives for a separate listing in the 1906 U.S. census (*see* Christ, Church of).

Following a very different path, the Christian Church (Disciples of Christ) gradually abandoned its primitivist platform and advocated instead a program of unity based on an already existing and generally recognized common faith in Christ. This branch of Disciples is the most widely known of the three, in part because it has identifiable denominational structures including a general office and a biennial delegate assembly. It participates in the National Council of Churches and the World Council of Churches and generally supports the positions of these organizations in social and theological matters.

While some congregations have experimented with liturgical forms, typical Christian Church worship still generally retains the basic elements of prayer, singing, preaching, and a weekly memorial observance of the Lord's Supper. Congregations have a high level of autonomy but acknowledge regional and general structures as equal "manifestations" of the church. In recent years the quest for Christian unity has been pursued through participation in the Consultation on Church Union since its formation, and in 1985 the Disciples of Christ entered into an ecumenical partnership with the United Church of Christ.

A number of congregations tracing their roots to the Disciples movement neither claim affiliation with the Christian Church (Disciples of Christ) denomination nor reject the use of musical instruments in worship. Most of these congregations continue to hold to a "Restoration" program. They began to separate from the Christian Church (Disciples of Christ) during and after World War I over such issues as ecumenical cooperation in missions, biblical criticism, and the rising influence of liberal theology. As early as the 1920s alternative strategies for overseas missions were developed, Bible colleges were established to prepare a ministry true to the Restoration tradition, and in 1927 a separate annual gathering, the North American Christian Convention, was

called. The division was formalized in the late 1960s when the Christian Church (Disciples of Christ) underwent restructuring, and many conservative congregations still in some cooperation with that more liberal body formally withdrew. As a group they continue to reject denominational status, retaining their group identity as a "movement" mainly through periodicals, annual conventions, and Bible colleges and seminaries.

The World Convention of Churches of Christ remains the only institutional manifestation of the common Disciples of Christ heritage. Organized in 1930, it meets every five years for worship and fellowship. Some member groups originated independently of American Disciples but associate in the convention because of similarities of doctrine and practice.

Discipline, Manual of (Essene document): *see* Manual of Discipline.

Disco Island (Greenland): *see* Disko Island.

Discoglossidae, family of primitive toads (order Anura) whose tongues are disk-shaped. The family contains four genera, which are confined to the Old World. Representatives occur in Europe, northern Africa, China, Korea, and the Philippines.

Discoglossid genera have been discovered from Jurassic deposits in Europe and represent some of the oldest frog fossils known. Included in the family are the fire-bellied toad (*q.v.*), with its brilliantly coloured underside, and the midwife toad (*q.v.*), noted for the peculiar reproductive behaviour of the male caring for the eggs.

Discordia (in Roman mythology): *see* Eris.

discount rate, also called REDISCOUNT RATE, or BANK RATE, interest rate charged by a central bank for loans of reserve funds to commercial banks and other financial intermediaries. This charge used to be an actual discount (an interest charge held out from the amount loaned), but the rate is now a true interest charge, even though the term discount rate is still used.

The discount rate serves as an important indicator of the condition of credit in an economy. Because raising or lowering the discount rate alters the banks' borrowing costs and hence the rates that they charge on loans, adjustment of the discount rate is considered a tool to combat recession or inflation. The discount rate is also used to deal with balance-of-payments deficits—that is, to regulate international movements of capital.

discount store, in merchandising, retail store that sells products at prices lower than those asked by traditional retail outlets. Some, like department stores, offer wide assortments of goods; others specialize in jewelry, phonograph records, radios, or electrical appliances. Food stores also have been operated on the discount principle. Stores that are open only to certain groups, such as labour unions, cooperatives, or government employees, are often known as closed-door discount stores.

Discount stores existed in the United States as early as the 1930s but matured only after World War II. They were successful because of the great postwar demand for consumer goods, because of their supermarket techniques, and because of the collapse of fair-trade laws that required distributors to sell at prices set by the manufacturers. Discount stores spread to Europe, Latin America, and Australia.

Discoverer, any of a series of unmanned experimental satellites launched by the United States Air Force. Although the Discoverer satellites had several apparent applications—such as testing orbital maneuvering and reentry techniques—they are often regarded as a forerunner of the military reconnaissance satellite. *Discoverer 1* (launched Feb. 28, 1959) was equipped with a camera and an ejectable capsule capable of carrying exposed film back to Earth. Like later reconnaissance satellites, it was placed in a low polar orbit. By orbiting almost directly over the poles, *Discoverer* was in position to photograph the entire surface of the Earth every 24 hours. All other satellites in the series were launched into a similar fixed orbit. The capsule ejection system was repeatedly tested, but in-air payload recovery was achieved only once during the early years of the program: the capsule released by *Discoverer 14* (Aug. 18, 1960) was retrieved in midair by a C-119 transport plane. *Discoverer 38* was the last Discoverer model to be officially announced. After Feb. 27, 1962, further launchings were classified.

discovery, in law, pretrial procedures providing for the exchange of information between the parties involved in the proceedings. Discovery may be made through interrogatories, which consist of sending written questions from one side to the other in an attempt to secure important facts; and discovery may be made through depositions, whereby a witness is sworn and, in the presence of attorneys for both sides, is subjected to questions. The written record of the proceedings is also called a deposition and may be introduced later if the case does come to trial. Other forms of discovery include order of production and inspection (by which the opposing party may be required to produce important documents or other evidence) and requests for medical examination (for cases in which a party's mental or physical condition is at issue).

Discovery Bay, wide curved bay indenting the south coast of Australia. An inlet of the Indian Ocean, it is 50 mi (80 km) across and is bounded on the east by Cape Bridgewater (Victoria) and on the west by Cape Northumberland (South Australia). Visited in 1800 by Lieut. James Augustus Grant of the Royal Navy, it was named in 1836 by Thomas Livingstone Mitchell as he descended the Glenelg River, which enters the bay at Nelson. Settlement is sparse along the east shore but is dense around Port Macdonell in the west.

discriminant, in mathematics, a number calculated from the coefficients of an algebraic equation that gives information about the solutions. In the case of a quadratic equation $ax^2 + bx + c = 0$, the discriminant is $b^2 - 4ac$; for a cubic equation $x^3 + ax^2 + bx + c = 0$, the discriminant is $a^2b^2 + 18abc - 4b^3 - 4a^3c - 27c^2$. Accordingly, a quadratic or cubic equation with real coefficients has only real roots if its discriminant is positive, only real roots with at least two equal if its discriminant is zero, or two imaginary roots if its discriminant is negative. A discriminant can be found for the general quadratic, or conic, equation $ax^2 + bxy + cy^2 + dx + ey + f = 0$; it indicates whether the general quadratic represents an ellipse, a hyperbola, or a parabola.

The discriminants of differential equations are algebraic equations that reveal information about the families of solutions of the original equations.

discrimination, in psychology, the ability to perceive and respond to differences among stimuli. It is considered a more advanced form of learning than generalization (*q.v.*), the ability to perceive similarities, although animals can be trained to discriminate as well as generalize.

Application of discrimination procedures permits description of the sensory acuities of laboratory animals. For example, if a dog's salivation response is conditioned to a red light by pairing it with food, while a green light is intermittently presented always without food, the dog will salivate to red light but not to green. It then might be inferred that the dog discriminates between colours. If, however, the brightness of the green light is varied, a brightness will be discovered to which the dog salivates. No amount of additional discrimination training with red and green lights will lead to differential response. It then is concluded that the dog is colour-blind.

discus fish (*Symphysodon*), any of a genus of fishes (class Osteichthyes) in the family Cichlidae (order Perciformes), characterized by a compressed, disk-shaped body. The two species (*S. discus* and *S. aequifasciata*) occur naturally in tributaries of the Amazon River in South America. Discus fish have an unusual form of parental care: the adults secrete a mucus-like substance onto their skin that provides nourishment for the young. Some reports indicate that both parents are involved in the care of the young, taking turns "nursing the babies." Discus fish are difficult to keep in aquariums because of the strict water quality requirements necessary to keep them alive. Because of their spectacular wavy markings of blue and green, however, aquarium hobbyists persist in efforts to breed and raise them.

discus throw, track-and-field athletics sport of throwing a disk-shaped object known as a discus for distance. In modern competition the discus must be thrown from a circle 2.50 metres (8 feet 2½ inches) in diameter and fall within a 40° sector marked on the ground from the centre of the circle.

The sport was known in the days of the Greek poet Homer, who mentions it repeatedly, and it was one of five events included in the pentathlon in the ancient Olympic Games. Throwing the discus was introduced as an event in modern athletics when the Olympic Games were revived at Athens in 1896.

Early modern athletes threw the discus from an inclined pedestal, using an exaggerated style derived from ancient representations of the sport. Throwing from a 2.13-m (7-ft) circle on the ground superseded this, however, and the circle was enlarged to its present size in 1912.

The modern throwing style is a graceful whirling movement, with the athlete making about one and a half quick turns while accelerating across the circle. Thus, the discus is slung out and not really thrown at all; the difficulty lies in controlling the discus, which is retained under and against the hand and wrist chiefly by centrifugal force.

The modern discus is circular, about 219 mm (8⅝ in.) in diameter and 44 mm thick at its centre. It is made of wood or similar material, with a smooth metal rim and small, circular brass plates set flush into its sides. Its weight must be not less than 2 kg (4 lbs 6.5 oz).

A discus event was included when women's track and field was added to the Olympic program in 1928. A slightly smaller, 1-kg discus is used in women's events.

Notable discus throwers include Al Oerter (U.S.), who first broke the 61-m mark; Mac Wilkins (U.S.), who was first to officially break the 70-m mark; Lisel Westermann (W.Ger.), the first woman to break the 61-m mark; and Faina Melnik (U.S.S.R.), who broke the 70-m mark in women's competition. For world championship and World Cup winners, *see* Sporting Record: *Athletics (Track-and-Field)*. For Olympic champions, *see* Olympic Games.

disease, an impairment of the normal state of an organism that interrupts or modifies its vital functions.

A brief discussion of disease follows. The subject is treated in a variety of MACROPAEDIA articles. For a general discussion of human, animal, and plant diseases, *see* Disease. For a discussion of diseases categorized according to their cause or transmission, *see* Infectious Dis-

eases; Nutrition; Occupational Diseases and Disorders. For a discussion of diseases associated with particular stages of human development, *see* Childhood Diseases; Growth and Development. For a discussion of malignancy, which may affect any organ or tissue in the body, *see* Cancer. For a discussion of disease-causing organisms such as viruses, bacteria, and parasites, *see* Viruses; Protophytes. For a discussion of bodily defenses against disease, *see* Immunity. For a discussion of the diagnosis and treatment of disease, *see* Diagnosis and Therapeutics; Drugs and Drug Action; Medicine; Tissue Culture. For a discussion of diseases affecting particular organs, tissues, or processes, *see* Blood; Circulation and Circulatory Systems; Digestion and Digestive Systems; Endocrine Systems; Excretion and Excretory Systems; Integumentary Systems; Metabolism; Muscles and Muscle Systems; Nerves and Nervous Systems; Reproduction and Reproductive Systems; Respiration and Respiratory Systems; Sensory Reception; Supportive and Connective Tissues; Tissues and Fluids. For a discussion of neuroses and psychoses, *see* Mental Disorders. For a discussion of alcoholism and other drug addictions, *see* Alcohol and Drug Consumption: *Addiction, Habituation, and Dependence.*

Disease may result from invasion of the organism by one or more outside agents—*i.e.*, infectious organisms (such as bacteria, viruses, fungi, or parasitic worms) or nonliving but harmful substances (such as toxins or ionizing radiation). Disease may also result from endogenous changes within the organism—an anatomical fault (congenital or acquired) or a physiological malfunction. Other diseases are a mixture of exogenous and endogenous factors. An organism's failure to adapt to changes in its environment can produce damaging changes within it. Physiological malfunctions and disturbances of normal growth can be induced by changes of diet or by invasion of microorganisms or other agents.

Nearly all organisms have defensive mechanisms against the most common diseases that affect them. Humans and other vertebrates have a system of specific immunity. When these organisms are invaded by an outside agent not only do they develop mechanisms to detoxify, kill, or expel the agent, but they also retain these defenses. If the same agent invades again, it is eliminated more rapidly, often before it can cause disease. This immunity explains why human beings rarely get more than one attack of such viral diseases as measles, mumps, and chicken pox. Doctors and veterinarians also stimulate immunity artificially by inoculating humans or animals with killed microorganisms (as in typhoid vaccine) or weakened (attenuated) ones (as in measles vaccine), which produce the defensive immune reaction without producing the disease. Sometimes an organism's defensive reaction to invasion by an outside agent can become part of the disease. The crippling of the lungs that tuberculosis can produce is caused partly by the destruction of lung tissue by the invading microorganism, usually *Mycobacterium tuberculosis*, and partly by the fibrous tissue that the body lays around the infection in a defensive reaction.

Disorders of the immune response itself can produce autoimmune disease in which the immune response is triggered not by an outside invader but by the body's own tissues, which some cells fight against and try to reject.

Not all organisms that invade another produce disease. Some can set up a commensalistic or mutualistic relationship with their host without impairing its vital systems; and organisms that are pathogenic to one species may be harmless to another.

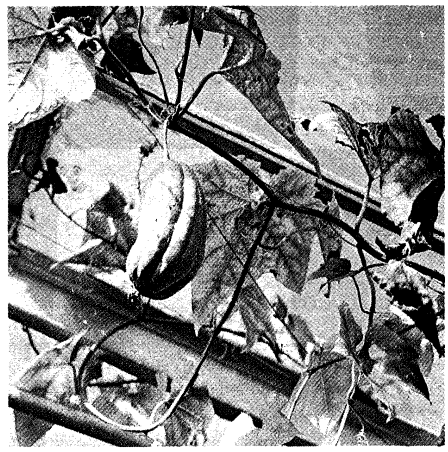
Most of the communicable diseases that one organism can transmit to another are caused by microorganisms or by larger parasites. These diseases can be prevented either by eliminating the pathogenic organism from the environment (as by killing pathogens or parasites existing in a water supply) or by placing a barrier in the path of its transmission from one organism to another (as by isolating individuals already infected).

Endogenous disease arising within an organism without any invasion by an outside agent is frequently caused by a biochemical defect—often inherited—that prevents the organism from handling natural materials it routinely encounters.

Disease can be prevented by eliminating the causative agent from the environment, moving the susceptible organism into an environment with which it can cope, strengthening the organism's defenses by making it healthier, or stimulating its defenses artificially with vaccination. Once established, disease can be treated by using drugs to kill the causative agent or to restore physiological or biochemical imbalances that have occurred, by moving the organism into another environment, or by removing the parts that are diseased.

disease, occupational: *see* occupational disease.

dishcloth gourd, also called VEGETABLE SPONGE, SPONGE GOURD, LUFFA, or LOOFAH, any of six species of annual climbing vines constituting the genus *Luffa*, of the gourd family (Cucurbitaceae). Dishcloth gourds are native to the Old World tropics. Two species cultivated in temperate areas are *L. acutangula* and *L. aegyptiaca.* The cucumber-shaped fruits, edible and greenish when young, become straw-coloured with age. They are about 30 centimetres (1 foot) long and have closely netted vascular bundles (food- and water-carrying tubes), the complex of which resembles a sponge in texture when the skin, pulp, and seeds are removed. The resulting sponge-like product is used for bathing, for washing dishes, and as an industrial filter.



Dishcloth gourd (*Luffa cylindrica*)
A to Z Botanical Collection—EB Inc.

disilicate (mineralogy): *see* phyllosilicate.

disinfectant, any substance, such as creosote or alcohol, applied to inanimate objects to kill microorganisms. Disinfectants and antiseptics are alike in that both are germicidal, but antiseptics are applied primarily to living tissue. The ideal disinfectant would rapidly destroy bacteria, fungi, viruses, and protozoans, would not be corrosive to surgical instruments, and would not destroy or discolour materials on which it is used.

disjunction, in logic, relation or connection of terms in a proposition to express the concept "or"; it is a statement of alternatives (sometimes called "alternation"). For clarity, exclusive disjunction (either x or y but not both), symbolized $x \not\equiv y$, must be distinguished from inclusive disjunction (either x or y or both x and y), symbolized $x \vee y$. *See also* implication.

disk bat, also called DISK-WING BAT (*Thyroptera*), either of two species of bats constituting the family Thyropteridae, inhabiting Central America and northern South America. They are small, reddish-brown bats, about 3.4 to 5.2 centimetres (1 to 2 inches) in length with tails about 2.4 to 3.3 cm long. Average weight is about 4 grams (0.14 ounces). Disk bats are distinguished by round pads at the base of the thumb and on the sole of the foot. These pads act as suction cups and enable the bats to cling to smooth, even glasslike, surfaces. One disk alone is capable of supporting the entire weight of the bat's body. Spix's disk bat (*T. tricolor*) lives in small, cohesive colonies and roosts in rolled-up leaves. It is unique among bats for its "heads-up" roosting posture.

disk jockey: *see* disc jockey.

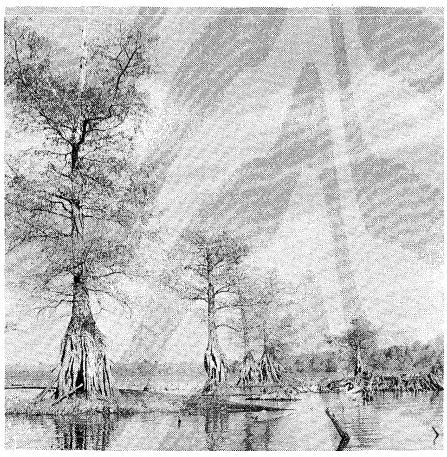
Disko Island, also spelled DISCO, Greenlandic QEQERTARSSUAP, island in Davis Strait off western Greenland, northwest of Disko Bugt (bay) and southwest of Vaigat Strait. It is 80 mi (130 km) long, 20–75 mi wide, 3,312 sq mi (8,578 sq km) in area, and has a maximum elevation of 6,296 ft (1,919 m). There are coal and iron deposits, and some lignite is mined around Qullissat in the northeast. Godhavn (Greenlandic: Qeqertarsuaq), the largest settlement, was established in 1773. The island, was first explored by Erik the Red *c.* 984. Pop. (1982) 1,047.

dislocation, in physiology and medicine, displacement of the bones forming a joint, with consequent disruption of tissues. Dislocations are caused by stresses forceful enough to overcome the resistance of the ligaments, muscles, and capsule that hold the joint in place. A dislocation is called simple when the joint surfaces are not exposed to the air; it is called compound when the joint surfaces are exposed by destruction of overlying skin or by the end of a bone piercing the skin. A congenital dislocation is present at birth as the result of defective formation of the joint. A recurrent, or habitual, dislocation (repeated dislocation of the same joint) may be the result of improper healing of an old injury or may be natural, as in "double joints," common in fingers and toes, which are the result of loose ligamentation. A pathological dislocation occurs as the result of a disease, such as Marfan's syndrome, which weakens the capsule and ligaments about the joint.

Symptoms of dislocation include pain and tenderness at the site, a sensation of grating or grinding on attempting to use the part, and inability to use the part. Common signs are deformed appearance of the joint, swelling of surrounding tissue, and discoloration of the overlying skin. X-ray examination is useful to indicate the extent of the injury. Simple dislocations are treated by returning the bones to their normal position (reduction) by manipulation or occasionally by traction. The joint is then kept immobile until healing is complete. Recurrent and congenital dislocations are special problems that usually require surgical reconstruction of the joint.

Dismal Swamp, also called GREAT DISMAL SWAMP, marshy region on the Coastal Plain of southeastern Virginia and northeastern North Carolina, U.S., between Norfolk, Va., and Elizabeth City, N.C. The swamp is densely forested and contains scattered natural elevations of 10 to 20 ft (3 to 6 m) above sea level. Along the western margin the Pamlico Formation (known as the Dismal Swamp Terrace) rises to 25 ft and more, forming a natural boundary. The name Great Dismal was given

by Col. William Byrd of Virginia, who surveyed it in 1728. In 1763 George Washington, as a member of a surveying and engineering company, surveyed the area with a view to canalizing, draining, and reclaiming it. At that time the swamp was about 40 mi (65 km) long and covered about 2,000 sq mi (5,200 sq km). In the late 18th century 40,000 ac (16,000



Lake Drummond in the centre of Dismal Swamp, Virginia

By courtesy of the Virginia Department of Conservation and Economic Development

ha) were drained. The swamp is now about 37 mi long north to south and covers an area of approximately 750 sq mi. Despite much lumbering and widespread destruction of timber by fire, the area is still heavily wooded with cypress, black gum, juniper and water ash, and a tangle of honeysuckle and woodbine. The swamp is the habitat of many rare birds, including the ivory-billed woodpecker. The cottonmouth and other poisonous snakes are numerous. It is noted for fishing and hunting; deer, bear, raccoon, and opossum are plentiful, especially in the nearly inaccessible Coldwater Ditch area.

The Dismal Swamp Canal (built 1790–1828) is a 22-mi-long north–south intracoastal waterway connecting Chesapeake Bay, by way of Deep Creek and the southern branch of the Elizabeth River, with Albemarle Sound in North Carolina through the Pasquotank River. The canal forms a link in the Atlantic Intracoastal Waterway. In the midst of the swamp is the freshwater Lake Drummond (about 3 mi in diameter), which is connected with the canal by the 3-mi-long Feeder Ditch; this lake is the basis of the poem *The Lake of the Dismal Swamp,* by the Irish poet Thomas Moore.

Disney, Walt, byname of WALTER ELIAS DISNEY (b. Dec. 5, 1901, Chicago—d. Dec. 15, 1966, Los Angeles), U.S. motion-picture and television producer and showman, famous as a pioneer of animated cartoon films and as the creator of such cartoon characters as Mickey Mouse and Donald Duck. He also planned and built Disneyland, a huge amusement park that opened near Los Angeles in 1955, and before his death he had begun building a second such park, Walt Disney World, near Orlando, Fla. (opened 1971).

Early life. Walter Elias Disney was the fourth son of Elias Disney, a peripatetic carpenter, farmer, and building contractor, and his wife, Flora Call, who had been a public school teacher. When Walt was little more than an infant, the family moved to a farm near Marceline, Mo., a typical small Midwestern town, which is said to have furnished the inspiration and model for the Main Street U.S.A. of Disneyland. Here Walt began his schooling and first showed a taste and aptitude for drawing and painting with crayons and watercolours.

His restless father soon abandoned his efforts at farming and moved the family to Kansas City, Mo., where he bought a morning newspaper route and compelled his young sons to assist him in delivering papers to home subscribers in rain or shine. Walt later said that many of the habits and compulsions of his adult life stemmed from the disciplines and discomforts of helping his father with the paper route. In Kansas City the young Walt began to study cartooning with a correspondence school and later took classes at the Kansas City Art Institute and School of Design.

In 1917 the Disneys moved back to Chicago, and Walt entered McKinley High, where he took photographs, made drawings for the school paper, and studied cartooning on the side, for he was hopeful of eventually achieving a job as a newspaper cartoonist. But his progress was interrupted by World War I, in which he participated as a truck driver for the American Red Cross in France and Germany.

Returning to Kansas City in 1919, he found occasional employment as a draftsman and inker in commercial art studios, where he met Ub Iwerks, a young artist who was to prove perhaps the most fortunate associate of his career after his brother Roy, who was his partner and strongest counsellor throughout life.

First animated cartoons. Dissatisfied with their progress, Disney and Iwerks started a small studio of their own and acquired a second-hand motion-picture camera with which they made one-and two-minute animated advertising films shown on local movie-theatre programs, much as commercials are shown on television today. They also did a series of animated cartoon sketches called "Laugh-O-Grams" and a series of seven-minute animated fairy tales, which they called "Alice in Cartoonland." A New York film distributor cheated the young producers, and, destitute and disheartened, Disney left for Los Angeles to join his brother Roy.

With Roy as business manager, Disney resumed the "Alice" series, persuading Iwerks to join him and assist with the drawing of the cartoons. They invented a character called Oswald the Rabbit, contracted for distribution of the films at $1,500 each, and propitiously launched their small enterprise. Just before the transition to sound in motion pictures in 1927, Disney and Iwerks experimented with a new character—a cheerful, energetic, and mischievous mouse called Mickey. They planned two shorts, called *Plane Crazy* and *Gallopin' Gaucho,* that were to introduce Mickey Mouse when *The Jazz Singer,* a motion picture with the popular singer Al Jolson, brought the novelty of sound to the movies. Fully recognizing

Walt Disney

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the possibilities for sound in animated-cartoon films, Disney quickly produced a third Mickey Mouse cartoon equipped with voices and music, entitled *Steamboat Willie,* casting the other two soundless cartoon films aside. When it appeared in 1928, *Steamboat Willie* was a sensation.

The following year Disney started a new series called "Silly Symphonies" with a picture entitled *The Skeleton Dance,* in which a skeleton rose from the graveyard and did a grotesque, clattering dance to the music of Saint-Saëns's *Danse macabre.* Original and briskly syncopated, the film launched the series most successfully, but, with costs mounting because of the more complicated drawing and technical work, Disney's operation was continually in peril.

The growing popularity of Mickey Mouse and his girl friend, Minnie, however, attested to the public's taste for the fantasy of little creatures with the speech, skills, and personality traits of human beings. (Disney himself provided the voice for Mickey.) This popularity led to the invention of other animal characters; such as Donald Duck and the dogs Pluto and Goofy. In 1933 Disney produced a short, *The Three Little Pigs,* which arrived in the midst of the Great Depression and took the country by storm. Its treatment of the fairy tale of the little pig who works hard and builds his house of brick against the huffing and puffing of a threatening wolf suited the need for fortitude in the face of economic disaster; and its song "Who's Afraid of the Big Bad Wolf " was a happy taunting of adversity. It was in this period of economic hard times in the early 1930s that Disney fully endeared himself and his cartoons to audiences all over the world, and his operation began making money in spite of the Depression.

Through successive additions and advances in the animated-cartoon field, Disney continued to progress all through the 1930s. He had now gathered a staff of creative young people, who were headed by Iwerks. Colour was introduced in the "Silly Symphony" film *Flowers and Trees* (1932), while other animal characters came and went in films such as *The Grasshopper and the Ants* (1934) and *The Tortoise and the Hare* (1935). Roy franchised tie-in sales with the cartoons of Mickey Mouse and Donald Duck—watches, dolls, shirts, and tops—and reaped more wealth for the company.

Feature-length cartoons. Walt Disney was never one to rest or stand still. He had long thought of producing feature-length animated films in addition to the shorts. In 1935 he began work on a version of the classic fairy tale that he called *Snow White and the Seven Dwarfs,* a project that required great organization and coordination of the creative and technical talents in his studio. Disney possessed a unique taste and capacity for such a task. While he actively engaged in all phases of creation in his films, he functioned chiefly as coordinator and final decision maker rather than as designer and artist. *Snow White* was widely acclaimed by critics and audiences alike as an amusing and sentimental romance. By animating substantially human figures in the characters of Snow White, the Prince, and the Wicked Queen and by forming caricatures of human figures in the seven dwarfs, Disney departed from the scope and techniques of the shorts and thus made a momentous transition in the nature of his type of film. While he continued for a while to do short films presenting the anthropomorphic characters of his little animals, he was henceforth to develop a wide variety of full-length entertainment films.

Snow White was followed three years later by other feature-length classics for children, *Pinocchio* (1940) and *Dumbo* (1941), the story of an elephant that could fly; and then Disney produced another totally unusual and exciting film—his multisegmented and stylized *Fanta-*

sia (1940), in which cartoon figures and colour patterns were made to move to the music of Igor Stravinsky, Paul Dukas, Peter Tchaikovsky, and others. In 1940 Disney moved his company into a new studio in Burbank, Calif., abandoning the old plant it had occupied in the early days of growth.

Major films and television productions. During World War II, the Disney studio did a great deal of work for the military and the federal government, in the course of which it perfected the methods of combined live action and cartoon. After the war, Disney made many films with these hybrid techniques: *The Reluctant Dragon* (1941), *Saludos Amigos* (1942), *The Three Caballeros* (1944), *Make Mine Music* (1946), and *Song of the South* (1946).

The Disney studios were now established as a big-business enterprise, and they began to produce a variety of entertainment films. One popular series, called "True-Life Adventures," featured actual motion pictures of nature, but they were usually so trickily edited that, rather than being true-to-life documentaries, they betrayed the Disney tendency to fantasize. Among these were *Seal Island* (1948), *Beaver Valley* (1950), and *The Living Desert* (1953). They also turned to production of full-length animation romances, such as *Cinderella* (1950), *Alice in Wonderland* (1951), and *Peter Pan* (1953), and produced low-budget, live-action films, including *The Parent Trap* and *The Absent-Minded Professor* in 1961.

The Disney studio was among the first to foresee the potentialities of television as a popular-entertainment medium and to produce films directly for it. The *Zorro* and *Davy Crockett* series were very popular with children, and *Walt Disney's Wonderful World of Color* became a continuing television fixture. But the climax of Disney's career as a theatrical film producer came with his release of the motion picture *Mary Poppins* in 1964. This adaptation of the popular children's story by Pamela L. Travers won worldwide popularity.

Disneyland. Meanwhile, back in the early 1950s, Disney had initiated plans for a huge amusement park to be built near Los Angeles. When Disneyland opened in 1955, much of Disney's disposition toward nostalgic sentiment and fantasy was evident in its design and construction. It soon became a mecca for tourists from all over the world. A second Disney park, Walt Disney World, near Orlando, Fla., which was under construction at the time of his death, opened in 1971.

Critical evaluation. Disney's imagination and energy, his whimsical humour, and his gift for being attuned to the vagaries of popular taste inspired him to develop well-loved amusements for "children of all ages" throughout the world. His achievement as a creator of entertainment for an almost unlimited public and as a highly ingenious merchandiser of his wares may be compared to that of a successful industrialist. (B.Cr./Ed.)

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Disney Company, in full WALT DISNEY COMPANY, formerly (1929–86) WALT DISNEY PRODUCTIONS, American corporation that became the best-known purveyor of children's entertainment in the 20th century. Its headquarters are in Burbank, Calif.

The company was founded by the motion-picture animator Walt Disney and his businessman brother Roy in 1929 under the name Walt Disney Productions to incorporate the brothers' studio, which produced animated motion-picture cartoons. Disney cartoons featuring Mickey Mouse, Minnie Mouse, Donald Duck, and Pluto achieved wide popularity in the United States in the 1930s, and their success encouraged the company to produce *Snow White and the Seven Dwarfs* (1937), the first feature-length animated cartoon. *Snow White* was followed by several other feature-length cartoons that are now regarded as classics of animation.

When the rising labour costs of animation in the late 1940s began to make full-length animated cartoons too expensive to produce, the Disney company began making nature documentaries and live-action motion pictures, as well as short cartoons and live-action programs for television. In 1955 the company opened the Disneyland amusement park, one of the world's most famous, in Anaheim, Calif. The park occupies a 75-acre (30-hectare) site and has different sections devoted to specific themes. A second and larger amusement complex, Walt Disney World, was opened near Orlando, Fla., in 1971. Besides containing the Epcot Center and Magic Kingdom theme parks, Disney World contains hotels, resort accommodations, and sports and other recreational facilities.

The Disney corporation declined after Walt Disney's death in 1966 deprived the company of its chief innovator. The company was revitalized under new management in the 1980s, however, and its motion-picture production unit subsequently became one of the most successful in the United States. In 1983 an unrelated Japanese corporation opened Tokyo Disneyland near Tokyo, with the Walt Disney Company receiving royalties from that venture. The Disney Company itself undertook the building of a Disneyland theme park near Paris that was scheduled to open in the early 1990s. In 1990 the Disney Company acquired Henson Associates, Inc., the company that owned many of the puppetlike characters known as the Muppets.

disorderly conduct, in law, intentional disturbing of the public peace and order by language or other conduct. It is a general term including various offenses that are usually punishable by minor penalties.

Disorderly conduct may take the form of directly disturbing the peace, as when one intentionally disrupts a public meeting or awakens a sleeping community. Less directly, it includes fighting in a public place, although it does not apply to one who defends himself on being attacked. Most jurisdictions penalize displays of public drunkenness. Some maintain vagrancy statutes that penalize persons found to be idle and without visible means of support. These may include prostitutes, beggars, gamblers, or alcoholics.

dispensation, in ecclesiastical law, the action of a competent authority in granting relief from the strict application of a law. It may be anticipatory or retrospective.

Economy is the term normally used in the Eastern Orthodox churches for this type of action. The church strives for the salvation of souls, and when this is more likely to be achieved by a relaxation of a rule rather than by a strict adherence to it, economy permits the relaxation. With typical Orthodox elasticity, no canon defines the limits or use of economy, though certain broad principles are discernible. Thus, to run counter to fundamental dogma is permissible when this is conducive to the greater good of the church and the salvation of souls. Lack of precision is also found with regard to the persons who may exercise economy. All bishops exercise it in their own right and not by delegation; but they should have regard to the views of episcopal synods, which themselves exercise economy, though only after consultation with the bishop of the district within which it is to be exercised. Above both the bishop and the synod is the general council, which can exercise economy of its own and can reverse the decisions of synods and bishops. Below the bishop is the priest, who exercises economy in day-to-day matters but whose authority is delegated to him by the bishop.

The Western Christian churches have evolved rules with regard to dispensation with far greater precision and, in the Roman Catholic church, in some detail. At first, it was held that only the common good of the church as a whole justified the granting of a dispensation and that only the person or body that made the laws, whether pope, synod, or bishop, could dispense from them. With the development of canon law and the growth of the power of the papacy, however, it came to be accepted that the ultimate dispensing power resided in the pope, though it could be delegated by him to subordinate persons and bodies. The field over which dispensation could operate was significantly widened, for, whereas formerly the divine law and the natural law were outside the scope of the dispensing power, the view was gradually reached that the jurisdiction of the pope, while unable to abrogate the divine or the natural law, could nevertheless dispense from the obligations imposed by them and from their effects in particular cases, though only where the ultimate object of such laws was not thereby thwarted.

Gradually, dispensations were granted solely for the benefit of individuals, regardless of whether or not the whole church could be said to benefit thereby, and the belief that such dispensations were granted too frequently and for financial gain was a factor contributing to the movement that led to the Protestant Reformation. The Council of Trent (1545–63) tried to guard against abuses but left intact the papal authority, and the Roman Catholic system of dispensation today is essentially the same as that which had developed by the end of the Middle Ages. While the authority that has the power to legislate may dispense from its own legislation, so also may its superior; and the subordinate authority's power may be limited by superior authority. The ultimate authority resides in the pope.

In England, the Reformation, inspired at least in part by the pope's refusal to grant Henry VIII a dispensation from his marriage to Catherine of Aragon, put an end to the papal authority in this and all other spheres of its previous jurisdiction. The need for a dispensing authority was, however, recognized, and a statute in 1534, which reserved for the bishops the power to dispense "in all cases in which they were wont to dispense by the common law or custom of this realm before the making of this Act," conferred upon the archbishop of Canterbury the power of dispensing formerly exercised by the pope, subject in the more important cases to royal confirmation and "for causes not being contrary or repugnant to the Holy Scriptures and laws of God." These provisions, however, have remained largely a dead letter, with the consequent lack of any ordered, practical system of dispensation in the Church of England.

dispersal, in biology, the dissemination, or scattering, of organisms over periods within a given area or over the Earth.

A brief treatment of dispersal follows. For full treatment, *see* MACROPAEDIA: Biosphere.

The two disciplines most intimately intertwined with the study of dispersal are systematics and evolution. Systematics is concerned with the relationships between organisms and includes the classification of life into ordered groups, providing the detailed information essential to all biology. The study of evolution grew from a combination of systematics and dispersal, or distribution, as both Charles Dar-

win and Alfred Russel Wallace, pioneers in evolutionary biology, attested; and in turn, an understanding of the process of natural selection has illuminated the reasons for changes in distribution in the history of the Earth.

A specific type of organism can establish one of three possible patterns of dispersal in a given area: a random pattern; an aggregated pattern, in which organisms gather in clumps; or a uniform pattern, with a roughly equal spacing of individuals. The type of pattern often results from the nature of the relationships within the population. Social animals, such as chimpanzees, tend to gather in groups, while territorial animals, such as birds, tend to assume uniform spacing. Close attention must be paid to the scale of study in order to get an accurate reading of these patterns. If a group of monkeys occupies three widely separated trees, their spacing will obviously be aggregate; yet in each tree, their spacing may appear to be uniform.

Distribution can be affected by time of day, month, or year. The most common form of distributional change occurs among migratory animals, which may be plentiful in the summer months and virtually absent in the winter. The forces governing the dispersal of organisms are either vectorial (directed motion), that is, caused by wind, water, or some other environmental motion, or stochastic (random), as in the case of the change in seasons, which gives no indication of where the dispersing organisms may ultimately settle. Dispersal may also be affected by the interrelationship of species with one another or with nutrients. Competition between species that depend on the same food types often leads to the elimination of one species, just as the extent of plant life often determines the boundaries of a species' territory.

The irregularities of most distribution patterns are simplified in the case of life forms dependent upon relatively restricted habitats, like that of intertidal mollusks, which have an almost linear distribution along rocky seacoasts. A few species, most notably humans and the animals dependent upon them, have a worldwide distribution.

Among both plants and animals, dispersal usually takes place at the time of reproduction. When overcrowding forces individuals to range outside the area in which they were born to find a mate or food, new populations occasionally arise. Insects often display distinctive abilities in this regard. East African locusts have been found in two forms, a bright green variety, which is sluggish and solitary, and a highly mobile, group-oriented, dark-coloured form that swarms in enormous numbers, eating all plant material in its path. It has been found that if the young of the green variety are raised in large, constricted groups, they metamorphosize into the dark form at maturity. This is called phase polymorphism. As their numbers increase and the food supply thins, the locusts undergo developmental and behavioral changes to produce the widest dispersal pattern possible.

Occasionally, natural selection acts to limit the dispersal of a species. On high mountaintops and isolated islands, for example, the predominance of flightless birds and insects is notable.

Organisms are also spread by passive means, such as wind, water, and by other creatures. This method is hardly less effective than active dispersal; spiders, mites, and insects have been collected by airplanes over the Pacific as much as 3,100 km (about 1,900 miles) from land. Plants regularly spread their seeds and spores by the action of the wind and water, often with morphological adaptations to increase their potential range, as in the case of milkweed seeds.

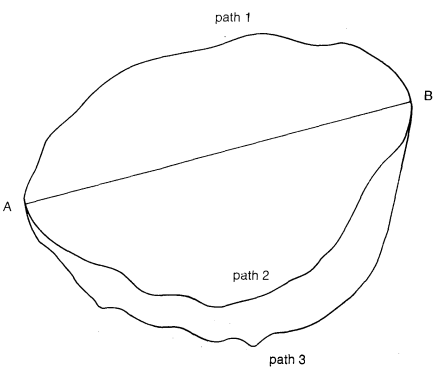
Seeds are also spread by animals, often as undigested matter in the excrement of birds or mammals, or by attaching to animals via an assortment of hooks, barbs, and sticky substances. Parasites regularly use either their hosts or other creatures as distribution mechanisms. The myxoma virus, a parasite in rabbits, is carried by mosquitoes, which may travel as far as 64 km (40 miles) before infecting another rabbit.

Mountains and oceans can be effective barriers to the dispersal of organisms, as can stretches of desert or other climatological extremes. Some organisms can cross these barriers; birds can cross the English Channel, while bears cannot. In such cases, the paths of the more mobile animals are called filter routes.

Over geologic ages there have been many dramatic changes in climate that have affected distribution and even the survival of many life forms. Futhermore, the continents appear to have undergone large-scale displacements (*see* continental drift), separating many species and encouraging their independent development. But the greatest factor in the dispersal of organisms, at least during the past 10,000 years, has been human influence.

dispersion, in wave motion, any phenomenon associated with the propagation of individual waves at speeds that depend on their wavelengths. Ocean waves, for example, move at speeds proportional to the square root of their wavelengths; these speeds vary from a few feet per second for ripples to hundreds of miles per hour for tsunamis. A wave of light has a speed in a transparent medium that varies inversely with the index of refraction (a measure of the angle by which the direction of a wave is changed as it moves from one medium into another). Any transparent medium—*e.g.,* a glass prism—will cause an incident parallel beam of light to fan out according to the refractive index of the glass for each of the component wavelengths, or colours. Dispersion is sometimes called the separation of light into colours, an effect more properly called angular dispersion.

displacement, in mechanics, distance moved by a particle or body in a specific direction. It is a vector quantity, possessing both magnitude and direction. In the Figure, A is the initial position of a point, B is the final position, and the vector directed from A to B is the displacement. The distance traveled by the point depends on the path that it follows; it will be equal to the magnitude of the displacement only if the path is straight. In mechanics, it is frequently necessary to distinguish between the distance that a point moves—or through which a force acts—and the displacement of the point or the force.



Displacement

displacement, electric: *see* electric displacement.

displacement activity, the performance by an animal of an act inappropriate for the stimulus or stimuli that evoked it. Displacement behaviour usually occurs when an animal is torn between two conflicting drives, such as fear and aggression. Displacement activities often consist of comfort movements, such as grooming, scratching, drinking, or eating. In courtship, for example, an individual afraid of its mate may, instead of fleeing or courting, stand still and feed or groom itself.

displacement current, in electromagnetism, a phenomenon analogous to an ordinary electric current, posited to explain magnetic fields that are produced by changing electric fields. Ordinary electric currents, called conduction currents, whether steady or varying, produce an accompanying magnetic field in the vicinity of the current. The British physicist James Clerk Maxwell in the 19th century predicted that a magnetic field also must be associated with a changing electric field even in the absence of a conduction current, a theory that was subsequently verified experimentally. As magnetic fields had long been associated with currents, the predicted magnetic field also was thought of as stemming from another kind of current. Maxwell gave it the name displacement current, which was proportional to the rate of change of the electric field that kept cropping up naturally in his theoretical formulations.

As electric charges do not flow through the insulation from one plate of a capacitor to the other, there is no conduction current; instead, a displacement current is said to be present to account for the continuity of the magnetic effects. In fact, the calculated size of the displacement current between the plates of a capacitor being charged and discharged in an alternating-current circuit is equal to the size of the conduction current in the wires leading to and from the capacitor. Displacement currents play a central role in the propagation of electromagnetic radiation, such as light and radio waves, through empty space. A traveling, varying magnetic field is everywhere associated with a periodically changing electric field that may be conceived in terms of a displacement current. Maxwell's insight on displacement current, therefore, made it possible to understand electromagnetic waves as being propagated through space completely detached from electric currents in conductors.

displacement law, in physics, any of the statements (originally formulated in 1913) that radioactive decay produces daughter atoms whose position in the periodic table of the chemical elements is shifted from that of their parents: two lower for alpha decay and one higher for negative beta decay. *See* radioactive series.

display behaviour, ritualized behaviour by which an animal provides specific information to others, usually members of its own species. Virtually all higher animals use displays to some extent. The best-known displays are visual ones—and some biologists restrict the term display to visual signals or gestures—but many also incorporate sound, smell, or even touch. Displays evolve through the ritualization of specific behaviour patterns. Some mating displays evolve from food-giving behaviours; the male bobwhite quail gives a food call and offers a tidbit to his potential mate. In many birds the food-giving behaviour is completely ritualized and proceeds without any exchange of food; domestic cocks, for example, call and peck at bare ground to attract a hen.

Agonistic (aggressive) displays usually occur near the borders of a territory. When a strange howler monkey approaches the territory of others, resident males set up a tremendous din, warning the intruder off. Many songbirds sit on highly visible perches while singing, providing both auditory and visual displays. Agonistic display is adaptive in conserving energy, making it unnecessary for the resident animal

to chase others away. Furthermore, where display occurs, injury is rare, as physical contact is rarely required. An impending threat to the group may provoke display behaviour that is protective, signaling danger at the approach of a predator.

Another type of display behaviour is that designed to deceive a predator or lure it away from vulnerable young. An example is the broken-wing display—where the parent flutters along the ground as if injured—used by many birds to lure predators away from the nests. *See also* alarm signal; courtship; territorial behaviour.

disposable income, that portion of an individual's income over which the recipient has complete discretion. An accurate general definition of income is not easy to provide. Income includes wages and salaries, interest and dividend payments from financial assets, and rents and net profits from businesses. Capital gains on real or financial assets should also be counted as income in most cases, at least insofar as they increase spending power. Such gains may even be counted where the asset is not actually sold and the increase in spending power is not exercised. In addition, receipts not in the form of cash—income in kind—may be included.

Disposable income involves a further adjustment to exclude obligatory payments in the form of direct taxes, compulsory payments to social-insurance schemes, and the like and to include simple transfers from other persons, institutions, or the government such as social-security benefits, pensions, and alimony. In some cases the boundary between voluntary and obligatory payments is blurred so that the meaning of disposable income becomes ambiguous. Also, a distinction may have to be made between transfer income to which a person is entitled and that which is actually received.

By convention, indirect taxes, such as value-added and other sales taxes, payroll taxes, and employers' contributions to social insurance, are not deducted from the computation of disposable income. Although these clearly reduce private spending power generally, it is difficult to attribute their incidence to specific persons and families. It should also be noted that when members of families or other units share in a "pool" of income, there may be a substantial divergence between a person's nominal disposable income (as recorded, for example, on his paycheck) and his actual discretionary spending power. Thus, a person who appears in official statistics as having a very low after-tax income may in fact be a part-time worker contributing to, and sharing in, his family's joint resources.

To compare flows of disposable income at different points in time, in different countries, or even in different locations within a country, the measured values of such incomes must be adjusted to allow for variations in the cost of living. Even after such adjustments have been made, disposable income should not be confused with standard of living (*q.v.*) or with economic welfare, the actual standard of consumption that a person has achieved.

Disraeli, Benjamin, EARL OF BEACONSFIELD, VISCOUNT HUGHENDEN OF HUGHENDEN, byname DIZZY (b. Dec. 21, 1804, London, Eng.—d. April 19, 1881, London), British statesman and novelist who was twice prime minister (1868, 1874–80) and who provided the Conservative Party with a twofold policy of Tory democracy and imperialism.

Early life. Disraeli was of Italian-Jewish descent, the eldest son and second child of Isaac D'Israeli and Maria Basevi. The most important event in Disraeli's boyhood was his father's quarrel in 1813 with the synagogue of Bevis Marks, which led to the decision in 1817 to have his children baptized as Christians. Until 1858 Jews by religion were excluded

Disraeli, albumen print by W. & D. Downey

By courtesy of the Gernsheim Collection, the University of Texas at Austin

from Parliament; except for the father's decision Disraeli's political career could never have taken the form it did.

Disraeli was educated at small private schools. At the age of 17 he was articled to a firm of solicitors, but he longed to become notable in a more sensational manner. His first efforts were disastrous. In 1824 he speculated recklessly in South American mining shares, and, when he lost all a year later, he was left so badly in debt that he did not recover until well past middle age. Earlier he had persuaded the publisher John Murray, his father's friend, to launch a daily newspaper, the *Representative.* It was a complete failure. Disraeli, unable to pay his promised share of the capital, quarreled with Murray and others. Moreover, in his novel *Vivian Grey* (1826–27), published anonymously, he lampooned Murray while telling the story of the failure. Disraeli was unmasked as the author, and he was widely criticized.

Disraeli suffered what would later be called a nervous breakdown and did little during the next four years. He wrote another extravagant novel, *The Young Duke* (1831), and in 1830 began 16 months of travel in the Mediterranean countries and the Middle East. These travels not only furnished him with material for Oriental descriptions he used in later novels but also influenced his attitude in foreign relations with India, Egypt, and Turkey in the 1870s.

Back in England, he was active in London social and literary life, where his dandified dress, conceit and affectation, and exotic good looks made him a striking if not always popular figure. He was invited to fashionable parties and met most of the celebrities of the day. His novel *Contarini Fleming* (1832) has considerable autobiographical interest, like many of his novels, as well as echoes of his political thought.

Political beginnings. By 1831 Disraeli had decided to enter politics and sought a seat in Buckinghamshire, near Wycombe, where his family had settled. As an independent radical, he stood for and lost High Wycombe twice in 1832 and once in 1835. Realizing that he must attach himself to one of the political parties, he made a somewhat eccentric interpretation of Toryism, which some features of his radicalism fitted. In 1835 he unsuccessfully stood for Taunton as the official Conservative candidate. His extravagant behaviour, great debts, and open liaison with Henrietta, wife of Sir Francis Sykes (the prototype of the heroine in his novel *Henrietta Temple* [1837]), all gave him a dubious reputation. In 1837, however, he successfully stood for Maidstone in Kent as the Conservative candidate. His maiden speech in the House of Commons was a failure. Elaborate metaphors, affected mannerisms, and foppish dress led to his being shouted down. But he was not silenced. He concluded, defiantly and prophetically, "I will sit down now, but the time will come when you will hear me."

Before long, Disraeli became a speaker who commanded attention. He established his social position by marrying in 1839 Mrs. Wyndham Lewis, a widow with a life interest in a London house and £4,000 a year. She was deeply devoted to Disraeli, and when he teased her in company that he had married for her worldly goods, she would say: "Dizzy married me for my money but if he had the chance again he would marry me for love." Her husband agreed.

Breach with Peel. The Conservative leader, Sir Robert Peel, encouraged Disraeli, but when in 1841 the Conservatives won the election and Peel became prime minister, Disraeli was not given office in the Cabinet. He was mortified at the rebuff, and his attitude toward Peel and his brand of Conservatism became increasingly critical. A group of young Tories, nicknamed Young England, and led by George Smythe (later Lord Stangford), looked to Disraeli for inspiration, and he obliged them, notably in his novel *Coningsby; or The New Generation* (1844), in which the hero is patterned on Smythe, and the cool, pragmatic, humdrum, middle-class Conservatism that Peel represented is contrasted to Young England's romantic, aristocratic, nostalgic, and escapist attitude.

In 1845, when the combination of the Irish famine and the arguments of Richard Cobden convinced Peel to repeal the protective duties on foreign imported grain known as the Corn Laws, Disraeli found his issue. Young England could rally against Peel not only their own members but the great mass of the country squires who formed the backbone of the Conservative Party. As lieutenant to Lord George Bentinck, the nominal leader of the rebels, Disraeli consolidated the opposition to Peel in a series of brilliant speeches. His invective greatly embittered the battle and created lasting resentment among Peel's followers. While Disraeli and his fellow protectionists could not stop the repeal of the Corn Laws because the Whigs also backed the bill, the rebels put Peel in the minority on another issue and forced him to resign in 1846.

Conservative leader. The loyalty of most of the Conservative former ministers to Peel and the death of Bentinck made Disraeli indisputably the leader of the opposition in the Commons. Disraeli spent the next few years trying to extricate his party from what he had come to recognize as the "hopeless cause" of protection. While Disraeli's policy was sensible, it raised mistrust among his followers, as did his pride in and insistence upon his Jewish ancestry. The party could not, however, do without his talents. His election to Parliament as member for Buckinghamshire in 1847 and his purchase of Hughenden Manor, near High Wycombe, in 1848 fortified his social and political power. His finances, however, remained shaky.

When the Whig government fell in 1852 and the Earl of Derby, leader of the Conservative Party, formed a short-lived minority government, Disraeli was chancellor of the Exchequer despite his protest that he knew nothing of finance. His budget in fact brought the government down in 1852, though Disraeli could hardly be blamed. The free-trade majority in the House was determined to defeat measures that relieved agriculture, even though the method chosen did not involve protection; yet Disraeli had to bring forward some such proposals to placate his followers. Again, until 1858, the Tories were in opposition. Then Derby again formed a minority government with Disraeli as chancellor of the Exchequer. Disraeli for some time had felt

there was no reason to allow parliamentary reform to be a Whig monopoly, and so he introduced a moderate reform bill in 1859. The bill, however, seemed too obviously designed to help his party, and so it was defeated; the Tories again were out of office and remained so for six years.

In 1865 when the Whig-Liberal leader Lord Russell brought forward a moderate reform bill, a combination of Tory opposition and a revolt against Russell toppled his government. Derby formed his third minority government with Disraeli as chancellor of the Exchequer. Although the initiative for a new Conservative reform bill came from Queen Victoria and Lord Derby, Disraeli introduced it in the House and conducted the fight for it with unsurpassed enthusiasm and mastery of parliamentary tactics. He believed the bill should be a sweeping one with certain safeguards, and he was determined that it should be carried by a Conservative government. The Liberals, however, had a majority, and he had to accept their amendments, which removed nearly all the safeguards. The bill that passed doubled the existing electorate and was more democratic than most Conservatives had foreseen. Derby called it "a leap in the dark"; but Disraeli could fairly claim that the bill had gone far toward "realizing the dream of my life and re-establishing Toryism as a national foundation."

The "top of the greasy pole." In 1868 when Derby retired from politics, Disraeli became prime minister. "Yes," he said in reply to a friend's congratulations, "I have climbed to the top of a greasy pole." The government was only a caretaker one, for the general election awaited only the completion of a new electoral register, and later in 1868 the Liberals won. Disraeli set a precedent by resigning before Parliament met.

In the following 12-year period, politics changed from the chaotic collection of ill-defined, shifting groups that had been common from the beginning of Disraeli's career. Now the old politics defined by personalities shifted to an emergence of two parties with coherent policies. The party leaders, Disraeli and William E. Gladstone, were implacable enemies, and they polarized the parties.

At first Disraeli played a comparatively peaceful role. He tried to create a new image for the Conservative Party that he hoped would persuade the new electorate. His seeming apathy disturbed his followers, and his novel *Lothair* (3 vol., 1870), a political comedy, seemed to some of them undignified.

From 1872, however, Disraeli ran the party with a firm hand. He sharply differentiated Conservative from Liberal policy on several issues: he defended the monarchy, the House of Lords, and the church against what he took to be the threat of radical Liberal policy; he put forth a policy to consolidate the empire, with special emphasis on India; he dwelt on social reform; he enunciated a strong foreign policy, especially against Russia.

In 1872 Disraeli's wife died of cancer after many months of illness. Her death brought material losses: her house in London and her fortune passed to cousins. At age 68 his health was not good, but he turned implacably to political battle. He began a romantic friendship with two sisters, Lady Bradford and Lady Chesterfield, with whom he corresponded on politics and his personal feelings until his death.

His political fortunes turned when Gladstone's ministry was defeated in 1873. When Gladstone resigned, Disraeli refused to take office, pleading there was too much uncompleted business to dissolve Parliament, and that a minority government could only damage his party's prospects. Gladstone reluctantly returned to office, but within a year he dissolved the Parliament himself. Disraeli had been at work on party organization and electoral machinery, and the Conservatives won a resounding victory in 1874.

Second administration. Disraeli gained power too late. He aged rapidly during his second ministry. But he formed a strong Cabinet and profited from the friendship of the Queen, a political conservative who disliked Gladstone. Disraeli treated her as a human being, whereas Gladstone treated her as a political institution.

In regard to social reform, Disraeli was able at last to show that Tory democracy was more than a slogan. The Artizans' and Labourers' Dwellings Improvement Act made effective slum clearance possible. The Public Health Act of 1875 codified the complicated law on that subject. Equally important were an enlightened series of factory acts (1874, 1878) preventing the exploitation of labour and two trades union acts that clarified the legal position of those bodies.

Disraeli's imperial and foreign policies were even more in the public eye. His first great success was the acquisition of Suez Canal shares. The extravagant and spendthrift khedive Ismāʾīl Pasha of Egypt owned slightly less than half the Suez Canal Company's shares and was anxious to sell. An English journalist discovered this fact and told the Foreign Office. Disraeli overrode its recommendation against the purchase and bought the shares using funds provided by the Rothschild family until Parliament could confirm the bargain. The deal was seen as a notable triumph for imperial prestige. Early in 1876 Disraeli brought in a bill conferring on Queen Victoria the title empress of India. There was much opposition, and Disraeli would have gladly postponed it, but the Queen insisted. For some time his poor health had made leading the Commons onerous, so he accepted a peerage, taking the title earl of Beaconsfield, and became leader in the House of Lords.

Foreign policy largely occupied him until 1878. The Russian–Turkish conflict had lain dormant since the Crimean War in the 1850s, but Christian subjects of the Ottoman Empire revolted against intolerable misrule. Russia declared war on Turkey in 1877 and reached the gates of Constantinople early in 1878. Britain feared for the safety of the route to India, but Disraeli correctly judged that a show of force would be enough to bring the exhausted Russian forces to terms. The highly Pan-Slavist Treaty of Stefano forced on Turkey by Russia had to be submitted to a European Congress at Berlin in 1878. Beaconsfield attended and won all concessions he wanted. He returned to London in triumph, declaring that he had brought back "peace with honour."

At this climax of his career, the Queen offered him a dukedom, which he refused, and the Order of the Garter, which he accepted. Thereafter his fortunes waned with disaster in Afghanistan, forces slaughtered in South Africa, agricultural distress, and an industrial slump. The Conservatives were heavily defeated in the general election of 1880. Beaconsfield kept his party leadership and finished *Endymion* (3 vol., 1880), a mellow, nostalgic political novel viewing his early career. His health failed rapidly, and a few days after his burial in the family vault at Hughenden, Queen Victoria came to lay a wreath upon the tomb of her favourite prime minister.

(B./Ed.)

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dissociation, in chemistry, the breaking up of a compound into simpler constituents that are usually capable of recombining under other conditions. In electrolytic, or ionic, dissociation, the addition of a solvent or of energy in the form of heat causes molecules or crystals of the substance to break up into ions (electrically charged particles). Most dissociating substances produce ions by chemical combination with the solvent. The idea of ionic dissociation is used to explain electrical conductivity and many other properties of electrolytic solutions.

dissonance (music): *see* consonance and dissonance.

distance-measuring equipment (DME), in aerial navigation, equipment for measuring distance by converting the time a special electronic pulse takes to travel from an aircraft to a ground station and for an answering pulse to return. The airborne equipment displays the information to the pilot. When used in connection with a radio-range bearing, which indicates direction, a DME reading shows the pilot the exact position of his aircraft.

distemper: *see* canine distemper; feline distemper.

disthene (mineral): *see* kyanite.

distillation, process involving the conversion of a liquid into vapour that is subsequently condensed back to liquid form. It is exemplified at its simplest when steam from a kettle becomes deposited as drops of distilled water on a cold surface. Distillation is used to separate liquids from nonvolatile solids, as in the separation of alcoholic liquors from fermented materials, or in the separation of two or more liquids having different boiling points, as in the separation of gasoline, kerosene, and lubricating oil from crude oil. Other industrial applications include the processing of such chemical products as formaldehyde and phenol and the desalination of seawater. The distillation process appears to have been utilized by the earliest experimentalists. Aristotle (384–322 BC) mentioned that pure water is made by the evaporation of seawater. Pliny the Elder (AD 23–79) described a primitive method of condensation in which the oil obtained by heating rosin is collected on wool placed in the upper part of an apparatus known as a still.

Most methods of distillation used by industry and in laboratory research are variations of simple distillation. This basic operation requires the use of a still or retort in which a liquid is heated, a condenser to cool the vapour, and a receiver to collect the distillate. In heating a mixture of substances, the most volatile or the lowest boiling distills first, and the others subsequently or not at all. This simple apparatus is entirely satisfactory for the purification of a liquid containing nonvolatile material and is reasonably adequate for separating liquids of widely divergent boiling points. For laboratory use, the apparatus is commonly made of glass and connected with

corks, rubber bungs, or ground-glass joints. For industrial applications, larger equipment of metal or ceramic is employed.

A method called fractional distillation, or differential distillation, has been developed for certain applications, such as petroleum refining, because simple distillation is not efficient for separating liquids whose boiling points lie close to one another. In this operation the vapours from a distillation are repeatedly condensed and revaporized in an insulated vertical column. Especially important in this connection are the still heads, fractionating columns, and condensers that permit the return of some of the condensed vapour toward the still. The objective is to achieve the closest possible contact between rising vapour and descending liquid so as to allow only the most volatile material to proceed in the form of vapour to the receiver while returning the less volatile material as liquid toward the still. The purification of the more volatile component by contact between such countercurrent streams of vapour and liquid is referred to as rectification, or enrichment.

Multiple-effect distillation, often called multistage-flash evaporation, is another elaboration of simple distillation. This operation, used primarily by large commercial desalting plants, does not require heating to convert a liquid into vapour. The liquid is simply passed from a container under high atmospheric pressure to one under lower pressure. The reduced pressure causes the liquid to vaporize rapidly; the resulting vapour is then condensed into distillate.

A variation of the reduced-pressure process uses a vacuum pump to produce a very high vacuum. This method, called vacuum distillation, is sometimes employed when dealing with substances that normally boil at inconveniently high temperatures or that decompose when boiling under atmospheric pressure. Steam distillation is an alternative method of achieving distillation at temperatures lower than the normal boiling point. It is applicable when the material to be distilled is immiscible (incapable of mixing) and chemically nonreactive with water. Examples of such materials include fatty acids and soybean oils. The usual procedure is to pass steam into the liquid in the still to supply heat and cause evaporation of the liquid.

distilled liquor, alcoholic beverage (such as brandy, whiskey, rum, or arrack) that is obtained by distillation from wine or other fermented fruit juice or plant juice or from a starchy material (such as various grains) that has first been brewed. The alcoholic content of distilled liquor is higher than that of beer or wine.

A brief treatment of distilled liquors follows. For full treatment, *see* MACROPAEDIA: Beverage Production.

In general, the raw material used for a distilled liquor is a natural sugar or a starchy substance that may be easily converted into a sugar. Grapes are a principal raw material used for the production of distilled liquor, producing brandy. Peaches, apples, and many other fruits are used according to local availability. The most common vegetables used are sugarcane and sugar beets, which produce rum. Corn is the most widely used grain. Rye, rice, and barley grains are also used. Distilled liquors made from grain are usually called whiskeys.

The distillation process is based on the different boiling points of water (212° F [100° C]) and alcohol (173° F [78.5° C]). The alcohol vapours that arise while the fermented liquid boils are trapped and recondensed to create a liquid of much greater alcoholic strength. The resultant distillate is matured, often for several years, before it is packaged and sold.

Distinguished Service Order, British military decoration awarded to officers who have performed meritorious or distinguished service in war. The decoration, instituted by Queen Victoria in 1886, entitles recipients to add D.S.O. after their names. Foreign officers associated with British forces can become holders of the award as "honorary members." The badge of the order is a white and gold cross with a red centre bearing a crown surrounded by a laurel wreath.

distortion, in acoustics and electronics, any change in a signal that alters the basic waveform or the relationship between various frequency components; it is usually a degradation of the signal. Straight amplification or attenuation without alteration of the waveform is not usually considered to be distortion. Amplitude distortion refers to unequal amplification or attenuation of the various frequency components of the signal, and phase distortion refers to unequal reproduction of the various phase relationships in the signal. Intermodulation distortion is a result of nonlinearities in the system such that one frequency component tends to modulate another frequency component—*e.g.,* a high audio frequency modulating a low audio frequency. In audio systems, the most noticeable types of distortion are amplitude, frequency, and intermodulation. In video systems, appreciable distortion of any kind may be observed as a degradation of the reproduced image. Noise added to a signal, either purposely or inadvertently, is sometimes referred to as distortion.

distress, in law, process that enables a person to seize and detain from a wrongdoer some chattel, or item of personal property, as a pledge for the redressing of an injury, the performance of a duty, or the satisfaction of a demand. Distress was frequently levied without legal process, but requirements have become more stringent and now often necessitate some type of court action.

Seizure of property was common in ancient societies as a means of obtaining satisfaction for crime, breach of contract, nonpayment of debt, or any other offense or injury. It continues in modern times in nearly all legal systems.

The main causes for which distress is allowed vary from country to country. In general, they include (1) the nonpayment of rent, (2) trespass and damage by cattle or other chattels, (3) nonpayment of taxes and certain fines, and (4) nonpayment for goods and services received.

Initially the right of distress was a mere passive right to detain goods distrained until payment or recompense was made; this right still exists in many places when there has been damage or trespass by cattle. In other cases the power to sell the goods to pay the sum due has been conferred by statute. Certain types of goods are usually exempt from distress: goods in actual use, perishable goods, and the apparel and bedding of a tenant.

Because it affords an opportunity for injustice and discriminates in favour of one particular class of creditors, the distress form of self-help, or seizure of property, has not been favoured in some countries, such as the United States. Where the remedy still remains, it generally has been modified to vest enforcement in a public official and to narrow the right in other ways.

distress signal, a method by which a ship at sea can summon assistance. Distress signals are fixed by custom and by internationally agreed-on rules of the road at sea. The most important are: (1) visual signals, such as a flame, a red flare, an orange smoke signal, or a square flag displayed with a ball below; (2) sound signals, such as a gun or rocket fired at regular intervals, or a continuous sounding of a fog-signal apparatus; and (3) radio signals such as the Morse group SOS, the international code signal NC, or the spoken word "Mayday" (from French *m'aider,* "help me"), by radiotelephone. Distressed vessels may also actuate alarms of other vessels by a radio signal consisting of a series of 12 four-second dashes or by a radiotelephone signal consisting of two tones alternately transmitted for 30 to 60 seconds.

distribution, also called DISTRIBUTION OF TERMS, in syllogistics, the application of a term of a proposition to the entire class that the term denotes. A term is said to be distributed in a given proposition if that proposition implies all other propositions that differ from it only in having, in place of the original term, any other term whose extension is a part of that of the original term—*i.e.,* if, and only if, the term as it is used in that occurrence covers all the members of the class that it denotes.

Thus, in a proposition of the form "No S is P," both the subject and the predicate are distributed. In the form "Some S is P," neither S nor P is distributed. In "Every S is P," S is distributed, but P is not. Lastly, in "Some S is not P," S is not distributed, but P is. Briefly, only universal propositions distribute the subject term (S), and only negative propositions distribute their predicate (P). Naturally, singular terms (including proper names used as singular terms) are always distributed, for they refer only to one object and cannot refer to fewer.

The importance of distribution lies in its being a principle of formal inference that no term may be distributed in the conclusion unless it was distributed in the premises.

distribution function, mathematical expression that describes the probability that a system will take on a specific value or set of values. For example, the probability (dP) that a molecule of gas will be found with velocity components u, v, and w in the x, y, and z directions, respectively, is given by the product of the distribution function and the infinitesimal volume $du\,dv\,dw$; *i.e.,* $dP = f(u, v, w)\,du\,dv\,dw$, in which $f(u, v, w)$ is the distribution function describing the velocity of the molecule and dP is the probability of finding the x component of velocity between u and $u + du$, the y component between v and $v + dv$, etc. (*see* Maxwell–Boltzmann distribution law). A complete description of a system may involve other variables as well, such as position and orientation. Distribution functions may take into account any or all such variables.

distribution theory, in economics, the systematic attempt to account for the sharing of the national income among the owners of the factors of production—land, labour, and capital. Traditionally, economists have studied how the costs of these factors and the size of their returns—rent, wages, and profit—are fixed.

A brief treatment of distribution theory follows. For full treatment, *see* MACROPAEDIA: Economic Theory.

Distribution theory may be applied to the question of whether national income is distributed among persons or among the factors of production (the problems of personal distribution and distributive shares), but it has proved most fruitful on the question of how the prices of the factors are determined (the problem of functional distribution). The classical economists of the 18th and 19th centuries applied the principles of the market to the determination of the rewards of the factors. Supply was thought to be the most important element, and the influence of demand was rated as fairly insignificant. The subsistence theory of wages, derived in large part from the teachings of Thomas Malthus, held that wages would not diverge significantly from a

"natural" level that was just enough to enable the wage earner to live at a subsistence level. Higher levels of earnings would increase the supply of labour through larger families and depress the wages back to subsistence level. Conversely, if the wage rate fell below the subsistence level, the number of workers would decrease and the ensuing shortage would push wages back up.

The classical theory of rent (from David Ricardo) held that rent—the return to landowners—was determined by the cost of production of the least favourable land worthwhile to cultivate. Thus, land of better quality had a surplus rent over and above the cost of production. For the economy as a whole the total amount of the rent surplus received from land represented the landowner's share of national income. The remainder of the income produced in the economy was available for distribution among the other two economic groups, labourers and capitalists. It was the view of a number of classical economists that in the long run these two groups would not reap the benefits of economic growth, while the position of the landlord class would be substantially improved.

As the rapid economic development of the 19th century produced conditions quite different from those predicted by the classical economists, new approaches were required to account for the prices of factors of production. Marginal-productivity theories were developed independently by a number of economists. According to the marginal-productivity theory, the price of a factor is not governed by simply its productivity but its productivity at the margin, that is, the value of the extra output made possible by the addition of a unit of the factor. The earnings rate of any factor of production tends to equal the value of the marginal product of the factor. The theory assumes that the law of diminishing returns applies to marginal productivity of a factor and that substitution of one factor for another at the margin is similarly affected by diminishing returns. The effect of the diminishing return is to reduce the price as the marginal productivity declines. Other key assumptions of the theory are that to a large degree the economy is static, that it is possible to measure the productivity of each factor of production, and that nearly perfect competition prevails in the marketplace. The ratio in which the factors are combined is determined by employers, guided by the principles of substitution and diminishing marginal productivity and varying their demand for any one factor until its marginal productivity is equal to its price or earnings.

This neoclassical theory is particularly successful in explaining the phenomenon, observed in industrializing nations, that labour commands an increasing share of national income and capital a decreasing one. The removal of the assumptions of stasis and perfect competition introduces an element of indeterminacy, because, in practice, wage rates are influenced by collective bargaining between trade unions and employers, by various forms of arbitration, or by minimum-wage levels set by government. Similarly, under imperfect and dynamic competition the earnings of capital are determined by a host of other factors, such as technological change, monopolistic trends, and government influence over the economy.

distributive law, in mathematics, the law relating to number operations stated symbolically, $a(b + c + d) = ab + ac + ad$; that is, the monomial factor a is distributed, or separately applied, to each term of the polynomial factor $b + c + d$, resulting in the product $ab + ac + ad$. Hence, the result of first adding several numbers and then multiplying the sum by some number is the same as first multiplying each separately by the number and then adding the products. *See also* associative law; commutative law.

District of Columbia, federal district, eastern United States, on the Potomac River, coextensive with the city of Washington, D.C. (*q.v.*).

disturbing the peace, also called BREACH OF THE PEACE, any of three distinct types of legal offense. In its broadest sense, the term is synonymous with crime itself and means an indictable offense. In another and more common sense, however, the phrase includes only those crimes that are punishable primarily because of their disrupting effect upon the peace and security of the community. Among these offenses are affray, unlawful assembly, riot, forcible entry and detainer, disturbance of public assemblies, keeping a disorderly house, and malicious mischief. In its third and narrowest meaning, the phrase is confined to willful conduct that does not fall within the definition of any other specific crime but that unreasonably disrupts the public tranquillity or has a strong tendency to cause a disturbance. In common law, and under many statutes, such a disturbance or breach of peace is punishable as a misdemeanour.

Ditch, Battle of the (AD 627), Arabic AL-KHANDAQ (The Ditch), an early Muslim victory that ultimately forced the Meccans to recognize the political and religious strength of the Muslim community in Medina.

A Meccan army of 3,000 men had defeated the undisciplined Muslim forces at Uḥud near Medina in 625, wounding Muḥammad himself. In March 627, when they had persuaded a number of Bedouin tribes to join their cause, the Meccans brought a force of 10,000 men against Medina again. Muḥammad then resorted to tactics unfamiliar to the Arabs, who were accustomed to brief, isolated raids. Rather than sally out to meet the enemy in the usual way—the mistake made at Uḥud—he had a ditch dug around Medina, according to tradition, at the suggestion of a Persian convert, Salmān. The Meccan horsemen were disconcerted and soon bored, and the coalition of Bedouin tribes started breaking up. After an unsuccessful siege, the Meccans dispersed. With the Muslim and Meccan forces now more evenly matched and the Meccans tiring of a war that was damaging their trade, Muḥammad used his victory to negotiate greater concessions for the Muslims in a treaty at al-Ḥudaybiyah (628).

ditcher: *see* trenching machine.

Dithmar (historian): *see* Thietmar.

Dithmarschen, Danish DITMARSKEN, area on the west coast of the Jutland peninsula between the Eider and Elbe rivers, now included in the *Land* (state) of Schleswig-Holstein, Germany, but down to 1866 a semi-independent territory under the king of Denmark. First mentioned in the 9th century, Dithmarschen was then one of the three Saxon districts north of the Elbe. In 1144 the ruling count was killed in a popular rising, and, after a dispute between the Duke of Saxony and the Archbishop of Bremen, Dithmarschen passed to the latter.

In 1434 the federated parishes created a central judiciary that developed into an administration by 48 regents, and in 1447 the customary laws were codified. In 1473 the Holy Roman emperor Frederick III enfeoffed Christian I of Denmark with Dithmarschen, but the Danish kings' attempts to make good this grant ended in humiliating defeat at Hemmingstedt (February 1500). In 1580 the province was divided into royal South Dithmarschen and ducal (Gottorp) North Dithmarschen; these districts remained even when in 1773 the whole territory fell to the king of Denmark. In 1867 Dithmarschen, together with Schleswig and Holstein, became Prussian.

dithyramb, in Greece in the 7th century BC, an improvised song in honour of the wine god Dionysus, sung by banqueters under the leadership of a man "wit-stricken by the thunderbolt of wine" (Archilochus). It was contrasted with the more sober paean, sung in honour of Apollo. The dithyramb began to achieve literary distinction about 600 BC, when the poet Arion composed works of this type, gave them names, and formally presented them at the Great Dionysia competitions at Corinth. These presentations consisted of a dithyrambic song accompanied by circular dances performed around the altar of Dionysus by choruses composed of 50 men and boys; the whole proceeding was accompanied by reed flutes and was led by the speaker of a prologue.

By the end of the 6th century BC, the dithyramb was a fully recognized literary genre. Its most famous composer was Lasus of Hermione (b. *c.* 548), who is said to have been one of Pindar's teachers. The great age of the dithyramb was also the great age of Greek choral lyric poetry in general; Simonides, Pindar, and Bacchylides all composed them. Of Simonides' and Pindar's dithyrambs, little is known; but two of Bacchylides' are complete, and there are considerable fragments of several others. Bacchylides' Ode 18 is unusual in that it contains a dialogue between a chorus and a soloist. This attempt to increase the dramatic interest of the narrative may explain why the classical dithyramb gave way before the more vivid methods of tragedy.

From about 450 BC onward, dithyrambic poets employed ever-more-startling devices of language and music, until for ancient literary critics "dithyrambic" acquired the connotations of "turgid" and "bombastic." True dithyrambs are rare in modern poetry, although John Dryden's "Alexander's Feast" (1697) may be said to bear a coincidental resemblance to the form.

dittany, any of several plants: European dittany (*see* gasplant), Maryland dittany (*Cunila origanoides*), and Crete dittany (*Origanum dictamnus*). The last two mentioned are of the mint family (Lamiaceae), order Lamiales. *C. origanoides,* common in dry woodlands and prairies, was once used as a remedy for fever and snakebite. It attains heights of 30 cm (1 foot) and has mint-scented leaves and clusters of rose-purple to white, tubular flowers. It and 14 other species of *Cunila* are native in North and South America.

Common dittany (*Cunila origanoides*)
Franklin Photo Agency

Origanum dictamnus, related to marjoram, has white, woolly, weak stems, thick leaves, and pinkish flower clusters. It is native in Greece and is much-used in cookery.

Dittersdorf, Karl Ditters von, original name (until 1773) KARL DITTERS (b. Nov. 2, 1739, Vienna—d. Oct. 24, 1799, Schloss Rothlhotta, Neuhof, Bohemia [now in Czechoslovakia]), violinist and composer of instrumental music and light operas that established the form of the Singspiel (*q.v.;* a comic 18th-century opera written in the German language).

Dittersdorf, engraving by Karl Traugott Riedel
By courtesy of the Osterreichische Nationalbibliothek, Vienna

A brilliant child violinist, Dittersdorf played regularly at the age of 12 in the orchestra of Prince von Sachsen-Hildburghausen and later in the orchestra of the Vienna opera. He became friendly with Christoph Gluck, whom he accompanied in 1761 to Bologna, where his violin playing brought him considerable celebrity. In 1765 he became director of the orchestra of the bishop of Grosswardein. There he wrote for it his first opera, *Amore in musica.* His first oratorio, *Isacco,* was also written during this time.

By 1770 Ditters was in the service of Count Schaffgotsch, prince-bishop of Breslau, at Johannisberg, Silesia. There he composed 11 comic operas, among them *Il viaggiatore americano* (1770), and an oratorio, *Davidde penitente* (1770). In 1773 he was ennobled under the name Ditters von Dittersdorf. In about 1779 he formed a close friendship with Joseph Haydn, and from 1783 he played in string quartets in Vienna with Mozart. From this period onward his output was enormous. He produced the oratorio *Giobbe* (1786) and several operas, three of which, *Doktor und Apotheker* (1786), *Hieronymus Knicker* (1789), and *Das rote Käppchen* (1790), had great success. *Doktor und Apotheker,* in particular, became one of the classic examples of the German Singspiel. He also wrote a large quantity of instrumental music. In 1795, following the bishop's death, he was dismissed with a small pension. Poor and broken in health, he accepted a post with Baron Ignaz von Stillfried at Schloss Rothlhotta, Neuhof, Bohemia. On his deathbed he dictated his autobiography, which, although naive in concept, is of great interest to students of 18th-century music.

Dittersdorf was one of the earliest composers of the Viennese Classical school. His symphonies are often of great interest. His violin concerti are worthy of study, and his concerti for harp, for flute, for harpsichord, double bass, and other instruments are performed and recorded. As an opera composer Dittersdorf is chiefly remembered for his light-hearted and sometimes sentimental Singspiels.

Diu, formerly DIO, town, Daman and Diu union territory, western India. It is situated on an island in the Gulf of Cambay of the Arabian Sea, off the Saurāshtra coast of Gujarāt state.

Diu Island is about 7 miles (11 km) long and 2 miles (3 km) wide. It is known for its magnificent cathedral of Sé Matriz and its idyllic beauty. Diu fell to the Portuguese in 1534 and remained a Portuguese colony until 1961. Bitter fighting then broke out at Diu before India was able to assert control of the island. Diu was part of Goa, Daman, and Diu union territory until 1987, when Goa became a separate state of India. Bajra (pearl millet) and coconuts are the major crops; industries include fishing, tapping of the toddy palm for its juice, and salt processing. The island has an airport. Pop. (1981) town, 8,020.

Diula (people): *see* Dyula.

diuretic, any drug that increases the flow of urine. Diuretics promote the removal from the body of excess water, salts, poisons, and accumulated metabolic products, such as urea. They serve to rid the body of excess fluid (edema) that accumulates in the tissues owing to various disease states.

There are many types of diuretics, but most act by decreasing the amount of fluid that is reabsorbed by the tubules of the kidneys, whence the fluid passes back into the blood. The most widely used diuretics, the benzothiadiazides (*e.g.,* chlorothiazide), interfere with the reabsorption of salt and water by the kidney tubules. Instead of being reabsorbed, the salt and water are ultimately excreted, thus increasing the flow of urine. After they were synthesized in the late 1950s, the benzothiadiazides replaced most other existing diuretics. They are more convenient than some other diuretics in that they can be taken orally in the form of pills. These drugs are also used to reduce high blood pressure (hypertension).

Mercurial diuretics (*e.g.,* calomel) work the same way that benzothiadiazides do but are less easy to use. Another class of diuretics are substances that cannot be reabsorbed by the kidney tubules and thus limit the reabsorption of water by the tubules. These substances include mannitol, sucrose, and urea. Other diuretics (such as acetazolamide) work by blocking the reabsorption of sodium bicarbonate by the tubules, thus increasing urine formation. These and still other types are used infrequently in conjunction with the mercurial diuretics.

diurnal motion, the apparent daily motion of the heavens from east to west in which celestial objects seem to rise and set, a phenomenon that results from the Earth's rotation from west to east. The axis of this apparent motion is coincident with the axis of rotation of the Earth.

The intersection of the plane of the Earth's Equator with the celestial sphere defines the celestial equator. The apparent daily paths of celestial objects are circles parallel to the celestial equator and are termed diurnal circles.

Diushambe (Tadzhik S.S.R.): *see* Dushanbe.

Divākarapaṇḍita, original name DIVĀKARA (b. 1040, Cambodia [now Kampuchea]—d. *c.* 1120), Hindu of the Brahman (priestly) caste who rose through religious and administrative ranks to serve four Cambodian kings—Harshavarman II, Jayavarman VI, Dharanindravarman I, and the great Suryavarman II—and who was the most trusted adviser to three of them.

The highly opportunistic Divākara was able not only to survive the successive usurpations of monarchies but also to ingratiate himself with each new sovereign. Divākarapaṇḍita played a singular role in Cambodian history, for it was at his urging that Suryavarman II began construction of the temple of Angkor Wat, one of the world's largest religious edifices and certainly one of the greatest achievements of ancient Khmer, or Cambodian, civilization. One of the monuments of Angkor Wat commemorates this powerful Brahman.

Dīvālī (Hindu festival): *see* Dīwālī.

divan, also spelled DIWAN, or DEWAN, Arabic DĪWĀN, in Islāmic societies, a "register" and later a "finance department," "government bureau," or "administration." The first divan appeared under the caliph 'Umar I (634–644) as a pensions list, recording free Arab warriors entitled to a share of the spoils of war. Out of rents and property taxes exacted from conquered farmers and landowners, hereditary pensions were assigned to warriors entered in the divan. Later the term came to signify a financial institution, and by the time of the caliphate of Mu'āwiyah (661–680) it meant a government bureau, *e.g.,* the chancellery or the postal service. Iranians used divan until about the 19th century to mean the central government in general, while in Mughal India, from the time of Akbar (1556–1605), the term was chiefly associated with government finance, the chief finance minister being the divan, with provincial *dawāwīn* under him. In the Ottoman Empire divan became the imperial chancery headed by the grand vizier, though a consultative assembly of senior officials summoned by Selim I in 1515 was also called a divan. The term was early extended to mean the audience chamber of important government officers, whose offices, furnished with mattresses and cushions along the walls, account for the extension of the meaning of divan to sofa. In modern Turkey a divan is an administrative unit in rural areas.

The English East India Company, during its period of administration in India, called its revenue administration "dewanee."

diver (bird): *see* loon.

divergence (meteorology): *see* convergence and divergence.

diverticulum, any small pouch or sac that forms in the wall of a major organ of the body. Diverticula form most commonly in the esophagus, small intestine, and large intestine and are most often a problem in the latter organ. Middle-aged and older people are particularly susceptible to the condition because of the inevitable weakening of the muscle walls of the colon with advancing age.

Fecal matter may be pushed into the pouches that form in the colon and may cause them to bulge out from the colon wall. Such a condition is called diverticulosis. This condition has no symptoms, but the feces-filled sacs may become inflamed, a more serious condition called diverticulitis. Its symptoms are pain and cramps in the lower left side of the abdomen, chills, and sometimes fever. At this stage an accurate diagnosis becomes necessary, and the presence of pouches can be determined on an X ray taken after the patient has been given a barium enema. The treatment for a mild case of diverticulitis consists of bed rest, antibiotics, an enema, and a bland diet. A severe case can cause the perforation, rupture, ulceration, or hemorrhaging of the colon wall at the spot of the bulge. In cases of rupture, the surgical operation known as a colostomy may be necessary.

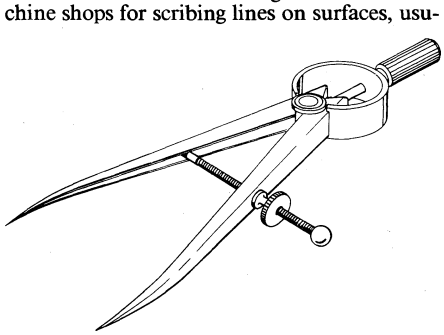
divertimento (Italian: "diversion," or "amusement"), plural DIVERTIMENTI, 18th-century musical genre of a light and entertaining nature usually consisting of several movements for strings, winds, or both. The movements included sonata forms, variation forms, dances, and rondos. One of Joseph Haydn's numerous divertimenti is a sextet written for a double string trio, to be played by two groups simultaneously in different rooms. The divertimenti of Mozart generally resemble his works entitled cassation and serenade; an exception is the *String Divertimento* K. 563, which ranks among the greatest chamber works of all time.

The divertimento was one of the sources from which the string quartet developed. Its style was to some extent maintained by Beethoven in the *Septet,* Opus 20, and Schubert in the *Octet,* Opus 166, both for winds and strings.

dividend, an individual share of earnings distributed among stockholders of a corporation or company in proportion to their holdings and as determined by the class of their holdings. Dividends are usually payable in cash, although sometimes distributions are made in the form of additional shares of stock. The preferred stockholders are entitled to a preferential dividend, usually at a fixed rate, and the common stockholders get a portion of what remains after payment of the dividends on preferred stock.

When a corporation declares a dividend, it indicates that stockholders of record as of a specific date will receive the dividend. If the stock is purchased between the date of record and the date the dividend is to be paid, the buyer does not receive the recently declared dividend, and the stock is said to sell ex dividend, or "without dividend." When a stock sells ex dividend, its price is usually reduced by the amount of the dividend.

divider, instrument for measuring, transferring, or marking off distances, consisting of two straight adjustable legs hinged together and ending in sharp points. It is used principally in drafting for the accurate transfer of dimensions from a measuring scale and in machine shops for scribing lines on surfaces, usually machined, with dimensions taken from a ruler. A compass is essentially a divider in which one of the points has been replaced by a pencil or other marking device. The compass is useful for scribing circles or arcs of circles; it usually includes a scale to indicate the radius of the circle being scribed.



Divider

divination, the practice of foretelling the future by various natural, psychological, and other techniques. Found in all civilizations—both ancient and modern, primitive and sophisticated—and in all areas, it is known in the Western world primarily in the form of horoscopic astrology (*see* astrology). No scientific evidence has been produced showing that divination can indeed foretell the future.

A brief treatment of divination follows. For full treatment, *see* MACROPAEDIA: Occultism.

Divinatory methods may be classified as inductive, interpretive, or intuitive. Inductive and interpretive divination are performed by inference from external facts. Manipulated accident is the essential dramatic element of interpretive divination. In a classic example, a diviner randomly tosses a bunch of selected objects on the ground and foretells the future by interpreting the final alignment of the objects where they fell. This approach has been used in a great variety of cultures. The casting of lots, for instance, was common in classical antiquity and survives in the throwing of dice. The use of lots and number lore directs consultation of the *I Ching* in Chinese tradition.

In haruspication (the inspection of entrails), in scapulimancy (divination by the spealbone, or shoulder blade), and in divination by footprints in ashes, the diviner foretells the future by interpreting the visual appearance or condition of a particular object or objects. In the case of augury and omens, the behaviour and cries of birds, encounters with ominous animals, and so on are interpreted. Astrology, based upon observation of the heavenly bodies, is an inductive divining method of great antiquity. Other phenomena commonly subject to such interpretation include dreams, weather, and sequences of cards (*e.g.,* Tarot cards).

Intuitive divination depends for its results on sensory or motor automatisms or mental impressions. The prototype of the intuitive diviner is the shaman who employs trance states—either spontaneous, self-induced, or drug-induced—to achieve contact with superior, nonhuman forces and thereby gain insight into the future.

Among sensory automatisms, crystal gazing is used to induce visions of future events. The Oüija board is a popular approach to divination using motor automatism.

Divine, Father, also called J. DEVINE, byname of GEORGE BAKER (b. 1877?, Hutchinson's Island, near Savannah, Ga., U.S.—d. Sept. 10, 1965, Philadelphia), American religious leader who in 1919 founded the Peace Mission movement.

Baker began preaching in Baltimore, where he became known as "The Messenger" by his followers. After briefly returning to Georgia, he moved to New York City in 1915. He adopted the name Major J. Devine (later Divine) shortly thereafter and in 1919 established his first "heaven," or communal dwelling, in Sayville, Long Island, N.Y. His predominantly black following expanded rapidly in the 1930s and '40s, and more "heavens" were provided in distant cities; by the 1960s the organization owned more than $10,000,000 in property. Father Divine was regarded by his followers as God, and he did not permit them to smoke, drink liquor, or use cosmetics. The movement declined after his death.

Divine Comedy, The, Italian LA DIVINA COMMEDIA, original name COMMEDIA, long narrative poem written *c.* 1310–14 by Dante Alighieri (*q.v.*). It is usually held to be one of the world's great works of literature. Divided into three major sections—*Inferno, Purgatorio,* and *Paradiso*—the narrative traces the journey of Dante from darkness and error to the revelation of the divine light, culminating in the Beatific Vision of God. Dante is guided by the Roman poet Virgil, who represents the epitome of human knowledge, from the dark wood through the descending circles of the pit of Hell (Inferno). Passing Lucifer at the pit's bottom, at the dead-centre of the world, Dante and Virgil emerge on the beach of the island mountain of Purgatory. At the summit of Purgatory, where repentant sinners are purged of their sins, Virgil departs, having led Dante as far as human knowledge is able, to the threshold of Paradise. There Dante is met by Beatrice (*q.v.*), embodying the knowledge of divine mysteries bestowed by Grace, who leads him through the successive ascending levels of heaven to the Empyrean, where he is allowed to glimpse, for a moment, the glory of God.

An early translation of *La divina commedia* into English was by Henry Boyd (1802). There are several later translations, the best-known among which are those by Dorothy L. Sayers and B. Reynolds (1949–62), W.F. Ennis (1965), and John Ciardi (1977).

Divine Faith (Mughal sect): *see* Dīn-i Ilāhī.

divine office, also called CANONICAL HOURS, LITURGY OF THE HOURS, or LITURGICAL HOURS, in various Christian churches, the public service of praise and worship consisting of psalms, hymns, prayers, readings from the Fathers of the early church, and other writings. Recurring at various times during the day and night, it is intended to sanctify the life of the Christian community.

The history of the office, and of its various forms, is difficult to trace, as a result of its antiquity and the revisions created during the numerous attempts to reform it. The practice of public morning and evening prayer is very ancient, and early writings attest to the tradition of prayer at the third, sixth, and ninth hours of the day (9:00 AM, 12:00 M, and 3:00 PM). The practice of midnight prayer, especially before a great feast, also was common. Two institutions greatly responsible for the evolution of the forms of the office, in both Eastern and Western Christianity, were the monasteries and the choirs associated first with the churches known as basilicas and later with cathedrals.

In the Roman Catholic Church, there are seven canonical hours. Matins, the lengthiest, originally said at a night hour, is now appropriately said at any hour of the day. Lauds and Vespers are the solemn morning and evening prayers of the church. Terce, Sext, and None correspond to the mid-morning, noon, and mid-afternoon hours. Compline, a night prayer, is of monastic origin, as was Prime, recited in the early morning before being suppressed in 1964. The office has for centuries been primarily the responsibility of monks, who sang it in choir, and priests, who often recited it privately. The second Vatican Council encouraged the celebration of Lauds and Vespers in parish churches and initiated significant changes in structure and texts to facilitate the recitation of the office by those involved in active pursuits.

In the liturgical tradition of the Eastern Orthodox Church, the day is considered to begin at sunset with Vespers. Compline is read after the evening meal. The midnight office, which has no exact equivalent in the West, is in practice normally recited before Matins, which in principle should conclude with sunrise. The lesser hours are celebrated at the first, third, sixth, and ninth hours. There is no separate office of Lauds. The daily cycle is celebrated in full only in large monasteries. Matins and Vespers, however, are celebrated in many parish churches. Because it is viewed as a corporate activity, the private recitation of the office has not been a custom in the East.

The Anglican Church has a morning prayer containing elements of the Matins, Lauds, and Prime of the medieval church and has an evening prayer with elements from Vespers and Compline. Both services have the same structure. Lutheran churches have forms for Matins and Vespers services for congregational celebration mainly on Sundays. Although encouraged by Martin Luther, the practice has not been consistently observed. There has been, however, a revival of interest in recent years. *See also* breviary.

divine right of kings, doctrine in defense of monarchical absolutism, which asserted that kings derived their authority from God and could not therefore be held accountable for their actions by any earthly authority such as a parliament. In its origins in Europe the divine right theory may be traced to the medieval conception of God's award of temporal power to the political ruler, paralleling the award of spiritual power to the church. By the 16th and 17th centuries, however, the new national monarchs were asserting their authority in matters of both church and state. King James I of England (reigned 1603–25) was the foremost exponent of the doctrine of the divine right of kings, but the doctrine virtually disappeared from English politics after the Revolution of 1688. In the late 17th and

the 18th centuries, kings such as Louis XIV of France continued to profit from the divine-right theory, even though many of them no longer had any truly religious belief in it. The American Revolution, the French Revolution, and the Napoleonic Era deprived the doctrine of most of its remaining credibility.

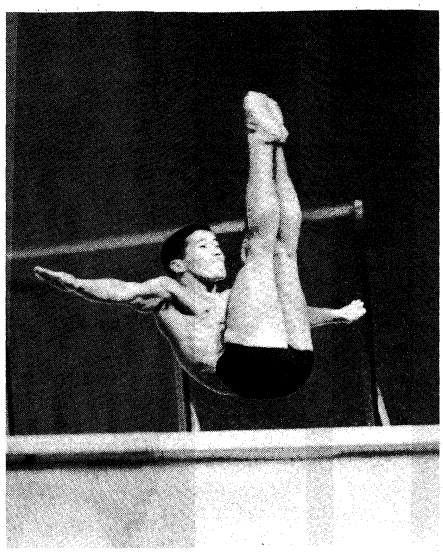
One of the principal French theorists of divine right, the bishop Jacques-Bénigne Bossuet (1627–1704), asserted that the king's person and authority were sacred; that his power was modeled on that of a father's (the paternalistic argument); that his power was absolute, deriving from God; and that he was governed by reason (that is, custom and precedent). The English Royalist squire Sir Robert Filmer, in his *Patriarcha* (1648), likewise held that the state was a family and that the king was a father, but he went on, in an interpretation of Scripture, to pronounce that Adam was the first king and that Charles I ruled England as Adam's eldest heir. The philosopher John Locke's antiabsolutist *First Treatise of Civil Government* (1689) was written to refute such arguments.

Divine Word Missionary, member of SOCIETY OF THE DIVINE WORD (S.V.D.), a Roman Catholic religious organization, composed of priests and brothers, founded in 1875 at Steyl, Neth., by Arnold Janssen to work in the foreign missions. Its members are engaged in all phases of missionary activity, from teaching in universities, colleges, and secondary schools to working among primitive peoples. In the late 20th century they were located in 14 European countries, in North and South America, Africa, Australia, Taiwan, India, Indonesia, New Guinea, the Philippines, and Japan. The training of a native clergy has been a major work of the society in all its missions. Divine Word Missionaries have traditionally been active in publishing and disseminating Catholic literature. Some members, notably Wilhelm Schmidt, a German anthropologist, have made valuable contributions in the fields of anthropology and ethnology.

diving, sport of plunging into water, usually head foremost, performed with the addition of gymnastic and acrobatic stunts. In its more elaborate, acrobatic form, diving originated in Europe early in the 19th century as a diversion of gymnasts and as a competitive sport in the late 19th century. It became a part of the swimming program of the Olympic Games in 1904 and developed rapidly through the first half of the 20th century. Divers from the United States have dominated Olympic Games and other international competition from 1920. (For lists of Olympic diving champions, *see* Olympic Games.)

In competition, dives are performed from a firm platform 5 or 10 m (16.4 or 32.8 feet) above the water or from an elastic springboard 1 or 3 m (3.28 or 9.84 feet) high. In Olympic contests only the 10-metre platform and 3-metre springboard are used. Dives performed in competition are listed, together with a rating of their degree of difficulty of performance, in a table published by the Fédération Internationale de Natation Amateur (FINA; International Amateur Swimming Federation), the world governing body of amateur aquatic sports. Contestants are required to do certain of the listed dives, as well as several of their own choice. At least three judges score each dive, with attention paid to takeoff, bearing of the body in the air, execution of the prescribed movements, and entry into the water. The scores for each dive are totaled and multiplied by the degree of difficulty. The diver with the highest total score for all dives at the end of the contest is the winner. Men make 11 dives: 5 required and 6 voluntary. Women make the same five required dives, but only five voluntary dives.

Competitive dives are divided into five groups, with the addition of armstand dives done from fixed platforms only. The first includes the forward dives, in which the person faces the water, dives out from the edge of the board or platform, and rotates forward one-half or more turns before entering the water. The second comprises the backward dives, in which the diver stands at the edge, facing away from the water, then springs and rotates backward. The third is the reverse group, in which the diver takes off in the forward position but then reverses his spin toward the board. In the fourth group, the inward dives, the diver stands on the edge of the platform and springs backward but rotates forward, again toward the board. The fifth classification is that of the twisting dives, in which the diver rotates the body on its long axis while performing one of the other four types of dives—as in a forward 1½ somersault with 3 twists.



Toshio Ohtsubo (Japan) executing a forward 1½ somersault, pike position, from a 10-metre tower during the Olympic Games in Mexico City, 1968
Don Wilkinson

The majority of dives included in the roster may be executed in three distinct positions: straight, pike, or tuck. In the straight position, the body is held extended, with no flexion at the hips or knees. In the pike position, there is a bend at the hips but no knee flexion. In the tuck position, both hips and knees are flexed and the body resembles a ball. The most complicated dives may be done in free (any) position, a loose but graceful combination of the others.

diving, underwater: *see* underwater diving.

diving beetle: *see* predaceous diving beetle.

diving bell, small diving apparatus that is used to transport divers between the seafloor or lower depths and the surface. Early diving bells consisted of a container open only at the bottom, usually provided with a source of compressed air. Though the diving bell in rudimentary form is mentioned by Aristotle, the device was not fully practicable until the end of the 18th century, when the British engineer John Smeaton fitted an air pump to the bell. Regardless of the depth to which a diving bell is lowered, in principle at least, fresh air fills the available vital space. Its pressure is automatically regulated by the pump and by the water pressure; surplus air escapes through the edges of the container. As the bell descends, the water level tends to rise inside the bell. As it surfaces, the decreasing water pressure lowers the level inside the bell. Thus, the pressure inside the bell remains the same as that outside. Some bells, however, are kept at working-depth pressure and are used to commute to and from an outfitted surface decompression chamber and the work site, thus eliminating the need for decompression between dives on a mission. Modern bells may accommodate up to four divers and have been used at depths of more than 1,000 feet (300 m).

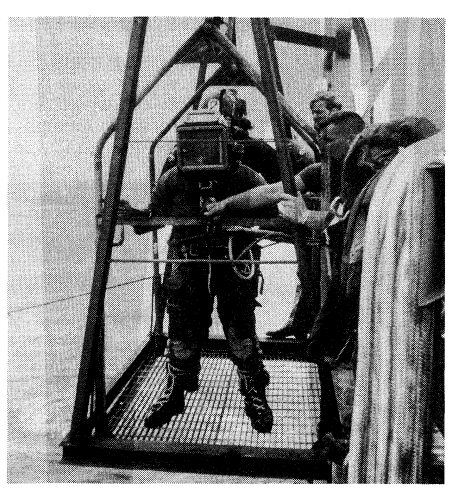
diving duck, any duck that obtains its food by diving to the bottom in deep water rather than by dabbling in shallows (*see* dabbling duck). On the basis of kinship and to the degree that it likes a marine environment, a diving duck may be popularly called either a bay duck or a sea duck.

Bay ducks of the tribe Aythyini, family Anatidae (*q.v.*; order Anseriformes), include canvasback, redhead, scaup, and allied species (*see* pochard). They are found more frequently in estuaries and tidal lagoons than on the open sea.

Sea ducks are any of the approximately 20 species of the tribes Mergini and Somateriini. The term is fairly apt, although some birds frequent inland waters as well as seacoasts. Ducks of the tribe Mergini include the bufflehead (*Bucephala,* or *Glaucionetta, albeola*), closely related to the goldeneye (*B.,* or *G., clangula*); the mergansers; the oldsquaw (*Clangula hyemalis*); and scoters (*Melanitta,* or *Oidemia,* species). The tribe Somateriini includes the eiders. *See also* eider; merganser.

diving petrel, any of five species of small seabirds of the sub-Antarctic regions that constitute the family Pelecanoididae (order Procellariiformes). Although their nearest relatives are the storm petrels, shearwaters, and albatrosses, diving petrels differ from these long-winged forms and instead resemble the smaller auks of the Northern Hemisphere, a classic example of convergent evolution. Like the auks, black-and-white diving petrels are shortwinged and heavy-bodied and use their wings for propulsion underwater. The smallest and most widespread is the common diving petrel (*Pelecanoides urinatrix*), about 16 cm (6½ inches) long; the largest is the Peruvian diving petrel (*P. garnotii*), about 25 cm (10 inches) long, restricted to the west coast of South America from about 6° to 37° S.

diving suit, watertight costume for underwater use, connected to the surface or to a diving bell by a tube that provides the wearer with air. The suit, invented early in the 19th century, consists of a watertight covering, weighted boots, and a metal helmet with transparent portholes and provision for air. Suits of articulated armour that do not require decompression have been developed. Diving suits have been supplanted in some applications by scuba-diving equipment.



U.S. Navy diver being lowered into the water on a platform at the Naval Coastal Systems Center, Panama City, Fla., U.S.
By courtesy of the U.S. Navy

Divini, Eustachio (b. Oct. 4, 1610, San Severino delle Marche, near Ancona, Papal States [now in Italy]—d. 1685, Rome), Italian scientist, one of the first to develop the technology necessary for producing scientific optical instruments.

After some scientific training under Benedetto Castelli, a disciple of Galileo, Divini established himself in Rome in 1646 as a maker of clocks and lenses. He constructed a number of compound microscopes and long-focus telescopes, the latter consisting of wooden tubes with four lenses, with a focal length of more than 15 m (50 feet).

In 1649 Divini published a copper engraving of a map of the Moon, based on his own observations made with his invention. He also made a number of astronomical observations, including some of the rings of Saturn and the spots and satellites of Jupiter. Many of his microscopes and telescopes have survived in museums in Florence, Rome, Padua, and elsewhere.

divining rod, instrument used in dowsing (*q.v.*).

Divino, El (poet): *see* Herrera, Fernando de.

Divinópolis, city, south-central Minas Gerais *estado* ("state"), Brazil. It is situated in highlands at 2,205 feet (672 m) above sea level, near the Pará River. It was made the seat of a municipality in 1911 and gained city status in 1915. The growing of cassava, corn (maize), rice, coffee, *feijão* (beans), and sugarcane and the raising of livestock are economically important in the surrounding area. The city is one of the most important industrial centres in Minas Gerais, with metallurgical plants, textile mills, tanneries, and dairy factories. Roads and a railway link Divinópolis to Belo Horizonte, the state capital, 97 miles (156 km) east. Pop. (1980 prelim.) 108,344.

division, in modern military organizations, the smallest formation that comprises a balanced team of all the arms and services needed for the independent conduct of operations. It usually numbers between 12,000 and 20,000 men and is commanded by a major general. In naval usage a division is a group of ships, usually four, forming part of a squadron or task force. It also denotes units into which a ship's company is divided for administrative purposes. The term air division denotes a command within an air force, containing two or more wings organized to perform an operational mission such as bombardment, fighter interception, reconnaissance, or airlift.

The military strength of an army for the conduct of war may be roughly measured by the number and quality of the divisions it can bring to bear against an enemy. Divisions, together with additional supporting combat and service troops, are formed into corps and field armies for the conduct of military campaigns.

To meet specialized requirements in warfare, divisions have evolved into several types, falling within two general classifications: infantry and armoured. Infantry divisions, known as rifle divisions in the Soviet army, are organized and equipped for combat under all conditions of terrain and weather; they comprise the principal portion of the fighting forces of an army. An infantry division consists chiefly of foot soldiers equipped with light weapons but also includes supporting artillery, armour, and engineer units and has its own communication, supply, maintenance, and evacuation services. Divisions of this general type, when modified by the introduction of light equipment and given special training, may perform specialized roles. Examples are airborne (parachute) divisions and mountain (Alpine) divisions. Some armies also have formed motorized (in American usage, mechanized) divisions by adding truck transport and light armoured vehicles sufficient to mount all the troops of an infantry division. The armoured, or (except in American usage) mechanized, division also contains elements of all arms and services but is comparatively much stronger in tank forces than the infantry division. When faced by defenses in depth, the tanks, infantry, engineers, artillery, and antitank weapons of a division work as a coordinated team.

division of labour: *see* labour, division of.

Divisionism, painting technique that formed the technical basis for Neo-Impressionism (*q.v.*).

Divo, town, south-central Côte d'Ivoire (Ivory Coast). It is the chief collecting centre among the Dida people for the bananas, pineapples, coffee, cocoa, timber, and rubber grown in the surrounding area for export. The town is the site of a government coffee and cocoa research institute and Christian churches. Pop. (1975) 37,896.

divorce, the act by which a valid marriage is dissolved, usually freeing the parties to remarry. In regions in which ancient religious authority still predominates, divorce may be difficult and rare, especially when, as among Roman Catholics and Hindus, the religious tradition views marriage as indissoluble. (For Jewish tradition of divorce, *see* get.) Custom, however, may make divorce a simple matter in some societies. Among some Pueblo Indian tribes a woman could divorce her husband by leaving his moccasins on the doorstep. The principles of individual determination and mutual consent are making divorce increasingly acceptable in the industrialized parts of the world.

Among premodern societies, the rate of marital stability is difficult to measure because of the varying definitions of marriage and divorce. It seems to be broadly true that wherever divorce is a legal impossibility the wedding is a well-defined event conducted with considerable formality. The contrary principle does not hold true: elaborate marriage ceremonial is quite compatible with high divorce rates. Many anthropologists agree that divorce is generally more permissible in matrilineal societies than in patrilineal ones, in which the procreative and sexual rights of the bride are often symbolically transferred to the husband with the payment of bride-price. *See also* family.

Divriği, town, central Turkey. It is situated near the Çaltısuyu River, which is a tributary of the Euphrates. The town lies near the end of a fertile valley surrounded by orchards and gardens and below a small hill dominated by a ruined 13th-century walled citadel. Formerly a Byzantine stronghold known as Tephrike, it was in the mid-9th century a place of refuge for the Paulicians, who were persecuted for heresy by the Byzantine emperors but protected by the Arab caliphs. The town fell to the Turks after their victory over Byzantium in 1071 and was ruled by Dānishmend Turkmens until sacked by the Mongols in the second half of the 13th century. It was incorporated into the Ottoman Empire in 1516. Buildings in Divriği from the 12th and 13th centuries exhibit some of the earliest examples of Muslim Turkish art, including an architectural group built *c.* 1229. Modern Divriği is the largest centre of iron-ore mining in Turkey. Most of the ore is shipped 560 miles (900 km) to the ironworks at Karabük and Ereğli in the Black Sea region. The town lies on the Sivas–Erzurum railway and is linked by road with Sivas city. Pop. (1985) 15,974.

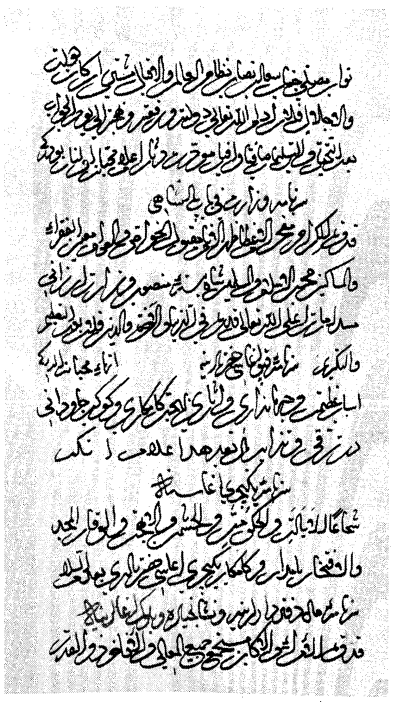
Dīwālī, also spelled DĪVĀLĪ, one of the major religious festivals in India, celebrated over a five-day period from the 13th day of the dark half of the Hindu month Āśvina to the 2nd day of the light half of Kārttika. (The corresponding Gregorian dates fall in late October.) The name is derived from the Sanskrit term *dīpāvali,* or row of lights. The festival is observed with particular enthusiasm by members of the merchant communities and honours Lakṣmī, the goddess of wealth (in Bengal the goddess Kālī is worshiped).

During the festival, small earthenware lamps filled with oil are lighted and placed in rows along the parapets of temples and houses and set adrift on rivers and streams. This is said to be in commemoration of the return of Rāma (an incarnation of the Hindu god Vishnu) to Ayodhyā and his delayed coronation as king after 14 years in exile. The fourth day—the main Dīwālī festival day—also marks the beginning of the new year according to the Vikrama calendar. Merchants perform religious ceremonies and open new account books. It is generally a time for visiting, exchanging gifts, decorating houses, feasting, and wearing new clothes. Gambling is encouraged at this season, as a way of ensuring good luck for the coming year and in remembrance of Lord Shiva and Pārvatī's games of dice played on Mount Kailāsa.

Dīwālī is also an important festival among members of the Jaina community, many of whom belong to the merchant class. For the Jainas, the day commemorates the passing into Nirvāṇa (*i.e.,* death) of Mahāvīra, the most recent of the Jaina Tīrthaṅkaras, or saints. The lighting of the lamps is explained as a material substitute for the light of holy knowledge that was extinguished with Māhavīra's passing.

dīwān: *see* divan.

dīwānī script, cursive style of Arabic calligraphy developed during the reign of the early Ottoman Turks (16th–early 17th century). It was invented by Housam Roumi and reached its height of popularity under Süleyman I the Magnificent (1520–66). As decorative as it was communicative, *dīwānī* was distinguished by the complexity of the line within the letter and the close juxtaposition of the letters within the word.



Diwānī script, 1598–99 (Oxford, Bodleian Library, MS. Laud Or. 67, fol. 77r)
By courtesy of the Bodleian Library, Oxford

Dīwānīyah, ad-, capital of al-Qādisīyah *muḥāfaẓah* (governorate), south-central Iraq. It is located in one of the nation's smallest gover-

norates and is about 100 mi (160 km) south of Baghdad, the national capital. The town lies in a riverine area about 20 mi west of a channel of the Euphrates River, and some nearby areas are under irrigation. Agriculture is the main occupation; palm trees, vineyards, and orchards are cultivated. Pop. (1965) 60,486.

Dix, Dorothea Lynde (b. April 4, 1802, Hampden, District of Maine, Mass., U.S.—d. July 17, 1887, Trenton, N.J.), social reformer and humanitarian whose devotion to the welfare of the mentally ill led to widespread reforms in the U.S. and abroad.

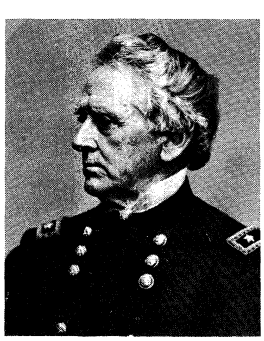
Dorothea Dix, portrait by S.B. Waugh, 1868; in Saint Elizabeths Hospital, Washington, D.C.

By courtesy of Saint Elizabeths Hospital, Washington, D.C.

In 1821 she opened a school for girls in Boston, where, until 1835, periods of intensive teaching were interrupted by periods of ill health. In 1841 she accepted an invitation to teach a Sunday school class in the East Cambridge (Mass.) jail. There the sight of mentally ill persons thrown into prison with criminals of both sexes disturbed her deeply. In the next 18 months she toured Massachusetts institutions where the mentally ill were confined. She revealed the shocking conditions she found in a report to the state legislature (1843). When improvements followed, she turned her attention to neighbouring states and then to those of the West and South. She saw special hospitals for mental patients built in more than 15 states and in Canada and improved treatment practiced throughout the nation. Although her efforts to secure public lands for her cause failed, she aroused a concern for the problems of mental illness in Europe as well as the U.S.

Dix, John Adams (b. July 24, 1798, Boscawen, N.H., U.S.—d. April 21, 1879, New York City), political leader and U.S. Army officer who, as secretary of the treasury of the United States (1861), issued to a treasury officer in New Orleans the famous order: "If any one attempts to haul down the American flag, shoot him on the spot."

He entered the U.S. Army at the age of 14 and served in the War of 1812 and the U.S. Civil War (1861–65). Following a period of law practice (1828–30) in Cooperstown, N.Y., he was appointed adjutant general of New York (1830) and became a member of the Albany Regency, a politically powerful group of New York Democrats. Rising rapidly in politics, he was secretary of state and superintendent of public schools (1833–39), a member of the State Assembly (1841), and a U.S. senator from New York (1845–49). He served as postmaster of New York City (1860), was U.S. minister to France (1866–69), and, in 1872, was elected governor of New York.

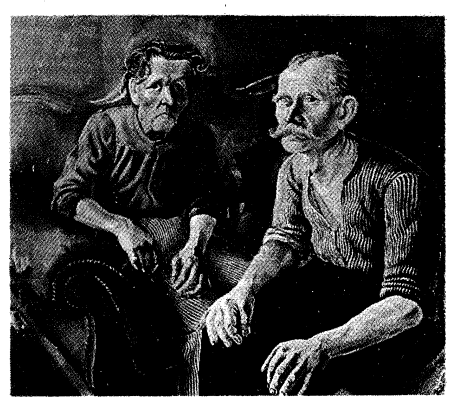


John Dix

By courtesy of the Library of Congress, Washington, D.C.

Dix, Otto (b. Dec. 2, 1891, Untermhaus, Thuringia, Ger.—d. July 25, 1969, Singen, Baden-Württemberg, W.Ger.), German painter and engraver who mixed compassion and Expressionist despair to create works harshly critical of society. He was associated and exhibited with the Neue Sachlichkeit (*q.v.*) group of painters.

Son of a railway worker, Dix was apprenticed to a decorative artist and received training in Dresden. An Impressionist at first, he experimented with various trends in modern art until he arrived at a mordantly individual style, a nightmarish vision of contemporary social reality. While teaching at Düsseldorf (*c.* 1922–25) he did such representative paintings and drawings as "Pimp and Girls" and "Two Sacrifices of Capitalism" (the sacrifices are a grotesque prostitute and a defaced former soldier). In 1924 he etched 50 plates, entitled "War," recording its horrors.



"Parents of the Artist," oil on canvas by Otto Dix, 1921; in the Öffentliche Kunstsammlung, Basel, Switzerland

By courtesy of the Offentliche Kunstsammlung and the Emanuel Hoffman-Stiftung, Basel, Switz.; photograph, Hans Hinz

Appointed a professor at the academy in Dresden (1927), Dix was elected to the Prussian Academy (1931). The Nazi regime, however, incensed at his antimilitary works, cancelled these affiliations and barred him from exhibiting. He was jailed in 1939 on a charge of complicity in a plot on Adolf Hitler's life, but in 1945 he was drafted into the home guard army at the age of 53. He was captured and released by the French.

Dix later turned to religious mysticism, as in "Saul and David" (1945) and "Crucifixion" (1946).

Dixie, the Southern U.S. states, especially those that belonged to the Confederate States of America (1860–65). The name came from the title of a song composed in 1859 by Daniel Decatur Emmett; this tune was popular as a marching song of the Confederate Army, and was often considered the Confederate anthem.

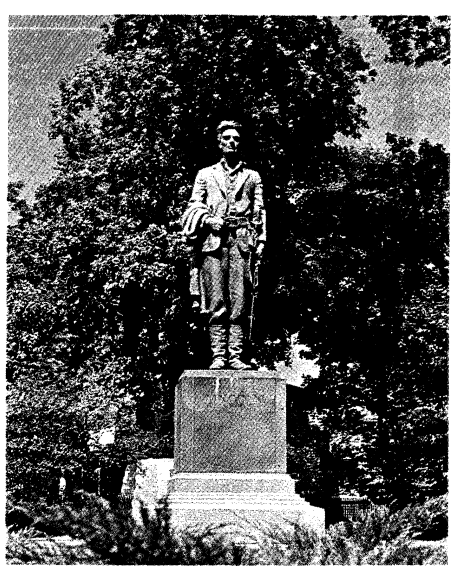
According to the most common explanation of the name, $10 notes issued before 1860 by the Citizens' Bank of New Orleans and used largely by French-speaking residents were imprinted with *dix* (French: "ten") on the reverse side; hence the land of Dixies, or Dixie Land, which applied to Louisiana and eventually the whole South.

The song "Dixie" was originally a "hooray song" or walk-around in Jerry Bryant's minstrel show, for which Emmett, a native Ohioan of Virginian parents, performed and wrote music. It was played at the inauguration of Confederate Pres. Jefferson Davis on Feb. 18, 1861, in Montgomery, Ala.

Dixiecrat, also called STATES' RIGHTS DEMOCRAT, member of a right-wing Democratic splinter group in the 1948 U.S. presidential election organized by Southerners who objected to the civil rights program of the Democratic Party. It met at Birmingham, Ala., and on July 17, 1948, nominated Gov. Strom Thurmond of South Carolina for president and Gov. Fielding L. Wright of Mississippi for vice president. The Dixiecrats, who opposed federal regulations they considered to interfere with states' rights, carried South Carolina, Mississippi, Louisiana, and Alabama, to receive 39 electoral votes; their popular vote totalled over 1,000,000.

Dixieland, in music, a style of jazz, often ascribed especially to the New Orleans pioneers of that movement, although many critics of popular music believe the term better describes the music of a later wave of white Chicago musicians including Jimmy McPartland, Bud Freeman, and Frank Teschemacher. Though a number of critics, especially Europeans, dismiss them, the white New Orleans musicians associated in the early 1920s with Nick LaRocca in the Original Dixieland Jass (later Jazz) Band and with Paul Mares in the New Orleans Rhythm Kings (originally the Friar's Society Orchestra) represent a style that closely parallels the black New Orleans style and had at least as much influence on jazz of the 1920s and '30s. Conspicuous differences are few, but the white New Orleans bands seem to have drawn more from ragtime and European music and less from 19th-century black ethnic music than did the black New Orleans bands. It also should be noted that New Orleans musicians including cornetist Freddie Keppard and bassist Bill Johnson performed in Los Angeles as early as 1912, thus casting doubt on the simplistic myth that jazz evolution ran smoothly "up the river" from New Orleans to Chicago. (*See also* Chicago style, New Orleans style.) H.O. Brunn's *The Story of the Original Dixieland Jazz Band* was published in 1960.

Dixon, city, seat (1834) of Lee County, north central Illinois, U.S., on the Rock River. In



Lincoln Monument State Memorial, Dixon, Ill.

By courtesy of the Illinois Department of Business and Economic Development

1830 John Dixon established a ferry service and tavern there on his mail route between Peoria and Galena. Gen. Henry Atkins built Ft. Dixon as a base for his campaign in 1832 against Chief Black Hawk. The Blockhouse was where Jefferson Davis, Zachary Taylor, and Abraham Lincoln met as comrades-in-arms; a bronze statue (by Leonard Crunelle) depicting the young Lincoln as a captain in the militia marks the site on the river's north bank. Dixon is the commercial centre of an agricultural region and has some industry, notably the manufacture of cement and auto parts. The Dixon Developmental Center is a hospital for the mentally retarded and the blind. Sauk Valley (junior) College (1966) is 5 mi (8 km) west. White Pines Forest State Park is to the north. Inc. 1857. Pop. (1980) 15,659.

Dixon, George (b. *c.* 1755—d. *c.* 1800), English navigator whose exploration of the western coast of North America helped to establish a profitable English fur trade in what is now British Columbia.

Upon returning from Capt. James Cook's third voyage in search of a northwest passage to the Orient (1776–79), he became a captain in the merchant navy. In 1785 he sailed in the "Queen Charlotte," in the service of the King George's Sound Company of London, to develop the fur trade in western North America. His discoveries there included Queen Charlotte Islands, part of Queen Charlotte Sound, Port Mulgrave, Norfolk Sound, Dixon Entrance, and Alexander Archipelago. He sold a cargo of furs in China, where he took aboard a cargo of tea with which he returned to England (1788). In 1789 he published *A Voyage Round the World; but More Particularly to the North-west Coast of America*, which consisted mainly of descriptive letters written by his supercargo, William Beresford. Some doubt exists as to whether he was the same George Dixon as the one who taught navigation at Gosport, Hampshire, and wrote *The Navigator's Assistant* (1791).

Dixon, George (b. July 29, 1870, Halifax, N.S., Can.—d. Jan. 6, 1909, New York City), U.S. boxer, first black to win a world boxing championship. He is considered one of the best fighters in the history of the bantamweight and featherweight divisions (present weight limits 118 pounds and 126 pounds, respectively).

A resident of Boston from 1887, Dixon won the world bantamweight championship by knocking out Nunc Wallace of England in the 18th round on June 27, 1890, in London. Later that year he resigned the title, after one successful defense, and subsequently fought as a featherweight. He held the championship of that class from July 28, 1891, when he knocked out Abe Willis of Australia in the fifth round in San Francisco, to Oct. 4, 1897, when he lost a 20-round decision to Solly Smith, also in San Francisco. He regained that title on Nov. 11, 1898, when he defeated Dave Sullivan in the 10th round in New York City, and he held it until Jan. 9, 1900, when he was knocked out by Terry McGovern in the eighth round, also in New York City. In 20 years of professional boxing (1886–1906) he fought 158 bouts (some boxing historians say 700), including 33 championship fights.

Dixon, Henry Horatio (b. May 19, 1869, Dublin—d. Dec. 20, 1953, Dublin), Irish botanist who investigated plant transpiration and, with John Joly, developed the tension theory of sap ascent.

Dixon studied at Trinity College, Dublin, and the University of Bonn; he became professor of botany at Trinity (1904) and director of the botanical gardens (1906). His early research included work on the cytology of chromosomes and first mitosis in certain plants. Familiarity with work on transpiration and on the tensile strength of columns of sulfuric acid and water led Dixon and Joly to experiment on transpiration. "On the Ascent of Sap" (1894) presented the hypothesis that the sap or water in the vessels of a woody plant ascends by virtue of its power of resisting tensile stress and its capacity to remain cohesive under the stress of great differences of pressure. Dixon and Joly further demonstrated that water is transported through passive vessels and not living cells.

Dixon wrote *Transpiration and the Ascent of Sap in Plants* (1914), which brought various theories and experimental work together in a coherent argument. He also wrote a textbook, *Practical Plant Biology* (1922).

Dixon, Jeremiah (d. 1777, Durham, Durham, Eng.), British surveyor who, working with fellow surveyor Charles Mason, established the boundary between Maryland and Pennsylvania, known since as the Mason and Dixon Line.

Almost nothing is known of Dixon's life prior to his association with Mason. In 1760 the two were selected by the Royal Astronomical Society to travel to Sumatra in order to observe the transit of Venus. They got no further than the Cape of Good Hope, however (where they did make some observations), before returning to England.

In 1763 Mason and Dixon were commissioned by the heirs of William Penn and Lord Baltimore to settle an old dispute over the boundary between Pennsylvania and Maryland. Arriving in Philadelphia in November, they began work the following month at the northeastern corner of Maryland. Proceeding along the parallel of latitude 39°43′17.6″ N, they set milestones bearing a P on one side and M on the other along 244 miles of the boundary; every fifth milestone bore the Penn arms and Calvert arms on appropriate sides. Hostile Indians prevented Mason and Dixon from marking the final 36 miles, and in 1767 they returned to Philadelphia. Their work cost $75,000, but it was ratified by the crown in 1769 and has been accepted ever since.

The Mason and Dixon Line has always been popularly regarded as the boundary between the North and the South, though it was limited to the two states of Pennsylvania and Maryland.

Mason and Dixon were discharged as surveyors of the colonial boundary on Dec. 26, 1767, but they did not return to England until Sept. 9, 1768. Mason continued to work for the Royal Society, but nothing more is known of Dixon other than the year and place of his death.

Dixon, Roland B(urrage) (b. Nov. 6, 1875, Worcester, Mass., U.S.—d. Dec. 19, 1934, Cambridge, Mass.), U.S. cultural anthropologist who, at the Peabody Museum of Harvard University, organized one of the world's most comprehensive and functional anthropological libraries. He also developed Harvard into a leading centre for the training of anthropologists.

Dixon's career was spent entirely at Harvard, where he rose from assistant in anthropology (1897) to professor (1915). His initial field researches were among the Indians of California and resulted in writings, some published jointly with the ethnologist A.L. Kroeber, on ethnography, folklore, and linguistics. A notable work is *The Northern Maidu* (1905). He also made field studies in Siberia, Mongolia, the Himalayas, and Oceania.

Oriented toward the organization and interpretation of anthropological facts rather than toward field work, Dixon introduced an emphasis on the interrelationship between culture and natural environment. Less a theoretician and more a cultural historian, he noted the importance of ethnic migration in cultural change. His most ambitious work is thought to be *The Racial History of Man* (1923), in which he attempted to classify racial types and revealed the diversity of many populations, notably the Polynesians and American Indians. Another major work, *The Building of Cultures* (1928), contained a meticulous examination of cultural diffusion.

Dixon, Thomas (b. Jan. 11, 1864, Shelby, N.C., U.S.—d. April 3, 1946, Raleigh, N.C.), U.S. novelist, dramatist, and legislator who vigorously propagated ideas of white supremacy. He is chiefly remembered for his novel *The Clansman* (1905), which presented a sympathetic picture of the Ku Klux Klan. Dixon's friend, D.W. Griffith, used the novel as the basis for the epic film *The Birth of a Nation* (1915).

After taking a degree from Greensboro (N.C.) Law School, Dixon was admitted to the bar in 1886. He spent a year as a member of the North Carolina legislature but resigned to become a Baptist minister, serving in Raleigh, N.C., Boston, and New York City (1889–99). His first novel, *The Leopard's Spots* (1902), forms a trilogy about the South during Reconstruction with *The Clansman* and *The Traitor* (1907). He wrote other novels and some plays, and as late as 1939 he wrote yet another fictional account of black–white relations in the United States, *The Flaming Sword.* His nonfiction work includes *The Inside Story of the Harding Tragedy* (1932), written with Harry M. Daugherty, President Harding's one-time campaign manager.

Dixon lived in Raleigh in his later years and was clerk of the U.S. District Court, Eastern District, North Carolina, from 1938 to 1943. Although a Democrat, he opposed Franklin D. Roosevelt's New Deal. Dixon espoused many right-wing causes.

Dixon Entrance, narrow passage (50 mi [80 km] wide) of the eastern North Pacific, stretching 50 mi east from the open ocean to Hecate Strait (Canada). The Alexander Archipelago of southeastern Alaska lies to the north and British Columbia's Queen Charlotte Islands to the south. Part of the United States–Canadian border follows the entrance. Once a path followed by the great continental glaciers as they pushed out to sea, the passage now serves as the principal approach to the port of Prince Rupert, B.C. It was named (1788) by Sir Joseph Banks after Capt. George Dixon, who had sailed his ship "Queen Charlotte" through in 1787.

diyah, in Islām, the traditional compensation due for the shedding of blood. In pre-Islāmic times, the compensation required for taking a life was 10 she-camels. The figure was increased to 100 in the area where Islām originated, and this regulation was subsequently endorsed by Muḥammad.

Elaborate rules were laid down concerning injuries of various degrees of severity. The loss of one eye or a foot was thus fixed at 50 she-camels; a blow that penetrated the head or abdomen at 33; the loss of a tooth or a wound that penetrated the skin and exposed the bone at 5 camels. The stipulated age of the camels varied with each case, *e.g.,* for intentional homicide: 25 she-camels that were one year old, 25 that were two years old, 25 that were three years old, and 25 that were four years old.

The stipulations changed when one or both parties were not adult, free, Muslim males. In most circumstances, a minor was not liable to pay the *diyah* at all. A woman would receive only half the *diyah* that a male would receive in identical circumstances. If a slave were killed, his *diyah* would be the same as his market value. If he were wounded, the amount of the *diyah* would correspond to the

loss reflected in his market value. The *diyah* of a Christian or a Jew came to half or one-third that of a Muslim. If a Christian or a Jew were treacherously murdered, his murderer would be put to death. Women and children were exempt from paying the *diyah.*

In case of intentional or unintentional murder, the perpetrator (or, in the case of his death, his heirs) was completely responsible for paying the *diyah.* His relatives might pay for him, but there was no obligation to do so. If the perpetrator could not pay the *diyah* in full immediately, the time could be extended with the approval of the recipient. Owners of shops or farms were responsible for injuries sustained by their employees while at work.

The *diyah* could be paid in silver or gold, particularly to town dwellers, who would generally not accept payment in camels. On the other hand, tent dwellers paid their *diyah*s in camels according to established rules.

Diyālā River, Arabic NAHR DIYĀLĀ, river, important tributary of the Tigris River, rising in the Zagros Mountains of western Iran near Hamadān as the Sīrvān River and flowing westward across lowlands to join the Tigris just below Baghdad, Iraq. Its total length is 275 miles (443 km). The upper Diyālā drains an extensive mountain area of Iran and Iraq, and its course is there marked by defiles and precipices. For 20 miles (32 km) it forms the frontier between the two countries. Thereafter it flows first into a rolling plateau country, forming part of the region known as Assyria and centred on the oil-field area of Khānaqīn, then through the Ḥamrīn Mountains (the southwestern boundary of Assyria) into the flat Tigris lowlands. Several dams, including the Khan Gorge, near the Iranian frontier, divert water for flood control, hydroelectric power, and the irrigation of wheat, rye, cotton, rice, and tobacco in the lower valley. Ba'qūbah, the main riparian centre, lies on the Kirkūk–Baghdad rail line, which parallels the river's lower course.

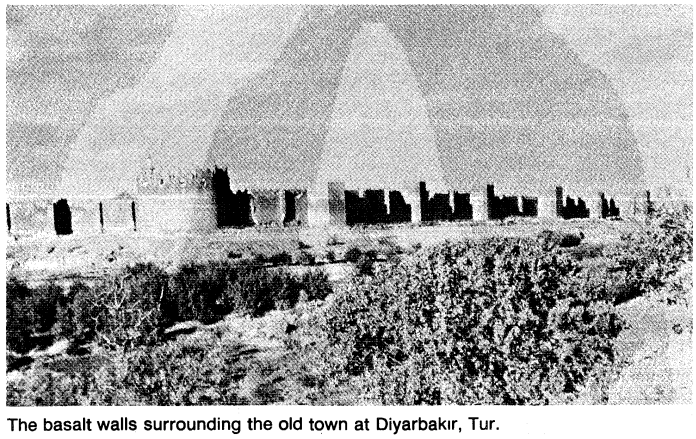
Diyarbakır, also spelled DİYARBEKIR, historically AMIDA, city, southeastern Turkey, on the right bank of the Tigris River. The name means "district (*diyar*) of the Bakr people." Capital of a large and important province under the Ottomans and protected from invasions, it regained its prosperity. Its location, near the Persian frontier, also gave it strategic importance, and the town was used as a base for armies facing Persia.

The old town is still surrounded by the ancient black basalt walls that gave it the name Kara (Turkish: "Black") Amid. The triple walls, an outstanding example of Middle Eastern medieval military art, were greatly expanded and restored during Arab and Turkish periods; they are about 3 miles (5 km) long and have numerous towers. There is a citadel, probably dating from the 4th century BC. Industries include woolen and cotton textiles and copper products; it long has been famous for its gold and silver filigree work. Diyarbakır University was founded in 1966 as a branch of Ankara University and acquired independent status in 1973. Diyarbakır is linked by air and railroad with Ankara and is well-served by roads to major Turkish towns and to Aleppo (Syria) and Mosul (Iraq).

The surrounding region is part of upper Mesopotamia, comprising a large depression crossed by the Tigris River. It is separated from eastern Anatolia by the Taurus Mountains in the north and from the Mesopotamian plain by the Mardin hills in the south; the Karaca Mountain lies to the west. Agricultural products include cereals, cotton, tobacco, and fruits, notably melons; mineral deposits include copper and some coal and petroleum. A large proportion of the population is Kurdish. Pop. (1985) 305,940.

Dizfūl (Iran): *see* Dezfūl.

Dja River, also called NGOKO RIVER, stream in west-central Africa which forms part of the Cameroon–Congo boundary. It rises southeast of Abong-Mbang, southeastern Cameroon, and flows generally southeast past Moloundou to Ouesso, Congo, where it empties into the Sangha River (a tributary of the Congo River) after a course of about 450 miles (720 km). The Dja game reserve (Cameroon) lies along its upper course. Below Moloundou, the river is navigable by small boats throughout the year.



The basalt walls surrounding the old town at Diyarbakır, Tur.
Josephine Powell, Rome

Amida, an ancient town predating Roman colonization in the 3rd century AD, was enlarged and strengthened under the Roman emperor Constantius II, who also erected new walls around the city (349). After a long siege, it fell to the king of Persia in 359. It changed hands frequently in the later wars between the Romans and the Persians and was in Byzantine hands when the Arabs took it (*c.* 639). With the weakening of 'Abbāsid control over the region and the emergence of the Ḥamdānid dynasty of Mosul (in Iraq) in the 10th century, Amida was ruled by various Arab, Turkish, Mongol, and Persian dynasties until its capture by the Ottoman sultan in 1516.

Djaferin Islands: *see* Chafarinas Islands.

Djailolo (Indonesia): *see* Halmahera.

Djajapura (Indonesia): *see* Jayapura.

Djakarta (Indonesia): *see* Jakarta.

Djambi (Indonesia): *see* Jambi.

Djawa (Indonesia): *see* Java.

Djeba (Egypt): *see* Idfū.

Djebar, Assia, original name FATIMA-ZOHRA IMALAYAN (b. Aug. 4, 1936, Cherchell, Alg.), one of the most talented and prolific of contemporary Algerian women writers.

Djebar's career as a novelist began in 1957 with the publication of her first novel, *La Soif* (*The Mischief*). It was followed by *Les Impatients* (1958; "The Impatient Ones"), which similarly dealt with the colonial Algerian bourgeois milieu.

Two later novels, *Les Enfants du nouveau monde* (1962; "The Children of the New World") and *Les Alouettes naïves* (1967; "The Naive Larks"), a sequel, chronicle the growth of an Algerian feminine collective consciousness and describe Algerian women's contributions to the war for independence from France. Djebar collaborated with Walid Garn on the play *Rouge l'aube,* published in the review *Promesses* in 1969. A collection of her poems, *Poèmes pour l'Algérie heureuse,* was also published that year.

Djebar spent most of the war years outside Algeria, but afterward she taught history at the University of Algiers, was made department head of the French Section at the university, and became a filmmaker for the national television station. In 1978 Djebar continued her analysis of the Algerian woman in her film *Nouba des femmes du mont Chenoua,* the story of an Algerian woman engineer returned to Algeria after a long Western exile. *Femmes d'Alger dans leur appartement* (1980), a collection of novellas, was another exploration of the feminine world.

Djedefre, also called REDJEDEF, third king of the 4th dynasty (*c.* 2575–*c.* 2465 BC) of Egypt who, coming from a secondary branch of the royal family, probably usurped the kingship after the death of Khufu, builder of the Great Pyramid.

Djedefre was Khufu's son by a secondary queen. The original crown prince, Kawab, who had married the heiress Hetepheres II, apparently predeceased his father. At Khufu's death, Djedefre married Hetepheres II and became pharaoh. There is some evidence that other princes who claimed the throne tried to overthrow him.

At Abū Ruwaysh, north of Giza, Djedefre started a pyramid about the size of the pyramid of Menkure at Giza, but it was never completed. Granite blocks of its casing have been found, together with the remains of a funerary temple with granite columns. The king also worked the diorite quarries in Nubia (the modern Sudan) near Abu Simbel, where his name occurs. Following an eight-year reign, he perished under unknown circumstances.

The opposition party elevated its candidate, Khafre, to the throne, and he was considered Khufu's legitimate successor. Probably at that time Djedefre's pyramid complex was ransacked and converted into a quarry, so that only a few blocks remain today.

Djeffara (Africa): *see* Jifārah, al-.

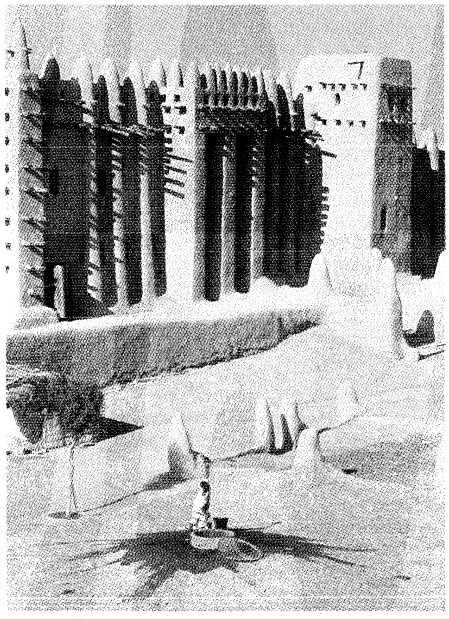
Djelfa, also called (after 1981) EL-DJELFA, town, north-central Algeria, in the Oulad Naïl Mountains at an elevation of 3,734 feet (1,138 m). It is situated between the towns of Bou Saâda and Laghouat. Djelfa town is at a point of transition between the dry, steppe-like Hauts Plateaux of the north, with their *chott*s (saline lakes), and the Sahara (south). The town was founded in 1852 as a French military post on a geometric plan. It serves as an important livestock (goats, sheep, and asses) market centre for the seminomadic Arab Ouled Naïl confederation.

The surrounding region for centuries has been the meeting place of the Ouled Naïl, who live in black-and-red striped tents and claim descent from the Prophet Muḥammad. The area is notable for its abundance of Neolithic rock carvings dating from 7,000 to 5,000 BC. North of Djelfa town there is an impressive physical feature known as Rocher de Sel ("Salt Rock") that resulted from the erosion of rock

salts and marls by rain, and to the west of the town Megalithic funerary structures are found. Pop. (1987) 84,207.

Djember (Indonesia): *see* Jember.

Djenné, also spelled JENNE, or DIENNÉ, ancient trading city and centre of Muslim scholarship, in southern Mali. It is situated on the floodlands of the Niger and Bani rivers, 220 miles (354 km) southwest of Timbuktu. Djenné was founded in the 13th century and served as an entrepôt between the traders of the central and western Sudan and those of Guinea's tropical forests. It is said by some historians to have been founded by Soninke merchants and to have been captured in 1468 by the Songhai emperor Sonni 'Alī. The city benefited both from its direct connection by river with Timbuktu and from its situation at the head of the trade routes to the gold mines of Bitou (now in Côte d'Ivoire), to Lobé, and to Bouré; it was also an important entrepôt for salt. Continuing to prosper throughout the 16th century, Djenné was known by the middle of the 17th century as a centre of Muslim learning. Djenné was besieged after 1818 and subsequently subdued by the Fulani ruler of Macina, Shehu Aḥmadu Lobbo, who expelled those inhabitants of whose form of Muslim worship he disapproved.



Mosque of Djenné, Mali
Abbas/Magnum

In about 1861 Djenné was conquered by the Tukulor emperor al-Ḥājj 'Umar and was occupied by the French in 1893. Thereafter its commercial functions were taken over by the town of Mopti, which is situated at the confluence of the Niger and the Bani rivers to the north. Djenné is now an agricultural trade centre, of diminished importance, with several examples of Muslim architecture, including a large mosque. Pop. (1976) 10,275.

Djerba, Île de (island, Tunisia): *see* Jarbah, Jazīrat.

Djerid, Chott (Tunisia): *see* Jarīd, Shaṭṭ al-.

Djhuty, also spelled DJHOWTEY (Egyptian god): *see* Thoth.

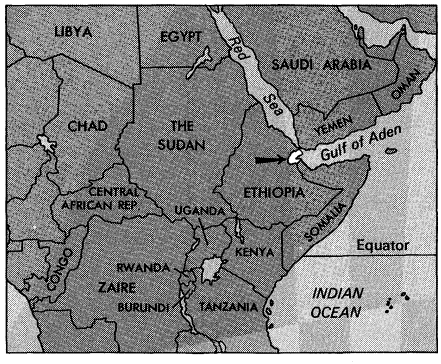
Djibouti, officially REPUBLIC OF DJIBOUTI, French RÉPUBLIQUE DE DJIBOUTI, formerly (until 1977) FRENCH TERRITORY OF THE AFARS AND ISSAS, small country of eastern Africa, situated on the northeast coast of the Horn of Africa and covering an area of 8,950 square miles (23,200 square km). The capital is the city of Djibouti. Facing the Strait of Mandeb (between the Red Sea and the Gulf of Aden) on the east, Djibouti is bordered by Ethiopia to the north, west, and southwest and by Somalia to the south. The population in 1990 was estimated at 528,000.

A brief treatment of Djibouti follows. For full treatment, *see* MACROPAEDIA: Eastern Africa.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. Djibouti may be divided into three principal regions: the coastal plain, deeply indented by the Gulf of Tadjoura, rising inland to less than 650 feet (200 m) above sea level; the volcanic plateaus in the country's southern and central part, rising from 1,000 to 5,000 feet (300 to 1,500 m) but bordered by sunken plains and lakes, some of which are the lowest surface elevations in Africa; and the mountain ranges in the northern part, reaching 6,768 feet (2,063 m) at Mount Mousâ. The land is bare, dry, and desolate, marked by sharp cliffs, deep ravines, burning sands, and thorny shrubs. Several sandy-bottomed streams flow in the mountain region, and a subterranean river, the Ḫoumbouli, is an important source of water. The climate is extremely hot, with mean daily maximum temperatures at Djibouti city ranging between 84° F (29° C) in January and 106° F (41° C) in July. From late summer to the end of March, sea winds bring rain from the Indian Ocean, averaging less than 5 inches (125 mm) annually along the coast to about 20 inches (510 mm) inland. Most of Djibouti is barren desert, and the vegetation consists of low-lying thorn scrub and some grasses. There are some permanent wooded areas in the mountain regions, and some date palms, castor-oil palms, tamarind, and euphorbia are found in the low-lying plain. Animal life includes hyena, jackal, antelope, gazelle, and ostrich. Less than 1 percent of the land in Djibouti is arable, and about 10 percent is available as pasture or rangeland.

The people. The two major Hamito-Semitic-speaking ethnic groups in Djibouti are the Afars (or Danakil) and Somalis of the Issa clan. More than half of the population are Issas and related Somali clans; Afars comprise nearly two-fifths of the population; the rest are Arabs and Europeans (mostly French). Both major ethnic groups are largely nomadic, though the Somalis are more urbanized, and both adhere to the Sunnite branch of Islām. The Afars are concentrated in the north and west of the country, and the Somalis are in the south. Official languages are French and Arabic. In the late 20th century nearly three-fourths of the total population was less than 30 years old. Djibouti city's inhabitants account for about one-half of the country's total population.



Djibouti

Many refugees escaping drought and war have fled to Djibouti from Ethiopia and Somalia since 1975. Most have settled in camps in and around Djibouti city, Dikhil, and Ali-Sabieh, placing a heavy burden on the country's environment and economy.

Economy. Djibouti has a developing market economy that is almost entirely based on trade and commercial services. Djibouti city serves as a major transshipment point for goods entering or leaving Ethiopia. The gross national product (GNP) per capita is significantly higher than those found in other nearby African countries, owing undoubtedly to the large European expatriate community in Djibouti.

Almost all the country's land area is desert, and most food must be imported. Agriculture accounts for less than one-tenth of the GNP. Livestock raising on scrub rangeland is the most important agricultural activity; extremely limited commercial crops include dates and some other fruits and vegetables. Deepwater wells have been sunk to alleviate the effects of periodic drought. Limited fishing is practiced along the coast.

Industry is limited to a few small-scale concerns, mineral-water bottling, dairy processing, and printing, and almost all consumer goods must be imported.

Transit trade and services account for more than three-quarters of the GNP. In addition to the expanding port and the Djibouti–Addis Ababa railway, there is a modern airport capable of servicing large jet aircraft, and several landlocked African countries airfreight their goods to Djibouti for reexport. Djibouti's banking sector is growing in importance, largely because of the relatively stable and easily convertible Djibouti franc, the absence of exchange controls, and Djibouti's international telecommunication services, which are some of the best in sub-Saharan Africa.

Principal exports from the region transiting Djibouti include coffee, salt, hides, dried beans, and cereals; imports, which are mainly consumed in the republic, include machinery, textiles, and foodstuffs. The unfavourable balance of trade is partially offset by transit taxes and harbour dues, but Djibouti is heavily dependent upon foreign assistance, which, because of the country's strategic position, is readily available. Chief trading partners include France, Yemen, Somalia, Bahrain, and Ethiopia.

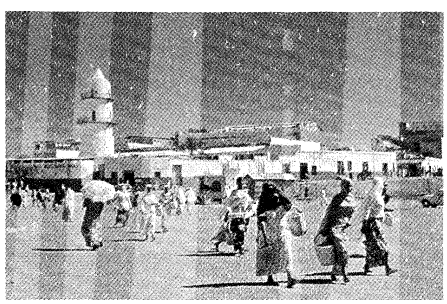
Government and social conditions. Djibouti is a republic, governed by a president elected by the National Assembly. A prime minister heads the cabinet. The legal system is based on a mixture of traditional practices, Islāmic law, and French civil practice. The only legally permitted political party is the ruling Popular Assembly for Progress (Rassemblement Populaire pour le Progrès; RPP).

Health service is provided through hospitals, clinics, multipurpose dispensaries and medical posts. Life expectancy is only 47 years. The labour force of the country contains a large number of unemployed, and wages are generally low. Education is free but not compulsory and comprises primary, secondary, and technical education. The government publishes a weekly newspaper, *La Nation de Djibouti.*

History. In about the 3rd century BC Ablé immigrants came from Arabia and settled generally in the north and partially in the south. The Afars, or Danakil, are descendants of these peoples. Later the Somali Issas pushed the Afars out of the south and settled in the coastal regions. In AD 825 Islām was brought to the area by missionaries. Arabs controlled the trade in this region until the 16th century, when the Portuguese competed for it. In 1862 France acquired Obock and in 1888 established French Somaliland (Côte Française des Somalis). Djibouti became the official capital of this French territory in 1892. A treaty with Ethiopia in 1897 reduced the territory somewhat in size. A railway was built to connect Djibouti with the Ethiopian hinterland, reaching Dire Dawa in 1903 and Addis Ababa in 1917. The interior of the area was

effectively opened between 1924 and 1934 by the construction of roads and administrative posts. After World War II Djibouti port lost trade to the port of Assab in Eritrea. In 1946 French Somaliland acquired the status of an overseas territory, and in 1958 it voted to become an overseas territorial member of the French Community under the Fifth Republic. In 1977 the French Territory of the Afars and Issas became independent as the Republic of Djibouti. The government of the new state had to deal with tension between the Afar and Issa peoples and with refugees from the war zones in Ethiopia and Somalia.

Djibouti, also spelled JIBUTI, port city and capital of the Republic of Djibouti, eastern Africa. It lies on the southern shore of the Gulf of Tadjoura, which is an inlet of the Gulf of Aden. Built on three level areas (Djibouti, Serpent, Marabout) linked by jetties, the city has a mixture of old and modern architecture. Menelik Square contains the government



Place Rimbaud and the Great Mosque in Djibouti, Djibouti

A. Picou—De Wys Inc.

palace. The native quarter of the city has a well-known camel market. The climate is dry and hot. Water is supplied by the underground Houmbouli Stream.

Djibouti owes its creation as a port (*c.* 1888) to Léonce Lagarde, first governor of French Somaliland, as the area was then called. Shortly after it became the capital (1892), work began on the railway that linked Addis Ababa, Eth., to the port in 1917. The harbour is landlocked, covers 160 acres (65 hectares), and has been modernized and dredged to depths of 40–65 feet (12–20 m). Djibouti became a free port in 1949, and the economic life of both the city and the nation depends on the city's use as an entrepôt especially between Ethiopia and the Red Sea trade and as a refueling and supply station. Trade declined during the closure (1967–75) of the Suez Canal. Guerrilla attacks on parts of the Djibouti–Addis Ababa Railway during the Ethiopian civil war in the late 20th century led to further disruption of Djibouti's economy. The Ethiopian-Somali conflict of the 1970s sent many refugees to Djibouti, swelling its population and creating an additional strain on the city's resources. Major population groups in the city are the Afars (Danakils), Issa Somalis, Arabs, Europeans (mostly French), and Asians. Pop. (1988 est.) 290,000.

Djidjelli (Algeria): *see* Jijel.

Djilas, Milovan, Djilas also spelled DILAS (b. 1911, Kolašin region, Montenegro [now in Yugoslavia]), political writer and former Yugoslav communist official remembered for his disillusionment with communism.

After receiving his law degree in 1933 from the University of Belgrade, Djilas was arrested for his political activities against Yugoslavia's royalist dictatorship and was imprisoned for three years. In 1937 he met Josip Broz Tito, the secretary-general of the Yugoslav Communist Party, who in 1945 was to become the communist president of Yugoslavia. Djilas became a member of the party's Central Committee in 1938 and two years later became a member of the Yugoslav party's Politburo. He played a major role in the Partisan resistance to the Germans in World War II and with the war's end in 1945 became one of Tito's leading cabinet ministers. He was actively involved in the Yugoslav communists' assertion of their independence from the Soviet Union in 1948.

In January 1953 Djilas became one of the four vice presidents of the country, and in December he was chosen president of the Federal People's Assembly. Within a month, however, Djilas' intensifying criticism of the Communist Party and his calls for increased liberalization of the regime led to his ouster from all political posts and his own resignation from the party in April 1954. For criticizing the regime in the foreign press he received an 18-month suspended sentence. He was imprisoned in 1956 for an article in an American magazine supporting the 1956 Hungarian uprising.

In the summer of 1957 Djilas' book *The New Class* was published in the West from a smuggled manuscript. In this important study he represented the typical governing communist oligarchy in eastern Europe as a new group of privileged and parasitical exploiters who were not so different from the capitalists and landowners that they had replaced. Rearrested after his book's publication, Djilas was released in 1961 but the following year was imprisoned again for the publication in the West of *Conversations with Stalin* (1962), which was critical of the Soviet leader. Djilas received amnesty in December 1966 and took up residence in Belgrade, where he continued his writing.

Among Djilas' other works are *Struggle of the Communist Party of Yugoslavia* (1948), *The Legend of Njegos* (1952), *Land Without Justice* (1958), *The Leper* (1964), *The Unperfect Society: Beyond the New Class* (1969), *Parts of a Lifetime* (1975), and *Wartime* (1977).

Djokjakarta (Indonesia): *see* Yogyakarta.

Djoser, also spelled ZOSER, also called NETJERYKHET (fl. 27th century BC), second king of the 3rd dynasty (*c.* 2650–*c.* 2575 BC) of Egypt, who undertook the construction of the earliest important stone building in Egypt. His reign was marked by great technological innovation.

Djoser succeeded his brother to the throne. Through his mother, he was related to the last ruler of the 2nd dynasty. Utilizing the brilliant talents of Imhotep, his chancellor, physician, and architect, the king erected a tomb at Ṣaqqārah, outside Memphis (southwest of modern Cairo). The structure was built entirely of stone and thus marked an innovation in Egyptian tomb building, which until then had used mud bricks along with stone. The greatest advance, however, was a complete alteration of the shape of the monument from a flat-topped rectangular structure to a six-stepped pyramid. Surrounding the Step Pyramid were a large number of white limestone temples used for royal rituals. The style of architecture of these buildings reproduced in minutest detail the wood, reed, and brick forms employed in utilitarian construction in Egypt, and the buildings' forms show clearly that this was a first attempt to build so extensively in stone. Surrounding the temple complex was an enclosure wall with numerous gates, which most scholars believe reproduced the walls of the royal capital, Memphis. In response to the internal troubles of the 2nd dynasty, Djoser was the first king to make Memphis his exclusive residence, and he is the king who probably set the city upon the course that made it the political and cultural centre of Old Kingdom Egypt.

Djoser became renowned as the king who brought Egypt to its first great cultural flowering. Together with his minister, Imhotep, who was himself deified, he was remembered into Greco-Roman times. Tradition assigned him a reign of 19 years.

djugurba (mythology): *see* Dreaming, the.

Djursland, eastward projection of Jutland, Denmark, northeast of Århus. Water bounds it on three sides: Århus Bay to the south, the Kattegat (strait) to the east, and Ålborg Bay to the north. Ancient burial places, dolmens, and stone circles dot the low, forested landscape. Old churches, castles, and manor houses (Rosenholm, Gammel Estrup, Løvenholm, and Neilgård) draw tourists, and parts of the long coast have been developed as holiday resorts. At Grenå, an old textile town 2 miles (3 km) from the east coast, an 18th-century hall houses the Djursland Museum. Neighbouring Grenå Harbour is a fishing port with boat connections to Sjælland, Anholt (a Danish island in the Kattegat), and Sweden. A commercial airport north of Feldballe serves the region.

Inlets cut the southern coast of Djursland into several smaller peninsulas. On one are the sandstone Mols Hills covered with heather and spruce. On Helgenæs peninsula across the Ebeltoft Inlet, the winding cobbled streets and half-timbered houses of Ebeltoft preserve its flavour as a medieval market town.

Długosz, Jan, Latin JOHANNES LONGINUS (b. 1415, Brzeźnica, Pol.—d. May 19, 1480, Kraków), Polish diplomat and historian who, with his monumental history of Poland, the first of its kind, inspired Poles with pride in their past and helped to change the attitude of educated Europeans toward Poland by providing an intensely favourable account of its history.

After studying at the University of Kraków (1428–31), Długosz entered the service of Zbigniew Oleśnicki, bishop of Kraków, and eventually became the head of his chancery. Appointed canon of Kraków (1436), Długosz in 1449 brought back from Rome a cardinal's hat for Oleśnicki and was thereafter entrusted with a succession of missions on behalf of church and state. After Oleśnicki's death, Długosz upheld his patron's theocratic views and paid for his attitude with a period of disgrace (1461–63). Unlike Oleśnicki, however, Długosz had from the start supported King Casimir IV in his Prussian policy, assisting him in the negotiations with the Teutonic Order before and during the Thirteen Years' War (1454–66) and at the peace negotiations. His relations with the king having gradually improved, Długosz was charged with the education of the royal princes in 1467. His *Liber beneficiorum ecclesiae Craceviensis* ("Book of the Benefices of the Bishopric of Kraków") is a primary source for economic history. His *Historiae Polonicae*—in 12 books, begun in 1455 and completed in 1480, first published in full in 1711–12 (2 vol.)—though deeply patriotic and often tendentious, contains evidence of many documents no longer extant in the original and compares favourably with similar contemporary works.

DME (navigation): *see* distance-measuring equipment.

Dmitry (personal name): *see under* Demetrius, except as below.

Dmitry, FALSE, also called PSEUDO-DEMETRIUS, Russian LZHEDMITRY, or DMITRY SAMOZVANETS, any of three different pretenders to the Muscovite throne who, during the Time of Troubles (1598–1613), claimed to be Dmitry Ivanovich, the son of Tsar Ivan IV the Terrible (reigned 1533–84), who had died mysteriously while still a child in 1591 at Uglich.

After Fyodor I (reigned 1584–98), the last tsar of the Rurik dynasty, died and his brother-

in-law Boris Godunov succeeded him, the first False Dmitry appeared, challenging Godunov's right to the throne. Considered by many historians to have been Grigory (Yury) Bogdanovich Otrepyev, a member of the gen-

First False Dmitry, portrait by an unknown Polish artist; in the State Historical Museum, Moscow
Novosti Press Agency

try who had frequented the House of the Romanovs before becoming the monk Grigory, the False Dmitry apparently sincerely believed he was the legitimate heir to the throne. While living in Moscow in 1601–02, he claimed to be Prince Dmitry; but, when he was threatened with banishment, he fled to Lithuania, where in 1603 he began to solicit support for a campaign to acquire the Muscovite throne. Aided by individual Lithuanian and Polish nobles, as well as by the Jesuits, the first False Dmitry gathered an army of Cossacks and adventurers and invaded Russia in the fall of 1604. Although his forces were defeated militarily, he attracted followers throughout southern Russia. When Tsar Boris suddenly died in April 1605, the government army shifted its support to the pretender; Muscovite boyars murdered Boris' infant son and heir; Dmitry triumphantly entered Moscow in June 1605 and was proclaimed tsar. Dmitry, however, alienated his supporters by failing to observe the traditions and customs of the Muscovite court, by favouring the Poles who had accompanied him and Marina Mniszek (a Polish nobleman's daughter who became Dmitry's wife) to Moscow, and by planning to engage Muscovy in an elaborate Christian alliance to drive the Turks out of Europe. In May 1606 Vasily Shuysky, one of the boyars who had turned against him, led a coup d'état, murdered the first False Dmitry, and succeeded him as tsar.

Rumours spread that Dmitry had survived the coup d'état, and in August 1607 another pretender appeared at Starodub claiming to be the recently deposed tsar. Although the second False Dmitry bore no physical resemblance to the first, he gathered a large following among Cossacks, Poles, Lithuanians, and rebels who had already risen against Shuysky. Gaining control of southern Russia, he marched toward Moscow and established his headquarters, including a full court and government administration, at the village of Tushino (spring 1608). Known thereafter as the Thief of Tushino, the second False Dmitry sent his bands to ravage northern Russia, and, after Marina Mniszek formally claimed him as her husband, he wielded authority that rivaled Shuysky's. In the spring of 1610, however, Shuysky, aided by Swedish troops, ejected the Thief of Tushino from northern Russia and forced him to flee to Kaluga. The second False Dmitry nevertheless continued to contend for the Muscovite throne until one of his own followers fatally wounded him in December 1610.

On March 28, 1611, a third False Dmitry, who has been identified as a deacon called Sidorka, appeared at Ivangorod. Gaining the allegiance of the Cossacks (March 1612), who were ravaging the environs of Moscow, and of the inhabitants of Pskov, he acquired the nickname Thief of Pskov. But in May 1612 he was betrayed and later executed in Moscow.

Dmitry (II) Donskoy, byname of DMITRY IVANOVICH (b. Oct. 12, 1350, Moscow—d. May 19, 1389, Moscow), prince of Moscow (1359–89) and grand prince of Vladimir (1362–89), who won a victory over the Golden Horde (Mongols who had gained control over the Russian lands in 1240) at the Battle of Kulikovo (Sept. 8, 1380).

Son of Ivan II the Meek of Moscow (reigned 1353–59), Dmitry became ruler of the principality of Moscow when he was only nine years old; three years later he convinced his suzerain, the great khan of the Golden Horde, to transfer the title grand prince of Vladimir (which had been held by Muscovite princes from 1328 to 1359) from Dmitry of Suzdal to him.

In addition to gaining the title grand prince of Vladimir for himself, Dmitry strengthened his position by increasing the territory of the principality of Muscovy, by subduing the princes of Rostov and Ryazan, and by deposing the princes of Galich and Starodub. While the Golden Horde was suffering from internal conflicts, Dmitry stopped making regular tribute payments and encouraged the Russian princes to resist the Mongols' raids. In 1378 the Russians defeated an army of the Horde on the Vozha River.

Subsequently, Mamai, the Mongol general who was the effective ruler of the western portion of the Golden Horde, formed a military alliance with neighbouring rulers for the purpose of subduing the Russians. Confronting the Mongols on the Don River, however, in the bloody battle on Kulikovo Pole, Dmitry routed Mamai's forces; for his victory Dmitry was honoured with the surname Donskoy ("of the Don"). Shortly afterward, however, his lands were resubjected to Mongol domination when the Mongol leader Tokhtamysh overthrew Mamai (1381), then sacked Moscow (1382) and restored Mongol rule over the Russian lands.

Dmowski, Roman (b. Aug. 9, 1864, Kamionek, near Warsaw—d. Jan. 2, 1939, Drozdowo, Pol.), Polish statesman, a leader of Poland's struggle for national liberation, and the foremost supporter of cooperation with Russia as a means toward achieving that goal.

As a student in Warsaw, Dmowski involved himself in the movement for Polish liberation and in 1895 helped found the influential *Przegląd Wszechpolski* ("All-Polish Review") at Lwów (Lvov). A leader of the National Democratic Party from its foundation (1897),

Dmowski, drawing by Lela Pawlikowska, 1929; in the collection of Dr. T. Bielecki
By courtesy of Dr. T. Bielecki

he opposed revolutionary methods of establishing an independent Poland and favoured an autonomist solution to national aspirations within the Russian Empire. During the Russo-Japanese War (1904–05) he actively combatted the plans of Polish revolutionaries—especially Józef Piłsudski, the future president of Poland—to secure an understanding with Japan as a prelude to national insurrection. He later distinguished himself in the second and third Russian Dumas (legislative assemblies) as the chief spokesman for Polish collaboration with Russia. By 1912, however, his policy had been largely discredited, and in October of that year he failed to be elected to the fourth Duma.

During the early months of World War I Dmowski helped form a "National Committee" that sought to achieve Polish national aims through cooperation with Russia and its Western allies. From the summer of 1915, however, he looked solely to the Western powers for deliverance and discarded his autonomist program for one demanding full national sovereignty for Poland. In August 1917 he formed a National Committee at Lausanne, Switz., which later was recognized by the Allies as the official representative of Polish interests.

After the war Dmowski represented the new Polish national government at the Paris Peace Conference, and in June 1919 he signed the Treaty of Versailles. He subsequently sat in the constituent Sejm (Polish national assembly) until 1922 and briefly served as foreign minister during 1923, but thereafter he largely retired from active politics. His book *Niemcy, Rosya i kwestya polska* (1908; "Germany, Russia, and the Polish Question") is an interesting exposition of his prewar views.

DMT, abbreviation of DIMETHYLTRYPTAMINE, powerful, naturally occurring hallucinogenic compound structurally related to the drug LSD (lysergic acid diethylamide). DMT blocks the action of serotonin (a transmitter of nerve impulses) in brain tissue. It is inactive when taken by mouth and produces effects only when injected, sniffed, or smoked. The hallucinatory action begins about five minutes after administration by injection and lasts for about an hour. Naturally-formed DMT has been found in the body fluids of persons suffering from schizophrenia. It also has been synthesized chemically. DMT is contained in cohoba, the hallucinogenic snuff made from the seeds of *Piptadenia peregrina* and used by the Indians of Trinidad and the Orinoco Plain in South America at the time of early Spanish explorations.

DNA, abbreviation of DEOXYRIBONUCLEIC ACID, organic chemical of complex molecular structure that is found in all living cells and that codes genetic information for the transmission of inherited traits.

A brief treatment of DNA follows. For full treatment, *see* MACROPAEDIA: Genetics and Heredity; Biochemical Components of Organisms.

The DNA molecule is the largest known molecule and can be seen under an electron microscope. The molecule's unique structure confers great stability, allowing it to act as a template for the production, or replication, of new DNA molecules or of a related molecule, RNA (ribonucleic acid), which mediates the synthesis of proteins by the cell. Although DNA was first discovered by Friedrich Miescher in 1869, it was not until 1943 that its role in genetic inheritance was demonstrated. The structure of DNA consists of two strands of a phosphoryl-deoxyribose polymer that are connected in a double spiral, or helix, by bonds between nitrogenous bases attached to the polymer. This structure was determined by James Watson and Francis Crick in 1953. The sequence of nitrogenous bases dictates what specific genetic information the molecule

encodes; a segment of DNA that codes for the cell's synthesis of a specific protein is called a "gene" and may be made up of hundreds of three-base sequences, or "codons," each determining a specific amino acid in the protein. Only four bases (the purines, adenine and guanine, and the pyrimidines, cytosine and thymine) occur in DNA, giving a total of 64 possible codons, the repeated sequences of which encode all inherited traits.

The nitrogenous bases on each strand of the DNA molecule bind to specific complementary bases on the opposing strand. DNA replicates by separation into two single strands, each of which serves as a template for a new strand built up by bonding of new bases to the bases of the original. Adenine binds only to thymine, and guanine only to cytosine, so the new strand is precisely complementary to the original strand. Ultimately, two new double-stranded molecules of DNA are produced, each containing one of the original DNA strands and one new strand; this "semiconservative" replication is the key to the stable inheritance of genetic traits.

In cells that contain a nucleus, DNA is organized into dense nuclear protein–DNA complexes called chromosomes. Some bacteria also have cytoplasmic DNA structures called plasmids and produce enzymes that cut these plasmids at specific points. Use of these enzymes in the laboratory to sever DNA strands and insert new pieces of DNA has led to the development in the 1980s of recombinant DNA technology, which can be used to confer new properties on organisms by the introduction of new genes into them.

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Dnepr River, also spelled DNIEPER, Ukrainian DNIPRO, Belorussian DNEPRO, river of Europe, the fourth longest (1,367 miles [2,200 km]) after the Volga, Danube, and Ural rivers. The Dnepr rises on the southern slopes of the Valdai Hills west of Moscow in Smolensk *oblast* (province), Russian S.F.S.R., and flows south and west through Belorussia and the Ukraine and then into the Dnepr estuary of the Black Sea.

The following article summarizes information about the Dnepr River. For full treatment, *see* MACROPAEDIA: Europe.

The river can be divided roughly into three parts: the swampy upper Dnepr (800 miles [1,300 km] long) as far as Kiev, where about four-fifths of the Dnepr River basin's annual runoff forms; the forest–steppe region of the middle Dnepr (340 miles [550 km] long); and the semiarid Black Sea Lowland region of the lower Dnepr (200 miles [320 km] long). The major tributaries in its drainage basin of 195,000 square miles (505,000 square km) are the Desna, Sozh, Berezina, Vorskla, Teterev, and Pripyat rivers. The climate of the Dnepr basin is continental, and annual precipitation decreases from 30 to 32 inches (760 to 810 mm) in the north to about 18 inches (460 mm) in the south. More than 300 hydroelectric plants operate in the Dnepr River basin, supplying water to the Donbass and Krivoy Rog industrial regions and, for irrigation, to the arid lands of the southern Ukraine and Crimea. The Kremenchug, Kakhovka, Dneproges, and Dnepr are some of the major hydroelectric power stations on the river. The mean annual runoff of the river is 13 cubic miles (54 cubic km), but there is considerable yearly variation. The water of the Dnepr is low in minerals; it carries annually an average of 8.6 million tons (7.8 million metric tons) of dissolved matter to the sea. More than 60 species of fish are found in the Dnepr, including pike, carp, roach, goldfish, whitefish, catfish, perch, and herring. The construction of dams and reservoirs has deepened the river and facilitated navigation for about 1,042 miles (1,677 km) during the 10 months of the year when it is not frozen. The principal cargoes are coal, ore, building materials, and other bulk freight. The chief ports on the Dnepr are Dorogobuzh, Smolensk, Orsha, Kiev, and Kherson.

Dneprodzerzhinsk, also spelled DNEPRODZERŽINSK, formerly (until 1936) KAMENSKOYE, city, Dnepropetrovsk *oblast* (province), Ukraine, U.S.S.R., along the Dnepr River. Founded about 1750 as the Cossack settlement of Kamenskoye, the town grew after 1889 with the development of the metallurgical industry. It was renamed Dneprodzerzhinsk in 1936. A large, modern iron and steel plant produces high-grade steels; there are also rolling-stock, cement, coke-chemical, and nitrate-fertilizer plants. In 1964 a dam and hydroelectric station were completed on the Dnepr immediately above Dneprodzerzhinsk. Most of the largest factories are located in the central parts of the city, but there is also new industrial and residential development to the south and southwest. There are a metallurgical institute and several technical schools. Pop. (1989 prelim.) 282,000.

Dnepropetrovsk, *oblast* (province), Ukraine, U.S.S.R. It lies astride the Dnepr River, which there comprises three reservoirs dammed for hydroelectric power. The *oblast*'s area of 12,300 square miles (31,900 square km) consists of rolling plains of loess-covered sedimentary rocks, very much dissected by erosion gullies. In the valleys are outcrops of underlying ancient crystalline rocks. The fertile soil was originally in grass-steppe vegetation that has been almost entirely removed by the plow. Only on the Dnepr and Samara floodplains are there forest groves, mainly of oak. The climate is continental, with hot summers and cold winters, the latter modified by incursions of warm air from the Black Sea. The *oblast,* formed in 1932, is important for its mineral wealth. Around Krivoy Rog are huge deposits of iron ore, and in the Nikopol–Marganets area are rich manganese deposits that are estimated to be the largest in the world. Titanium is mined at Volnogorsk; natural gas is extracted at Pereshchepino, and some coal is extracted in the east. These minerals are the basis of large-scale heavy industry in the *oblast*'s four large cities—Dnepropetrovsk city (the *oblast* headquarters), Krivoy Rog, Dneprodzerzhinsk, and Nikopol—which engage in iron and steel production and a wide range of heavy engineering. Agriculture is also important in the *oblast,* especially the cultivation of winter wheat, corn (maize), spring barley, sunflowers, fodder crops, and melons. Pop. (1989 prelim.) 3,883,000.

Dnepropetrovsk, formerly (until 1926) YEKATERINOSLAV, or EKATERINOSLAV, city and administrative centre, Dnepropetrovsk *oblast* (province), Ukraine, U.S.S.R. It lies along the Dnepr River, near its confluence with the Samara. The river has been considerably widened by the construction of a dam about 50 miles (80 km) downstream. Founded in 1783 as Yekaterinoslav on the river's north bank, the settlement was moved to its present site on the south bank in 1786. The community was known as Novorossiysk from 1796 to 1802, when its old name was restored and it became a provincial centre. Despite the bridging of the Dnepr in 1796 and the growth of trade in the early 19th century, Yekaterinoslav remained small until the 1880s, when railways were built to Odessa, the Donets Basin, and Moscow and industrialization began. In 1926 it was renamed Dnepropetrovsk.

Since the October Revolution (1917), Dnepropetrovsk has developed into one of the largest industrial cities of the U.S.S.R. With iron ore from Krivoy Rog, manganese from Nikopol, coal from the Donets Basin, and electric power from the cascade of hydroelectric plants on the Dnepr, a huge iron and steel industry has grown up in the city; and castings, plates, sheets, rails, tubes, and wire are produced. Large engineering industries make electric locomotives, agricultural machinery, mining and metallurgical equipment, presses, and other heavy machinery, as well as light-industrial machinery and radio equipment. Coke-based chemicals, tires, plastics, paint, clothing, footwear, foodstuffs, and other materials are also produced. Dnepropetrovsk has a university and teaching institutes of mining, agriculture, chemical technology, metallurgy, medicine, and railway and constructional engineering. Cultural amenities include several theatres and a philharmonic hall. Newer suburbs have spread to the north bank. The neighbouring suburbs of Igren and Pridneprovsk were annexed in the 1970s. Pop. (1989 prelim.) 1,179,000.

Dnestr River, English conventional DNIESTER, Turkish TURLA, Romanian NISTRUL, river of the Soviet Union, rising in the Carpathian Mountains and flowing south and west for 840 miles (1,352 km) to the Black Sea near Odessa. It is the second longest river in the Ukraine and the main water artery of Moldavia.

The Dnestr and its tributaries drain a long, narrow basin of about 28,000 square miles (72,000 square km) that is bounded on the north by the Volyno-Podolsk Upland and on the south of the river's upper course by the Carpathian Mountains. Farther to the south are hilly plains and the Moldavian plateau, and at the southernmost end of the basin is the Black Sea Lowland. The estuary of the Dnestr is formed by the incursion of the sea into the lower Dnestr River valley, forming a shallow basin that is separated from the sea by a narrow strip of land. The Dnestr has many tributaries, only 15 of which are more than 60 miles (95 km) long. They include the Stry, Svicha, Lomnitsa, Bystritsa, Zolotaya Lipa, Strypa, Seret, Smotrich, Ushitsa, Murafa, Reut, Byk, and Botna.

The climate of the river basin is humid, with warm summers. Annual precipitation varies within a range of from 40 to 50 inches (1,000 to 1,250 mm) in the Carpathians down to 20 inches (510 mm) near the Black Sea. A large proportion of the land of the basin is under cultivation.

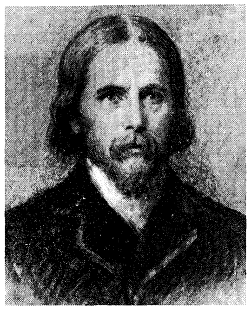
The Dnestr frequently floods, causing extensive damage to settled areas. The water level in its middle course varies by 25–35 feet (7.5–10.5 m) at different times of the year because of melting snow and rainfall in the upper part of its basin. The river's average discharge is about 10,000 cubic feet (300 cubic m) per second, but it has been known to reach 250,000 cubic feet (7,100 cubic m) per second or more at times of flood. Freezing usually occurs at the end of December or the beginning of January and lasts about two months, although in some years there is no icebound period.

Although the basin of the Dnestr is densely populated, there are no large towns along the river itself. Lvov, Ternopol, Stanislav, Kishinyov, and other urban centres lie above the main valley on tributaries.

The Dnestr is navigable for about 750 miles (1,200 km), from its mouth to Rozvaduv; regular passenger and freight lines run from Soroki to Dubossary and from Dubossary to the sea. Navigation is made difficult on the lower reaches by shallow water and sandbars. The river is used extensively for carrying logs, which are brought together at the mouths of the Carpathian tributaries and rafted downstream. Fishing is of little importance except near the coast. In the lower reaches and in the Dubossary Reservoir there are fish hatcheries for sturgeon, whitefish, pike perch, and carp.

DNVP: *see* German National People's Party.

Dobell, Sydney Thompson, pseudonym SYDNEY YENDYS (b. April 5, 1824, Cranbrook, Kent, Eng.—d. Aug. 22, 1874, Nailsworth, Gloucestershire), English poet of the spasmodic school (*q.v.*). His long and formless dramatic poem *The Roman* (1850) was hailed by the critics and secured for its author the acquaintance of many notable figures in liberal politics and in literature. *The Roman* celebrated the revolutionary year of 1848; another long poem, *Balder* (intended as part of a trilogy), was not appreciated and was cruelly burlesqued in *Firmiliam: . . . a Spasmodic Tragedy,* by W.E. Aytoun. The vague aesthetic of the spasmodic school was expressed by Dobell in a number of essays collected in 1876 as *Thoughts on Art, Philosophy and Religion.* Dobell also wrote lyrics and, with Alexander Smith, a sonnet sequence on the Crimean War.



Dobell, portrait by Briton Riviere in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

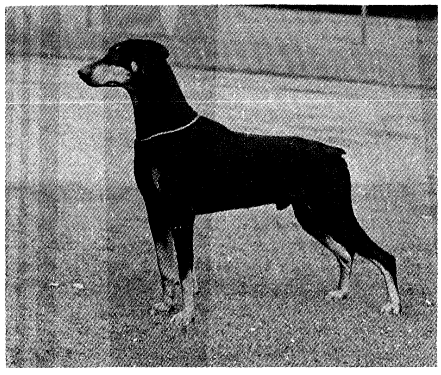
Dobeneck, Johannes: *see* Cochlaeus, Johannes.

Döbereiner, Johann Wolfgang (b. Dec. 13, 1780, Hof an der Saale, Ger.—d. March 24, 1849, Jena), German chemist whose observation of similarities among certain elements anticipated the development of the periodic system of elements.

As a coachman's son he had little opportunity for formal schooling, but he was apprenticed to an apothecary, read widely, and attended learned science lectures. Eventually he was able to attend the University of Jena, where he became an assistant professor (1810) and later was supervisor of science instruction. He was a lifelong friend of Johann Wolfgang von Goethe.

During the 1820s Döbereiner's experiments with the ignition of hydrogen on contact with powdered platinum led the Swedish chemist J.J. Berzelius to develop the concept of catalysis. Toward the end of the decade Döbereiner found that the properties of bromine, a liquid, seem halfway between those of chlorine gas and the solid iodine. He recalled a comparable graduation of properties in two other sequences—calcium, strontium, barium; and sulfur, selenium, tellurium. He showed that in each triad the mean of the lightest and heaviest atomic weights approximated the atomic weight of the middle element. But he could not substantiate his hypothesis with a sufficient number of triads, and his findings were regarded in his time as merely interesting curiosities. Döbereiner also discovered the organic compound furfural and developed the separation of calcium and magnesium.

Doberman pinscher, breed of working dog developed in Apolda, Ger., by Louis Dobermann, a night watchman and keeper of the dog pound, in the late 1800s. The Doberman pinscher is a clean-cut, agile, and powerful dog standing 24 to 28 inches (61 to 71 centimetres) and weighing 60 to 75 pounds (27 to 34 kilograms). It has a short, smooth coat, black, blue, fawn, or red, with rust markings on the head, throat, chest, base of the tail, and feet. The breed has a reputation for fearlessness, alertness, loyalty, and intelligence. It has been used in police and military work, as a watchdog, and as a guide dog for the blind.



Doberman pinscher

Sally Anne Thompson—EB Inc.

Döblin, Alfred (b. Aug. 10, 1878, Stettin, Ger.—d. June 28, 1957, Emmendingen, near Freiburg im Breisgau, W.Ger.), German novelist and essayist, the most talented narrative writer of the German Expressionist movement.

A doctor by profession, he practiced psychiatry in the workers' district of the Alexanderplatz in Berlin. Döblin lived in exile in France and the U.S. from 1933 to 1945.

Although Döblin's technique and style vary, the urge to expose the hollowness of a civilization heading toward its own destruction and a quasi-religious urge to provide a means of salvation for suffering humanity are two of his constant preoccupations.

Die drei Sprünge des Wang-Lun (1915; "The Three Leaps of Wang-Lun") was his first successful novel. Wang-Lun, a roaming revolutionary crushed by the power of the state, demonstrates the possibility of the victory of the nonviolent spirit over brute force. A variation on this theme, in which mere power brings about the collapse of the state, is developed in the historical novel *Wallenstein* (1920). In his novel *Berge, Meere und Giganten* (1924; "Mountains, Seas, and Giants"; republished as *Giganten* in 1932), he unfolds, with merciless satire, an apocalyptic vision of man's future, in which nature revenges itself on man for having, through science, so radically invaded its domain.

In his best known and most Expressionistic novel, *Berlin Alexanderplatz* (1929; Eng. trans., *Alexanderplatz, Berlin,* 1931), he combines interior monologue (in colloquial language and Berlin slang) with the technique of the camera to create a rhythm that powerfully dramatizes man's state in a disintegrating world. Other works are the novels *Babylonische Wanderung* (1934; "Babylonian Wandering"), sometimes described as a late masterwork of German Surrealism; *Pardon wird nicht gegeben* (1935; *Men Without Mercy,* 1937); and his discriminating essay on German literature, *Die deutsche Literatur* (1938).

Dobrič, also spelled DOBRICH (Bulgaria): *see* Tolbukhin.

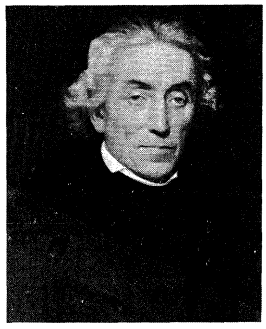
Dobrolyubov, Nikolay Aleksandrovich (b. Feb. 5 [Jan. 24, old style], 1836, Nizhny Novgorod, Russia—d. Nov. 29 [Nov. 17, O.S.], 1861, St. Petersburg), radical Russian Utilitarian critic who rejected traditional and romantic literature.

Dobrolyubov, the son of a priest, was educated at a seminary and a pedagogical institute. Early in his life he rejected traditionalism and found his ideal in progress as represented by Western science. In 1856 Dobrolyubov began contributing to *Sovremennik* ("The Contemporary"), an influential liberal periodical, and from 1857 until his death he was chief critic for that journal. He was perhaps the most influential critic after Vissarion Belinsky among the radical intelligentsia; his main concern was the criticism of life rather than of literature. He is perhaps best known for his essay "Chto takoye Oblomovshchina" (1859–60; "What Is Oblomovism?"). The essay deals with the phenomenon represented by the character Oblomov in Ivan Goncharov's novel of that name. It established the term Oblomovism as a name for the superfluous man of Russian life and literature.

Dobrovolsky, Georgy Timofeyevich (b. June 1, 1928, Odessa, Ukrainian S.S.R.—d. June 29, 1971, in space, probably over Iran), Soviet cosmonaut, mission commander on the Soyuz 11 mission in which he, along with design engineer Viktor Ivanovich Patsayev and flight engineer Vladislav N. Volkov, remained in space a record 24 days. They created the first manned orbital scientific station by docking their Soyuz 11 spacecraft with the unmanned Salyut station launched two months earlier, but they were found dead in their space capsule after it made a perfect landing in Kazakhstan. Death was caused by decompression resulting from a leak in their capsule when a hatch was improperly closed. While in the space station, they had performed meteorological and plant-growing experiments.

Dobrovský, Josef (b. Aug. 17, 1753, Gyarmat, Hung.—d. Jan. 6, 1829, Brno, Moravia, Austrian Empire), Czech language scholar, antiquary, and a principal founder of comparative Slavic linguistics.

Educated for the Roman Catholic priesthood, he devoted himself to scholarship after the 1773 dissolution of the Jesuit Order. Indefatigable in his research of ancient Slavic manuscripts, he travelled widely, notably to Russia and Sweden in 1792, in search of works that had been removed during the Thirty Years' War. Textual criticism of the Bible led him to the study of Old Church Slavonic and, subsequently, to the Slavic languages as a group. His erudition ultimately extended to all fields of Slavic literature, language, history, and antiquities.



Dobrovský, detail of an oil painting by J. Tkadlík, 1821; in the Muzeum české literatury, Prague

By courtesy of P.N.P. Muzeum ceske literatury, Prague

The first of his three most important works was *Geschichte der böhmischen Sprache und Litteratur* (1792; "History of the Bohemian Language and Literature"), which included considerations of many earlier works long suppressed because of their Protestant religious content. His grammar of Czech, *Lehrgebäude der böhmischen Sprache* (1809; "Learning System of the Bohemian Language"), codified the language and brought order into the usage of the literary language that had come to be neglected in the preceding 150 years. The foundation of comparative Slavic studies was

laid in Dobrovský's grammar of Old Church Slavonic (1822).

Dobruja, also spelled DOBRUDJA, Romanian DOBROGEA, historic region of eastern Europe between the Danube (west) and the Black Sea (east). It is divided politically between Bulgaria and Romania. The Bulgarian portion is largely upland, while the Romanian section is mostly lowland, with coastal lagoons and marshes. Dobruja was colonized by the Greeks, Romans, and Byzantines and was repeatedly overrun by Goths, Alani, and Huns. It was a battleground during the Russo-Turkish wars of the 18th and 19th centuries.

Dobrynin, Anatoly Fyodorovich (b. Nov. 16, 1919, Krasnaya Gorka, Russian S.F.S.R.), Soviet diplomat, ambassador to the United States (1962–86), and dean of the Washington, D.C., diplomatic corps (1979–86). In 1986 he was appointed to the Communist Party Secretariat in Moscow. He retired from this position near the end of 1988, but later that year was appointed a special foreign-policy adviser.

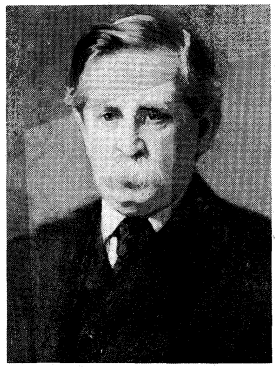
The son of a worker, Dobrynin graduated from the Sergo Ordzhonikidze Moscow Aviation Institute during the war year of 1942 and served as an engineer at an aircraft plant. In 1944–46 he studied at the Higher Diplomatic School of the Ministry of Foreign Affairs (becoming a Communist Party member in 1945) and thereafter served in the Moscow foreign office until 1952, when he was sent to Washington, D.C., first as counselor (1952–54) and then as the second-ranking minister-counselor (1954–55). From 1955 to 1957 he was again based in Moscow and took part in several international conferences abroad, and from 1957 to 1960 he held posts in the United Nations Secretariat in New York City.

Dobrynin became Soviet ambassador in Washington, D.C., in March 1962 and—because he spoke English and French fluently, was good-humoured, and had intellectual flair—became a highly visible presence on the Washington scene. He became a candidate member (1966) and then a full member (1971) of the Central Committee of the Communist Party of the Soviet Union, and in 1986 he was called back to Moscow to become a member of its prestigious and powerful Secretariat, which executes the party's policies.

Dobšiná, mining village, Východoslovenský *kraj* (region), Czechoslovakia, in the Slovak Ore Mountains, on the Slaná River, west of Košice. The settlement, founded in 1326 by immigrant German miners, has retained a tradition of lumbering and iron mining. A few miles northwest is Dobšiná Ice Cave, set in massive limestone rocks. The largest room, called "Big Hall," is 396 feet by 148 feet by 39 feet (120 m by 45 m by 12 m); there is also a "Little Hall." The floor is an ice sheet 66 feet (20 m) thick. Pop. (1982 est.) 4,285.

Dobson, (Henry) Austin (b. Jan. 18, 1840, Plymouth, Devonshire, Eng.—d. Sept. 2, 1921, London), English poet, critic, and biographer whose love and knowledge of the 18th century lent a graceful elegance to his poetry and inspired his critical studies.

In 1856 Dobson entered the Board of Trade, where he remained until his retirement in 1901. Married in 1868, he became a father of 10 and lived in the London suburb of Ealing until his death at 81. His first collection of poems, *Vignettes in Rhyme* (1873), was followed by *Proverbs in Porcelain* (1877). In these and in *At the Sign of the Lyre* (1885), he showed the polish, wit, and restrained pathos that made his verses popular. The ease with which he handled the artificial French forms—the ballade, the triolet, and the rondeau—helped to revive their use in English. After 1885 Dobson was chiefly occupied with biographical and critical works: books on Henry Fielding, Thomas Bewick, Richard Steele, Oliver Goldsmith, Horace Walpole,



Austin Dobson, detail of a portrait by Frank Brooks, 1911; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

William Hogarth, Samuel Richardson, and Fanny Burney revealed careful research into, and sympathy with, 18th-century life. Three series of *Eighteenth Century Vignettes* (1892–96) and *A Paladin of Philanthropy* (1899 and 1901) typify his delicate prose style.

Dobson, Frank (b. Nov. 18, 1888, London—d. July 22, 1963, London), English sculptor influential in the promotion and development of modern art in England.

Dobson studied at the City and Guilds of London Art School and worked with the Cornish granite cutters. Influenced by Cubism, his early work was geometric and abstract, revealing a concern for volume and space and the relationship of mass to mass that was to earmark all his work. From his early abstract forms he turned to figurative sculpture inspired by the classically ideal style of Aristide Maillol. His subject matter at this time was chiefly allegorical and symbolic, often interpreted through the nude female figure.

Dobson used a wide variety of materials—white marble, Ham hill stone, Portland stone, bronze, faience, terra-cotta, plaster, silver, glass, concrete—suggesting a greater interest in the revelation of the intrinsic qualities of the material than in the subjective meaning of the image. In later years his forms again became more abstract.

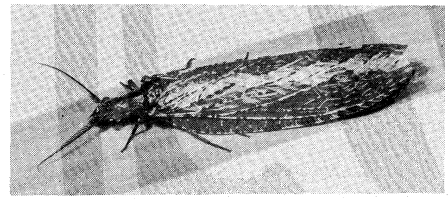
Dobson, William (b. 1610, London—d. Oct. 28, 1646, London), English portrait painter, one of the first distinguished native English painters.

His father was master of the Alienation Office in London but, upon falling on hard times, was forced to bind his son as an apprentice to a stationer and picture dealer. While in such employment the young Dobson began to copy the pictures of Titian and Anthony Van Dyke and also to draw pictures from life.

Van Dyck, happening to pass a shop in Snow Hill where one of Dobson's pictures was exposed, sought out the artist and presented him to Charles I, who took Dobson under his protection and not only sat for him several times for his own portrait but also caused the Prince of Wales, Prince Rupert, and many others to do the same. The king had a high opinion of his artistic ability, styled him the English Tintoretto, and appointed him sergeant-painter on the death of Van Dyck. After Charles's fall, Dobson was reduced to great poverty and died at the age of 36. Examples of Dobson's portraits are to be seen at Blenheim and several other country seats throughout England.

dobsonfly, any insect of the megalopteran family Corydalidae with four net-veined wings. Dobsonflies are found in North and South America, Asia, Australia, and Africa.

Corydalus cornutus is a large insect with a wingspread of about 13 cm (5 inches). The jaws (or mandibles), considerably larger in the male than in the female, may exceed 2.5 cm (1 inch). Females lay up to about 3,000 eggs in whitish clusters near streams; after the eggs hatch, the young larvae crawl to the water and mature there in two or three years. The maturing larvae, large (sometimes 8 cm [3 inches] long) and blackish in colour, live beneath stones in rapidly flowing streams. These larvae have strong biting mouthparts and are ferocious predators on other aquatic insects and small invertebrates. They can inflict painful bites on humans. Mature larvae migrate from their water habitat to wet soil, moss, or decaying vegetation near the water to form pupal cells from which adults emerge.



Dobsonfly (*Corydalus cornutus*)

Henry C. Johnson

The larvae, sometimes known as hellgrammites, or toebiters, are eaten by fish, especially bass, and are used as bait by fishermen.

Dobuni, also spelled DOBUNNI, an ancient British tribe centred on the confluence of the Severn and Avon rivers. The Dobuni, who were ruled by a Belgic aristocracy, apparently made peace with the Roman emperor Claudius (reigned AD 41–54). Later, Corinium (Cirencester) was made the capital, and it soon became the second largest city in Britain. The Dobuni economy was based primarily on beef and wool, and the tribe's prosperity is attested by the numerous villas in the area.

doby mouth (animal disease): *see* sore mouth.

Dobzhansky, Theodosius, original name FEODOSY GRIGOREVICH DOBRZHANSKY (b. Jan. 25, 1900, Nemirov, Ukraine, Russian Empire [now in Ukrainian S.S.R.]—d. Dec. 18, 1975, Davis, Calif., U.S.), Ukrainian-American geneticist and evolutionist whose work had a major influence on 20th-century thought and research on genetics, evolutionary theory, and human evolution.

The son of a mathematics teacher, he lived in Kiev from age 10 and attended the University of Kiev (1917–21), where he remained to teach. In 1924 he moved to Leningrad.

In 1927 Dobzhansky went to Columbia University in New York City as a Rockefeller Fellow to work with the geneticist Thomas Hunt Morgan. He accompanied Morgan to the California Institute of Technology in Pasadena and, on being offered a teaching position there, decided to remain in the United States, becoming a citizen in 1937. He returned to Columbia as a professor of zoology in 1940, remaining until 1962, and then moved to

Dobzhansky

By courtesy of The Rockefeller University, New York

Rockefeller Institute (later Rockefeller University). After his official retirement, Dobzhansky went in 1971 to the University of California at Davis.

Between 1920 and 1935, mathematicians and experimentalists began laying the groundwork for a theory combining Darwinian evolution and Mendelian genetics. Starting his career about this time, Dobzhansky was involved in the project almost from its inception. His book *Genetics and the Origin of Species* (1937) was the first substantial synthesis of the subjects and established evolutionary genetics as an independent discipline. Until the 1930s, the commonly held view was that natural selection produced something close to the best of all possible worlds and that changes would be rare and slow and not apparent over one life span, in agreement with the observed constancy of species over historical time.

Dobzhansky's most important contribution was to change this view. In observing wild populations of the vinegar fly *Drosophila pseudoobscura,* Dobzhansky found extensive genetic variability. Furthermore, around 1940 evidence accumulated that in a given local population some genes would regularly change in frequency with the seasons of the year. For example, a certain gene might appear in 40 percent of all individuals in the population in the spring, increase to 60 percent by late summer at the expense of other genes at the same locus, and return to 40 percent in overwintering flies. Compared to a generation time of about one month, these changes were rapid and effected very large differences in reproductive fitness of the various types under different climatic conditions. Furthermore, the course of many of the changes could be observed in laboratory populations, which could be maintained for years in small cages with a continuing supply of new food. Other experiments showed that, in fact, flies of mixed genetic makeup (heterozygotes) were superior in survival and fertility to pure types.

It was already known that these superiorities of such heterozygotes would ensure the preservation of both sets of genes in the population. Dobzhansky pointed out that newly arisen genes are rare at first and that an individual is exceedingly unlikely to receive such a gene from both parents. Hence, in the beginning, the only genes that can "get ahead" and become more widespread in the population are those that are "good mixers"—that is, those that produce superior genotypes when combined with a random gene from the population.

A genetic system of the kind proposed by Dobzhansky can change rapidly, in response to natural selection, if environmental conditions should change. Among the myriad genotypes appearing in each generation would be many that were adapted to the changed conditions and that would leave more descendants; thus, these genes would be more common in the next generation. In contrast, under the older idea of a fairly uniform population in which most gene variants occurred rarely, much more time would be needed before variants adapted to new conditions could arise and become common. Meanwhile, local populations of the species could be in danger of becoming very reduced in numbers or even extinct.

Other important work of Dobzhansky dealt with speciation: the process by which a species does not merely change its characteristics over time but actually splits into two or more species. In extension of his work in human genetics and in human paleontology, Dobzhansky also wrote on the "descent of man." His *Mankind Evolving* (1962) has proved to be almost as influential among anthropologists and other students interested in human evolution as his *Genetics and the Origin of Species* was for those primarily interested in the evolution of nonhuman organisms. Finally, his interest in the direction that human evolution might take in the future, added to a natural philosophical inclination, led him into thought on the nature of man and the purpose of life and death, as shown in his works *The Biological Basis of Human Freedom* (1956) and *The Biology of Ultimate Concern* (1967). *Genetics of the Evolutionary Process* (1970) reflects 33 years of scientific progress in the study of evolution, largely by Dobzhansky or under his influence.

Although preeminently a laboratory biologist and writer, Dobzhansky never lost his liking for fieldwork; he boasted of having collected specimens from Alaska to Tierra del Fuego and in every continent except Antarctica. An inspiring teacher and lecturer, he received over the years a steady stream of scientists from other countries, who came to spend time in his laboratory to learn his approach to research.

Beginning in 1918, Dobzhansky published well over 400 research papers that provide an important part of the factual evidence for modern evolutionary theory. His preeminence, however, lay even more in the rare talent for synthesizing the masses of experimental and theoretical data in the literature into a broad, comprehensive view of the subject.

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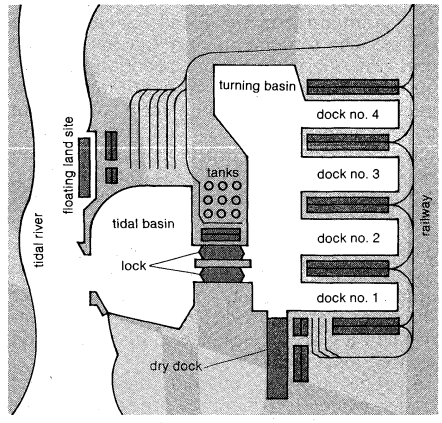
Doccia porcelain, porcelain produced at a factory near Florence founded by Marchese Carlo Ginori in 1735; until 1896 the enterprise operated under the name Doccia, since then under the name Richard-Ginori. After an initial experimental period, during which he imported Chinese porcelain samples, Ginori engaged two Viennese painters, J.C.W. Anreiter and his son Anton, with Gaspare Bruschi employed as chief modeler. By 1740 Doccia had a monopoly of porcelain making in Tuscany and in 1746 began public sales. The product was a grayish, hard-paste porcelain made from local clay, with a glaze lacking in brilliance; a finer, white paste was adopted later. Early wares were decorated by stencil, a rare process that was to give way to a fine range of painted colours. In the main, Doccia continued, belated by some 30 years, the late Baroque styles of Meissen. Three decorative themes distinguish this Doccia ware: the *a galletto* design, of Chinese origin, consisting of two fighting cocks; the *a tulipano* pattern, a central, stylized red tulip with surrounding flowers; and a range of polychrome or white-figured reliefs of mythological subjects often erroneously named Capodimonte and introduced during the highly successful directorship of Lorenzo Ginori (1757–91). Doccia figures (some of which are very large) include Meissen-like figurines and Oriental figures, peasant and rustic groups, and versions of Baroque sculpture in both single figures and groups. Virtually the only Italian porcelain factory to prosper in the 19th century, Doccia extended its production to porcelain for industrial use. In recent times modern ware has been complemented by the reintroduction of traditional patterns. Early Doccia porcelain, hardly ever marked, is often credited to other factories.

Doce River, Portuguese RIO DOCE, river, eastern Brazil, formed by the junction of the Carmo and Piranga rivers in southeastern Minas Gerais state. Flowing northeastward to Governador Valadares, southeastward to Colatina, and thence eastward across the coastal plain of Espírito Santo state, it empties into the Atlantic Ocean near Regência after a course of approximately 360 mi (580 km). It is the only water-level route by land to Brazil's interior from the eastern shore. The swamps and lagoons of the lower Doce have given rise to large sanitation works. Its upper course is commercially important because the mineral riches of Minas Gerais are funneled out via the railroad paralleling the river.

Articles are alphabetized word by word, not letter by letter

Docetism (from Greek *dokein,* "to seem"), Christian heresy and one of the earliest Christian sectarian doctrines, affirming that Christ did not have a real or natural body during his life on earth but only an apparent or phantom one. Though its incipient forms are alluded to in the New Testament, such as in the Letters of John (*e.g.*, I John 4:1–3; II John 7), Docetism became more fully developed as an important doctrinal position of Gnosticism, a religious dualist system of belief arising in the 2nd century AD which held that matter was evil and the spirit good and claimed that salvation was attained only through esoteric knowledge, or gnosis. The heresy developed from speculations about the imperfection or essential impurity of matter. More thoroughgoing Docetists asserted that Christ was born without any participation of matter and that all the acts and sufferings of his life, including the Crucifixion, were mere appearances. They consequently denied Christ's Resurrection and Ascension into heaven. Milder Docetists attributed to Christ an ethereal and heavenly body but disagreed on the degree to which it shared the real actions and sufferings of Christ. Docetism was attacked by all opponents of Gnosticism, especially by Bishop Ignatius of Antioch in the 2nd century.

dock, artifically enclosed basin into which vessels are brought for inspection and repair. Originally, docks were used for many purposes: as dry basins, isolated from the water by dikes or other means, they served as a place for building and repairing ships (dry docks, *q.v.*); as wet basins, open to the water, they



Harbour installation on a tidal river, showing dock cargo handling and dry dock facilities

provided berthing space for ships in the normal course of traffic and cargo transfer. The latter function was later rendered by another group of structures especially designed for that purpose and given different designations such as quay wall, pier, and wharf. The term dock is still often used in a generic sense to indicate all waterfront docking facilities, either dry basin or berthing structures.

Docks used as berthing structures include quay walls, wharves, piers, and floating pontoon docks. Perhaps the oldest and most com-

mon waterfront facility for vessels, the quay wall is simply a retaining wall along the shore topped with a deck or platform, serving both as a barrier to protect the shore and as a staging area for cargo and passengers. Usually earth is placed behind the wall in order to build up the deck to the needed height above the prevailing high water level. In addition, it may be necessary to do some dredging in front of the wall to obtain the required water depth.

Portland cement, either poured in place or used as precast blocks, has supplanted stone as the leading quay-wall material. The entire system also may be built of timber or of concrete framing, with concrete or sheet steel piling used as retaining walls.

At locations where the conformation of the shore and depth of water do not favour economical construction of a quay wall, a wharf, consisting of a trestle-mounted rectangular platform running parallel to the shoreline, and with a connecting passageway to the shore, may be constructed. Normally only the front or seaward side of a wharf is used for berthing, since the water depth and accessibility on the other three sides may not be suitable for many vessels.

Because quay walls occupy valuable waterfront space, docking cost at a quay wall is high. A more economical expedient is the pier, which in its simplest form is merely a platform extending over the water, usually at right angles to the shoreline. Vessels can be moored to the pier, which serves as a transfer platform for cargo and passengers.

A pier is composed of two main parts: the deck and its supporting system. The deck is usually built of reinforced concrete, though timber may be used. The supporting system is an assembly of beams, girders, and bearing piles, framed together to form a series of bents or trestles. The framing material may be wood, concrete, steel, or a combination of these. In some piers with concrete framing, the deck and walls are cast together to form an enclosed cellular structure. The buoyancy of such a structure greatly reduces the load on the foundations, and the interior space can be utilized for storage.

Floating pontoon docks, of which few have been built, rise and fall with the water level. One such dock floats up or down guided by walls of sheet-steel piling driven to bedrock, which serves to anchor or moor the whole assemblage. Access to shore is provided by a trestle hinged at the shore end and resting freely on the pontoon at the other end.

Dock, Christopher (b. 1698?, Germany—d. 1771, Skippack, Montgomery County, Pa.), Mennonite schoolmaster in colonial Pennsylvania whose teaching methods gave rise to publication of the first known book dealing with education in America.

Drawn from Germany to Pennsylvania by the religious freedom accorded Mennonites, Dock opened a school at Skippack around the year 1718, and—with the exception of the interval from 1728 to 1738, during which he devoted himself to farming—he taught there and at a second school in Salford for the rest of his life.

Pious and humble, Dock in 1750 reluctantly wrote a description of his teaching methods. Originally intended for posthumous publication, his manuscript, *Schulordnung* ("School Management"), was published in 1770, a year before Dock's death. The volume proved very influential and went into a second edition the same year; it was republished as late as 1861.

Dock advocated gentleness and encouragement in the teacher–student relationship. He counselled that discipline should grow from love, and he encouraged teachers to be simple, direct, and understanding, rather than harsh and overbearing. He prayed each evening that he might be forgiven for any injustices or neglect he might have committed that day. In that posture he died and was found the next morning in the schoolhouse.

In addition to his book, Dock also wrote a number of Mennonite hymns, some of which were still being sung in the 20th century.

Docodon, extinct genus of primitive mammals known only from fossilized teeth found in Late Jurassic deposits of Europe (the Jurassic Period began about 190,000,000 years ago and lasted about 54,000,000 years). The patterns of the cusps and other structures seen in the molar teeth are complex and distinct. Although it is uncertain whether *Docodon* is related to any modern mammals, it has been suggested that the genus may be close to that of the monotremes, the modern platypus and spiny anteater.

Doctors' Commons, formerly a self-governing teaching body of practitioners of canon and civil law. Located in London, it was similar to the Inns of Court, where English common law, rather than civil law, was taught. Members of the Doctors' Commons were those who held degrees either of doctor of civil law at Oxford or doctor of law at Cambridge and who subsequently had been admitted as advocates (similar to admittance to the bar for common lawyers) by the dean of arches, the presiding officer of the Court of Appeal under the authority of the archbishop of Canterbury. Members of the governing body, called fellows, were elected from the advocates by existing fellows. The members practiced in the ecclesiastical courts and in the Court of Admiralty. They also participated in arbitrations involving questions of international law.

In 1565 the society leased a site in Paternoster Row, near St. Paul's, which served as its headquarters until 1858. In that year, the society was dissolved, under terms of the Court of Probate and Matrimonial Causes acts of 1857. These measures were forerunners of the Judicature Act of 1873, which established a single supreme court of the judicature that inherited the jurisdiction of the courts of civil law as well as those of common law and equity, with a single bar practicing before it. *See also* Inns of Court.

Doctors' Plot (1953), alleged conspiracy of prominent Soviet medical specialists to murder leading government and party officials; the prevailing opinion of many scholars outside the Soviet Union is that Stalin intended to use the resulting doctors' trial to launch a massive party purge.

On Jan. 13, 1953, the newspapers *Pravda* and *Izvestiya* announced that nine doctors, who had attended major Soviet leaders, had been arrested; they were charged with poisoning Andrey A. Zhdanov, Central Committee secretary, who had died in 1948, and Alexander S. Shcherbakov, who had been head of the Main Political Administration of the Soviet army, deceased in 1945, and with attempting to murder several marshals of the Soviet army. The doctors, at least six of whom were Jewish, also were accused of being in the employ of U.S. and British intelligence services, as well as of serving the interests of international Jewry. The Soviet press reported that all of the doctors had confessed their guilt.

The trial and the rumoured purge to follow did not occur; the death of Stalin (March 5, 1953) intervened. In April *Pravda* announced that a reexamination of the case showed the charges against the doctors to be false and their confessions to have been obtained by torture. The doctors (except two who had died during the course of the investigation) were exonerated. In 1954 an official in the Ministry of State Security and some police officers were executed for their participation in fabricating the cases against the doctors.

In his secret speech at the 20th Party Congress (February 1956), Nikita S. Khrushchev asserted that Stalin had personally ordered that the cases be developed and confessions elicited, the "doctors' plot" then to signal the beginning of a new purge. Khrushchev revealed that Stalin had intended to include members of the Politburo in the list of victims of the planned purge.

documentary film, motion picture that shapes and interprets factual material for purposes of education or entertainment. Documentaries have been made in one form or another in nearly every country and have contributed significantly to the development of realism in films. John Grierson, a Scottish educator who had studied mass communication in the U.S., adapted the term in the mid-1920s from the French word *documentaire.*

Scene from *Drifters* (1929), directed by John Grierson and produced by the British Film Board
By courtesy of the Museum of Modern Art Film Stills Archive, New York

The documentary-style film, though, had been popular from the earliest days of film making. In Russia, events of the Bolshevik ascent to power in the early 1900s were filmed, and the pictures were used as propaganda. In 1922 the American director Robert Flaherty presented *Nanook of the North,* a record of Eskimo life based on personal observation, which was the prototype of many documentary films. At about the same time, the British director H. Bruce Woolfe reconstructed battles of World War I in a series of compilation films, a type of documentary that bases an interpretation of history on factual news material. The German *Kulturfilme,* such as the feature-length film *Wege zu Kraft und Schönheit* (*Ways to Health and Beauty,* 1925), were in international demand.

The British documentary film movement, led by Grierson, influenced world film production in the 1930s by such films as Grierson's *Drifters* (1929), a description of the British herring fleet, and *Night Mail* (1936), about the nightly mail train from London to Edinburgh. The U.S., too, made significant contributions to the genre. Early examples include two films directed by Pare Lorentz: *The Plow That Broke the Plains* (1936), set in America's dust bowl, and *The River* (1937), a discussion of flood control.

The production of documentaries was stimulated by World War II. The Nazi government of wartime Germany used the nationalized film industry to produce propaganda documentaries. U.S. director Frank Capra presented the *Why We Fight* (1942–45) series for the U.S. Army Signal Corps; Great Britain released *London Can Take It* (1940), *Target for Tonight* (1941), and *Desert Victory* (1943); and the National Film Board of Canada turned out educational films in the national interest.

In the early 1950s attention once again focussed on the documentary in the British free cinema movement, led by a group of young film makers concerned with the individual and his everyday experience. Documentaries also became popular in television program-

ming, especially in the late 1960s and the early 1970s. *See* also *cinéma vérité.*

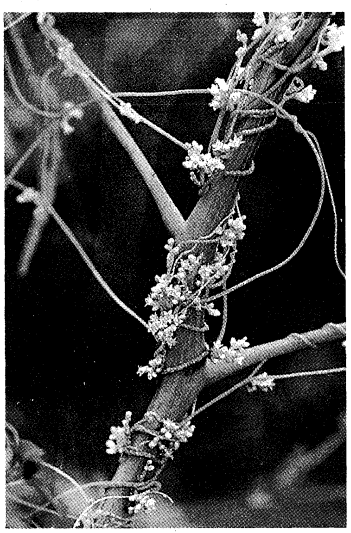
Documentary Theatre: *see* Fact, Theatre of.

Doda Betta, mountain peak, highest point in Tamil Nādu state, southeastern India, rising to an elevation of 8,652 feet (2,637 m) near Uthagamandalam (Ootacamund). Doda Betta is a grass-covered hill that is frequently climbed by summer visitors, and the summit is accessible by automobile. It is the second highest peak in the Western Ghāts after Anai Mudi, about 100 miles (160 km) to the south.

dodder, any leafless, twining, parasitic plant of the genus *Cuscuta,* the only genus of the family Cuscutaceae. The genus contains more than 150 twining species that are widely distributed throughout the temperate and tropical regions of the world. Many species have been introduced with their host plants into new areas.

The dodder contains no chlorophyll and instead absorbs food through haustoria; these are rootlike organs that penetrate the tissue of a host plant and may kill it. The slender, stringlike stems of the dodder may be yellow, orange, pink, or brown in colour. The dodder's flowers, in nodulelike clusters, are made up of tiny yellow or white bell-like, lobed corollas (united petals). Its leaves are reduced to minute scales. The Cuscutaceae family is so close to the morning glories that some authorities unite it with the family Convolvulaceae.

The dodder's seed germinates, forming an anchoring root, and then sends up a slender stem that grows in a spiral fashion until it reaches a host plant. It then twines around the stem of the host plant and throws out haustoria, which penetrate it. Water is drawn through the haustoria from the host plant's



Dodder (*Cuscuta gronovii*)
Russ Kinne—Photo Researchers/EB Inc.

stem and xylem, and nutriments are drawn from its phloem. Meanwhile, the root of the dodder rots away after stem contact has been made with a host plant. As the dodder grows, it sends out new haustoria and establishes itself very firmly on the host plant. After growing in a few spirals around one host shoot, the dodder finds its way to another, and it continues to twine and branch until it resembles a fine, densely tangled web of thin stems enveloping the host plant.

Dodder can do great damage to crops of clover, alfalfa, flax, hops, and beans. It is mainly controlled by the hand removal of the plants from fields and by preventing the accidental introduction of the plants into fields in the future.

Dodds, Alfred-Amédée (b. Feb. 6, 1842, Saint-Louis, Senegal—d. July 18, 1922, Paris), French military figure who played a leading role in French colonial expansion in West Africa in the late 19th century.

After training at the prestigious military academy of Saint-Cyr, Dodds joined the French marine force. A company commander in the Franco-German War, he was captured at the Battle of Sedan in 1870, only to escape and return to combat in the Loire compaign. After the war Dodds returned to West Africa, where, except for brief visits to Indochina (1878 and 1883), he spent the next 20 years. In 1892–93, he led the campaign against the native forces of King Behanzin of Dahomey. His victory at Abomey (1892) was vital to the eventual linkage of French possessions in upper Senegal and the upper Niger region.

In 1899 Dodds was appointed inspector general of the marine infantry and soon after was given command of the 20th (colonial) army corps. In 1904 he returned to Paris and served on the *conseil supérieur de guerre* (high command of war, an autonomous command group) until 1914.

Dodecanese, Modern Greek DHODHEKÁNISOS, group of islands in the Aegean Sea, off the southwestern coast of Turkey, and constituting the *nomós* (department) of Dhodhekánisos, Greece. The city of Rhodes is the administrative centre. The name Dodecanese means "12 islands." The term has been applied at various times to groups differently composed and numbering more than 12. The main islands of the Dodecanese group, with their Italian names in parentheses, are: Kárpathos (Scarpanto), Pátmos (Patmo), Kásos (Caso), Astipálaia (Stampalia), Lipsoí (Lisso), Léros (Lero), Kálimnos (Calino), Nísiros (Nisiro), Tílos (Piscopi), Khálki (Calchi), Sími (Simi), Rhodes (Rodi), and Cos (Coo) and the outlying Kastellórizon (Castelrosso). Their land area is 1,031 square miles (2,670 square km).

The islands' substantial economic deficit has been cut gradually by increasing tourism. Except for Rhodes and Cos, the Dodecanese suffer from deforestation and poor drainage. Their crops—fruit, tobacco, olives, and wheat—have varied from marginal to enough to export, and the principal nonagricultural occupations of the islanders—fishing, shipping, sponge diving—are still underdeveloped. The islands have benefited, however, from the remarkable development of tourism in the principal islands of the group.

The islands were a part of the ancient Greek world, and Rhodes and Cos (*qq.v.*) have long histories (*see also* Astipálaia; Kárpathos; Pátmos). In neither the Hellenistic nor the Roman Empire periods did the islands function as a single political or geographical unit. In the Byzantine Empire the theme (province) of the Dodecanese included the Cyclades islands as well.

The Dodecanese group came to be fixed at 12 islands during the long Turkish administration of them, which began in the 16th century. The Turks recognized 12 of the islands, "the 12 Sporades," as being entitled to special treatment since they had voluntarily submitted to Turkish rule. But the larger and richer islands of Rhodes and Cos had submitted involuntarily to Turkish rule and were given no special privileges. Turkish rule of the islands lasted until May 1912, when during the Italo-Turkish War Italian forces seized the islands—except Ikaría (which was occupied by Greek forces in November) and Kastellórizon (which remained Turkish).

Secret treaties on the future of the islands, drawn up by the Allies during and after World War I, led to a dispute between Italy and Greece over which nation should have jurisdiction over the islands. In 1919 an agreement was reached whereby Italy would cede the Dodecanese to Greece with the exception of Rhodes, which was to have broad local autonomy. Subsequent Italian governments, however, unilaterally denounced the accord with Greece and refused to carry it out, and Italy used a special article in the Treaty of Sevres (1920), whereby Turkey had ceded to Italy all rights and titles to the Dodecanese and Kastellórizon, to enforce its claim on the Dodecanese. Italian sovereignty over the islands was confirmed by the Treaty of Lausanne (1923).

Italian rule over the Dodecanese was firm and efficient but never popular. Italian became the official language, and in 1925 the Dodecanesians were obliged to take Italian citizenship. As a result, considerable migration from the islands to the United States occurred. After World War II the islands temporarily came under British occupation, with Greek participation. The conference of foreign ministers in Paris agreed in 1946 that the islands should pass to Greece; they were formally ceded in 1947. Pop. (1981) 145,071.

Dodeigne, Eugène (b. July 27, 1923, Rouvreux, near Liège, Belg.), Belgian-born French sculptor best known for his monumental stone figures, usually placed outdoors.

Dodeigne was trained by his father, a stonemason, and attended the École des Beaux-Arts in Tourcoing and the Académie des Beaux-Arts in Paris. From the emaciated angularity of his earliest carved wooden figures he moved steadily toward a use of eroded curves and complete abstraction. In 1949 he settled in Bondues in northern France, where he began to sculpt in the local Soignies blue limestone. His works range widely in scale. While the smaller of his Soignies forms are highly polished, the surfaces of the monumental outdoor pieces (*e.g.,* "Sculpture," 1958) are stressed and patterned, suggesting weathered traces of archaic decoration.

Doderer, Heimito von (b. Sept. 6, 1896, Weidlingau, near Vienna—d. Dec. 23, 1966, Vienna), Austrian novelist who achieved international fame with his novel of post-World War I Vienna, *Die Dämonen* (1956; *The Demons*), on which he had worked since 1931. It explores the society and mood of Vienna in 1926–27 in a many-layered web of detail and complex characters.

Doderer served as an officer in the Imperial Austrian Dragoons in World War I and was captured by the Russians, spending several years in Siberia working as a lumberjack before repatriation in 1920. He received a doctorate in history from the University of Vienna in 1925. An involved psychological thriller, *Ein Mord, den jeder begeht* (1938; *Every Man a Murderer*), and several other novels attracted little attention. In the 1930s Doderer was briefly a member of the then-outlawed National Socialist Party in Austria, which he described in a book of reminiscences, *Tangenten* (1964; "Tangents"). In World War II he was a Luftwaffe captain. *Die Strudlhofstiege* (1951; "The Strudlhof Stairs"), which covered the Vienna scene in 1910–11 and 1923–25, sets the stage for *Die Dämonen,* which was a success and established Doderer's reputation. *Die Wasserfälle von Slunj* (1963; *The Waterfalls of Slunj*) was the first novel in an intended tetralogy spanning life in Vienna from 1880 to 1960 and collectively entitled *Roman Nr. 7* ("Novel No. 7"). The second volume, *Der Grenzwald* ("The Frontier Forest"), unfinished, appeared posthumously in 1967.

Grundlagen und Funktion des Romans (1959; "Principles and Function of the Novel") describes the novel as he sees it. Doderer's style and ideas are traditional and formal and had little influence.

Dodge, Bernard Ogilvie (b. April 18, 1872, Mauston, Wis., U.S.—d. Aug. 9, 1960, New York City), American botanist and pioneer researcher on heredity in fungi.

After completing high school (1892), he taught in district schools and eventually became a high school principal. At the age of 28 he resumed his formal education by entering the Milwaukee Normal School, meeting the requirements for graduation in one year. In 1908 he entered the University of Wisconsin, Madison, where he obtained a bachelor's degree in 1909, demonstrating an interest in the lower plants, especially fungi. At the university he was much influenced by R.A. Harper, an eminent U.S. botanist who was soon to become professor of botany at Columbia University. As a consequence, Dodge moved to New York City and entered Columbia in 1909, receiving his Ph.D. three years later. In 1920, after eight years as a low-paid instructor at Columbia, he accepted an appointment as plant pathologist in the U.S. Department of Agriculture, Washington, D.C., where he was able to continue his research. In 1928 he was invited to become plant pathologist at the New York Botanical Garden, a position he held until his retirement in 1947. Even after retirement, he continued his research there until shortly before his death.

Because of the long delay in finishing his formal education, Dodge was over 40 when his first paper on mycology was published, his last work appeared when he was 85, and he was already 55 when his major work on the genetics of *Neurospora* began. In 1920 he had discovered heterothallism in the ascomycetes (sac fungi), first in *Ascobolus* and then in *Neurospora.* His early papers demonstrated the excellent potential of *Neurospora* for genetic research, and later he was able to prove conclusively that this fungus obeys the basic laws of genetics. He worked out excellent techniques for the experimental manipulation of *Neurospora*, as well as other microorganisms, and his many basic discoveries of new phenomena set the stage for the development of the field of biochemical genetics. At the age of 71, Dodge published jointly with H.W. Rickett the highly influential book, *Diseases and Pests of Ornamental Plants.*

Dodge, Grace Hoadley (b. May 21, 1856, New York City—d. Dec. 27, 1914, New York City), U.S. philanthropist who supported the formation of organizations for the welfare of working women in the United States.

A great-granddaughter of David L. Dodge, New York merchant and peace activist, and granddaughter of William Earl Dodge, metals business executive (Phelps, Dodge & Company) and philanthropist, Grace Dodge donated about $1,500,000 and years of leadership to her philanthropies. In 1880 she helped to form the Kitchen Garden Association, later the Industrial Education Association, to foster manual and domestic training and industrial arts in the public schools. In 1887 she funded the New York College for the Training of Teachers, which became Teachers College in 1892 and subsequently a school of Columbia University.

In 1884 Dodge helped organize a club for working women that eventually developed into the Association of Working Girls' Societies, a group encompassing some 75 units by 1890. Dodge served as president of that association until 1905, when she mediated the merger of two rival Young Women's Christian Association groups into the Young Women's Christian Association (YWCA) of the United States. She served as president of the YWCA board until her death nine years later.

Dodge also organized the New York Travelers' Aid Society in 1907—a group devoted to the protection of migrant and immigrant women, and in 1912 she led efforts to organize the National Travelers' Aid Society; she contributed as well to the growth of the international travellers' aid movement.

Dodge, Grenville Mellen (b. April 12, 1831, Danvers, Mass., U.S.—d. Jan. 3, 1916, Council Bluffs, Iowa), U.S. civil engineer who was responsible for much of the railroad construction in the western and southwestern United States during the 19th century.

Educated at Durham (N.H.) Academy and Norwich (Vt.) University, Dodge graduated as a military and civil engineer in 1851, just when railroad building was beginning in the United States on a large scale. During the Civil War he was promoted rapidly to the rank of brigadier general of volunteers and provided valuable service in bridge and railroad construction. For example, he built a bridge 14 feet (4 metres) high and 710 feet (216 metres) long across the Chattahoochee River in only three days. From 1866 to 1870 he was chief engineer for construction of the Union Pacific Railroad. In 1873 he joined Jay Gould in railroad development in the Southwest and in the next 10 years helped build nearly 9,000 miles (14,484 kilometres) of track in the United States.

Dodge, John V(ilas) (b. Sept. 25, 1909, Chicago), U.S. editor and publishing executive of the *Encyclopædia Britannica.*

A graduate of Northwestern University, Evanston, Ill. (1930), Dodge also studied at the University of Bordeaux, Fr. (1930–31). During World War II he served with U.S. Army Intelligence (private to first lieutenant, 1944–46). He joined Encyclopædia Britannica, Inc., in 1938, was managing and later executive editor of all Britannica publications (1950–64), and was vice president (International Editorial) when he retired in January 1972. Consultant to the editors of the 20-volume *Encyclopædia Universalis* (Paris), he also advanced planning and work on multivolume encyclopaedias in Japanese and other languages.

Dodge, Josephine Marshall Jewell, *née* JEWELL (b. Feb. 11, 1855, Hartford, Conn., U.S.—d. March 6, 1928, Cannes, Fr.), pioneer in the day-nursery movement in the U.S.

In 1875 she was married to Arthur Murray Dodge (died 1896), son of a New York philanthropist. By the 1880s day nurseries for the children of working mothers were few in number and attempted, generally speaking, only to alleviate the immediate child-care needs of the mother. In 1888 Josephine Dodge founded the Jewell Day Nursery in New York City, hoping to show that the day nursery should have a broader goal—that of instilling middle-class values into working-class children. In 1893 she demonstrated a model nursery at the World's Columbian Exposition in Chicago; in 1895 she founded the Association of Day Nurseries in New York City. In 1898 Dodge founded and directed the National Federation of Day Nurseries, which grew to 700 affiliates within some 20 years.

Dodge was also a prominent antisuffragist. She formed the National Association Opposed to Woman Suffrage in 1911 and edited *Woman's Protest,* an antisuffrage newsletter.

Dodge, Mary (Elizabeth) Mapes (b. Jan. 26, 1831, New York City—d. Aug. 21, 1905, Onteora Park, N.Y., U.S.), U.S. author of children's books and first editor of *St. Nicholas* magazine.

As the daughter of an inventor and scientist, Mary Mapes grew up surrounded by creative figures. At 20 she married William Dodge, a lawyer, and they had two sons. To maintain her independence after she was suddenly widowed seven years later, she started writing children's stories. Her first collection, *Irvington Stories* (1864), centred on the American colonial family. Its success prompted her publisher to request another. The following year Dodge's beloved classic, *Hans Brinker: or, The Silver Skates,* appeared. The tale of an impoverished Dutch boy whose determination enabled him to win a coveted pair of ice skates went through more than 100 editions during the author's lifetime.

In 1873, in the midst of an economic depression, Dodge was asked to become editor of a new publishing venture, the children's magazine *St. Nicholas.* Its subsequent success stemmed from Dodge's high literary and moral standards, which inspired contributors to encourage youngsters' imaginations while maintaining a respect for traditional values. Dodge's editorial excellence enabled *St. Nicholas* to attract such well-known contemporary writers as Mark Twain, Bret Harte, Lucretia Peabody Hale, Louisa May Alcott, Robert Louis Stevenson, and Rudyard Kipling.

Dodge, William E(arl) (b. Sept. 4, 1805, Hartford, Conn., U.S.—d. Feb. 9, 1883, New York City), U.S. merchant, co-founder of Phelps, Dodge & Company, later to become one of the "big three" mining companies in the United States.

Descended from early New England settlers, Dodge began his career in the dry-goods business. In 1833 he and his father-in-law Anson Phelps organized the firm of Phelps, Dodge & Company, a dealer in metals, with offices in New York City and Liverpool. The company soon established a prosperous trade throughout the United States and abroad, eventually becoming the largest U.S. importer of metals. Dodge's extensive investments included timber lands in Pennsylvania, Michigan, and elsewhere; a copper mine in Minnesota; an iron mine in New Jersey; and mills in Connecticut, New Jersey, and other states. Dodge also had interests in a number of railroads, several of which served his metals companies.

In 1882 the company purchased the Copper Queen mine in Arizona, which signalled its entry into the front ranks of American mining companies, although metals extraction did not become the firm's primary business until after Dodge's death.

Considered an energetic but essentially conservative man, Dodge became noted late in life for his civic activities and his efforts on behalf of religious and temperance societies.

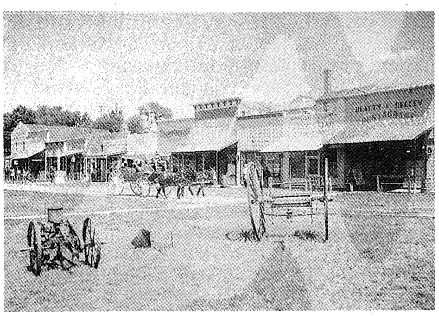
dodge ball, children's game that requires a large, soft rubber ball, the size of a volleyball or beachball, and several players. Ten or more makes a good game.

Dodge ball has three basic forms: one team against another team; one player against all the other players; or every man for himself. A popular version is circle dodge: in one variation the players form a circle about 30 ft (9 m) in diameter and throw the ball, trying to hit a single player, or an equal number of players, within the circle. If a dodger within the circle is hit, he is out of the game; if the dodger manages to catch the ball, the thrower is out of the game and the dodger who caught the ball can try to hit a player on the outside circle. The game goes on until all the players but one have been hit. In the every-man-for-himself version, one player who is the thrower tries to hit the other players and any dodger who is hit is out of the game. A dodger who catches the ball thrown at him becomes the thrower. The last surviving player wins.

Dodge ball is similar to an ancient Greek game played with seashells, called *ostrakinda.* Court dodge was a similar game played in 16th-century England.

Dodge City, city, seat (1873) of Ford County, southwestern Kansas, U.S., on the Arkansas River. Ft. Dodge, 5 mi (8 km) east, was established in 1864 and named for Col. Henry I. Dodge. Settled in 1872, Dodge City attained notoriety as a frontier town on the old Santa Fe Trail, the rendezvous of picturesque characters, the centre of freight lines, and headquarters of the cattle business. At the peak of the cattle drives, in 1884, herds totalling 8,000,000 head passed through from

Texas. Lawlessness and gunfights resulted in the establishment of Boot Hill Cemetery, and a succession of marshals and sheriffs, including Bat Masterson and Wyatt Earp, won fame



Historic Front Street, Dodge City, Kan.
By courtesy of Boot Hill Museum, Dodge City, Kan.

in the annals of the West. The famous Front Street has been restored. Beeson Museum exhibits many pioneer relics. The modern city has railroad shops, cattle feed yards, and farm implement plants and is the supply centre for a wheat, sorghum, and stock-raising area. The meridian separating central from mountain time passes near Dodge City. It is the site of Dodge City Community College (1935) and St. Mary of the Plains College (1952). Inc. 1875. Pop. (1984 est.) 19,545.

Dodgson, Charles Lutwidge (novelist): *see* Carroll, Lewis.

Dodington, George Bubb, BARON MELCOMBE OF MELCOMBE-REGIS, original name (until 1717) GEORGE BUBB (b. 1691—d. July 28, 1762, Hammersmith, Middlesex, Eng.), English politician, a career office seeker who was the subject of a satirical engraving by William Hogarth, "Chairing the Members" (1758), and kept a diary (published 1784) that remains one of the best sources on British politics of his time.

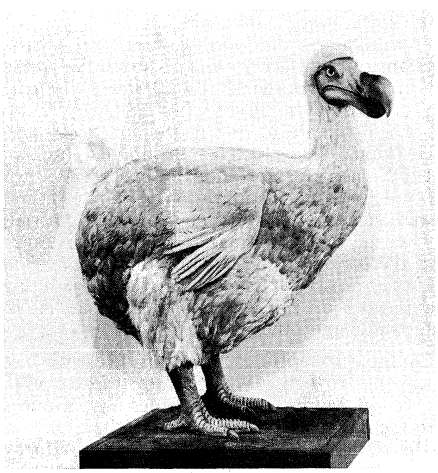
Until he was raised to the peerage (1761), he represented one of the House of Commons constituencies controlled by his family and selected members for two or three others. After serving capably as envoy extraordinary to

Dodington, detail of an engraving
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Spain (1715–17), he held a succession of government sinecures. In 1744 he was appointed treasurer of the navy, but he wavered in his support of George II, periodically opting instead to back the Prince of Wales. His political philosophy was summarized in his couplet: "Strive thy little bark to steer/With the tide, but near the shore." His most creditable action was a speech (Feb. 22, 1757) against the impending execution of Admiral John Byng on a questionable charge of neglect of duty in battle. He died without legitimate issue, and his peerage became extinct.

dodo (*Raphus cucullatus*), extinct flightless bird of Mauritius (an island of the Indian Ocean), one of the three species that constituted the family Raphidae, usually placed with pigeons in the order Columbiformes but sometimes separated as an order (Raphiformes). The other two species, also found on islands of the Indian Ocean, were the solitaires (*R. solitarius* of Réunion and *Pezophaps solitaria* of Rodrigues). The birds were first seen by Portuguese sailors about 1507 and were exterminated by man and his introduced animals. The dodo was extinct by 1681, the Réunion solitaire by 1746, and the Rodrigues solitaire by about 1790.

The dodo, bigger than a turkey, weighed about 23 kg (about 50 pounds). It had blue-gray plumage, a big head, a 23-centimetre (9-inch) blackish bill with reddish sheath forming the hooked tip, small useless wings, stout yellow legs, and a tuft of curly feathers high on



Restoration of a dodo (*Raphus cucullatus*)
By courtesy of the Peabody Museum of Natural History, Yale University

its rear end. The Réunion solitaire may have been a white version of the dodo. The brownish Rodrigues solitaire was taller and more slender, with smaller head, short bill lacking the heavy hook, and wings with knobs. All that remains of the dodo is a head and foot at Oxford, a foot in the British Museum, a head in Copenhagen, and skeletons, more or less complete, in various museums of Europe, the United States, and Mauritius. Many bones of solitaires have also been preserved.

Dodoens, Rembert, Latin REMBERTUS DODONAEUS, original name REMBERT VAN JOENCKEMA (b. June 29, 1516/17, Mechelen, Spanish Netherlands [now in Belgium]—d. March 10, 1585, Leiden, Neth.), Flemish physician and botanist whose *Stirpium historiae pemptades sex sive libri XXX* (1583) is considered one of the foremost botanical works of the late 16th century.

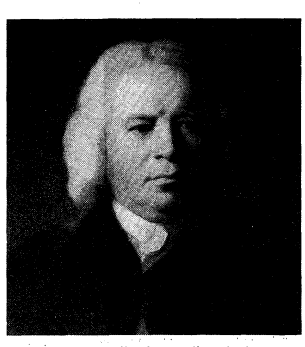
Dodoens received a medical degree from the University of Louvain in 1535 and composed works on cosmography and physiology before turning to botany with the brief treatise *De frugum historia* (1552). His *Cruydeboek* (1554), an extensive herbal, owes a great deal to the "German fathers of botany," especially Leonhard Fuchs; instead of arranging plants in alphabetical order, Dodoens grouped plants according to their properties and reciprocal affinities. Translated into French in 1557, it became a standard in England through Henry Lyte's English translation of 1578. *Pemptades* introduced new families, arranged plants into 26 groups, and added many original and borrowed illustrations. It was the basis of John Gerard's celebrated *Herball.* Dodoens served as physician to the Holy Roman emperor Maximilian II and his successor, Rudolph II. He joined the faculty of medicine at Leiden University in 1582.

Dodoma, city, designated national capital of Tanzania since 1974 (pending complete transfer of official functions from Dar es-Salaam), eastern Africa, about 300 miles (480 km) inland (west) from the Indian Ocean. Situated at an elevation of 3,720 feet (1,135 m) in a sparsely populated agricultural region, it is a market centre for peanuts (groundnuts), castor beans, sunflower seeds, gum, corn (maize), rice, wheat, coffee, tea, tobacco, and sorghum. Coffee and sisal are cultivated in the northern part of the region, and cattle raising is important throughout the region. Dodoma is connected by air, road, and rail with Arusha, Dar es-Salaam, and Tanga. The relocation of the national capital from Dar es-Salaam to Dodoma began in the early 1980s and was scheduled to be completed by 1990. The population is primarily agricultural and is engaged in small-scale farming carried on in immediate proximity to residential quarters. Most of Dodoma's inhabitants are of the Gogo, Sanawe, Rangi, and Burungi peoples. Industries produce wood and furniture, beverages, processed food, milled rice and flour, soap, and oil. Pop. (1978) 45,807.

Dodona, ancient sanctuary of the chief Greek god, Zeus, in Epirus, Greece; the ceremonies held there had many remarkable and abnormal features. The earliest mention of it is in the *Iliad* (xvi, 234), where its priests are called the Selloi (or Helloi) and are described as "of unwashen feet, sleeping on the ground." The description suggests worshipers or servants of an earth goddess or of some chthonian power with whom they kept in continual contact, day and night. Homer (*Odyssey,* xiv, 327) was also the first to mention the oracle at Dodona. A tree (or trees) was reputed to give oracles, presumably through the rustling of its leaves and other sounds. Herodotus, but no earlier writer, mentions priestesses, whom he describes as the givers of the oracles, doubtless under some kind of inspiration from the god. A further peculiarity of Dodona was the "bronze," a large gong set vibrating at every breeze by a scourge held in the hand of a figure standing over it; the persistent ringing passed into a Greek proverbial phrase—*Khalkos Dodones* ("Brass of Dodona")—for a continuous talker who has nothing to say.

Dodsley, Robert (b. 1703, near Mansfield, Nottinghamshire, Eng.—d. Sept. 23, 1764, Durham, Durham), British author, London bookseller, publisher, playwright, and editor who was influential in mid-18th-century literary England and is associated with the publication of works by Samuel Johnson, Alexander Pope, Thomas Gray, and Oliver Goldsmith.

Apprenticed to a stocking weaver, Dodsley ran away and went into domestic service as a footman; during this period he published a poem, *Servitude* (1729), which was later reissued as *The Muse in Livery: or, the Footman's*



Dodsley, detail of an oil painting by Sir Joshua Reynolds, 1760; in Dulwich College Picture Gallery, London
By permission of the Governors of Dulwich College Picture Gallery

Miscellany (1732). His other early works included a satirical farce, *The Toy-Shop* (1735). Financed by his friends, who included Alexander Pope, he established himself as a publisher in 1735, publishing Johnson's poem *London* (1738) and suggesting and backing his *Dictionary of the English Language.*

Dodsley founded several literary periodicals, including *The Annual Register* (1758), edited by the political philosopher Edmund Burke. Dodsley himself edited two major collections: *A Select Collection of Old Plays* (1744) and *A Collection of Poems. By Several Hands* (1748). In 1758 his tragedy *Cleone* began a long run at London's Covent Garden (2,000 copies of its text sold on the day of publication); and in 1759 he retired, leaving the conduct of his business to his brother James.

Doe, Samuel K(anyon) (b. May 6, 1950/51, Tuzon, Liberia—d. Sept. 9/10, 1990, Monrovia), soldier and Liberian head of state from 1980 to 1990.

Doe, a member of the Krahn (Wee) tribe, enlisted in the army at age 18. He rose through the ranks to become a master sergeant in 1979. Like other indigenous Liberians, Doe resented the privilege and power granted the Americo-Liberians, descendants of the freed American slaves who founded the colony of Liberia in 1822. In April 1980 Doe led an attack by a group of Krahn soldiers on the Liberian executive mansion, killing President William R. Tolbert. Later, 13 prominent Tolbert associates were summarily tried and executed.

After the coup Doe assumed the rank of general and established a People's Redemption Council (PRC) composed of himself and 14 other low-ranking officers to rule the country. Doe suspended the nation's constitution until 1984, when a new constitution was approved by referendum. In 1985 he won a presidential election that was denounced as fraudulent by some observers. Doe faced opposition both at home and abroad, where his regime was often described as corrupt and brutal. His term of office was burdened by deteriorating economic conditions, and his life was continually threatened by assassination attempts and plots, which he suppressed with considerable brutality. These actions, along with Doe's favouritism toward his own Krahn tribe, sparked a rebellion against him that began in eastern Liberia in late 1989. By July 1990 the rebel forces had advanced into the capital city of Monrovia, but Doe refused to yield power. As the civil war continued, he was captured and assassinated.

Does, Johan van der, also called JANUS DOUSA (b. Dec. 5, 1545, Noordwijk, Spanish Habsburg domain [now in The Netherlands]—d. Oct. 8, 1604, The Hague), Dutch statesman, *jonkheer* (squire) of Noordwijk, poet, and historian who commanded the citizens' resistance movement during the Spanish siege of Leiden (1573–74); he was also the first curator of the University of Leiden.

In recognition of his leadership during the siege, as well as his background as a humanist scholar at the universities of Louvain and Paris, van der Does was appointed curator of the university, which was founded in 1575 to commemorate the raising of the siege. While curator he wrote many poems and historical treatises. His most important historical work was *Annales rerum a priscis Hollandiae comitibus per CCCXLVI annos gestarum* ("Annals of the Affairs of the Noble Counts of Holland Through 346 Years"), the first critical history of the province of Holland. This work first appeared in poetic form (1599) and later in prose (1601) as *Bataviae Hollandiaeque Annales* ("Annals of Batavia and Holland"). His poems include *Nova poemata* (1575; "New Poems").

Van der Does led a delegation (1584–85) that unsuccessfully offered sovereignty of the Netherlands to Queen Elizabeth I of England. He also served as legal adviser to the Supreme Court (Hoge Raad) of Holland from 1591.

Doesburg, Theo van, pseudonym of CHRISTIAN EMIL MARIE KÜPPER (b. Aug. 30, 1883, Utrecht, Neth.—d. March 7, 1931, Davos, Switz.), Dutch painter, decorator, poet, and art theorist, a leader of the de Stijl movement.

Originally he intended to follow a career in the theatre, but he turned to painting about 1900 and worked in Post-Impressionist and Fauvist styles until 1916, when he began to paint geometric abstractions of subjects from nature. In 1917 he was instrumental in founding the de Stijl group and founded the avant-garde art review *De Stijl* (a publication that was continued until 1931). His advocacy of de Stijl's geometric style influenced the modernist architects Le Corbusier, Walter Gropius, and Ludwig Mies van der Rohe. From 1921 to 1923, when he taught at the Weimar Bauhaus, Doesburg's painting style was much influenced by Piet Mondrian's aesthetic of neoplasticism. Using the alias J.K. Bonset, he exhibited as a Dadaist in Holland in 1923 and published another art review, *Mechano.* In 1926 he wrote his manifesto "De Stijl," explaining his theory of elementarism, an aesthetic concept based on the use of inclined planes in geometric abstract paintings to increase the dynamic effect of the composition.

dog (species *Canis familiaris*), domestic mammal of the family Canidae (order Carnivora); it is related to wolves, foxes, and jackals.

A brief treatment of dogs follows. For full treatment, *see* MACROPAEDIA: Dogs.

Dogs are the first animal to have been domesticated. They probably originated somewhere in Eurasia approximately 12,000 to 14,000 years ago. The association may have developed gradually as wild dogs took to hanging around encampments to pilfer scraps, and humans began to rely on the dogs for warning of any approaching danger. Through the centuries many breeds were developed for specific tasks, such as hunting, herding, or guarding. Today, however, most dogs are kept chiefly for companionship.

Selective breeding by humans has had great effect on the natural variation present in one species. The smallest dog, the chihuahua, may weigh less than 2 pounds (0.9 kg), while 150 pounds (68 kg) is not uncommon for a mastiff or a Saint Bernard. Selective breeding has also altered the physical form of many breeds of dog. Early in domestication a mutation occurred for the upcurved tail; this trait occurs in most dog populations, but it is not found among wolves. Other variations from the original wolflike body-form include the very short legs of breeds such as dachshunds and Welsh corgis; the foreshortened face of bulldogs, mastiffs, and Pekingese; and the drooping ears that are more typical of domestic dogs than are the ancestral erect ears still found on some of the most wolflike breeds, such as German shepherds and malamutes. Coat colour also has been modified and includes solid black, black and tan, piebald (mottled), and white. Coat texture may be wolflike (as in German shepherds), curly (poodles), wiry (Airedale terriers), long (briards), short (Labrador retrievers), or even nonexistent (Mexican hairless).

Selective breeding has also enhanced particular behavioral patterns. Hounds, such as bloodhounds, foxhounds, and beagles, have been developed to hunt by scent; bloodhounds can follow a faint trail that is days old. The herding instinct, part of the hunting behaviour of the wolf and wild dog, has been highly developed in such breeds as border collies (used by shepherds) and Welsh corgis (used by cowherds). Some breeds, including the Great Pyrenees and komondors, live with flocks of sheep and protect them from predators. Terriers, such as fox terriers and miniature schnauzers, were developed to follow small game and vermin—such as foxes and rats—into their burrows and to trap and kill them. Sporting breeds are used to find game birds—setters and pointers to stand on point (*i.e.,* stop and wait) when they locate a bird, spaniels to rush in and flush the bird, and retrievers to collect dead and wounded birds and bring them to the hunter. Mastiffs, originally used as guard dogs and watchdogs, have been superseded by more agile breeds, such as Doberman pinschers and German shepherds. Breeds like the husky, malamute, and Bernese mountain dog were developed mainly as draft animals. Members of all these breeds also serve as companions, as do the various toy or miniature dogs and breeds that are categorized as nonsporting dogs—*e.g.,* the Lhasa apso (originally a temple dog), the poodle (bred as a water retriever), and the Dalmatian (originally a hunting dog and later used to escort and guard horse-drawn carriages).

The dog's best-developed senses are smell and hearing. Its nasal passages can process large amounts of air, and the olfactory centre in the brain is enlarged. The dog's hearing is also acute; it can respond to frequencies of up to 35,000 vibrations per second (human hearing stops at 20,000). Sight is relatively poorly developed, although certain hounds (*e.g.,* greyhounds and Afghans), known as gazehounds, or sight hounds, have been bred to follow their prey—usually antelopes or hares—visually. All dogs lack colour vision.

Wild dogs are highly social animals and, like wolves, tend to run in groups and follow a leader. In domestic dogs, this characteristic makes possible the transference of "pack" loyalties to human owners. They are also fairly intelligent animals, and, when motivated, many can learn a large number of commands. German shepherds, Labrador retrievers, and poodles are among the most amenable to extended training, although individuals of almost any breed may excel in obedience.

Domestic dogs are mature by about one year of age, and females, called bitches, may come into their first heat, or estrus, before six months of age. Most bitches have two heats yearly, about six months apart. To avoid unwanted puppies, females can be spayed (removing the ovaries) and males castrated. After mating, dogs are attached in a copulatory tie for up to half an hour. Gestation lasts approximately nine weeks. An average litter consists of 4 to 6 puppies—born blind, deaf, and helpless—but the tiny breeds may have only 1 or 2 and the large breeds more than 10. Puppies should be allowed to nurse for at least six weeks before they are weaned. Between six and eight weeks is the ideal age at which to transfer the pup's social allegiance from dogs to humans, but this usually can be accomplished any time up to 12 weeks. Puppies that interact only with other dogs for a longer period of time may never become fully adapted to humans.

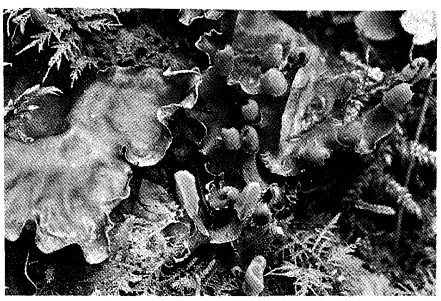
Simple training may begin at six to eight weeks, but complex training generally is not successful until the dog is about six months old. The reward system seems to be the best basis for training a dog; most work willingly for a pat and a fond word.

Various competitions are held by groups interested in dogs and dog breeding. During dog shows animals are judged on how closely they match the breed standards set by the ruling organization. In the United States these rules are formulated by the American Kennel Club, in Britain by the Kennel Club of England. Other competitions include field trials (for hunting and shepherd dogs) and obedience trials.

dog days, periods of exceptionally hot and humid weather that often occur in July, August, and early September in the northern temperate latitudes. The name originated with the ancient Greeks, Romans, and Egyptians;

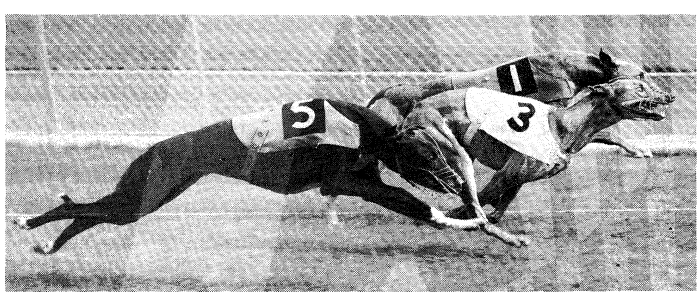
they believed that Sirius, the dog star, which rises simultaneously with the Sun during this time of the year, added its heat to the Sun's and thereby caused the hot weather. Their belief that dogs were subject to spells of madness at this time also may have contributed to the name. Because people tended to become listless during the dog days, Sirius was held to have a detrimental effect on human activities.

dog lichen (*Peltigera canina*), foliose (leafy) lichen usually found in patches 5 to 10 centimetres in diameter on heaths, sand dunes, walls, or grassy ground. The dull brown thallus with rounded lobes is soft when moist and papery when dry. Because its reproductive bodies resemble the teeth of a dog, it was used as a treatment for rabies in the Middle Ages; powdered *Peltigera* was mixed with black pepper and warm milk.



Dog lichen (*Peltigera canina*)
Louise K. Broman—Root Resources

dog racing, also called GREYHOUND RACING, 20th-century sport, an outgrowth of coursing (*q.v.*), the racing of greyhounds around an enclosed track in pursuit of an electrically controlled and propelled mechanical hare (rabbit). The greyhound chases by sight. Oliver P. Smith demonstrated the sport in 1919 at Emeryville, Calif., and the first track opened at St. Petersburg, Fla., in 1925. The sport was introduced in England in 1926 and became more popular there than in the United States. Dog racing later spread to such other countries as Ireland, Belgium, France, Spain, Italy, Australia, New Zealand, and Mexico.



Greyhounds racing on a track
By courtesy of the National Greyhound Racing Club Ltd.

In England there are normally eight races to a meeting. The National Greyhound Racing Club (founded 1928), the governing body, established race distances for flat and hurdle races from 230 to 1,200 yards (210 to 1,100 metres). Usually no more than six greyhounds run in a race, which is run on grass. Most races are held at night under lights.

In the United States, dog races were at first held only in Florida and Massachusetts, but by the 1980s the sport had spread to Alabama, Arizona, Arkansas, Colorado, Connecticut, South Dakota, New Hampshire, and Oregon. Racing is under the supervision of state commissions. Eight dogs compete in each race, and there may be 10 or 11 races to a program. In the United States the track, which is sand and loam, is normally a quarter mile (400 metres), most races being at 5/16 or 3/8 mile. For winners of the British and Irish greyhound derbies, *see* Sporting Record: *Dog (greyhound) racing.*

dog show, competition in which purebred dogs are judged on the basis of their physical perfection, as determined by breed standards. Dog shows in the United States are held according to rules set up by the American Kennel Club; shows in Great Britain follow the rules of the Kennel Club of England.

The first English dog show was held in Newcastle in 1859, and a more ambitious one followed at Chelsea in 1863. The best known of English dog shows is Cruft's, which has been held annually in London since 1886.

The first formal dog show in the United States was held in 1877 and was sponsored by the Westminster Kennel Club. The annual shows sponsored by this kennel club, in New York City, and by the International Kennel Club, in Chicago, are two of the most important dog shows in the United States.

Dog Star: *see* Sirius.

dog tooth: *see* canine tooth.

dogbane beetle (*Chrysochus auratus*), member of the insect subfamily Eumolpinae of the leaf beetle family Chrysomelidae (order Coleoptera). The dogbane beetle of eastern North America is iridescent blue-green with a metallic copper, golden, or crimson shine. It is one of the most brightly coloured beetles in its family. It feeds on dogbane and milkweed. It is oval, convex, and between about 8 to 11 millimetres (less than 1/2 inch) in length.

doge (Venetian Italian: "duke"), highest official of the Republic of Venice for more than 1,000 years (from the 8th to the 18th century) and symbol of the sovereignty of the Venetian state. The title was also used relatively briefly, in Genoa.

In Venice the office of doge (from Latin *dux*, "leader") originated when the city was nominally subject to the Byzantine Empire and became permanent in the mid-8th century. According to tradition, the first doge was Paolo Lucio Anafesto, elected in 697.

From the 8th to the 12th century the doge's power was extensive, but all attempts to make the office hereditary failed. From the 12th century the aristocracy placed strict limits on the doge. Newly developed constitutional bodies took over many of the functions of government, and the doge on taking office had to swear an oath that restricted his freedom of action. During the same period, the main characteristics of the office were fixed: the doge was chosen from among the ruling families of Venice and held office for life. By the 15th century the office had assumed the character of prince subject to law. The last doge, Ludovico Manin, was deposed when Napoleon conquered northern Italy in 1797.

Among the most famous doges, capable of exerting considerable political influence because of personal ability, were Enrico Dandolo (doge, 1192–1205), under whom Venice led an invasion of the Byzantine Empire, and Francesco Foscari (doge, 1423–57), under whom Venice first undertook conquests on the Italian mainland.

The name doge was also given to the principal civil official of Genoa, the office being modeled on that of Venice and instituted in 1339 to help end disorders among factions in the city. From 1384 to 1515 the popular elements of Genoa controlled the office of doge except for brief periods of foreign domination. In 1528 the office was reinstituted but restricted to aristocrats who held it for a term of two years. This office, like that of Venice, ended with French control of the peninsula.

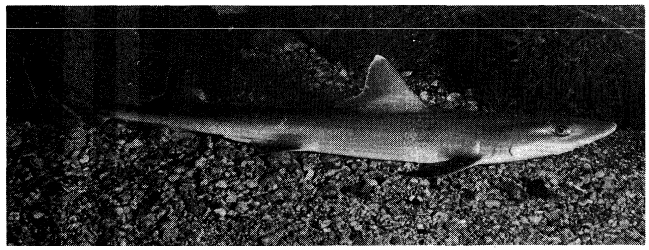
Dōgen, also called JŌYŌ DAISHI, or KIGEN DŌGEN (b. Jan. 19, 1200, Kyōto—d. Sept. 22, 1253, Kyōto), leading Japanese Buddhist during the Kamakura period (1192–1333), who introduced Zen to Japan in the form of the Sōtō school (Chinese Ts'ao-tung). A creative personality, he combined meditative practice and philosophical speculation.

Dōgen was born into a family of the court nobility and was orphaned at the age of seven. He was ordained a monk at 13 and studied the holy scriptures of Buddhism on Mt. Hiei, the centre of Tendai Buddhism, without, however, fully satisfying his spiritual aspirations. Between 1223 and 1227 he studied Zen meditation in China and gained enlightenment under the Zen master Ju-ching. Back in Japan again, he lived at various temples and worked for the spread of Zen practice. He spent his last years at the Eihei-ji (Eihei Temple), which he founded northwest of Nagoya. His first literary work, *Fukan zazen gi* (1227; "General Teachings for the Promotion of *Zazen*"), contains a brief introduction to the Zen practice. He wrote a number of other instructive works as well. His chief work, *Shōbōgenzō* (1231–53; "Treasury of the True Dharma Eye"), containing 95 chapters and written over a period of more than 20 years, consists of his elaboration of Buddhist principles. Dōgen taught *shikan taza,* "*zazen* only," *zazen* signifying the Zen practice of meditation in the cross-legged (lotus) position. He stressed the identity of practice and enlightenment.

Doges' Palace, Italian PALAZZO DUCALE, official residence in Venice of the doges, who were the elected leaders of the former Venetian Republic. The first palace was built in 814 and was burned by the populace in 976. It was reconstructed, damaged by a second fire, and begun in its present form in the early 14th century. In 1424 the completion of this Venetian Gothic-style palace was undertaken, and the two identical facades facing the Molo (steps) and the Piazzetta S. Marco were extended. The Porta della Carta, the main gateway, was designed by Giovanni and Bartolomeo Bon (Buon) and begun in 1438. Severe fires later necessitated rebuilding parts of the palace and destroyed the frescoes of, among others, Pisanello and the paintings by the Bellini family and Titian. Partly in replacement of these, important paintings (still *in situ*) were commissioned from such artists as Tintoretto and Veronese.

dogfish, any of several small sharks of the families Squalidae, Scyliorhinidae, and Triakidae. In North America, the name is also used for a freshwater fish, the bowfin (*q.v.*).

The spiny dogfishes of the family Squalidae possess a sharp spine in front of each of their two dorsal fins. The most widely known species is *Squalus acanthias,* called the spiny dogfish, spurdog, or skittle dog. It is abundant along northern Atlantic and Pacific coasts; a closely related, if not identical, form inhabits the southern half of the world. The spiny dogfish is gray, with white spots, and is about 60 to 120 centimetres (2 to 4 feet) long. Often found in dense schools, it preys on fishes and various invertebrates. It is often a nuisance,



Smooth dogfish (*Mustelus canis*)
George Whiteley—The National Audubon Society Collection/Photo Researchers

as it takes baits and damages fishing nets, but it is edible and also yields liver oil and is ground for fertilizer. Its dorsal fin spines are associated with small venom glands and can cause painful wounds.

The spotted dogfishes of the family Scyliorhinidae include the larger spotted dogfish, or nursehound (*Scyliorhinus stellarius*), which grows about 150 centimetres (5 feet) long, and the lesser spotted dogfish (*S. cuniculus*), which is about 90 centimetres (3 feet) long. Both of these common, brown-spotted sharks are caught and sold as food.

The smooth hound, or smooth dogfish (*Mustelus canis*), is widely used in anatomy classes and laboratories. One of the best known members of the family Triakidae, it is also one of the most common sharks on the American Atlantic coast. It is a slim shark, up to 150 centimetres long, and is grayish in colour. Like others of its family, it has small teeth, arranged in series, and lacks a well-developed lower tail lobe. It is a bottom dweller and preys on fish and crustaceans.

Dogger Bank, extensive isolated shoal in the North Sea, lying about 60 miles (100 km) off the northeastern coast of England. It rises 70 feet (20 m) higher than the surrounding sea floor, is 160 miles long and 60 miles wide at the 120-feet level, and reaches its shallowest point (50 feet below the sea surface) at its western end. The bank is a huge moraine that was deposited at the southern limit of the last glaciation. For centuries it has been a well-known fishing ground. The large amounts of food available to the fish result in the catch of sizable quantities of plaice, cod, haddock, turbot, dabs, and herring. The origin of the name is obscure, but the Dutch *dogger,* signifying a trawling vessel, was formerly applied to two-masted ships employed in North Sea fishing and, by extension, to their crews (doggermen) and the fish taken (doggerfish). The lines demarcating the international rights of Great Britain, The Netherlands, Germany, Denmark, and Norway to the North Sea (*q.v.*) intersect just north of the Dogger Bank; all but Norway have rights to the bank itself.

doggerel, a low, or trivial, form of verse, loosely constructed and often irregular, but effective because of its simple mnemonic rhyme and loping metre. It appears in most literatures and societies as a useful form for comedy and satire. It is characteristic of children's game rhymes from ancient times to the present and of most nursery rhymes.

One of the earliest uses of the word is found in the 14th century in the works of Chaucer, who applied the term "rym doggerel" to his "Tale of Sir Thopas," a burlesque of the long-winded medieval romance.

John Skelton (*c.* 1460–1529), caught in the transition between Chaucer's medieval language and the beginning of the English Renaissance, wrote verse long considered to be almost doggerel. He defended himself in *Colin Clout:*

> For though my rhyme be ragged,
> Tattered and jagged,
> Rudely rain-beaten,
> Rusty and moth-eaten,
> If ye take well therewith,
> It hath in it some pith.

Since then, doggerel has been employed in most English comic verse, from that of Samuel Butler and Jonathan Swift to the U.S. poet Ogden Nash.

The German version, called *Knüttelvers* (literally "cudgel verse"), was popular during the Renaissance and was later used for comic effect by such poets as Goethe and Schiller. Doggerel verse is still commonly heard in limericks and nonsense verse, popular songs, and commercial jingles.

Doggett, Thomas (b. *c.* 1670, Dublin—d. September/October 1721, London), English actor who excelled in low comedy parts and is best remembered as a member of a famous actor-manager triumvirate of Cibber, Doggett, and Wilks at the Drury Lane Theatre, London.

Doggett is said to have begun his acting career about 1691 in the provinces, appearing in London some years later. William Congreve so admired Doggett's acting that he wrote him the parts of Fondlewife in *The Old Batchelour* and Ben in *Love for Love.* For a while Doggett managed the Drury Lane Theatre with Colley Cibber and Robert Wilks, but the partnership broke up in a quarrel over politics. He wrote a comedy, *The Country Wake* (1696), that was successfully staged at Lincoln's Inn Fields Theatre and later revived by Cibber in 1711. He was a friend of Addison, Steele, and Pope.

Doggett's Coat and Badge, one of the world's oldest continuing rowing races, held annually in England along the Thames River from London Bridge to Chelsea, a distance of 4 miles 5 furlongs (7.4 kilometres). The race is a sculling contest between skiffs originally used to ferry passengers across the river. The boats are manned by watermen who have recently completed their apprenticeship. The contest was instituted in 1715 by Thomas Doggett, an English comic actor, to commemorate the accession of George I in 1714. Doggett provided for a cash prize and "an Orange coloured Livery with a Badge representing Liberty" to be awarded to the winner. Although the colour of the uniform has changed from orange to red and the cash prize is no longer awarded, Doggett's decree continues to be fulfilled.

Dogon, people of Mali. There is some doubt as to the correct classification of the Dogon language, which has been placed in the Mande, Voltaic, and other language groups. The majority of the Dogon live in the rocky hills, mountains, and plateaus of the Bandiagara district. They are mainly an agricultural people; and their few craftsmen, largely metalworkers and leatherworkers, form distinct castes. They have no centralized system of government but live in villages composed of patrilineages and extended families, whose head is the senior male descendant of the common ancestor. Polygyny is practiced but reportedly has a low incidence.

Each large district has a spiritual leader, or *hogon;* and there is a supreme *hogon* for the whole country. In his dress and behaviour the *hogon* symbolizes the Dogon myth of creation, to which the Dogon relate much of their social organization and culture. Their metaphysical system—which categorizes physical objects, personifies good and evil, and defines the spiritual principles of the Dogon personality—is more abstract than that of most other African peoples. The climax of Dogon religious life occurs every 60 years, in a ceremony called the *sigui.* It occurs when the star Sirius appears between two mountain peaks (a phenomenon revealing a keen knowledge of astronomy). Before the ceremony, young men go into seclusion for three months, during which they talk in secret language. The general ceremony rests on the belief that some 3,000 years ago amphibious beings from Sirius visited the Dogon.

Although most Dogon practice traditional religion, a large number are Muslim.

Dogra DYNASTY, Rājput clan, or group of clans, that still dominates the Indian state of Jammu and Kashmir. They form the chief, or *mīān,* portion of Rājputs of the Jammu territory (lying north of Lahore and stretching roughly between the rivers Chenāb and Rāvi). They are a hardy and martial people who attained prominence in the 19th century. There had long been a small state of Jammu, but after 1780 it became tributary to the Sikhs. One of the princely house, Gulab Singh, distinguished himself in the service of the Sikhs and was made raja of Jammu in 1820, which was the beginning of the Dogra dynasty. He expanded to the north, annexing Ladākh and Baltistān.

In the First Sikh War (1845–46), Singh held aloof and then appeared as a mediator. As a reward, Kashmir (annexed by the Sikhs in 1819) was given to him by the British for a payment of Rs. 7,500,000 (£750,000). This was the origin of what became known as the Kashmir problem. Kashmir itself, apart from a Brahman minority, was Muslim in population, so that a Hindu thus ruled a Muslim majority state. In 1947 Hari Singh, the great-grandson of Gulab Singh, faced with an incursion of Pashtuns from Pakistan, acceded to union with India.

Dogrib, also called THLINGCHADINNE, a group of Athabascan-speaking Indian tribes inhabiting the forested and barren-ground areas between the Great Bear and Great Slave lakes in northwestern Canada. The name is an English adaptation of their own name, Thlingchadinne, or Dog-flank People, referring to their fabled descent from a supernatural dog-man.

Traditionally, the Dogrib subsisted chiefly on barren-ground caribou, which were trapped or speared, but they also fished. Their usual habitation was a skin-covered tepee, although in the hard winters they sometimes built wooden and brush-covered lodges. Their social organization comprised many independent, loosely led bands, each with its own territory. Dogrib women enjoyed generally better status than those of other northern tribes (*compare* Chipewyan), but the aged and infirm were often cast off to die. Their chief enemies were the Cree, Chipewyan, and Yellowknife; the Yellowknife they eventually massacred in raids in the late 18th and early 19th centuries.

The Dogrib remained relatively isolated until the mid-20th century, when improved transportation and communication facilities brought them into greater contact with other parts of Canada. In the late 20th century the Dogrib numbered about 1,200.

dogsled racing, sport of racing sleds pulled by dogs over snow-covered cross-country courses; it was developed from a principal Eskimo method of transportation. Dogsleds are still used for transportation and working purposes in some northern areas, although they have been replaced to a great extent by aircraft and snowmobiles.

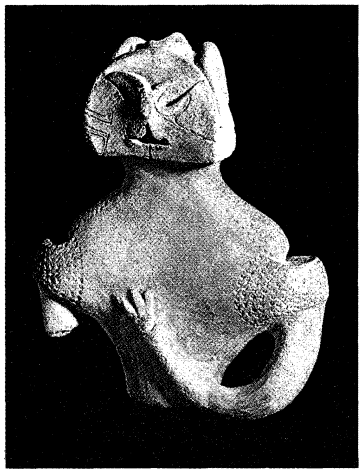
The modern, lightweight racing sled weighs about 30 pounds. Its ash frame is lashed together with leather and its runners sheathed

Dogsled racing
By courtesy of the Department of Economic Development, State of Minnesota

with steel or aluminum. Dogs are usually especially bred and trained Eskimos, Siberian huskies, Samoyeds, or malamutes. The teams, most often consisting of five, seven, or nine dogs, are driven in the gang hitch—a single leader with the rest of the team in pairs. Control of the team is by voice, although drivers may carry whips of limited length. In open country, point-to-point races are held. In more populated areas, back roads form the course, with races usually varying in length from 12 to 30 miles. A team of five to seven dogs can pull the sled and its driver, called a musher, at speeds over 20 miles per hour. Teams start at intervals and race for time. Usually, all dogs must finish in the order they start, and an injured dog must be carried on the sled.

A dogsled-racing event was included in the 1932 Winter Olympics program and won by E. Goddard of Canada. The sport is popular in Norway, Canada, Alaska, and the northern United States, where races are often held during winter carnivals, such as the Anchorage Fur Rendezvous in Alaska. A world-championship event is held annually at Laconia, N.H.

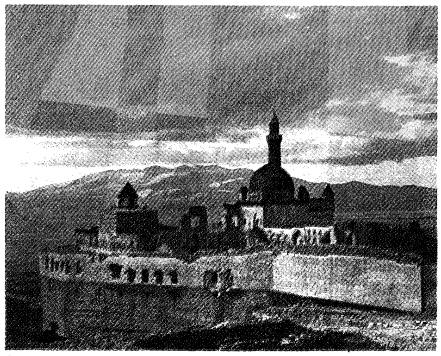
dogū, abstract clay figurines, generally of pregnant females, made in Japan during the Jōmon period (5th or 4th millennium–*c.* 250 BC). *Dogū* are reminiscent of the rigidly frontal fertility figures produced by other prehistoric cultures.



Harelipped clay *dogū* figurine, mid-Jōmon period (5th or 4th millennium to *c.* 250 BC); in the Tokyo National Museum
By courtesy of the Tokyo National Museum

Although their precise function is unknown, archaeological evidence suggests that *dogū* were aids in childbirth as well as fertility symbols. They are also found in simulated burials, thereby indicating some kind of ceremonial function. Fired at a low temperature, they often have crumbly surfaces; a number are painted in red.

Doğubayazıt, chief town of Doğubayazıt *ilçe* (district), Ağrı *il* (province), eastern Turkey, at an altitude of 6,000 ft (1,800 m) close to the frontiers of the Soviet Union and Iran. Lying near the ancient trade route from Trabzon (ancient Trebizond) to northwestern Iran, Doğubayazıt was once an important trading town, but its importance declined with the



İşhak Paşa's palace, Doğubayazıt, Tur.
K. Scholz—Shostal/EB Inc.

reduction of trade along this route and was destroyed during the Russo–Ottoman wars of the 19th century and World War I, when the town was occupied by Russian troops. On a spur above the town are cuneiform inscriptions dating from the 1st millennium BC. Now a transit station on the main Europe–Iran highway, Doğubayazıt is the trading centre for animal products of the region. Pop. (1980) town, 23,513; *ilçe,* 73,794.

dogwood, any of the shrubs, trees, or herbs of the genus *Cornus,* in the dogwood family (Cornaceae), native to Europe, eastern Asia, and North America. The bunchberry (*q.v.*), *C. canadensis,* is a creeping perennial herb. Flowering dogwood (*C. florida*), a North American species, is widely grown as an ornamental for its showy petallike bracts (modified leaves) under the tiny flowers. Cornelian cherry (*C. mas*), a European species also grown as an ornamental, produces fruit that is eaten fresh or made into preserves or wine (*vin de corneulle*). The Pacific, or mountain, dogwood (*C. nuttallii*) resembles the flowering dogwood with minor differences. A few shrubby species are planted for their variegated leaves and colourful twigs—which can be red, purple, or yellow—and as food for game.

Doha, Arabic AD-DAWḤAH, city, capital of Qatar, on the east coast of the Qatar Peninsula, in the Persian Gulf. About two-thirds of Qatar's population lives within the city's limits. Situated on a shallow bay, about 3 mi (5 km) from east to west, Doha (meaning "bay") has long been a locally important port. Because of offshore coral reefs and a shallow bottom, it handled only small vessels until the construction of its deepwater port in the 1970s.

The original quarter of the city, al-Bida', Bida in sailor's parlance, is at the northwest; it was probably founded by Sudanese refugees from the shaykhdom of Abu Dhabi. Long a centre of pirate activity in the Persian Gulf, Doha, then a small village, was destroyed in 1867 in the war between Bahrain, which was aided by Abu Dhabi, and Qatar. In the following year, the British government installed Muḥammad ibn Thānī Āl Thānī, *shaykh* of ad-Dawḥah, as the premier ruler of Qatar. He agreed to abide by the terms of the Perpetual Maritime Truce of 1853, and piracy was greatly reduced. In the late 19th century, the Ottoman Empire, as suzerain of much of the Arabian Peninsula, sporadically maintained a garrison at Doha. After Qatar became a British protected state in 1916, a British political agency was maintained in the town. In late 1971, Doha became the capital of newly independent Qatar.

Long a sleepy pearling and fishing village, Doha had about 350 pearling boats at the beginning of the 20th century. The development of Japanese cultured pearls and the worldwide economic depression after 1929 severely affected the town. The development of Qatar's considerable oil reserves after World War II, however, led to a complete economic transformation. Qatar became an extremely prosperous country with a high per capita income and undertook the thorough modernization of its capital. Old slum sections were razed, and modern commercial and residential quarters were built; Doha has piped water (obtained from distilling seawater) and has electricity. The deepwater port accommodates oceangoing vessels. The Qatar National Fishing Company, using modern motorized craft, is headquartered at the port, where a modern shrimp refrigeration and packing plant has been built.

(Top) flowers and (bottom) leaves and fruit of flowering dogwood (*Cornus florida*)
J.C. Allen and Son

Quay in Doha, capital of Qatar
J. Allan Cash—EB Inc.

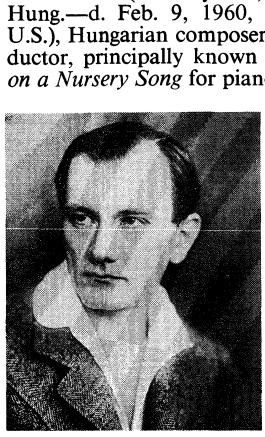
Sites of interest include the new Clock Tower Square, the *sūq* (marketplace), and the new Government House (1969), built on reclaimed waterfront land. Doha International Airport is located just southeast of the city. Pop. (1986) 217,294.

Doherty, Laurie; and Doherty, Reggie, bynames of HUGH LAWRENCE DOHERTY and REGINALD FRANK DOHERTY (respectively b. Oct. 8, 1875, London, Eng.—d. Aug. 21, 1919; b. Oct. 14, 1872, London, Eng.—d. Dec. 29, 1910), English tennis-playing brothers who dominated the sport from 1897 to 1906. As a team they were almost unbeatable and held the record for the most doubles titles at Wimbledon, winning eight from 1897 to 1905.

Laurie held the Wimbledon record for most men's titles altogether, with 13 between 1897 and 1905, winning British singles from 1902 to 1906. Reggie took Wimbledon singles from 1897 to 1900. The Dohertys also won the U.S. doubles championships in 1902 and 1903, and Laurie was the first foreigner to win the U.S. singles, in 1903.

The brothers were vital to British Davis Cup competition from 1902 to 1906, during which time Laurie achieved the best record ever in Davis finals, going 7–0 in singles and 5–0 in doubles. Between 1902 and 1906 Reggie lost one singles match outright, to Malcolm Whitman of the United States in 1902, and one by default, to Bill Larned in 1903.

Dohnányi, Ernst von, Hungarian ERNŐ DOHNÁNYI (b. July 27, 1877, Pozsony, Hung.—d. Feb. 9, 1960, New York, N.Y., U.S.), Hungarian composer, pianist, and conductor, principally known for his *Variations on a Nursery Song* for piano and orchestra.



Dohnányi, *c.* 1920
Jean-Loup Charmet—J.P. Ziolo

Dohnányi studied in Budapest at the Royal Academy of Music, where his first symphony was performed in 1897. As a pianist he traveled widely and established a reputation as one of the best performers of his day.

He taught at the Berlin Hochschule für Musik (1908–15) and was conductor of the Budapest Philharmonic and associate director of the Budapest Academy of Music (1919). In 1931 Dohnányi was director of the Hungarian radio. In 1948 he left Hungary as a political exile; his influence under the prewar regime was held against him, and his music was banned in communist Hungary for more than 10 years. He taught in Argentina and from 1949 held the position of composer-in-residence at Florida State University, Tallahassee, Fla., U.S.

Dohnányi's music, which was chiefly influenced by Johannes Brahms, was late Romantic and conservative in style, and after 1910 he occupied only a minor place among contemporary Hungarian composers. His works include the *Ruralia Hungarica* for violin, three symphonies, a ballet, the *Suite in F Sharp Minor*, three operas, and chamber works, notably the *Second String Quartet* and the two piano and string quintets.

Doi Takako (b. Nov. 30, 1928, Kōbe, Japan), Japanese politician, educator, and head of the Japan Socialist Party (JSP) from 1986. She was the first woman ever to head a political party in Japan.

Doi was the daughter of a physician. She attended Doshisha University in Kyōto, and after her graduation she taught constitutional law there. She was elected to the Diet (parliament) in 1969. After the JSP, second largest party in Japan's multiparty system, suffered a major defeat in the general elections of 1986, Doi was asked to lead the party. From the outset of her leadership she attempted to bring the party more into the mainstream on such divisive issues as defense and nuclear power; the party, for example, softened its traditional stance by accepting, within limits, a role for Japan's Self-Defense Forces.

Doi experienced much success in wooing women voters, who became a new power base in Japanese politics. Although she had done little to identify with feminist issues at the outset, she helped channel the dissatisfaction of women angered by old-boy money politics and the sex scandals plaguing the ruling Liberal-Democratic Party (LDP). Following her "madonna strategy," a number of women candidates succeeded in winning office in the summer elections of 1989, and for the first time in three decades the LDP lost its majority of upper-house seats to the JSP under Doi's leadership.

Doire (Northern Ireland): *see* Londonderry.

Doisy, Edward Adelbert (b. Nov. 13, 1893, Hume, Ill., U.S.—d. Oct. 23, 1986, St. Louis, Mo.), American biochemist who shared the 1943 Nobel Prize for Physiology or Medicine with Henrik Dam for discovery of the antihemorrhagic vitamin K (1939). Doisy and his associates also isolated a variant form of the vitamin, vitamin K_2, and the sex hormones estrone (theelin, 1929; the first estrogen to be crystallized), estriol (theelol, 1930), and estradiol (dihydrotheelin, 1935).

Doisy earned his bachelor's and master's degrees at the University of Illinois and his Ph.D. at Harvard University (1920). He taught at Washington University School of Medicine, St. Louis, Mo. (1919–23), and St. Louis University (1923–65; emeritus 1965–86). Over the years he worked with the embryologist Edgar Allen developing assay techniques that facilitated research on sex hormones. In recognition of his contributions to the knowledge of vitamins, antibiotics, hormones, and blood buffer systems, St. Louis University's department of biochemistry was named for him in 1955.

Besides his publications in scientific periodicals, his writings include *Sex Hormones* (1936) and *Sex and Internal Secretions* (1939), with Edgar Allen and Charles H. Danforth.

Dokuchayev, Vasily Vasilyevich (b. March 1 [Feb. 17, Old Style], 1846, Milyukovo, Russia—d. Nov. 8 [Oct. 26], 1903, St. Petersburg, Russia [now Leningrad]), Russian geomorphologist and early soil scientist.

In 1872 Dokuchayev became curator of geology at the University of St. Petersburg; in 1879 he joined the geology faculty and instituted the first course in Quaternary geology taught at a university. From 1892 to 1895 he reorganized and directed the Novo-Aleksandr Institute of Agriculture and Forestry, adding departments of soil science and plant physiology. He organized soil surveys throughout most of Russia and introduced the term chernozem to describe the black soil, rich in carbonates and humus, that occurs in the temperate latitudes of Russia. Dokuchayev viewed soil as the result of interaction between climate, bedrock, and organisms. In 1898 he introduced a classification of Russian soils that showed that similar bedrocks give rise to different soils, depending on climate. His emphasis on interactions among bedrock, climate, and organisms foreran the biome theory.

Dōkyō (d. 772, Shimotsuke province, Japan), Japanese Buddhist priest who attempted to usurp the Japanese imperial throne.

Preaching at the imperial temple in 761, he won the confidence of the former empress Kōken, who had occupied the throne from 749 to 758. He became the empress' lover, and with her aid he began to exercise a dominant influence within the government. In 764 Dōkyō succeeded in eliminating his major political rival, the minister Oshikatsu, who was the favourite of the emperor Junnin.

In the ensuing coup, the emperor was deposed, and the former empress reascended the throne, ruling as the empress Shōtoku (764–770). Within a year Dōkyō was named prime minister, and in 766 he was also made archbishop. Not content with virtually ruling the country, he persuaded an oracle to predict his succession to the throne, a pretension that angered many important members of the government, especially those of the powerful Fujiwara family. When the empress died in 770, the Fujiwara had Dōkyō banished from the capital. As a result of this episode no woman was allowed to succeed to the Japanese throne for nearly a thousand years.

Dōkyō (from Chinese *Tao-chiao,* "Teaching of the Way"), popular or religious Taoism, as distinguished from philosophical Taoism. It was introduced into Japan from China and is the source of many widespread folk beliefs and practices of divination and magic, some of which persist into modern times.

Popular Taoism found its way into Japan (1) via philosophical texts such as the *Tao-te Ching* ("The Classic of the Way of Power") and other literary texts; (2) as an integral part of Buddhism and Chinese culture; and (3) informally, through court festivals and popular festivals and beliefs. A government department of divination, the On-myō-ryō ("Bureau of On-myō" [Chinese: Yin-Yang]), patterned after the Chinese practice, existed as early as 675 AD but later died out. One of the duties of the bureau, in keeping with the Yin-Yang theory of the balance of complementary forces, was to regulate the calendar in order to maintain a balance between the social order and the cosmic order. The introduction of the Chinese calendar had a lasting impact on Japanese religious history (*i.e.,* even Shintō shrines hold their festivals in accordance with the Chinese calendar).

dolce stil nuovo (Italian: "sweet new style"), nuovo also spelled NOVO, in Dante's *Purgatorio* of *La divina commedia,* the style of a group of 13th–14th-century poets, mostly Florentines, whose vernacular sonnets, canzones, and ballate celebrate a spiritual and ide-

alized view of love and womanhood in a way that was considered sincere, delicate, and musical. The Bolognese poet Guido Guinizzelli is considered a forerunner of the *stilnovisti,* and the most brilliant poets of the group are Guido Cavalcanti and Dante himself (in his lyric works). The most prominent minor poet associated with the group is Cino da Pistoia; others are Lapo Gianni, Gianni Alfani, and Dino Frescobaldi.

Several influences prepared the way for the development of the *dolce stil nuovo:* the troubadour poetry of Provence, which contained a courtly love tradition and used poetic forms that evolved into the Italian sonnet and canzone; the simplicity and mysticism of St. Francis and his followers; the 13th-century Sicilian school of poets, who created the sonnet and canzone from Provençal forms and who were the first poets in Italy to use the vernacular; and the philosophical doctrines of Thomism, Platonism, and Aristotelianism, with which all the *stilnovisti* had contact. Guinizzelli's contribution was his own gentle style of poetry as well as the exalted view of woman and love, which he presented in the canzone "Al cor gentil ripara sempre amore" ("Within the gentle heart Love shelters him").

The genius of Dante and Cavalcanti brought the movement to its full power. Dante pointed out in *Il convivio* ("The Banquet") that he deliberately chose sweet and musical language for his love poetry, and the lovely lyrics to Beatrice that interlace *La vita nuova* ("The New Life") amply prove his success. His notion of love is a very exalted one: even while she was alive, Beatrice was pictured as an angelic presence, and after her death, Dante gave her the role of his divine guide in *La divina commedia.*

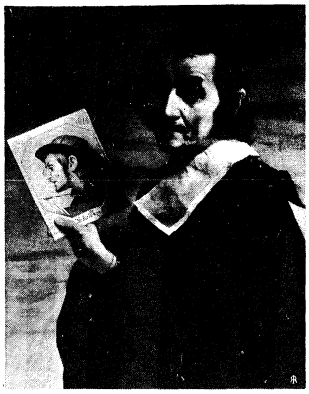
The beatific quality suffusing Dante's love for Beatrice is somewhat different from that which his "first friend," Cavalcanti, expresses in his emotionally complex, often anguished love lyrics. But Cavalcanti, the poet of the complexities of love, contributed some of the most stunning examples of the *dolce stil nuovo,* for example, the sonnet that begins "Who is she coming, whom all gaze upon." Cavalcanti was also the author of a famous and difficult canzone analyzing the nature of love, called "Donna me prega" ("A lady entreats me"), which suggests the notion that love exists when a man encounters a woman who corresponds to an ideal image in his mind and ceases to exist when this correspondence of images ceases.

The influence of the *stilnovisti* extended far beyond their own period, affecting the poetry of Petrarch, Lorenzo de' Medici (who consciously imitated them), Michelangelo, Pietro Bembo, Torquato Tasso, Dante Gabriel Rossetti, and Ezra Pound.

Dolci, Carlo, byname CARLINO (b. May 25, 1616, Florence—d. Jan. 17, 1686, Florence), Italian painter, one of the last representatives of the Florentine school of Baroque painting, whose mainly devotional works are characterized by their oversweet and languid piety.

He studied with a minor local painter and at an extremely early age showed a talent for portrait painting. Failing to develop significantly in this direction, however, he vowed, inspired by Counter-Reformation teachings, to devote his career to painting religious subjects. At a time when other Florentine artists migrated to Rome, the centre of monumental Baroque painting, Dolci remained in Tuscany and developed his manner out of the more sober, static native traditions of Florence.

Although he possessed little genius or inventiveness, Dolci painted pictures that were highly popular in his day. The figures in his dramatically concentrated compositions are typically half-length and treated with refinement of detail, soft colour, and strong contrasts of light and dark.



Dolci, self-portrait, oil painting; in the Uffizi, Florence
Brogi—Alinari from Art Resource/EB Inc.

doldrums, equatorial regions of light ocean currents and winds within the intertropical convergence zone, a belt of converging winds and rising air encircling the Earth near the Equator. The northeast and southeast trade winds meet there; this meeting causes slow air uplift and produces the doldrums. They occur along the Equator in the Indian and western Pacific oceans, and slightly north of the Equator off the African and Central American west coasts. The crews of sailing ships dreaded the doldrums because their ships were often becalmed there; the designation for the resultant state of depression was apparently thus extended to these geographical regions themselves.

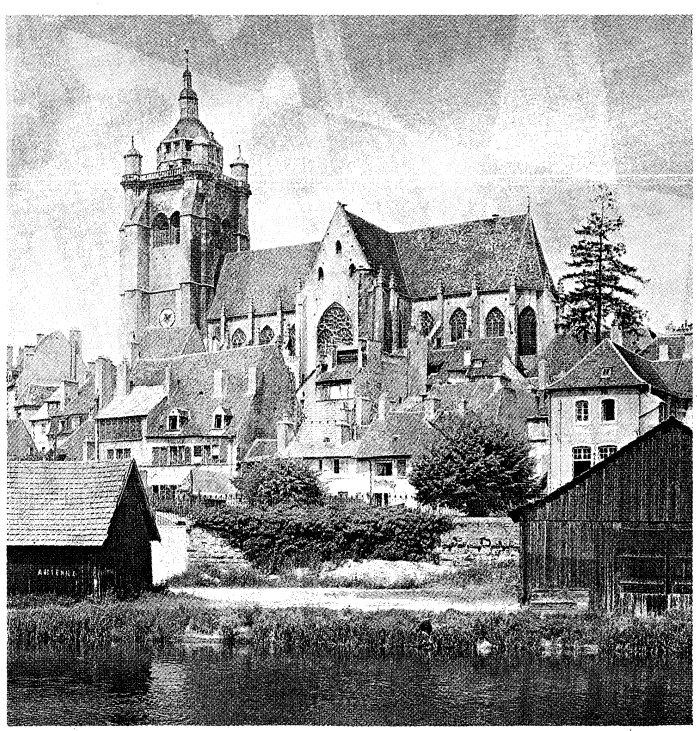
Dole, town, Jura *département,* Franche-Comté region, eastern France, on the Doubs River and the Rhine-Rhône Canal, southeast of Dijon. It was called Dolla under the Romans. It was the seat of the dukes of Burgundy in medieval times and was the capital (1332–1674) of Franche-Comté. It belonged to the House of Habsburg from 1493 until the Peace of Nijmegen made it French in 1678, when its *parlement* and university (founded 1423) were transferred to Besançon. The birthplace of Louis Pasteur (43 rue Pasteur) is preserved as a monument. The Hôpital Pasteur is housed in a 17th-century building. The Gothic church of Notre-Dame dates from the 16th century. Dole has metal and sanitary porcelain manufacturing and trades in grain, wine, and cheese. Pop. (1982) 25,445.

Dole, Sanford Ballard (b. April 23, 1844, Honolulu—d. June 9, 1926, Honolulu), first president of the Republic of Hawaii (1894–1900), and first governor of the Territory of Hawaii (1900–03) after it was annexed by the U.S.

The son of U.S. Protestant missionaries, Dole spent two years in the U.S. (1866–68) studying at Williams College in Williamstown, Mass. He then returned to Hawaii, practiced law in Honolulu (1869–87), and was twice elected to the Hawaiian legislature (1884, 1886). An opponent of the policies of King Kalakaua, Dole was a leader of the reform movement that brought about the adoption of a constitution in 1887. Also in 1887, he was appointed a justice of the Supreme Court of Hawaii.

In January 1893 Dole yielded to pressure from friends and agreed to serve as the leader of the committee that was formed to overthrow Queen Liliuokalani (who had succeeded her brother, Kalakaua, in 1891) and to seek annexation of Hawaii by the United States. The committee deposed the Queen peacefully and installed a provisional government with Dole as president (Jan. 17, 1893), but annexation was blocked when Pres. Grover Cleveland withdrew an annexation treaty from the Senate and demanded the restoration of Liliuokalani to the throne. Refusing to recognize Cleveland's authority in the matter, Dole and his colleagues established the Republic of Hawaii (1894), with Dole as president, and continued to seek annexation. When, finally, in 1900 Congress created the Territory of Hawaii, Dole was appointed the first territorial governor by Pres. William McKinley. In 1903 he resigned to become judge of the U.S. district court of Hawaii, a post he held until his retirement in 1915. The standard biography is Ethel M. Damon, *Sanford Ballard Dole and His Hawaii* (1957).

dolerite (petrology): *see* diabase.



The church of Notre-Dame, Dole, Fr., on the Rhine-Rhône Canal
Toni Schneiders—Bruce Coleman Inc.

Dolet, Étienne (b. Aug. 3, 1509, Orléans, Fr.—d. Aug. 3, 1546, Paris), French Humanist, scholar, and printer whose *Commentarii linguae Latinae* contributed notably to Latin scholarship. He is often described as "the first martyr of the Renaissance."

After studying at Paris and the Italian universities at Padua and Venice, Dolet settled

Dolet, engraving, *c.* 1546
J.E. Bulloz

in Toulouse, Fr. His quarrelsome temperament, unrestrained enthusiasm for Renaissance learning, and anticlericalism involved him in personal and public controversies. He was banished from the University of Toulouse and moved to Lyon, where for a time he was imprisoned for the justifiable homicide of a painter; he was released by royal pardon.

An ardent Ciceronian, he answered Erasmus' attack on slavish imitations of Cicero's style with *Dialogus de imitatione ciceroniana* (1535) and in 1536 published the first volume of his *Commentarii;* the second followed in 1538. This work was dedicated to Francis I, who gave him permission to set himself up as a printer. His first publication, *Cato Christianus* ("The Christian Cato"), was a profession of his creed as a Christian moralist. *Cato* was followed by Dolet's translations and editions of classical authors, Erasmus, the New Testament and Psalms, and Rabelais.

He was thrice accused of atheism and imprisoned (1542 and 1544) on the double charge of having published Calvinistic works and a dialogue by Plato denying the immortality of the soul; his third imprisonment was in 1546. He was finally condemned by the theological faculty of the Sorbonne and, having first been tortured, was burned at the stake.

Whether Dolet was a Protestant or an anti-Christian rationalist and freethinker is debatable. He was condemned by both Calvin and the Roman Catholic Church, but he published many religious books and repeatedly advocated the reading of the Scriptures in the vernacular. It seems likely that his fate was the result of his capacity to make enemies rather than the result of his opinions.

Dolgan, Turkic-speaking people constituting the basic population of the Taymyr autonomous okrug, far above the Arctic Circle in the north-central U.S.S.R. They numbered about 5,100 at the 1979 Soviet census. The Dolgan migrated to the area from the southwest presumably in the 18th century, displacing ancestors of the Nganasans, who moved northward into the Taymyr Peninsula. The nucleus of the Dolgan people was formed from a few Evenk, or Tungus, clans that subsequently adopted a dialect of the Turkic-speaking Yakuts.

In the 1970s the Dolgan were principally reindeer herders, collectivized under the Soviets, though their way of life was only gradually becoming less nomadic. Vegetable gardening had become important, along with traditional game hunting. Before the Russian Revolution they were organized into clans, headed by clan elders or princelings.

Dolgano-Nenets national okrug (Russian S.F.S.R.): *see* Taymyr autonomous okrug.

Dolgoprudny, also spelled DOLGOPRUNDNYJ, city, Moscow *oblast* (region), Russian Soviet Federated Socialist Republic, north of Moscow, where the Savyolovo railway crosses the Moscow Canal, linking the capital with the Volga River. Dolgoprudny appeared in the first Soviet five-year plans as a centre for airship construction. It now has machine-building and engineering industries. It is the site of the Moscow Physicotechnical Institute, the Central Aerological Observatory, and the Pryanishnikov Agrochemical Laboratory. Pop. (1984 est.) 69,000.

Dolgoruky FAMILY, Dolgoruky also spelled DOLGORUKOV, a Russian princely family whose origins are believed by some to go back to Yury Dolgoruky (1090–1157), a son of Vladimir II Monomakh of Kiev. The Dolgorukys produced well-known statesmen, military leaders, and men of letters.

Yury Alekseyevich Dolgoruky (d. 1682) was a high ranking nobleman and military commander who achieved a number of victories in the Russo-Polish war of 1654–57. In 1676 he was appointed guardian of the child tsar Fyodor Alekseyevich; he was killed during the Moscow Uprising of 1682. Yakov Fyodorovich Dolgoruky (1639–1720), a close associate of Peter I the Great, served in the military and was held prisoner in Sweden for 10 years. After returning to Russia (1711), he became a senator and was appointed president of the Auditing Collegium. Grigory Fyodorovich Dolgoruky (1656–1723) was ambassador to Poland (1701–21) and helped conclude a treaty of alliance with Poland (1701) and the Narva Alliance (1704).

Vasily Vladimirovich Dolgoruky (*q.v.*) became a high-ranking military officer and served on the Supreme Privy Council. His distant cousin, the diplomat Vasily Lukich Dolgoruky (*q.v.*), also served on the Supreme Privy Council.

Yury Vladimirovich Dolgoruky (1740–1830), a memoirist, served in the armies of the field in the Seven Years' War (1756–63) and the two Russo-Turkish Wars (1768–74 and 1787–91). Ivan Mikhaylovich Dolgoruky (1764–1823), vice-governor of Penza (1791–97) and governor of Vladimir (1802–12), wrote lyric poetry, comedies, and memoir-like works. His reminiscences characterized the culture, the upbringing, and the education of children of the nobility.

Dolgoruky, Vasily Lukich, Knyaz (Prince) (b. *c.* 1670—d. Nov. 19 [Nov. 8, old style], 1739, Novgorod, Russia), Russian diplomat and statesman who acquired political power for himself and his family during the reign of Tsar Peter II (reigned 1727–30).

Dolgoruky began his diplomatic career as an aide to his uncle Yakov Fyodorovich in Paris (1687). In 1700 he accompanied another uncle, Grigory Fyodorovich, to Poland and in 1706 replaced him as Russian ambassador there. He subsequently served as Russia's ambassador to Denmark (1707–20), France (1721–22), and Sweden (1725–27).

He shortly secured a position on the powerful Supreme Privy Council and arranged the betrothal of the young tsar to his niece, Yekaterina Alekseyevna. Peter II died suddenly (1730) before the marriage could take place and Dolgoruky's involvement in intrigues concerning the succession—including the manufacture of a letter purporting to be the Tsar's last will in which he appointed Yekaterina his successor—resulted in his banishment (1730), first to Siberia and then to the Solovetsky monastery. In 1739 he and two other Dolgorukys were found guilty of the forgery and beheaded.

Dolgoruky, Vasily Vladimirovich, Knyaz (Prince) (b. January 1667, Russia—d. Feb. 22 [Feb. 11, old style], 1746, St Petersburg), military officer who played a prominent role in political intrigues against Peter I the Great (ruled 1682–1725) and Empress Anna (ruled 1730–40) of Russia.

A member of the large and influential Dolgoruky family, which is said by some to be descended from the Rurik prince Yury Dolgoruky (1090–1157), Vasily Vladimirovich participated in the Great Northern War (1700–21). In 1707–08 he suppressed a Cossack rebellion led by Ataman Bulavin, and thereby won the confidence of Tsar Peter I.

Nevertheless, Dolgoruky apparently opposed Peter's innovations and reforms. Accused of conspiring with a group of boyars (*i.e.,* high-ranking noblemen) to replace Peter on the throne with Peter's more traditionally minded son Alexis, he was deprived of his rank and title and sent into exile (1718).

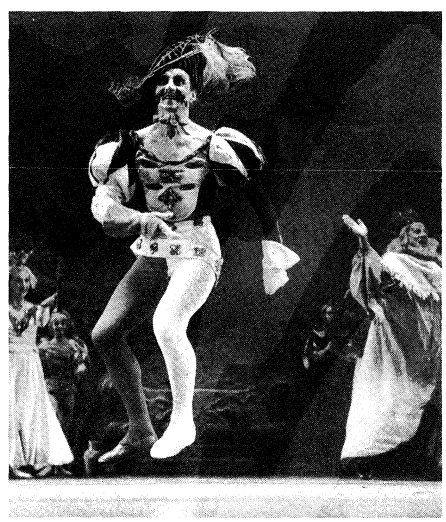
Pardoned in 1724, Dolgoruky was restored to favour by Peter's successors. In 1728 he became field marshal and was appointed to the Supreme Privy Council (the governmental body that determined policy), on which he served with his distant cousin Vasily Lukich Dolgoruky.

In 1730, when Peter II died, Dolgoruky supported the accession of Anna Ivanovna (a niece of Peter I) to the throne. He also helped compose the set of "conditions," which were intended to transfer real authority to the Supreme Privy Council. Anna was compelled to accept them before becoming empress, but she repudiated them shortly after arriving in Moscow and then abolished the Supreme Privy Council. Dolgoruky was again deprived of his rank and title and banished, first to Ivangorod in northwestern Russia, and then (1739) to Solovetsky Monastery on Solovetsky Island in the White Sea.

In 1741, when Empress Elizabeth attained the throne, Dolgoruky's rank and title were restored to him and he was named president of the War College.

Dolin, Sir Anton, original name SYDNEY FRANCIS PATRICK CHIPPENDALL HEALEY-KAY (b. July 27, 1904, Slinfold, Sussex, Eng.—d. Nov. 25, 1983, Paris), British ballet dancer, choreographer, and director who, with his frequent partner Alicia Markova, founded the Markova–Dolin companies and London's Festival Ballet.

Trained by the notable Russian teachers Serafima Astafieva and Bronislava Nijinska, Dolin began his ballet career in 1921 in the corps de ballet of Sergey Diaghilev's Ballets Russes. As a soloist with Diaghilev's company,



Dolin in *Bluebeard,* 1942
Fred Fehl

he created the leading role in Nijinska's *Train Bleu* (1924) and an important role (one of two Servants) in George Balanchine's *Prodigal Son* (1929). Dolin was considered to be one of the finest partners of his time. He eventually danced leading roles in numerous classical ballets but was also noted for such creations as Satan in Ninette de Valois's *Job* (1931) and the title role in Michel Fokine's *Bluebeard* (1941).

Active in the formation of many companies, Dolin helped establish the Camargo Society (1930–33), whose productions greatly influenced British ballet, and he danced leading roles in the first productions of the Vic-Wells Ballet (now the Royal Ballet). He joined the Ballet Theatre, New York City (now American Ballet Theatre) at its inception in 1940, remaining until 1946 as a dancer and choreographer. He was also director and principal male dancer of the Markova–Dolin companies (1935–38; 1945–48). In 1949 he and Markova founded another company that in 1950 became London's Festival Ballet; Dolin was premier danseur and artistic director until 1961. He then organized and toured with the troupe Stars of the Ballet, worked as choreographer and director of the Rome Opera Ballet, and served as artistic adviser to Les Grands Ballets Canadiens. He was knighted in 1981.

As a choreographer Dolin restaged *Swan Lake*, *Giselle*, and the last act of *The Sleeping Beauty*, which he presented alone as *Princess Aurora* (1941). His original ballets include *Capriccioso* (1940), *The Romantic Age* (1942), and *Variations for Four* (1957), a popular all-male divertissement. Dolin is particularly noted for his reconstruction (1941) of Jules Perrot's classical divertissement, *Pas de Quatre*. His many books on the dance include *Ballet Go Round* (1938), *Pas de Deux: the Art of Partnering* (1950), *Alicia Markova* (1953), *Autobiography* (1960), and *The Sleeping Ballerina: The Story of Olga Spessivtzeva* (1966). In 1980 he played the part of the teacher Cecchetti in the motion picture *Nijinsky*.

doline (landform): *see* sinkhole.

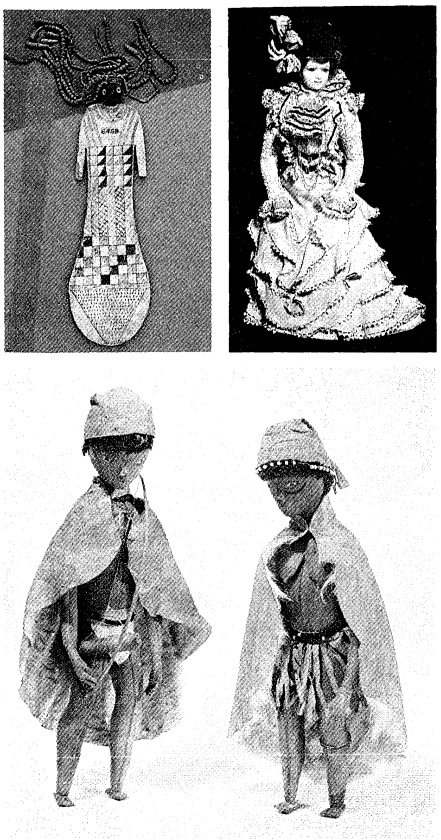
Dolisie (Congo): *see* Loubomo.

Dolittle, Doctor, hero of 10 children's books by the British-American author Hugh Lofting (*q.v.*).

Dolj, *judeţ* (district), southwestern Romania, occupying an area of 2,862 sq mi (7,413 sq km), bounded on the south by Bulgaria. The Jiu and Teslui rivers drain the district southward through lowlands and rolling hills to the Danube River, which marks the southern boundary. Craiova (*q.v.*), the district capital, has machinery, metallurgical, and chemical industries. Textiles, leather goods, wood products, and building materials are manufactured in Craiova and several smaller towns in the district, including Tîrgu Jiu, Filiaşi, and Işalniţa. A coalfield is worked at Petroşani, and a hydroelectric plant operates on the Jiu River near Craiova. Calafat, Bechet, and Corabia are small ports, located on the Danube. Remnants of the Cofeni culture (1900–1700 BC), the castrum of Răcari, and a Roman road between Filiaşi and Craiova, were discovered in the Jiu River Valley. There is a university in Craiova. Highway and railway connections extend through Craiova. Pop. (1984 est.) 770,-609.

doll, a child's toy modeled in human or animal form. It is perhaps the oldest plaything of humankind.

No dolls have been found in prehistoric graves, probably because they were made of such perishable materials as wood and fur or cloth, but a fragment of a Babylonian alabaster doll with movable arms has been recovered. Dolls dating from 3000–2000 BC, carved of flat pieces of wood, geometrically painted, with long, flowing hair made of strings of clay or wood beads, have been found in some Egyptian graves.



(Top left) Painted wooden Egyptian doll, 2000 BC; (top right) French fashion doll (wax), late 19th century; (bottom) leather dolls possibly made by Pondo people, South Africa

By courtesy of (top left) the trustees of the British Museum, (top right) Victoria and Albert Museum, London—photographs, (top right) John Webb, (bottom) EB Inc.

Some ancient dolls may have had religious meaning, and some authorities often argue that the religious doll preceded the toy. In ancient Greece and Rome, marriageable girls consecrated their discarded dolls to Diana or Venus. Dolls were buried in children's graves in Egypt, Greece, and Rome and in early Christian catacombs. Ancient rag, or stuffed, dolls have been found, as well as dolls crocheted of bright wool and others with woolen heads, clothed in coloured wool frocks. Dolls dating from the Middle Ages are little known.

As early as 1413 there were *Dochenmacher*, or doll makers, in Nürnberg, Germany, which, from the 16th to the 18th century, was the leading manufacturer of dolls and toys. Paris was another early mass-producer of dolls, making chiefly fashion dolls.

Doll heads were made of wood, terra-cotta, alabaster, and wax—the last a technique perfected in England by Augusta Montanari and her son Richard (*c.* 1850–87), who introduced the first infant dolls. In about 1820, glazed porcelain (Dresden) doll heads and unglazed bisque (ceramic) heads became popular. A French bisque doll made by the Jumeau family in 1862 had a swivel neck; the body was of kid-covered wood or kid stuffed with sawdust, a type of manufacture that remained common until it was supplanted by molded plastics in the 20th century. Socket joints, movable eyes, dolls with voices, and walking dolls were introduced in the 19th century, as were paper-doll books and dolls of India rubber or gutta-percha. The period from 1860 to 1890 was the golden age of the elaborately dressed Parisian bisque fashion dolls and the smaller "milliner's models."

The oldest American dolls may be those found in Aztec graves, such as those near the pyramids of Teotihuacán. Colonial dolls mostly followed European models. Among American Indian dolls, the kachina doll of the Pueblo Indians is noteworthy.

In Japan, dolls are more often festival figures than playthings. At the girls' festival held in March, dolls representing the emperor, empress, and their court are displayed; girls from 7 to 17 visit each other's collections, and refreshments are offered: first, to their majesties, then to the guests, in a ritual more than 900 years old. Japanese boys also have an annual doll festival, from the first May after they are born until they are about 15 years old. Warrior dolls, weapons, banners, and legendary-figure groups are displayed to encourage chivalrous virtues; and some modern dolls are even attired as athletes.

In India, elaborately dressed dolls were given to child brides by both Hindus and Muslims. In Syria, girls of marriageable age hang dolls in their windows. In South Africa, among the Mfengu of the Orange Free State, every grown girl is given a doll to keep for her first child; on its birth, the mother receives a second doll to keep for the second child.

In the 20th century, notably popular dolls included the Kewpie Doll (1903); the Bye-lo Baby, who closed her eyes in sleep (1922); the Dydee and Wetsy Betsy dolls (1937); and the Barbie doll (1959).

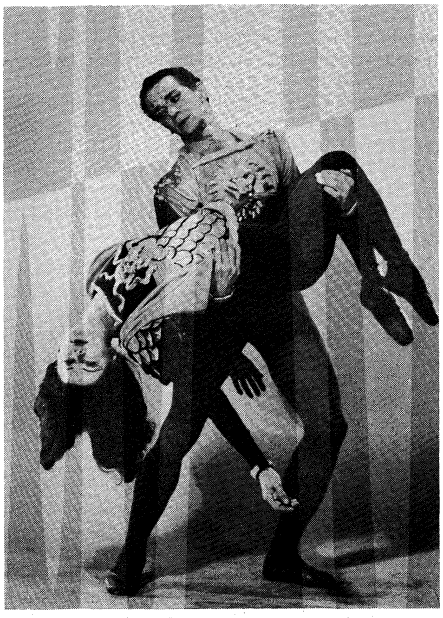
dollar, originally, a silver coin that circulated in many European countries; in modern times, the standard monetary unit in the United States, Canada, Australia, New Zealand, and other countries. The Spanish peso, or piece of eight, which circulated in the Spanish and English colonies in America, was known as a dollar by the English-speaking peoples. Familiarity with this coin resulted in the official designation of the United States monetary unit as the dollar in 1792. Canada adopted the dollar and monetary decimal system in 1858; Australia in 1966; and New Zealand in 1967.

The word itself is a modified form of the Germanic word *thaler,* a shortened form of *Joachimst(h)aler,* the name of a silver coin first struck in 1519 under the direction of the Count of Schlick, who had appropriated a rich silver mine discovered in St. Joachimsthal (Joachim's dale), Bohemia. These coins were current in Germany from the 16th century onward, with various spelling modifications such as daler, dalar, daalder, and tallero. Only in 1873 was the thaler replaced by the mark as the German monetary unit.

Dollar, William (Henry) (b. April 20, 1907, St. Louis, Mo., U.S.—d. Feb. 28, 1986, Flourtown, Pa.), American ballet dancer, choreographer, and ballet master associated with numerous U.S. companies for more than 30 years.

Trained almost entirely in the United States, Dollar studied with the choreographers George Balanchine and Michel Fokine and with Mikhail Mordkin and Pierre Vladimirov, both formerly premiers danseurs in Russia. Dollar was a leading dancer with the American Ballet (1936–37), Ballet Caravan (1936–38), and the American Ballet Caravan (1941), companies that preceded and led to the establishment of the New York City Ballet in 1948. His creations with those companies included roles in Balanchine's versions of *Le Baiser de la fée* ("The Fairy's Kiss"; 1937), *The Card Party* (1937; later known as *Card Game*), and *Transcendence* (1935), which Balanchine choreographed especially for him.

His first ballet, *Classic Ballet* (1936), was choreographed with Balanchine; Dollar restaged this work in 1944 as *Constantia* for Ballet International. He choreographed many other ballets, of which his best known is *The*



Dollar and Melissa Hayden in *The Duel*

By courtesy of the Dance Collection, the New York Public Library at Lincoln Center; photograph, Walter E. Owen

Duel (1950), he originally staged in 1949 as *Le Combat* for Roland Petit's Ballets de Paris. Dollar also created a ballet for the Ford Motor Company's pavilion at the New York World's Fair of 1940. Later works include *The Leaf and the Wind* (1954) and *Mendelssohn Concerto* (1958). He worked with ballet companies in Brazil, Japan, and Monte Carlo and founded a national ballet company in Iran.

Dollar Diplomacy, foreign policy created by U.S. president William Howard Taft (served 1909–13) and his secretary of state, Philander C. Knox, to ensure the financial stability of a region while protecting and extending U.S. commercial and financial interests there. It grew out of Theodore Roosevelt's peaceful intervention in the Dominican Republic, where U.S. loans had been exchanged for the right to choose the Dominican head of customs (the country's major revenue source).

Under the name of Dollar Diplomacy the Taft administration engineered such a policy in Nicaragua. It supported the overthrow of José Santos Zelaya and set up Adolfo Díaz in his place, it established a collector of customs, and it guaranteed loans to the Nicaraguan government. The resentment of the Nicaraguan people, however, eventually resulted in U.S. military intervention as well.

Taft and Knox also attempted to promulgate Dollar Diplomacy in China, where it was even less successful, both in terms of U.S. ability to supply loans and in terms of world reaction. The dismal failure of Dollar Diplomacy—from its simplistic assessment of social unrest to its formulaic application—caused the Taft administration to finally abandon the policy in 1912. The following year Pres. Woodrow Wilson publically repudiated Dollar Diplomacy, though he acted as vigorously as had his predecessors to maintain U.S. supremacy in Central America and the Caribbean.

Dollar diplomacy has come to refer in a disparaging way to the heedless manipulation of foreign affairs for strictly monetary ends.

Dollfus, Audouin(-Charles) (b. Nov. 12, 1924, Paris), French astronomer, successor to Bernard Lyot as the principal French authority on the solar system.

Dollfus made several balloon flights for high-altitude observations, including the first stratospheric ascension in France. On the basis of comparative light-polarizing qualities he concluded that the surface material of Mars consists of pulverized limonite (an iron oxide, Fe_2O_3) and prepared a map of Venus showing what he believed to be permanent features. On Dec. 15, 1966, he discovered Saturn's 10th known satellite, Janus.

Dollfuss, Engelbert (b. Oct. 4, 1892, Texing, Austria—d. July 25, 1934, Vienna), Austrian statesman and, from 1932 to 1934, chancellor of Austria, who destroyed the Austrian Republic and established an authoritarian regime based on conservative Roman Catholic and Italian Fascist principles.

After studying law and economics in Vienna and Berlin, Dollfuss became secretary to the Lower Austrian Peasant Federation and, in 1927, director of the Lower Austrian chamber of agriculture. He was a member of the conservative and clerically oriented Christian Social Party, the core of whose constituency came from Austria's conservative peasantry. Dollfuss rose rapidly in Austrian politics, serving as president of the federal railways in 1930 and minister of agriculture from 1931 on. In May 1932 he became chancellor, heading a conservative coalition led by the Christian Social Party.

Faced with a severe economic crisis caused by the worldwide depression, Dollfuss decided against joining Germany in a customs union, a course advocated by many Austrians. He was in part dissuaded by a League of Nations loan of $9,000,000 and by the fear of Allied countermeasures. Severely criticized by both Social Democrats and nationalists, he countered by drifting toward an increasingly authoritarian regime. Mussolini became his principal foreign ally. Italy guaranteed Austrian

Dollfuss, 1934

UPI

independence at Riccione (August 1933), but in return Austria had to abolish all political parties and reform its constitution on the Fascist model. His attacks on Parliament, begun in March 1933, culminated that September in the permanent abolition of the legislature and the formation of a corporate state based on his Vaterländische Front (Fatherland Front), with which he expected to replace Austria's political parties. In foreign affairs he steered a course that converted Austria virtually into an Italian satellite state. Hoping therewith to prevent Austria's incorporation into Nazi Germany, he fought his domestic political opponents along fascist–authoritarian lines.

In February 1934 paramilitary formations loyal to the Chancellor crushed Austria's Social Democrats in bloody encounters. With a new constitution of May 1934, his regime became completely dictatorial. In June Germany incited Austrian Nazis to civil war. He was assassinated by the Nazis in a raid on the chancellery.

Döllinger, Johann Joseph Ignaz von (b. Feb. 28, 1799, Bamberg, Bamberg—d. Jan. 10, 1890, Munich), German historical scholar, prominent Roman Catholic theologian who refused to accept the doctrine of papal infallibility decreed by the first Vatican Council (1869–70). He joined the Old Catholics (Altkatholiken), those who separated from the Vatican after the council but believed they maintained Catholic doctrine and traditions.

Ordained in 1822, he became professor of canon law and church history at Munich in 1826. From 1835 he was a member of the Bavarian Royal Academy of Sciences and served as its president from 1873. Though he lost his professorship in 1847 for protesting the dismissal of four colleagues by King Ludwig I of Bavaria, he was given posts that made him second to the archbishop of Munich and was reappointed professor of church history in 1849. His historical studies and his belief in religious freedom brought him into conflict with papal policy. His opposition to the Ultramontanists, those who supported papal infallibility, led to his designation as the leader of the antipapal party in Germany.

In 1869 Döllinger wrote a series of articles, later enlarged and published as *Der Papst und das Konzil* (1869; *The Pope and the Council*), under the pen name Janus. Bishop Ullathorne of Birmingham, Warwickshire, called it "the greatest and severest attack on the Holy See and the Jesuits, and especially on the policy of Rome, for a thousand years." The book immediately was placed on the Vatican's *Index of Forbidden Books.*

After his refusal to accept the doctrine of papal infallibility promulgated by the first Vatican Council, Döllinger was excommunicated (1871) but was elected rector of Munich University in the same year. Döllinger and his colleagues, all excommunicated, organized a congress to oppose the council's dogmas. The council, held in Munich, Sept. 22, 1871, was attended by 300 Old Catholics and Eastern Orthodox, Anglican, and Lutheran sympathizers. A committee, of which Döllinger was a member, drew up a doctrinal basis and a program for separate organization. At first opposing this program, Döllinger later associated himself fully with it; he saw it as the vocation of the Old Catholic communion to protest the Vatican dogmas, to support a Catholic Church free from error, and to reunite Christendom. In his last years he and F.H. Reusch collaborated to write *Moralstreitigkeiten in der römisch-katholischen Kirche*, 2 vol. (1889; "Moral Disputes in the Roman Catholic Church") and other works. J. Friedrich's *Ignaz von Döllinger* (3 vol.) appeared in 1899–1901.

Dollmann, Georg (Carl Heinrich) von (b. Oct. 21, 1830, Ansbach, Bavaria—d. March 31, 1895, Munich), German architect, builder of three grandiose curiosities sponsored by the mentally ill king Louis (Ludwig) II of Bavaria: Linderhof (1869–78), Neuschwanstein (1869–86), and Herrenchiemsee (1878–85; incomplete). The neo-Baroque or neo-Rococo Linderhof is especially incongruous in its mountainous setting. For Neuschwanstein, which was intended to suggest the medieval Teutonism of Richard Wagner's opera *Tannhäuser* (1845), Dollmann utilized Christoph Jank's design for an inflated Wartburg (castle near Eisenach, Thuringia). Herrenchiemsee was planned as a replica of the French royal residence at Versailles.

Dollond, George (b. Jan. 25, 1774, London—d. May 13, 1852, London), British optician who invented a number of precision instruments used in astronomy, geodesy, and navigation.

Throughout most of his life, he worked for the family firm of mathematical instrument makers, assuming full control after the retirement in 1819 of his uncle Peter Dollond. His micrometer made of rock crystal, announced in 1821, was used by the English astronomer William Rutter Dawes in measuring close double stars. Other inventions followed, including improvements to astronomical and navigation devices. Dollond received the council medal of the Great Exhibition of 1851 for his atmospheric recorder that simultaneously measured

and recorded on paper tape temperature, atmospheric pressure, wind speed and direction, evaporation, and electrical phenomena.

Dollond, John (b. June 10, 1706, London—d. Nov. 30, 1761, London), British maker of optical and astronomical instruments who developed an achromatic (non-colour-distorting) refracting telescope and a practical heliometer, a telescope used to measure the Sun's diameter and the angles between celestial bodies.

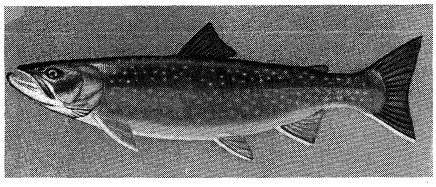
The son of Huguenot refugees, Dollond learned the family trade of silk weaving. He became proficient in optics and astronomy and, in 1752, joined his eldest son, Peter, in an optical business. Two years later he introduced his heliometer.

In 1747 a controversy arose over Newton's statement that chromatic aberration in lenses could not be corrected. After later experiments proved otherwise, Dollond devised an achromatic lens made of flint and crown glasses for use in telescopes. The invention earned him the Copley Medal of the Royal Society, but the prior discovery by Chester Moor Hall of England was later recognized.

Dollond, Peter (b. 1730, London—d. July 2, 1820, Kennington, London), British optician who, though lacking a theoretical background, invented the triple achromatic lens still in wide use, made substantial improvements in the astronomical refracting telescope, and improved navigation instruments of his day. In 1765 he combined two convex lenses of crown glass with one double-concave lens of flint glass to make a triple achromatic lens that rendered images free from extraneous colour and greatly reduced the spherical error of existing equipment, thus increasing clarity.

Dollo's law, biological principle, formulated about 1890 by Louis Dollo, a French-born Belgian paleontologist, that evolution is not reversible; *i.e.,* structures or functions discarded during the course of evolution do not reappear in a given line of organisms. The hypothesis was first advanced by a historian, Edgar Quinet.

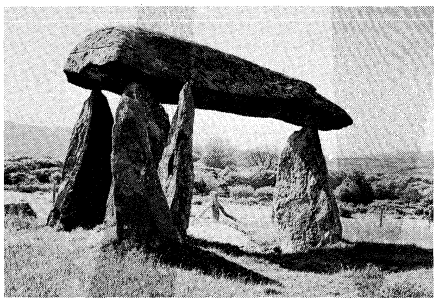
Dolly Varden trout, also called MALMA, or BULL TROUT (*Salvelinus malma*), char, of the family Salmonidae, found in northwestern North America and northeastern Asia. It has yellow spots on the back, reddish spots on the sides, and a white edge on the lower fins. Because it eats the eggs and young of salmon, it is destroyed as a pest in Alaska. It often migrates to sea, grows large and silvery, and returns to streams to spawn. A good food fish, it fights well when hooked. Average size is about 0.5 to 1.8 kilograms (1 to 4 pounds) but may be much larger.



Dolly Varden trout (*Salvelinus malma*)

dolma, in Middle Eastern and Greek cuisine, any of various stuffed vegetable dishes, notably, the young leaves of the grapevine stuffed with a lemon-flavoured mixture of rice, onion, and frequently ground lamb. Although dolmas are usually eaten cold as an appetizer, Greek *dolmades* with lamb are served hot as a main course with an *avgolémono* sauce of egg yolks and lemon juice. Other vegetables such as zucchini, green peppers, cabbage or Swiss chard leaves, and onions are similarly prepared.

dolmen, Welsh CROMLECH, prehistoric monument usually consisting of several great stone slabs set edgewise in the earth to support a flat stone, which served as a roof. Designed as a burial chamber, the structure is typical of the Neolithic Period in Europe. The word is Celtic in origin but probably is not Breton.



Dolmen at Pentre Evan, Dyfed, Wales

By courtesy of the Department of the Environment, London, Crown copyright reserved

Dolmens, although found in covered form as far east as Japan, are mainly confined to Europe, the British Isles, and northern Africa.

Dolmetsch, (Eugène) Arnold (b. Feb. 24, 1858, Le Mans, Fr.—d. Feb. 28, 1940, Haslemere, Surrey, Eng.), French-born British musician whose lifework, pursued in the face of prolonged indifference and misunderstanding, established the modern search for authenticity in the performance and instrumentation of early music. His craftsmanship in restoring and reproducing early musical instruments, his insistence on consultation of source material, coupled with his intuitive understanding, gave him remarkable insight into the problems of presenting music of Bach's generation and earlier.

Dolmetsch, pen-and-ink drawing by Edmond X. Kapp, 1920; in a private collection

Edmond X. Kapp

Dolmetsch learned piano and organ building from his father and grandfather, and after study at the Brussels Conservatory and the Royal College of Music in London, he taught violin. He discovered British Museum manuscripts of viol music by early English composers, began investigating how to perform their music in authentic style, and in 1890 gave his first viol concert.

With his wife and Kathleen Salmon he formed a trio for the performance of early music on authentic instruments. His 1902 concert tour of the U.S. prompted the Chickering factory in Boston to extend its facilities to him. There he supervised the building of harpsichords, lutes, and viols (1905–09). From 1911 to 1914 he was at the Gaveau factory in Paris. After World War I he built the first successful modern recorders.

Like George Bernard Shaw, who reviewed his concerts with enthusiasm, Dolmetsch was a rebel whose reforms aroused a response of mingled alarm and fascination. His work slowly gained acceptance after 1914. He published several editions of early music, and his book, *The Interpretation of the Music of the XVII and XVIII Centuries* (1915 and 1944), became a basic work in its field. Dolmetsch settled in England in 1914 and in 1916 established a centre for the study of early music in Haslemere. In 1928 the Dolmetsch Foundation was organized to support him and to spread his ideas.

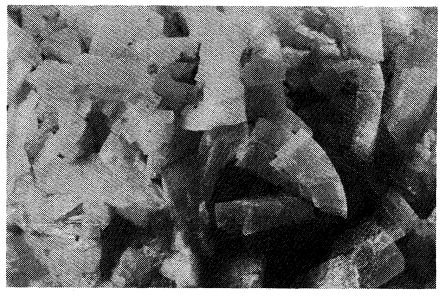
Dolomieu, Dieudonné, also called DÉODAT DE GRATET DE DOLOMIEU (b. June 23, 1750, Dolomieu, near Tour-du-Pin, Fr.—d. Nov. 26, 1801, Château-Neuf, Saône-et-Loire), French geologist and mineralogist after whom the mineral dolomite was named.

A member of the order of Malta since infancy, he was sentenced to death in his 19th year for killing a brother knight in a duel but was pardoned. He continued to study natural sciences, which he had begun earlier, and after giving up his commission as a carabineer, visited Spain, Sicily, the Pyrenees, and the Calabria region of southern Italy. Following a study of the Alps (1789–90), he described dolomite (1791). A member of Napoleon's expedition to Egypt (1798), he was captured on the way home and imprisoned at Messina. During his imprisonment he wrote his main treatise, *Sur la philosophie minéralogique et sur l'espèce minérale* (1801), on the margins of a Bible.

dolomite, type of limestone the carbonate fraction of which is dominated by the mineral dolomite, calcium magnesium carbonate [$CaMg(CO_3)_2$]. For detailed physical properties of the minerals, *see* carbonate mineral (table).

A brief treatment of dolomites follows. For full treatment, *see* MACROPAEDIA: Minerals and Rocks: *Important sedimentary rock types.*

Dolomite is generally formed from limestone when the calcite (calcium carbonate, $CaCO_3$) in the limestone is replaced by calcium magnesium carbonate volume for volume. This process, known as dolomitization, may occur either soon after limestone deposition by exchange with sea water or after lithification by exchange with magnesium-bearing solutions.



Dolomite from Corydon, Ind.

By courtesy of the MacFall collection; photograph, Mary A. Root—EB Inc.

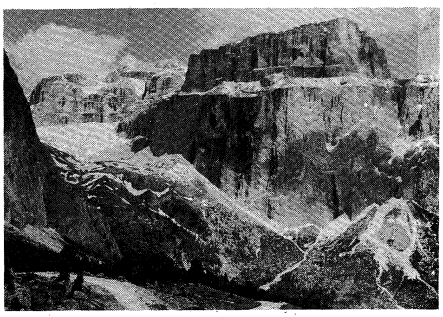
In most cases, textures coarsen during dolomitization and original structures (and textures) are eradicated. In a few instances, however, the structural and textural features of the parent limestone are preserved, resulting in a finely crystalline dolomite. Such rocks are considered primary dolomites and are typically associated with evaporites.

The mineral dolomite occurs in marbles, talc schists, and other magnesium-rich metamorphic rocks; textural studies have shown that at least some of this dolomite has formed on cooling from highly magnesian calcite, stable at higher temperatures. It occurs in hydrothermal veins, in cavities in carbonate rocks, and less commonly in various sedimentary rocks as a cement. It is most common as a rock-forming mineral in carbonate rocks. In dolomitized limestones it is a secondary replacement, and individual dolomite crystals cut across pre-existing fossil outlines and other

textural features; fossil coral reefs are often replaced in this fashion.

Dolomitization is very selective, giving rise to interbedded limestone and dolomite. Modern dolomite forms in supratidal flats such as the Bahamas or in hypersaline lagoons associated with the precipitates of calcite, aragonite, magnesium calcite, gypsum, and anhydrite. Hydrothermal dolomite occurs in veins associated with lead, zinc, or copper ores, as well as with fluorite and barite.

Dolomites, Italian ALPI DOLOMITICHE, mountain group lying in the eastern section



Cima Pordoi seen from Sella Pass in the Dolomites, Italy

J. Allan Cash—Rapho/Photo Researchers

of the northern Italian Alps, bounded by the valleys of the Isarco (northwest), the Pusteria (north), the Piave (east and southeast), the Brenta (southwest), and the Adige (west). The range comprises a number of impressive peaks, 18 of which rise to more than 10,000 ft (3,050 m). The highest point is the Marmolada (10,964 ft), the southern face of which consists of a precipice 2,000 ft high. The range and its characteristic rock take their name from the 18th-century French geologist Dieudonné Dolomieu, who made the first scientific study of the region and its geology. Geologically, the mountains are formed of light-coloured dolomitic limestone, which erosion has carved into grotesque shapes. The resulting landforms include jagged, saw-edged ridges, rocky pinnacles, screes (pebble deposits) of limestone debris, deep gorges, and numerous steep rock faces at relatively low levels. Glaciated features occur at higher levels; 41 glaciers lie in the region. Many of the lower and more gentle scree slopes were once forested; only patches of woodland remain, however, interspersed with grassy meadows.

The main valleys provide relatively easy access to most parts of the Dolomites. The main north–south road uses the Campolongo Pass (6,152 ft). The east–west roads cross the well-known passes of Pordoi (7,346 ft), Falzarego (6,906 ft), Tre Croci (5,935 ft), Sella (7,404 ft), and Gardena (6,959 ft). The main centre of this tourist and mountain-climbing region is Cortina d'Ampezzo. Other resorts are Auronzo, San Martino di Castrozza, and Ortisei, with its narrow-gauge railway. On the western and southeastern margins, respectively, are located the larger towns of Bolzano and Belluno.

Most of the main peaks were first climbed in the 1860s and '70s by English mountaineers. Landslides after heavy rainstorms in the southern Dolomites twice caused the Vaiont Dam (on a tributary of the Piave River) to overspill and drown the village of Longarone, causing the loss of 2,000 lives in 1963 and the destruction of houses and communications in 1966.

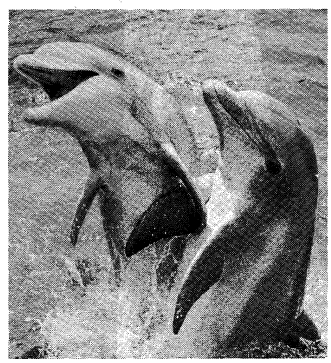
Dolon Nor, also spelled DOLOON NUUR (China): *see* To-lun.

Dolores, Grito de, English CRY OF DOLORES (Mexican battle cry): *see* Grito de Dolores.

Dolores River, river in southwest Colorado, U.S., rising in La Plata Mountains and flowing southwest through deep canyons, past Dolores, then northwest through Paradox Valley, at the north end of which it is met by its chief tributary, the San Miguel River. It continues on past Gateway and across the Utah border to join the Colorado River near Moab after a course of about 250 mi (400 km). Melting snow produces high water in spring and early summer, but in midsummer the flow is a trickle. The Dolores and its tributaries are used for irrigation. The river probably was named Río de Nuestra Señora de los Dolores (River of Our Lady of Sorrows) by the Spanish trader Juan Maria Rivera *c.* 1765.

dolphin, either of two distinct types of animals: aquatic mammals of the whale families Delphinidae, Platanistidae, and Stenidae; or oceanic fishes of the family Coryphaenidae.

The mammalian dolphins are small, streamlined whales, usually with a well-defined, beaklike snout. They are often called porpoises, but that name is usually reserved for similar, but beakless, whales of the family Phocoenidae (*see* porpoise). Dolphins are



Bottle-nosed dolphins (*Tursiops truncatus*)

By courtesy of the Miami Seaquarium

popularly noted for grace, intelligence, playfulness, and friendliness to man. The most widely recognized species are the common and bottle-nosed dolphins (*Delphinus delphis* and *Tursiops truncatus*); both are of the family Delphinidae and are widely distributed in warm and temperate seas. These are probably the species of dolphins mentioned in the works of Aristotle, Aesop, Herodotus, the Plinys, and other early writers, often as a child's mount or the rescuer of someone lost in the sea.

The family Delphinidae contains 14 genera and about 32 species of dolphins distributed throughout the world oceans. Most are gray, blackish, or brown above and paler below, and most are about 1 to 4 metres (3 to 13 feet) long. Risso's dolphin (*Grampus griseus*), found in tropical and temperate seas throughout the world, is grayish in colour and lacks a beak. Teeth are usually lacking in the upper jaw. The pilot and killer whales, also members of this family, are much larger and, because of their size, are not usually thought of as dolphins.

The majority of the delphinids feed primarily on fish, and most of them are gregarious, appearing in groups of a few to several hundred. A number of species are attracted by moving ships, often accompanying them or leaping alongside and sometimes riding the wave created by the moving bow. The bottle-nosed dolphin, characterized by a "built-in smile" formed by the curvature of its mouth, has become a familiar performer in oceanaria. It has also become the subject of scientific studies because of its apparent intelligence and its ability to communicate with its kind through a range of sounds and ultrasonic pulses. It adapts to captivity better than the common dolphin, which is timid.

The Platanistidae, or river dolphins, comprise four genera and species of small, mainly freshwater dolphins found in South America and Asia. They have long, slender beaks, reduced eyes, and poor vision. The Stenidae, or long-snouted dolphins, comprise three genera and eight species of little-known dolphins, also with long, slender beaks. They are found in tropical rivers and oceans and are sometimes included in the family Delphinidae.

The fish commonly known as a dolphin (*Coryphaena hippuras*), also called mahimahi and dorado, is a popular food and sport fish. Famed for the rapid changes undergone by its bright blue and gold coloration as it dies, this dolphin inhabits tropical and temperate waters throughout the world. It has a large, blunt head, a tapered body, and a slender, forked tail. The male, considerably larger than the female, may attain a length and weight of about 1.5 m and 30 kilograms (70 pounds). A swift carnivorous fish, this dolphin lives alone or in schools and feeds on invertebrates and other fishes. It and the similar, though smaller, pompano dolphin (*C. equiselis*) are the only living members of the family Coryphaenidae.

Ḍom, also called ḌOMRA, or ḌOMB, widespread and versatile caste of scavengers, musicians, vagabonds, traders, and, sometimes, weavers in northern India and the Himalayas. Some scholars regard the Ḍoms as originating from an aboriginal tribe. They list seven endogamous subcastes. The Ḍoms are completely outside Brahminic control. They have their own deities and an elaborate demonology. Considerable interest is attached to the Ḍoms because there is reason to believe that the Gypsies, who originally came from India, are an offshoot of that caste. This connection is indicated by their use of the name Rom for themselves, a variant pronunciation of Ḍom; Syrian Gypsies refer to themselves as Ḍoum.

Domagk, Gerhard (b. Oct. 30, 1895, Lagow, Brandenburg, Ger.—d. April 24, 1964, Burgberg, near Königsfeld, W.Ger.), German bacteriologist and pathologist who was awarded the 1939 Nobel Prize for Physiology or Medicine for his discovery (announced in 1932) of the antibacterial effects of Prontosil, the first of the sulfonamide drugs.

After teaching at the universities of Greifswald (1924) and Munich (1925), Domagk became director of the I.G. Farbenindustrie (Bayer) Laboratory for Experimental Pathology and Bacteriology, Wuppertal-Elberfeld. There, in a systematic survey for new dyes

Domagk, *c.* 1960

Archiv fur Kunst und Geschichte, West Berlin

and new drugs, he noticed the antibacterial action of one of the dyes against streptococcal infection in mice. The dye, Prontosil red, was then tried clinically.

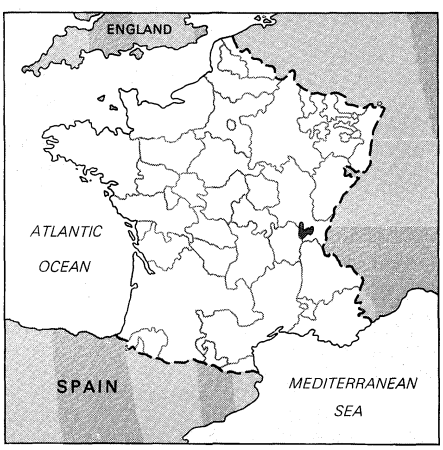
Unable to accept the Nobel award at the time because of Nazi German policy, Domagk later (1947) received the gold medal and diploma.

He also was active in research on tuberculosis and cancer.

domain, in Anglo-American law, the absolute and complete ownership of land, or the land itself which is so owned. Domain is the fullest and most superior right of property in land. Domain as a legal concept is derived from the dominium of the Roman law, which included the right of property as well as the right of possession or use of the property. The English common-law adoption of dominium was not comprehensive, omitting some of the finer distinctions developed by the Roman law.

The concept has several specific applications. Land to which title is still retained by the United States, including agricultural and mineral land not yet granted to private owners, as well as land occupied by federal government buildings and facilities, is referred to as the public domain, which also describes the absolute ownership of such land by the United States. Eminent domain, in English common law, refers to the sovereign power of the king or state to appropriate private land for public use. *See also* eminent domain.

Dombes, historic region of east-southeastern France, once a sovereign municipality and now included in the *département* of Ain. From 1032, when the Kingdom of Arles, of which Dombes was part, passed to the Holy



The *intendance* (administrative area) of Dombes in 1789

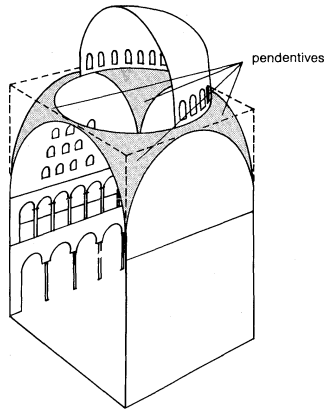
Roman emperor Conrad II, effective authority in the region was exercised by local lords. After 1378 it was under the nominal authority of the kings of France but was actually ruled as an independent principality by the Bourbon family. Francis I of France seized it from the Bourbons in 1523, and, although Dombes was later restored to the House of Bourbon-Montpensier (1561), it ultimately returned to the French crown in 1762.

Dombrowska, Maria: *see* Dąbrowska, Maria.

Dombrowski, Jan Henryk: *see* Dąbrowski, Jan Henryk.

dome, in architecture, hemispherical structure evolved from the arch, usually forming a ceiling or roof. Domes first appeared as solid mounds and in techniques adaptable only to the smallest buildings, such as round huts and tombs in the ancient Middle East, India, and the Mediterranean. The Romans introduced the large-scale masonry hemisphere. The dome exerts thrusts all around its perimeter, and the earliest monumental examples, such as the Roman Pantheon, required heavy supporting walls.

Byzantine architects invented a technique for raising domes on piers, permitting lighting and communication from four directions. The



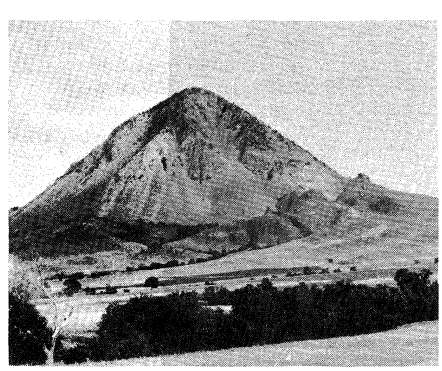
Dome, showing pendentive construction; Hagia Sophia, Constantinople, 6th century

transition from a cubic base to the hemispherical dome was achieved by four pendentives, inverted triangular masses of masonry curved both horizontally and vertically, as shown in the figure. Their apexes rested on the four piers, to which they conducted the forces of the dome; their sides joined to form arches over openings in the four faces of the cube; and their bases met in a complete circle to form the dome foundation. The pendentive dome could rest directly on this circular foundation or upon a cylindrical wall, called a drum, inserted between the two to increase height.

Displaced architecturally by the light, vertical styles of Gothic architecture, the dome regained popularity during the European Renaissance and Baroque periods. Vaulting is simpler than doming, and so the effort and ingenuity devoted to doming rectangular structures must be explained principally by the symbolic character of the dome. The desire to observe tradition preserved the dome in the early era of iron and steel construction. The modern reinforced concrete slab used in vaulting can be curved in length as well as width to form a dome. Here the distinction between vaults and domes has lost its original significance, being based only on the type of curvature in the slab.

The geodesic dome (*q.v.*) is built up of triangular or polygonal facets that distribute stresses within the structure itself.

dome, in geology, any large or elliptical structure formed by the fractureless upwarping of rock strata. It is a type of anticline that lacks clear-cut elongation and that slopes outward in all directions from the highest point. Typical examples of such a dome can be found in the Black Hills of South Dakota in the western United States. Where strata plunge more or less uniformly toward surrounding lowlands, erosion may produce a series of concentric ridges with their steep slopes facing inward toward the centre. In some areas domes in which a layer of relatively impermeable shale



Dome in the Black Hills of South Dakota
By courtesy of the U.S. Geological Survey; photograph, N.H. Darton

overlies a layer of permeable sandstone are structural traps for oil and natural gas. The oil and gas migrate upward, becoming trapped against the shale at the uppermost part of such anticlinal formations.

dome, volcanic: *see* volcanic dome.

Dome of the Rock, Arabic QUBBAT AṢ-ṢAKHRAH, also called MOSQUE OF OMAR, shrine in Jerusalem that is the oldest extant Islāmic monument. The rock over which the shrine was built is sacred to both Muslims and Jews. The Prophet Muḥammad, founder of Islām, is traditionally believed to have ascended

Dome of the Rock in Jerusalem, built 685–691
D. Edwards—FPG/EB Inc.

into heaven from the site. In Jewish tradition, it is here that Abraham, the progenitor and first patriarch of the Hebrew people, is said to have prepared to sacrifice his son Isaac. The Dome and Al-Aqsā Mosque are both located on the Temple Mount, the site of Solomon's Temple and its successors.

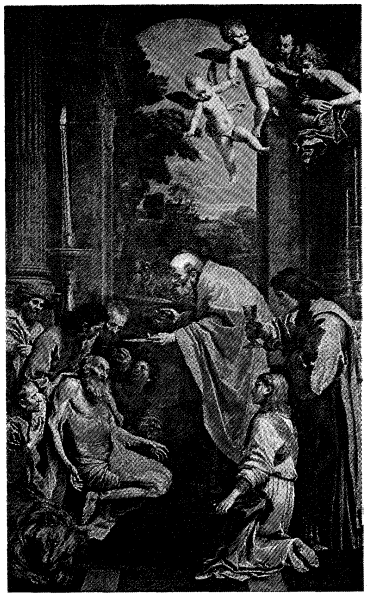
The Dome of the Rock was built between AD 685 and 691 by the caliph 'Abd al-Malik ibn Marwān, not as a mosque for public worship but rather as a *mashhad,* a shrine for pilgrims. It is virtually the first monumental building in Islāmic history and is of considerable aesthetic and architectural importance; it is rich with mosaic, faience, and marble, much of which was added several centuries after its completion. Basically octagonal, the Dome of the Rock is more typically Roman or Byzantine than Islāmic. A wooden dome—approximately 60 feet (18 m) in diameter and mounted on an elevated drum—rises above a circle of 16 piers and columns. Surrounding this circle is an octagonal arcade of 24 piers and columns. The outer walls repeat this octagon, each of the eight sides being approximately 60 feet (18 m) wide and 36 feet (11 m) high. Both the dome and the exterior walls contain many windows.

Christians and Muslims in the European Middle Ages believed the Dome itself to be the Temple of Solomon (Templum Domini). The Knights Templars were quartered there in the Crusades, and Templar churches in Europe imitated its plan.

Dōmei, abbreviation of ZEN NIHON RŌDŌ SŌDŌMEI, English JAPANESE CONFEDERATION OF LABOUR, Japan's second largest labour union federation until it disbanded in 1987. Dōmei was formed in 1964 by a merger of three politically moderate federations that opposed the leftist stance of the larger and more militant union Sōhyō. Unlike most Sōhyō members, who were public employees, most Dōmei members worked for private employers. Dōmei was a supporter of the Democratic Socialist Party and was affiliated with the International Confederation of Free Trade Unions. Dōmei disbanded in 1987 when many of its member unions joined with other private-sector unions to form a new confederation called Rengo.

Domenichino, original name DOMENICO ZAMPIERI (b. October 1581, Bologna, Papal States [Italy]—d. April 6, 1641, Naples), Italian painter who was a leading practitioner of Baroque classicism in Rome and Bologna.

He was trained in the academy of Lodovico Carracci and in 1602 was in Rome, where he joined the Bolognese artists at work under the direction of Annibale Carracci in the decoration of the Farnese Palace. He was employed by Cardinal Aldobrandini to decorate a room



"Last Communion of Saint Jerome," oil painting by Domenichino, 1614; in the Vatican Museum

SCALA—Art Resource/EB Inc.

in the Villa Belvedere at Frascati with mythological frescoes and by Cardinal Farnese to paint a chapel in the Badia at Grottaferrata. Both fresco cycles reflect the spirit of Annibale Carracci, though their more rigidly classical schemes look forward to the "Scenes from the Life of St. Cecilia" that Domenichino painted between 1615 and 1617 for San Luigi dei Francesi and which are among his most successful works.

In 1617–18 Domenichino painted for Cardinal Borghese the celebrated canvas of "The Hunt of Diana" (Borghese Gallery, Rome). This work shows that he was a sensitive colourist, and its idyllic mood departs from the arid classicism of his frescoes. Between 1624 and 1628 he was occupied with the frescoed pendentives and apse of Sant'Andrea della Valle. Though his work remained in great demand, there was a reaction against the rigid classicism of his style, and in the last works that he produced in Rome—four frescoed pendentives in San Carlo ai Catinari (1628–30) and the "Martyrdom of St. Sebastian" for St. Peter's, now in Santa Maria degli Angeli—he worked in a broader, less classical style. This closer approximation to the Baroque is also apparent in the frescoed "Scenes from the Life of St. Januarius" (1631–41, Cathedral of Naples). In Naples his style was less acceptable than it had proved in Rome, and he appears to have been the victim of systematic persecution by local artists, such as José de Ribera.

Domenichino's work is classical in its lucid and balanced compositions; even and serene lighting and subdued colours; and the sober expressions and restrained gestures of its figures. Domenichino also occupies an important place in the history of landscape painting because his work had a profound influence on the classical landscapists Nicolas Poussin and Claude Lorrain.

Domenichino, Il (composer): *see* Sarti, Giuseppe.

Domenico DI PACE (Italian painter): *see* Beccafumi, Domenico.

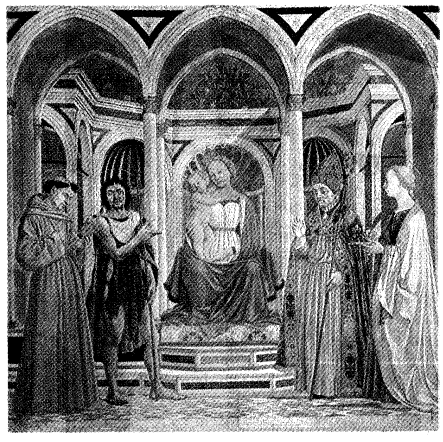
Domenico DI TOMMASO BIGORDI (painter): *see* Ghirlandajo, Domenico.

Domenico VENEZIANO, in full DOMENICO DI BARTOLOMEO DA VENEZIA (active by 1438—d. May 15, 1461, Florence [Italy]), early Italian Renaissance painter, one of the founders of the 15th-century Florentine school of painting.

He was probably first trained in the International Gothic manner in Venice, where it is likely he saw paintings by northern European artists. He settled in Florence around 1439 and, except for brief periods, worked there until his death.

Two signed works by Domenico survive. The first, a much-damaged fresco of the Virgin and Child enthroned and two damaged heads of saints (National Gallery, London), formed part of the "Carnesecchi Tabernacle" and may have been the first work Domenico executed in Florence. Its accurate perspective and the sculptural quality of the figures suggest he was influenced by Masaccio. The second work is an altarpiece for the Church of Santa Lucia dei Magnoli, usually called the Magnoli or St. Lucy altarpiece, which was probably painted about 1445. The central panel, the Virgin and Child with four saints (Uffizi, Florence), is one of the outstanding paintings produced in Florence in the middle of the 15th century. It is remarkable for the soft contours of its figures, its fresh and delicate palette, its mastery of light, and its precise and subtle space construction. The five panels of the predella are now dispersed. "The Annunciation" (Fitzwilliam Museum, Cambridge, Eng.) is the most successful of Domenico's experiments in rendering outdoor light: the pale morning light fills and defines the space of the courtyard, and the cool light on the broad plane of white wall heightens the sense of moment and loneliness in the two figures.

A tondo of the "Adoration of the Magi" (Staatliche Museen Preussischer Kulturbesitz, Berlin) is of uncertain date. It combines gay



"The Virgin and Child with SS. Francis, John the Baptist, Zenobius and Lucy," tempera on wood, central panel from the St. Lucy altarpiece by Domenico Veneziano, *c.* 1445; in the Uffizi, Florence

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colour with careful realism and has an expansive and accurately drawn landscape background.

Domenico's two profile portraits of Matteo and Michele Olivieri (National Gallery of Art, Washington, and Rockefeller Collection, New York City) are in the tradition of Pisanello.

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

Domesday Book, the original record or summary of William I the Conqueror's survey of England. By contemporaries the whole operation was known as "the description of England," but the popular name Domesday—*i.e.,* "doomsday," when men face the record from which there is no appeal—was in general use by the mid-12th century. The survey, in the scope of its detail and the speed of its execution, was perhaps the most remarkable administrative accomplishment of the Middle Ages.

The survey was carried out, against great popular resentment, in 1086 by seven or eight panels of commissioners, each working in a separate group of counties, for which they compiled elaborate accounts of the estates of the king and of his tenants in chief (those who held their land by direct services to him). From these documents the king's clerks compiled a summary, which is Domesday Book.

Domesday Book covers all of England except the northern areas. Though invariably called Domesday Book, in the singular, it in fact consists of two volumes quite different from each other. Volume I (Great Domesday) contains the final summarized record of all the counties surveyed except Essex, Norfolk, and Suffolk. For these three counties the full, unabbreviated return sent in to Winchester by the commissioners is preserved in volume II (Little Domesday), which, for some reason, was never summarized and added to the larger volume.

Several related documents survive, one of which is the Exon Domesday, an early draft of the return for the circuit comprising the counties of Somerset, Dorset, Wiltshire, Devon, and Cornwall.

From yet another related document, the *Inquisitio comitatus Cantabrigiensis* ("The Inquisition of the County of Cambridge"), a very early draft of the Cambridgeshire material, the actual procedure followed by the commissioners is revealed. Their method was that of the sworn inquest, by which answers were given to a long list of definite questions. Formal sessions were apparently held in the chief county town, and the facts were supplied by the sheriff, the barons, and their subtenants and by representatives from each hundred (or subsidiary division of the county) and from every village.

The procedure was thus strictly geographical, material being collected by shires, hundreds, and villages. But, before being sent to the royal court at Winchester, the material for each county was regrouped under the names of the king and his tenants in chief, thus recognizing the new Norman conception of a feudal society based on the honour or barony, a complex of estates that were treated as a unit even if not adjacent.

Volume I thus gives, under each county heading, a roll of the holders of land, from the king to the humblest tenant in chief. Their fiefs are described consecutively and consist of long lists of manors, with the names of their holders in 1066 and 1086, their dimensions and plowing capacity, the number of agricultural workers of various sorts, their mills, fishponds, and other amenities, and finally their values in pounds.

For the majority of English villages and towns (but not, unfortunately, London and Winchester, for which no Domesday records survive), Domesday is the starting point of their history. For historians of Anglo-Norman England, the survey is of immeasurable importance.

Domesday Book is kept at the Public Record Office in Chancery Lane, London, where it is on view to the public.

domestic architecture: *see* residential architecture.

domestic cat (species *Felis catus*), also called HOUSE CAT, domesticated member of the family Felidae, order Carnivora.

A brief treatment of the domestic cat follows. For full treatment, *see* MACROPAEDIA: Cats, Domestic.

The domestic cat retains many of the characteristics of larger wildcats. Its eyes are extremely sensitive to light. Its triangular ears rotate rapidly to identify the source of a sound and can respond to frequencies of up to 25,000 vibrations per second. Domestic cats also retain the main specializations of all cats toward predation—teeth and strong, sharp, retractile claws. The canine teeth stab and hold prey, and the sharp-edged molars function as scissors. The incisors and premolars are hardly functional and do not meet when the mouth is closed.

Domestic cats vary a great deal from larger cats in coat as well as size. Male domestic cats may reach 71 cm (28 in.), but 51 cm (21 in.) is a more usual length for females. An alley cat (*i.e.*, a nonpedigreed cat) may weigh up to 13 kg (28 lb), but the weight of most domestic cats varies from 2.5 to 4.5 kg (6 to 10 lb). Most house cats, including the Siamese and Abyssinian, are short-haired, but the Persian has a long, thick coat and mixed breeds vary. A British breed, the Rex, has a curly coat. Domestic cats are usually black, yellow, gray, tabby (dark stripes or swirls on a lighter background), white, or a mixture of these. Tortoiseshell marking—a piebald mix of white, black and yellow—is normally found only in females. The rare males born with this colour pattern are almost invariably sterile. Siamese cats are distinguished by pale ground colour with darker points (face-mask, ears, feet, and tail). Blue eyes are usually associated with a dilution in coat colour, as in the Siamese. Blue-eyed white cats are frequently deaf.

The earliest authenticated record of the domestication of the cat dates from 1500 BC in ancient Egypt, although the cat was proclaimed to be sacred in that country about 1,000 years earlier. The actual domestication of cats probably came about when the Egyptians noticed that cats protected their granaries from rodents. The Egyptians worshipped a goddess with a cat's head (Bast), and thousands of mummified cats have been found.

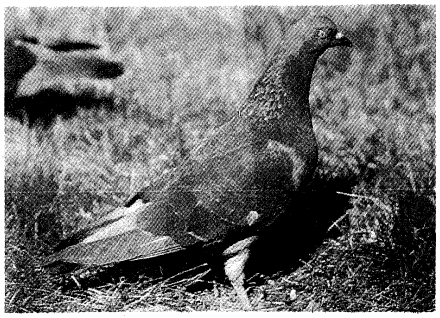
Domestic cats spread to other cultures and were common to Greece and China by 500 BC, and known in India by 100 BC. The first record of domestic cats in Britain dates to AD 936, when a law was passed in Wales for their protection. By the mid-18th century domestic cats were present in the United States.

Throughout the ages the cat has been associated with several superstitions and with witchcraft. They often have been regarded as witches' familiars, and black cats have been regarded generally as unlucky omens.

Cats are ideal house pets and are easily house-trained. Their size and agility enable them to adjust quickly to small households. They are able to produce three litters in one year. Estrus or heat may occur up to five times a year, during which the female (queen) calls, or yowls, to alert the male (tom). Gestation is about 63 days and an average litter contains four kittens, which are born blind, deaf, and helpless. A simple operation, called spaying, neutering, or fixing, removes a cat's ability to reproduce.

domestic pigeon (*Columba livia*), bird of the family Columbidae (order Columbiformes) that was perhaps the first bird tamed by man. Figurines, mosaics, and coins have portrayed the domestic piegeon since at least 4500 BC (Mesopotamia). From Egyptian times the pigeon has been important as food. Its role as messenger has a long history. Today it is an important laboratory animal, especially in endocrinology and genetics.

Throwbacks among modern domestic pigeons indicate a common ancestor, the rock dove. This tendency is clearly seen in street pigeons in cities everywhere. Many are white,



Domestic pigeon (*Columba livia*)
Lilyan Simmons—EB Inc.

reddish, or checkered like some of their cousins in racing-pigeon lofts, but most are somewhat narrow-bodied and broad-billed replicas of the blue-gray ancestral form. Street pigeons nest year-round, on buildings and beneath bridges, where they may be a nuisance with their droppings and transmission of disease. These hardy birds may live 35 years.

The three main kinds of domestic pigeons are fliers, fancy breeds raised chiefly for show, and utility breeds, which produce squabs for meat—nestlings taken when 25 to 30 days old and weighing 350 to 700 grams (¾ to 1½ pounds). Utility breeds are known as dual-purpose birds if they are bred to exhibition standards.

Pigeon-raising is a worldwide hobby, and business as well. National preferences are evident; *e.g.*, in England for birds of highly standardized appearance and bearing ("form pigeons"), in Germany for birds that have unusual markings ("colour pigeons"), in Belgium for racing pigeons, and in the United States for dual-purpose breeds. Hundreds of varieties of complicated lineage represent centuries of development. *See also* fowl.

domestic service, the employment of hired workers by private households for the performance of tasks such as housecleaning, cooking, child care, gardening, and personal service. It also includes the performance of similar tasks for hire in public institutions and businesses, including hotels and boarding houses.

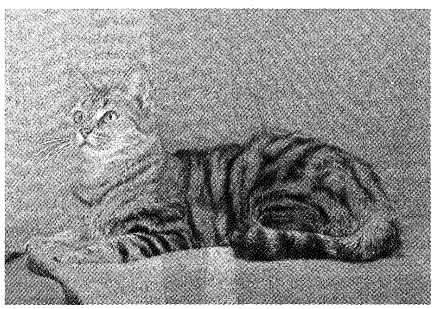
In ancient Greece, Rome, and various other early civilizations, domestic service was performed almost exclusively by slaves. In medieval Europe, serfs provided much of the necessary labour force. Domestic service remained closely linked to servility even in subsequent ages, as for example, in colonial America and the pre-Civil War South, where the use of indentured servants and black slaves prevailed. By the 1870s, however, domestic servants had become wage earners in the United States and in most European countries.

Domestic service, as an occupation, reached its height in Victorian England. The great households of the royalty and gentry employed large numbers of servants of both sexes. The elaborate hierarchy of positions afforded ample opportunity for advancement. A man could work his way up from groom to valet and then on to butler or even steward. Similarly, a woman could rise from scullery maid to cook or from chambermaid to housekeeper. In general, stewards and housekeepers had their own private servants. Households of lesser, though well-to-do, families often had in their employ a staff of six or more servants, including a lady's maid, nanny, and butler.

The number of people in paid domestic work increased dramatically throughout the late 19th century in most European countries. The United States experienced a similar situation, which continued into the early 1900s and was largely due to the growing number of middle- and upper-class families that wanted and could afford household help. The arrival of a great many unskilled immigrants who could find no other form of employment contributed this growth.

Since 1921 domestic service has become a steadily declining occupation in the United States and, to a large extent, in most western European countries as well. This trend has been attributed to various factors, including a levelling of social classes; the low status of domestic work; increased job opportunities for women in business and industry after World War II; and the proliferation of household labour-saving devices and comparatively less expensive outside services, such as laundries, day-care centres, and convalescent homes. Although domestic servants are not covered by minimum wage legislation, increases in the legal minimum wage and the coverage of most domestic workers by social security and workers' compensation programs have raised the cost of domestic service considerably.

domestic shorthair, also called BRITISH SHORTHAIR, breed of domestic cat often referred to as a common, or alley, cat; a good show animal, however, is purebred and pedigreed and has been carefully bred to conform



Domestic shorthair cat
John Gajda —EB Inc.

to a set standard of appearance. The domestic shorthair is required by show standards to be a sturdily built cat with strong-boned legs and a round head with round eyes and ears that are rounded at the tips. The coat must be short and may be any of the colours recognized for the longhair (*q.v.*), or Persian. Some colours, such as blue cream, are infrequently found in shorthairs; others, such as the tabby colours (silver, brown, blue, and red), are commoner. In Britain, the shorthair is called the British shorthair to distinguish it from other breeds classified as foreign shorthairs.

Although the alley, or common, cat may resemble a pedigreed shorthair, it is not a purebred animal; rather, it is a combination of breeds and may differ considerably in build and coat from the purebred shorthair.

domestic system, also called PUTTING-OUT SYSTEM, production system widespread in 17th-century western Europe in which merchant-employers "put out" materials to rural producers who usually worked in their homes but sometimes laboured in workshops or in turn put out work to others. Finished products were returned to the employers for payment on a piecework or wage basis. The domestic system differed from the handicraft system of home production in that the workers neither bought materials nor sold products. It undermined the restrictive regulations of the urban guilds and brought the first widespread industrial employment of women and children. The advantages to the merchant-employer were the lower wage costs and increased efficiency due to a more extensive division of labour within the craft.

The system was generally superseded by employment in factories during the course of the Industrial Revolution but was retained in the 20th century in some industries, notably the watchmaking industry in Switzerland, toy manufacturing in Germany, and numerous industries in India and China.

domestic tragedy, drama in which the tragic protagonists are ordinary middle class or lower class individuals, in contrast to Classical and Neoclassical tragedy, in which the protagonists are of kingly or aristocratic rank, and their downfall is an affair of state as well as a personal matter. The earliest known examples of domestic tragedy are three anonymous late Elizabethan dramas: *Arden of Feversham* (*c.* 1591), the story of the murder of Mr. Arden by his wife and her lover and their subsequent execution; *A Warning for Faire Women* (1599), which deals with the murder of a merchant by his wife; and *A Yorkshire Tragedy* (*c.* 1606), in which a father destroys his family. To these may be added Thomas Heywood's less sensational but no less tragic *Woman kilde With Kindnesse* (1603). Domestic tragedy did not take hold, however, until reintroduced in the 18th century by George Lillo with *The London Merchant, or the History of George Barnwell* (1731). The popularity of this sordid drama of an apprentice who murders his uncle-guardian influenced domestic tragedy in France and Germany, where the dramatist and critic G.E. Lessing, in his *Hamburgische Dramaturgie* (1767–68), paved the way for its critical acceptance.

Bourgeois tragedy found its mature expression in the plays of Henrik Ibsen toward the end of the 19th century. In earlier domestic dramas by other playwrights the protagonists were sometimes villains and at other times merely pathetic, but the bourgeois heroes of Ibsen's *Brand* (1866), *Rosmersholm* (1886), *Master-Builder* (1892), and *When We Dead Awaken* (published 1899) are endowed with some of the isolated grandeur of the heroes of classical tragedy.

A tragedy on a humbler social level than that of the middle class, *Woyzeck,* was written as early as 1836 by the German dramatist Georg Büchner. Its hero, a poor soldier and former serf, is so reduced in status he finds employment as a doctor's guinea pig. Yet the work has a shattering tragic impact and bears out the precept stated by another German tragic dramatist of the 19th century, Friedrich Hebbel: "One need only be a man, after all, to have a destiny." *Woyzeck* was well in advance of its time; lower class tragedy did not come to the fore until the turn of the 20th century with such works as Gerhart Hauptmann's *Die Weber* (1892; "The Weavers") and *Rose Bernd* (1903). Other outstanding examples are Eugene O'Neill's *Long Day's Journey into Night* (1956) and Arthur Miller's *Death of a Salesman* (1949).

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domestication, the process of hereditary reorganization of wild animals and plants into domestic and cultivated forms according to the interests of people. In its strictest sense it refers to the initial stage of human mastery of wild animals and plants. The fundamental distinction of domesticated animals and plants from their wild ancestors is that they are created by human labour to meet specific requirements or whims and are adapted to the conditions of continuous care and solicitude people maintain for them.

Domestication has played an enormous part in the development of mankind and its material culture. It has resulted in the appearance of agriculture as a special form of animal and plant production. It is precisely those animals and plants that became objects of agricultural activity that have undergone the greatest changes when compared with their wild ancestors.

The first attempts at domestication of animals and plants apparently were made in the Old World by peoples of the Mesolithic Period. The tribes that engaged in hunting and in gathering wild edible plants made attempts to domesticate dogs, goats, and possibly sheep as early as 9000 BC. It was not until the Neolithic Period, however, that primitive agriculture appeared as a form of social activity, and domestication was well under way. Although the great majority of domesticated animals and plants that still serve man were selected and developed during the Neolithic Period, a few notable examples appeared later. The rabbit, for example, was not domesticated until the Middle Ages; the sugar beet came under cultivation as a sugar-yielding agricultural plant only in the 19th century; and mint became an object of agricultural production as recently as the 20th century. Also in the 20th century, a new branch of animal breeding was developed to obtain high-quality fur.

Domestication of vegetatively reproducing plants, such as those with tubers, probably preceded domestication of the seed plants—cereals, legumes, and other vegetables. Some plants were domesticated for the strong fibres in their stalks, which were used for such purposes as making fishing nets. Hemp, one of the most ancient plants domesticated in India, is an example of a multipurpose plant: oil is obtained from its seeds, fibres from its stalk, and the narcotic hashish from its flowers and leaves.

Some plants were domesticated especially for the production of narcotics; such a plant is tobacco, which was probably first used by American Indian tribes for the preparation of a narcotic drink and only later for smoking. The opium poppy is another example of a plant domesticated solely for a narcotic. Beverage plants of many kinds were discovered and cultivated, including tea, coffee, and cola. Only when humans reached a sufficiently high level of culture did they begin to domesticate to fulfill aesthetic requirements for the beautiful and the bizarre in both plants and animals.

The specific economic application of domesticated animals did not appear at once. Dogs probably accompanied hunters and helped them hunt wild animals; they probably also guarded human settlements and warned the inhabitants of possible danger. At the same time, they were eaten by humans, which was probably their main importance during the first stages of domestication. Sheep and goats were also eaten in the initial stages of domestication but later became valuable for producing the commodities of milk and wool.

The principal aim of cattle breeding in ancient times was to obtain meat and skin and to produce work animals, which greatly contributed to the development of agriculture. Cattle, at the initial stages of domestication, produced a small amount of milk, sufficient only to rear their calves. The development of high milk yield in cows with their breeding especially for milk production is a later event in the history of domestication.

The first domesticated horses were also used for meat and skin. Later the horse played an enormous role in the waging of war. Peoples inhabiting the Middle East in the 2nd millennium BC used horses in chariot battles. With time the horse began to be used as transportation. In the 1st millennium BC carts appeared, and the horses were harnessed to them; other riding equipment, including the saddle and the bit, seems to have appeared in later centuries.

The donkey and the camel were used only for load transport and as means of conveyance; their unpalatability ruled out their use as a preferred food.

The first domesticated hens perhaps were used for sport; cockfighting was instrumental in bringing about the selection of these birds for larger size. Cocks later acquired religious significance. In Zoroastrianism the cock was associated with protection of good against evil and was a symbol of light. In ancient Greece it was also an object of sacrifice to gods. It is probable that egg production of the first domesticated hens was no more than five to ten eggs a year; high egg yield and improved meat qualities of hens developed at later stages of domestication.

Early domestication of the cat was probably the result of the pleasure experienced from keeping this animal. The cat's ability to catch mice and rats was surely another reason that impelled people to keep cats at home. In ancient Egypt the cat was considered a sacred animal.

Some animals were domesticated for utilitarian purposes from the very beginning. Here belongs, first of all, the rabbit, whose real domestication was carried out from the 6th to the 10th centuries AD by French monks. The monks considered newborn rabbits fish and ate them when the church calendar indicated abstinence from meat.

For the sake of honey, the bee was domesticated at the end of the Neolithic Period. Honey has played an enormous role in human nutrition since ancient times; it ceased being the sole sweetening agent only about 200 years ago. Bees also provided wax and bee venom, which was used as medicine. Bees were used also, to a limited extent, in warfare, hives being thrown among enemy troops to rout them.

To obtain silk, the silkworm was domesticated in China no later than 3000 BC, and by 1000 BC the technology of silkworm breeding and raising had been thoroughly documented.

Shepherdy and nomadic animal breeding, which determined the social and economic organization and the way of life of some peoples to a great extent, appeared at later stages of human development, after the accumulation of a large number of domestic animals. Rudiments of nomadic animal breeding in Eurasia appeared no earlier than 1000 BC, considerably after the domestication of animals took place.

The process of domestication in the New World took place somewhat later than in the Old World and independently of the latter, since humans first appeared in the New World only during the Pleistocene, long after settlement of the Old World.

Traditionally, the main criteria for judging relationships between domestic or cultivated organisms and wild ancestors are similarities of structure and function, but cytogenetical examinations, particularly comparisons of chromosomes and chromosome sets, also are adding to the knowledge of the origins of domesticated organisms. With animals, morphological and biochemical (*i.e.*, blood typing) studies are made.

During the 10,000 or 11,000 years that have passed since the beginning of domestication, the animals and plants that humans have selected as useful to them have undergone profound changes. The consequences of domestication are so great that the differences between breeds of animals or varieties of plants of the same species often exceed those between different species under natural conditions.

The most important consequence of domestication of animals consists of a sharp change in their seasonal biology. The wild ancestors of domesticated animals are characterized by strict seasonal reproduction and molting rhythms. Most domesticated species, on the contrary, can reproduce themselves at almost any season of the year and molt little or not at all. No less characteristic are the changes that occur in plants as a result of domestication. Their structure and general appearance may be drastically changed.

The elementary genetic mechanism that draws the recessive genes out from the cover of the wild genotype of the natural species also

brings about the first domestication-dependent changes and the initial differentiation of a wild species into types that can serve as the basis for breed formation. Nature, in effect, has a store of various types and forms hidden as recessive mutations in every natural population of wild animals and plants. It is this accumulated mutation pool that is exploited by humans in breeding. Such interference, called artificial selection, plays a truly creative role in the formation of modern animal breeds and plant varieties to suit human needs.

Artificial selection differs considerably from natural selection, which creates stabilized biological systems that ensure the development of a normal, or so-called wild, phenotype; *i.e.*, an organism containing a wealth of properties that preadapt it to a wide variety of environmental conditions and ensure continuation of the species. Artificial selection breaks down precisely these stabilized systems, thereby creating gene combinations that could not survive in nature and providing a range of new possibilities.

Domett, Alfred (b. May 20, 1811, Camberwell, Surrey, Eng.—d. Nov. 2, 1887, London), writer, poet, politician, and prime minister of New Zealand (1862–63), whose idealization of the Maori in his writings contrasts with his support of the punitive control of Maori land.

Following study at Cambridge and being admitted to the bar, Domett travelled to New Zealand (1842) and, after a half-hearted attempt at farming, devoted his time to journalism and public affairs. He became editor of the *Nelson Examiner* (1843) and began his involvement with the administration of settler land by accepting appointment by Governor, later Prime Minister, Sir George Grey (*q.v.*) as member of the legislative council (1846), as colonial secretary for the province of New Munster (1848), and as civil secretary to the general government. Elected from Nelson to the House of Representatives (1855), he also accepted appointment as commissioner of crown lands (1856). Reelected to Parliament (1860), Domett was asked to form a ministry by Governor Grey at a time of crisis in the administration of Maori land (1862). Domett's government maintained that the responsibility for Maori affairs belonged to the British government along with the cost of military troops to enforce control of the Maori. Another war ensued, and Domett's government ended (1863). He accepted appointments as secretary for lands (1863) and registrar-general of lands (1865) and also joined the legislative council, thus combining paid service with an advisory position once again. In 1870 an act was passed disqualifying any person holding office from accepting paid appointment by the crown, but Domett was specifically exempted; his talents as an administrator of land law were indispensable. He retired to England (1871) and wrote and published several works, including the romantic narrative epic *Ranolf and Amohia* (1872).

domeykite, a copper arsenide mineral (formulated Cu_3As) that is often intergrown with algodonite, another copper arsenide. Both are classified among the sulfide minerals, although they contain no sulfur. They occur in Chile, in Keweenaw County, Mich., and in other localities. Domeykite crystallizes in the isometric system. For detailed physical properties, *see* sulfide mineral (table).

domicile, in law, a person's dwelling place as it is defined for purposes of judicial jurisdiction and governmental burdens and benefits. Certain aspects of a person's legal existence do not vary with the state he happens to be in at any given moment but are governed by a personal law that follows him at all times. In Anglo-American countries, where common law applies, one's personal law is that of his domicile; in civil-law countries (*e.g.*, those of Europe and Latin America) it is often that of his nationality.

The place in which a man is domiciled has judicial jurisdiction over him—*i.e.*, a case can be tried against him in its courts, even though he happens to be outside its borders at the time he is summoned. So far as governmental burdens and benefits are concerned, only the place of a man's domicile can impose an inheritance tax upon all of his intangibles. The law of a person's domicile determines the validity of his will with respect to personal property or decides how such property shall be distributed if he dies without a will. The law of a man's domicile also may play a part in determining the legitimacy of his birth and the validity of his marriage.

It is a fundamental principle in Western law that every person must have a domicile at all times. A domicile is not lost until another domicile has been acquired, and a person cannot have more than one domicile at a time for the same purpose. The burden of proof is upon him who asserts that there has been a change of domicile. It is commonly said that there are three kinds of domicile: domicile of origin; domicile of choice; and domicile by operation of law.

At birth a person acquires a domicile of origin, almost always that of his father. If the father is deceased or the child is illegitimate, the domicile is that of his mother.

Most people possess a domicile of choice, usually established by voluntary physical presence at the place where domicile is claimed; presence by reason of compulsion, as imprisonment, is not sufficient. If a person claims a place as a home but is not living there, he must prove intent to make the place a home.

Persons who lack the legal capacity to acquire a domicile of their own possess domicile by operation of law. The prime example is minor children whose domicile is that of the father. The domicile of a married woman is that of her husband as long as she lives with him.

Complications arise because statutes rarely use the word domicile but refer instead to residence (or, in some statutes, abode). Residence, in such a context, usually bears the same meaning as domicile. But on occasion it may mean something else, such as a well-settled physical connection with the state without bearing toward it the requisite attitude of mind that one intends to reside there. Sometimes residence means something more than domicile, namely, domicile in a place plus physical presence there during a specified period of time. Residence when used in a statute means, in any event, a far closer relationship with a state than mere physical presence there. As in the case of domicile, a residence, once it has been acquired, is not lost by a temporary absence from the state. In contrast to domicile, a man may have more than one residence at a time.

dominance, in genetics, greater influence by one of a pair of genes (alleles) that affect the same inherited character. If an individual pea plant with the alleles T and t (T = tallness, t = shortness) is the same height as a TT individual, the T allele (and the trait of tallness) is said to be completely dominant; if the Tt individual is shorter than the TT but still taller than the tt individual, T is said to be partially or incompletely dominant; *i.e.*, it has a greater influence than t but does not completely mask the presence of t, which is said to be recessive.

In ecology, the term dominance is used to describe a species of animal or plant that exerts the most influence on the other species of its community because its members are the most abundant or the largest. In animal behaviour, a ruling animal in a social grouping is described as dominant. *See also* recessiveness.

dominance hierarchy, a form of animal social structure in which a linear or nearly linear ranking exists, with each animal dominant over those below it and submissive to those above it in the hierarchy. Dominance hierarchies are best known in social mammals, such as baboons and wolves, and in birds, notably chickens (in which the term peck order or peck right is often applied).

In most cases the dominance hierarchy is relatively stable from day to day. Direct conflict is rare; an animal usually steps aside when confronted by one of higher rank. Temporary shifts occur; for instance, a female baboon mated to a high-ranking male assumes a high rank for the duration of the pair bond. An individual weakened by injury, disease, or senility usually moves downward in rank. *See also* submissive behaviour.

dominant, in music, fifth tone of the diatonic scale (which has five whole tones and two semitones), *e.g.*, G in the scale of C. In the tonality of Western music of the 17th to 19th century, the dominant was particularly important, for it stood in strongest relation to the tonic, or keynote (C in the key of C).

Chords based on the dominant had a strong tendency to move to the tonic chord, and the key built upon the dominant was most strongly related to the tonic key. The relation between dominant and tonic was exploited in musical forms such as the sonata.

Domingo DE GUZMÁN, SANTO: *see* Dominic, Saint.

Domingo, Plácido (b. Jan. 21, 1941, Madrid), Spanish-born operatic tenor whose resonant, powerful voice, imposing physical stature, good looks, and dramatic ability made him one of the most popular tenors of the second half of the 20th century.

Domingo's parents were noted performers in zarzuela, a form of Spanish light opera. He grew up in Mexico, where he studied piano at the National Conservatory of Music. In 1961 he made his operatic debut in Mexico City and then went to Dallas, Texas, to perform in its opera company. From 1962 to 1965 he was a resident performer at Tel Aviv's Hebrew National Opera. He made his debut at the New York City Opera in 1965, at the Metropolitan Opera House in New York City in 1968 (subsequently becoming a regular performer there), and at La Scala in Milan in 1969.

A prolific and versatile performer, Domingo made numerous recordings and several film versions of operas, and he ventured into popular music as well. His autobiography, *My First Forty Years*, was published in 1983.

Domínguez Bastida, Gustavo Adolfo (Spanish writer): *see* Bécquer, Gustavo Adolfo.

domini: *see* dominus.

Dominic, SAINT, Spanish in full SANTO DOMINGO DE GUZMÁN (b. *c.* 1170, Caleruega, Castile—d. Aug. 6, 1221, Bologna, Romagna; canonized July 3, 1234; feast day August 8), founder of the Order of Friars Preachers (Dominicans), a religious order of mendicant friars with a universal mission of preaching, a centralized organization and government, and a great emphasis on scholarship.

Early life and career. Domingo de Guzmán was born in Castile, possibly a year or two later than 1170, the traditional date. His father was lord of the manor in the village, and his mother was also from the local nobility. He studied at Palencia and then joined the canons regular (a religious community attached to the cathedral of a diocese) of Osma about 1196, and he became subprior, or assistant to the superior, a few years later. In 1203, Diego, bishop of Osma, was sent on a royal mission abroad and took Dominic with him.

This journey first made Dominic aware of the threat posed to the church in the south of France by the Albigensian heretics, or Cathari, who were reviving and developing the Manichaean teaching that two supreme beings, Good and Evil, dominate spirit and matter respectively, so that whatever concerns the body—such as eating, drinking, procreation, and the possession of worldly goods—is essentially evil, and the ideal is the renunciation of these things and even of life itself.

St. Dominic, detail of a panel by the school of Messina (?), 15th century; in the Museo Archeologico Nazionale, Palermo, Italy
Anderson—Alinari from Art Resource/EB Inc.

Thus, there arose among them a caste of the "perfect," who led a life of great austerity, while ordinary people were regarded as reprobates. A regularized Albigensian hierarchy had come into existence, and local feudal lords, especially the count of Toulouse, supported the Albigenses. Pope Innocent III had launched a mission to preach against the heresy.

On a second journey Dominic and the bishop visited the pope, who refused their request to preach to the pagans, so they returned to France. In 1206 the papal legates and preachers, depressed at the failure of their mission, consulted the bishop and Dominic, who reasoned that the heretics would be regained only by an austerity equal to their own; the preachers must tramp the roads barefoot and in poverty. This was the birth of Dominic's "evangelical preaching." An important part of his campaign was the establishment of a convent of nuns at Prouille, formed in 1206 from a group of women converted from the heresy.

In 1208 the papal legate, Peter de Castelnau, was murdered by an emissary of the Count of Toulouse. The pope called upon the Christian princes to take up arms. The leader on the papal side was Simon de Montfort, a subject of the king of France. The Albigensian leader was Raymond VI, count of Toulouse, an opponent of the king of France and brother-in-law of King John of England, lord of neighbouring Aquitaine. Dominic's work, though confined to the Prouille area, continued, and six others eventually joined him. Meanwhile, the civil war dragged on until Simon's victory at Muret in 1213. The Catholic party entered Toulouse, and Dominic and his friends were welcomed by the bishop, Foulques, and established as "diocesan preachers" in 1215.

Foundation of the Dominicans. From Foulques's charter in that year, Dominic's design for an order devoted to preaching developed rapidly. A characteristic concern was for the theological formation of his men, whom he therefore took to lectures given at Toulouse by an Englishman, Alexander Stavensby. Still in 1215, he went to Rome with Foulques (bound for the Fourth Lateran Council) to lay his plans before the pope, who, however, recommended adoption of the rule of one of the existing orders. It was, perhaps, at this time that Dominic met Francis of Assisi (though the meeting may not have taken place until 1221), and the friendship of the two saints is a strong tradition in both the Franciscan and the Dominican orders. In the summer of 1216 Dominic was back at Toulouse conferring with his companions, now 16 in number. This meeting has been called the *capitulum fundationis* ("chapter, or meeting, of foundation"). The rule of St. Augustine was adopted, as well as a set of *consuetudines* ("customs"), partly based on those of the canons regular, concerning the divine office, monastic life, and religious poverty; these are still the core of Dominican legislation. In July, Innocent III died, and it was from his successor, Honorius III, that Dominic, once more in Rome, finally received on Dec. 22, 1216, formal sanction of his order.

The order was now an established body within the church, and Dominic returned to Toulouse. On Aug. 15, 1217, he sent his men to Paris and to Spain, leaving two each at Toulouse and Prouille, while he and another went to Bologna and Rome. He placed his two principal houses near the universities of Paris and Bologna and decided that each of his houses should form a school of theology. This at once determined the capital role that the Dominicans would play in university studies. In setting up his houses in the larger cities, especially in those that were teaching centres, he involved his order in the destiny of the medieval urban movement.

Dominic was gifted in being able to conceive his ideal, to form his men to that ideal, and then to trust them completely. His leadership had great clarity of vision (even to the geographical distribution of his forces and precise details of legislation), firmness of command, and certainty of execution. At the same time it was said of him that his gentleness was such that anyone who came to speak to him, even for reproof, went away happier.

The rest of Dominic's life was spent either in Rome, where he was given the Church of San Sisto, or traveling. In 1218–19 he made a great tour (3,380 miles entirely on foot) from Rome to Toulouse and Spain and back, via Paris and Milan, and in 1220 a tour of Lombardy. Everywhere his communities were growing, and he planned many new foundations covering the key points of France and northern Italy. In Rome the pope gave him the delicate task of reforming various groups of nuns, whom he finally gathered at San Sisto in 1221, when the men moved to Santa Sabina, which is still the residence of the master general of the order.

At Pentecost in 1220 the first general chapter of the order was held at Bologna, and a system of democratic representative government was devised. At the second general chapter, held on Pentecost in 1221, also at Bologna, the order was divided geographically into provinces. After a visit to Venice in 1221, Dominic died at Bologna. (S.Bh./Ed.)

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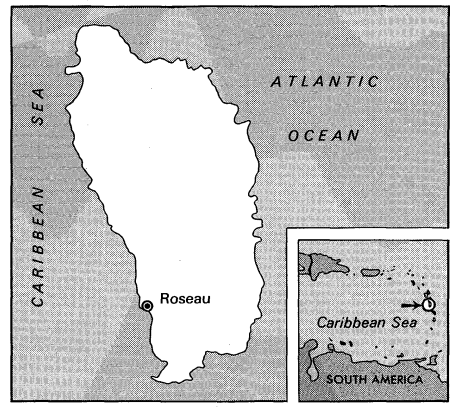
Dominic OF THE MOTHER OF GOD: *see* Barberi, Domenico.

Dominica, officially COMMONWEALTH OF DOMINICA, island republic of the Lesser Antilles in the Caribbean Sea. It is situated between the French islands of Guadeloupe to the north and Martinique to the south; on its eastern shore is the Atlantic Ocean. The capital is Roseau. Dominica covers an area of 290 square miles (750 square km) and is some 29 miles (47 km) long and 16 miles (26 km) wide. The population in 1990 was estimated to be 80,500.

For information about regional aspects of Dominica, *see* MACROPAEDIA: West Indies.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.



Dominica

The land. Dominica is a mountainous island of volcanic origin, and its main physical feature is a high, forest-clad range that runs from north to south, culminating in Mount Diablotin (4,747 feet [1,447 m]). It is broken midway through its north–south length by a plain, which is drained by the Layou River, flowing west. There are numerous other rivers and streams, but most are unnavigable. Dominica has a warm year-round tropical climate with temperatures that range from 78° F (26° C) to 90° F (32° C). Rainfall on the island is extremely heavy, averaging 250 inches (6,350 mm) in the mountains and 70 inches (1,780 mm) along the coast.

Dominica's volcanoes are probably extinct, but Boiling Lake in the south and a number of thermal springs provide evidence of some continuing volcanic activity. The volcanic basis of the island has provided it with a rich soil, and dense tropical plant growth has developed in places into rain forest.

Bird life on the island is especially rich, with 135 species, including parrots, the blue-headed hummingbird, and the trembler, a thrush whose courtship involves a rapid quivering movement. There are also iguana, opossum, the agouti, the boa constrictor, and many species of bat.

The people. Most of the people of Dominica are of African or of mixed African and European descent. Other peoples of the island include small groups of European and Syrian ancestry and the main surviving community of Caribs, who were the Pre-Columbian inhabitants of the Caribbean islands. The first European settlers of Dominica were mainly French, and the most common language spoken is a French patois. English, however, is the official language and is also widely used. The people are mainly Roman Catholics, but there are long-established Protestant denominations as well. The largest city is Roseau. Dominica grew rapidly during the 1970s, mainly as the result of a drop in its death rate and despite steady out-migration. Hurricane David resulted in a massive exodus in 1979, but the migratory trend reversed in the 1980s. The population of Dominica is relatively young, with two-fifths of the people under 15 years of

age. Most of the islanders live in rural areas and work in agriculture.

The economy. Dominica is one of the poorest of the Caribbean nations. The performance of the economy through the 1970s was characterized by declining production and reduced private investment and was complicated by devastating hurricanes that struck the island in 1979 and 1980. The economy had recovered by the mid-1980s, in part through foreign assistance from such sources as the United States, the United Kingdom, Canada, and the United Nations. Although the gross national product (GNP) is growing much more rapidly than the population, the GNP per capita remains relatively low.

Agriculture remains the most important sector of the economy, in terms of both contribution to the GNP and employment. The banana crop provides the country with its chief agricultural product and its main export. Farms also produce grapefruit, limes, oranges, and vegetables. Coconuts are important and have given rise to industries that produce copra, coconut oil and fats, soap, and detergents. Other industries that derive from agricultural products are those producing fruit juices and rum. Handicrafts are important, and a local industry makes cigarettes from imported tobacco. Pumice, the country's only commercial mineral resource, is mined. There is some livestock raising and a small commercial fishing industry. Hurricane David in 1979 destroyed many of the island's fishing boats, and recovery has been slow.

The Industrial Development Corporation was established in 1974 to promote industrial expansion. Exports include, in addition to bananas, coconut oil and fruit juices. Imports are largely made up of foods, metals, and manufactured goods. The United States is the major import source, and the United Kingdom is the major export destination.

Dominica's rich tropical environment and mild climate provide the island nation with the potential for a thriving tourist industry, but tourism has been slow to develop. Tourist trade was enhanced by the establishment in 1975 of Morne Trois Pitons National Park, a unique tropical mountain wilderness.

A number of steamship services call at the deepwater port near Roseau, which was completed in 1976. Portsmouth is the major banana-shipping port. The main airfield is Melville Hall, about 36 miles (58 km) from Roseau. A secondary airfield, Canefield Airport, just 3 miles (5 km) north of Roseau, was opened in 1982. About three-fifths of the nation's road network is paved.

Government and social conditions. Dominica is governed in accordance with the constitution that took affect on independence day, Nov. 3, 1978. It established Dominica as a republic and provided for a Parliament, composed of a president and a House of Assembly, as the chief organ of government. The House is made up of 21 elected representatives, 1 ex officio member, and 9 members, usually called senators, who may be either elected or appointed. Executive power resides in the president, who is elected by the House for a five-year term; he may hold the office for no longer than two terms. The prime minister is appointed by the president to preside over the Cabinet. Dominica is a member of The Commonwealth, the United Nations, the Organization of American States, and the Caribbean Community.

The government is trying to improve social conditions in Dominica, which has serious problems of poverty and underdevelopment. Programs to clear slums and provide more adequate housing are being dealt with through international aid and community efforts. Medical services are provided by the government through dispensaries, hospitals, and health centres. Intestinal diseases, diabetes, anemia, and sexually transmitted diseases are among the most prevalent health problems on the island.

Primary education is free for children 5 to 15 years of age and is compulsory where practical. Most of the schools are government-run, but a few denominational schools are also in operation. Dominica has several secondary schools. There is a teacher-training college and a branch of the University of the West Indies on the island.

Several newspapers are published locally. There is a government-owned radio station, and television broadcasts are received through a television relay station, which brings programs from Barbados.

History. The earliest known inhabitants of the West Indies were two Amerindian tribes: the Arawaks, who migrated from South America, and the Caribs, who later drove them out. At the time of Columbus' arrival, Dominica was inhabited by the fierce, warlike Caribs, who were at war with the inhabitants of neighbouring islands.

The island received its name from the Latin *dies dominica* ("the Lord's day," or "Sunday"), the day on which Christopher Columbus sighted it in 1493. It remained one of the last islands to be explored by Europeans, because of its steep coastal cliffs and inaccessible mountains. The island's strategic position, however, later caused it to become the centre of a threefold conflict between the Carib Indians, the British, and the French. Control of the island was contested between the British and French until it was ultimately awarded to Britain in 1783. Subsequent hostilities between the settlers and the native inhabitants resulted in the near extinction of the Caribs by war, disease, and deportation.

Dominica's position in the eastern rim of the Caribbean, where the Windward Islands are off to the south and the Leewards to the west, has caused ambiguity in its geographic grouping. At first Dominica was one of the Leeward Islands, part of a British Caribbean government administered from Barbados. In 1671 Dominica, along with several other islands, was separated from Barbados, and in 1771 it was made a separate government. In 1833 it was united with seven other islands under the government of the Leeward Islands; it was a member of the Federation of the Leeward Islands, created in 1871, but was transferred to the Windward Islands in 1940. In 1956, with three other islands, it formed the Territory of the Windward Islands, which in 1958 joined the Territory of the Leeward Islands to form the Federation of the West Indies. In 1967 Dominica, among other islands, became a self-governing state within the West Indies Associated States, retaining complete control of internal affairs while Britain remained responsible for external relations and defense. In 1978 it became independent as the Commonwealth of Dominica.

In August 1979 Hurricane David virtually destroyed the island: nearly 75 percent of the population was homeless, the capital was in ruins, and damage to schools was severe. There was a 60 percent decline in general agricultural production and near total destruction of export crops and timber; all essential services were stopped. Before recovery could get fully underway, another hurricane struck in 1980, bringing additional destruction. Adding to Dominica's problems was a confused political scene, which was complicated by two attempted coups in 1981. Nevertheless, considerable progress was made toward recovery in the 1980s.

Dominica Channel, marine passage in the Lesser Antilles, West Indies, connecting the Caribbean Sea with the open Atlantic Ocean to the east. It flows between the island of Dominica (north) and the French island and overseas *département* of Martinique (south) and is about 25 miles (40 km) wide.

Consult the INDEX *first*

Dominican, byname BLACK FRIAR, member of ORDER OF FRIARS PREACHERS, also called ORDER OF PREACHERS (O.P.), one of the four great mendicant orders of the Roman Catholic church, was founded by St. Dominic in 1215. Dominic, a priest of the Spanish diocese of Osma, accompanied his bishop on a preaching mission among the Albigensian heretics of southern France, where he founded a nunnery at Prouille in 1206, partly for his converts, which was served by a community of preachers. From this developed the conception of an institute of preachers to convert the Albigensians, which received provisional approval from Pope Innocent III in 1215. Dominic gave his followers a rule of life based on that of St. Augustine and made his first settlement at Toulouse; on Dec. 22, 1216, Pope Honorius III gave formal sanction. The novelty of the institute was the commission to preach Christian doctrine, a task previously regarded as the prerogative and monopoly of bishops and their delegates; a corollary was the obligation of theological study, and, as early as 1218, Dominic sent seven of his followers to the University of Paris.

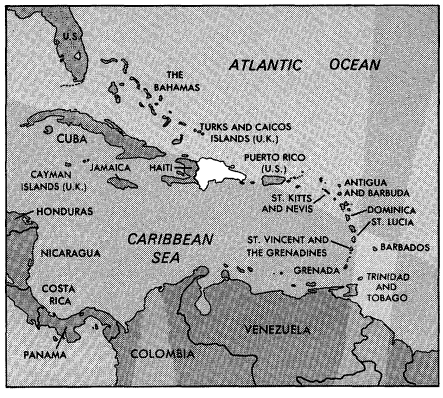
From the beginning the order has been a synthesis of the contemplative life and the active ministry. The members live a community life; and a careful balance is maintained between democratically constituted chapters, or legislative assemblies, and strong but elected superiors. In contrast to the monastic orders that predated it, the Dominican order was not a collection of autonomous houses; it was an army of priests, organized in provinces under a master general and ready to go wherever they were needed. The individual belonged to the order, not to any one house, and could be sent anywhere at any time about its business; this innovation has served as a model for many subsequent bodies.

Within 40 years of the order's foundation, talented members were concentrated in the schools at Paris, Bologna, Cologne, and Oxford; many eminent masters of the universities took the Dominican habit and became in time regents in the friaries. Originally students of theology only, and with no distinguishing philosophical opinions, they were led by Albertus Magnus and his pupil Thomas Aquinas to a study of the newly available works of Aristotle that had been transmitted to Europe by Muslim scholars and to the integration of philosophy and theology. After a short initial opposition, the system of St. Thomas Aquinas was adopted as official (1278). Meanwhile, the Dominicans pursued their vocation to preaching. In southern France they spoke out against the Albigensians and, in Spain and elsewhere, against the Moors and Jews. They evangelized the non-Christians in northern and eastern Europe, in the lands of the eastern Mediterranean, and in India. When the Inquisition was established, Dominicans were entrusted with its execution. They were among the first and most energetic missionaries in the "expansion of Europe" under the Spanish and Portuguese explorers and later under the French. In modern times they have broadened their preaching apostolate to include work in the fields of radio, television, films, and stage.

The Dominican order has continued to be noted for an unswerving orthodoxy, based upon the philosophical and theological teaching of Aquinas, and has steadfastly opposed novelty or accommodation in theology. The 19th and 20th centuries have witnessed a

tremendous development of congregations of Dominican sisters engaged in teaching, nursing, and a wide variety of charitable works. Some of these congregations, such as the Maryknoll Sisters, are devoted to work in foreign missions.

Dominican Republic, Spanish REPÚBLICA DOMINICANA, independent country of the West Indies, comprising the eastern two-thirds of the island of Hispaniola and several small, adjacent islands, situated about 670 miles (1,080 km) southeast of the U.S. state of Florida, between the Atlantic Ocean to the north and the Caribbean Sea to the south, and covering total land area of 18,704 square miles (48,443 square km). It is the second largest country, after Cuba, in the West Indies. The capital is Santo Domingo. The Dominican Republic is bordered on the west by Haiti (occupying the western third of the island) and is separated from Puerto Rico to the east by a channel called the Mona Passage. The population in 1990 was estimated at 7,170,000.



Dominican Republic

For information about regional aspects of the Dominican Republic, *see* MACROPAEDIA: West Indies.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. The country is generally mountainous, with ranges and hills running northwest–southeast. The most prominent feature is the Cordillera Central (Central Highlands; average elevation 6,000 feet [1,800 m]), which reaches 10,417 feet (3,175 m) at Duarte Peak, the highest point in the West Indies. The Cibao Valley (140 miles [225 km] long and 14 miles [23 km] wide) in the north-central area is noted for the fertility of its soil; it is the most prosperous region of the country and produces rice, corn (maize), beans, tobacco, and coffee. The western part of the country is generally dry with large stretches of desert. The Yaque del Norte in the north, the Yaque del Sur in the south, and the Yuna in the east are the principal rivers and provide water for irrigation and hydroelectric power. The salt lake of Enriquillo (23 miles [37 km] long and 11 miles [18 km] wide) is the lowest (144 feet [44 m] below sea level) point in the West Indies.

The country has a moderate tropical climate. The annual mean temperature is 77° F (25° C), ranging from 69° F (21° C) in the heart of the central mountains to a high of 82° F (28° C) on the coastal plains; annual precipitation is about 53 inches (1,346 mm), varying from more than 100 inches (2,540 mm) in the northeast to only about 30 inches (760 m) in the west. Tropical storms and hurricanes are a major weather hazard. Dense evergreen forests of pine and hardwood (including mahogany) thrive in the wetter northeast and east, and savanna vegetation and low shrubs are common in the drier west. Much of the eastern savanna is used for sugarcane cultivation and cattle ranching. Herds of wild pigs roam the high mountains, and alligators and flamingos are found near Lake Enriquillo.

The Dominican Republic's mineral resources include bauxite, gypsum, iron ore, nickel, silver, gold, and platinum; the rock salt deposits in the southwest are among the largest in the world. There are also known deposits of sulfur, coal, molybdenum, cobalt, tin, and zinc, as well as petroleum.

The people. Predominantly populated with people of mixed European and African ancestry (mulatto), the Dominican Republic also has small groups of European minorities (including German Jews); a Japanese colony engages in truck farming in the Constanza Valley; and the Chinese particularly have established themselves in the hotel and restaurant industry. During the 19th century many Mediterranean immigrants intermarried with the population. Spanish is the official language, and various European languages are also spoken. Most of the population is Roman Catholic.

Although birth and death rates have declined substantially since 1960, they are still considered by the government to be too high. Two-fifths of the population is younger than 15 years of age. The government has been trying to decrease the growth rate with family-planning programs since 1968. Emigration is encouraged, and New York City has been a major destination. Immigration, particularly of Haitian labourers, has been restricted since 1965.

More than half of the population was living in urban areas in 1980 after extensive rural-to-urban migration during the 1970s, mostly because of the government's intensive development of Santo Domingo.

The economy. The Dominican Republic has a mixed economy in which both the public and private sectors participate. It is heavily dependent on the production and export of sugar, and unemployment and underemployment affect up to half of the work force. The gross national product (GNP) is slowly increasing; the population, however, is increasing much more rapidly. The GNP per capita is among the lowest in the Caribbean.

Agriculture accounts for less than one-fifth of the GNP and employs up to one-half of the work force. Subsistence farming predominates and produces much of the nation's basic food. Rice and corn are the chief staples. Sugar accounts for as much as one-fourth of the Dominican Republic's exports. Significant quantities of tobacco, coffee, and cocoa are also grown for export.

Mineral industries are dominated by the production of gold, silver, and ferronickel, which amounts to about one-third of all exports. Petroleum is imported. Manufacturing industries account for up to one-fifth of the GNP and employ about one-eighth of the work force. Light industries predominate and centre on the production of refined sugar, molasses, cigarettes, textiles, furniture, and fertilizers. Four-fifths of the nation's electricity is generated from imported fuels; the rest is generated from hydroelectric power. The government is actively promoting the development of tourism, which has become, after sugar, the most important source of foreign exchange.

The balance of trade has remained negative as a result of high prices for petroleum and the wide differential between domestic and international interest rates. Fuels, foodstuffs, and capital and consumer goods lead imports and come primarily from the United States and Venezuela; the United States is also the main export destination.

Government and social conditions. The Dominican Republic is a representative democracy whose constitution, promulgated in 1966, vests executive power in the president, who is directly elected to a four-year term. The president is commander in chief of the armed forces and has broad powers. He governs with the assistance of an appointed Cabinet. Legislative power is vested in the bicameral National Congress, comprising the Senate and the Chamber of Deputies, whose members are directly elected to four-year terms. The Senate has 30 members, one representing each province and the national district, while the Chamber of Deputies has 120 members chosen on the basis of population. The major political parties are the Dominican Revolutionary Party and the Reformist Party. The independent judiciary is headed by the Supreme Court.

A voluntary social-security system introduced in 1947 provides sickness, maternity, accidental-injury, old-age, disability, and survivor benefits. Health conditions are poor, particularly in rural areas. Health services are inadequate and are concentrated in urban areas. Poor sanitation contributes to the high incidence of infectious and parasitic diseases. The average life expectancy is about 60 years for males and about 63 years for females; the infant mortality rate is high.

Education is free in primary schools and, where available, compulsory between the ages of 7 and 14. Only a small percentage of students advance beyond the primary level. Higher education is available at several universities, including the Autonomous University of Santo Domingo, which was founded in 1538 and was one of the first universities in the New World.

The Dominican press has been relatively free from censorship since the Trujillo period. Newspapers are generally of a high quality. Radio and television broadcasting, both government and commercially operated, are widely received.

Cultural life. Dominican culture is based on folk arts and traditions. Music, especially when accompanying dancing, is important at all social levels and in all regions. Typical forms are those with clear African antecedents. Literary clubs are popular, and local painters are gaining some international recognition.

History. Little is known of the pre-Columbian history of Hispaniola. When Columbus reached the island in 1492, it was inhabited by Caribs who had migrated from South America and preyed on the peaceable Arawak (or Taino) inhabitants. Columbus established a colony on the north (Atlantic) coast that was destroyed by the native Indians. On his second voyage another north-coast colony was founded, but it was soon abandoned and Santo Domingo was established on the Caribbean coast.

The Spanish colony of Hispaniola prospered until the greater riches of Mexico and Peru turned it by 1550 into a neglected and poverty-ridden outpost, which it remained for the next three centuries. In 1697 the western third of the island was formally ceded to France, and a prosperous sugar-producing colony based on black slavery grew up in the area that was later to become the independent nation of Haiti. All of Hispaniola island passed to France in 1795. The eastern two-thirds of the island were returned to Spain in 1809, and the colony declared its independence as the Dominican Republic in 1821. Within a matter of weeks, however, it was overrun by Haitian troops and occupied until 1844. Since then the country has been under the rule of a succession of dictatorial strongmen, except for short interludes of democratic government. Twice (1916–24 and 1965–66) the United States intervened during periods of revolution. In 1930 Rafael Trujillo came to power and established an absolute rule that lasted until his assassination in 1961. Joaquín Balaguer was first elected to the presidency in 1966 and served until 1978; his conservative government maintained close ties with the United States. In 1978 the country

experienced its first peaceful transfer of power to an opposition candidate, Antonio Guzmán Fernández. In the early 1980s a sharp increase in strikes and demonstrations was met with violence by the Dominican Republic's security forces. Presidential and congressional elections held in 1982 showed a shift to the left with the election of Salvador Jorge Blanco, a moderate leftist within the ruling Dominican Revolutionary Party, as president. His austerity measures proved very unpopular, however, and Balaguer, despite his frail health, was returned to the presidency in 1986.

Dominion, town, Cape Breton county, northeastern Nova Scotia, Canada, immediately northwest of Glace Bay and a few miles northeast of Sydney, on the northeast coast of Cape Breton Island. The town, originally named Dominion No. 1, was developed in the 1890s around a colliery (now defunct) of the Dominion Coal Company. The area was estimated to have had a population of 1,500 in 1904. The name of the town was changed to Dominion in 1906. The first of the mines of Dominion was closed in 1926; in 1955 a second mine was closed. A Miners' Memorial Museum is located in nearby Glace Bay. Inc. 1906. Pop. (1986) 2,754.

Articles are alphabetized word by word, not letter by letter

dominion, the status, prior to 1939, of each of the British Commonwealth countries of Canada, Australia, New Zealand, the Union of South Africa, Eire, and Newfoundland. Although there was no formal definition of dominion status, a pronouncement by the Imperial Conference of 1926 described Great Britain and the dominions as "autonomous communities within the British Empire, equal in status, in no way subordinate one to another in any aspect of their domestic or external affairs, though united by a common allegiance to the Crown and freely associated as members of the British Commonwealth of Nations."

The main characteristics of dominion status were regarded as complete legislative authority as provided in the Statute of Westminster (1931) and, in the executive sphere, the right of dominion ministers to direct access to the sovereign, in contrast to the previous position whereby advice on dominion matters could be tendered only by United Kingdom ministers. Internationally, it connoted the recognition of the dominions (except Newfoundland) as separate states, entitled to have separate representation in the League of Nations and other international bodies, to appoint their own ambassadors, and to conclude their own treaties. At the same time the dominions were not considered to stand in the same relation to the United Kingdom or among themselves as foreign countries. After 1947 the use of the expression was abandonded because it was thought in some quarters to imply a form of subordination, and the phrase "members of the Commonwealth" came into use.

The definition of 1926 was modified by a declaration issued by the Commonwealth prime ministers' meeting of 1949. According to this, India, which intended to adopt a republican form of constitution, desired to continue full membership in the Commonwealth and accepted the British sovereign as the symbol of the free association of the independent member nations and as such the head of the Commonwealth; the other countries of the Commonwealth recognized India's continued membership on those terms. Pakistan, Ghana, Cyprus, Nigeria, Uganda, Zambia, Tanzania, Kenya, Singapore, Malawi, and other countries followed a similar course as they ceased to recognize the queen as their sovereign. The Federation of Malaya (Malaysia) became an elective monarchy in 1957. Later Lesotho, Swaziland, and Tonga became independent monarchies within the Commonwealth. In 1949 Newfoundland joined the Canadian confederation, and the Republic of Ireland withdrew from the Commonwealth, followed by the Union (Republic) of South Africa in 1961.

Dominion Arboretum and Botanic Garden, Central Experimental Farm, Ottawa, part of the Plant Research Institute of Agriculture Canada (formerly Canada Department of Agriculture). Established in 1889, the arboretum is Canada's oldest. It occupies 40 hectares (99 acres) and includes about 10,000 kinds of plants. Its special collections of flowering crabs, lilacs, lilies, and hedge plants are as much for experimental work and study as for display to the public. The Dominion Arboretum has three greenhouses, the largest of which (2,760 square metres [30,000 square feet]) is used for research. It also has an herbarium containing 695,000 preserved plant specimens for reference purposes.

Dominion Day: *see* Canada Day.

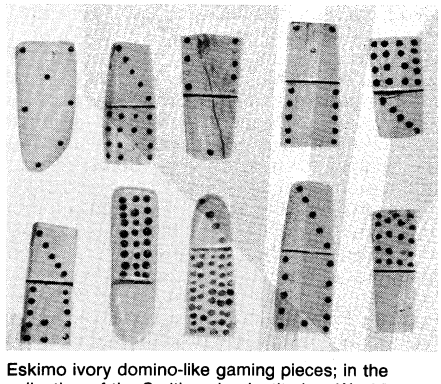
domino whist, domino game for four players. Partners are drawn for as in the card game whist; the player drawing the highest domino leads. Each player takes seven dominoes, or bones. There are no tricks, trumps, or honours. The bones are played as in ordinary dominoes, a hand being finished when one of the players plays his last bone or when both ends are blocked. Pips are then counted, and the holders of the highest number have that number scored against them. The side that is first debited with 100 points loses the game.

dominoes, game played with small, rectangular blocks of wood or other material, each identified by a number of dots, or pips, on its face. The blocks are usually called bones, dominoes, or pieces and sometimes men, stones, or even cards.

The face of each piece is divided, by a line or ridge, into two squares, each of which is marked as would be a pair of dice, except that some squares are blank (indicated in the listing below by a zero). The usual set comprises 28 pieces, marked respectively: 6-6 ("double six"), 6-5, 6-4, 6-3, 6-2, 6-1, 6-0, 5-5, 5-4, 5-3, 5-2, 5-1, 5-0, 4-4, 4-3, 4-2, 4-1, 4-0, 3-3, 3-2, 3-1, 3-0, 2-2, 2-1, 2-0, 1-1, 1-0, 0-0. Some sets run up to 9-9 and others as high as 12-12.

Any group of pieces having a common end number constitutes a suit, doublets belonging to one suit each and all other pieces to two suits. Of two bones, the one bearing the greater number of dots is called the heavier, the other the lighter.

Dominoes in China date back to perhaps the 12th century AD. They were apparently designed to represent all possible throws with two dice, for Chinese dominoes (which they called "dotted cards") have no blank faces. Western dominoes were probably not derived from the Chinese. There is no record of them before the middle of the 18th century in Italy and France. Apparently they were introduced into England by French prisoners toward the end of the 18th century. The North American Eskimos also play a domino-like game, using sets comprised of as many as 148 pieces.



Eskimo ivory domino-like gaming pieces; in the collection of the Smithsonian Institution, Washington, D.C.

By courtesy of the Smithsonian Institution, Washington, D.C.

The principle in nearly all modern dominoes games is the matching of one end of a piece to another, identically or reciprocally numbered. Most basic are the block and draw games for two to four players. The dominoes are shuffled face downward on the table. Players draw for the lead, which is won by the heaviest piece; then each player draws at random the number of pieces required for the game, usually seven. The bones left behind are called the boneyard (U.S.), or stock.

The leader plays first, generally playing his highest domino (since at the end the player with the fewest pips wins). By some rules, a player, after playing a double, may play another bone that matches it; *e.g.,* if he plays double six, he may play another bone that has a six at one end. The second player has to match the leader's pose, or play, by putting one of his bones in juxtaposition at one end. Doublets are placed à cheval (crosswise). If a player cannot match, he says "go" and his opponent plays, unless the draw game—the usual game—is being played, in which case the player who cannot match draws from the stock until he finds a bone that matches. If a player succeeds in posing all his bones, he calls "Domino!" and wins the hand, scoring as many points as there are pips on the bones still held by his opponent. If neither player can match, that player wins who has the fewest pips left in his hand, and he scores as many points as are left in the two hands combined (sometimes only the excess held by his opponent). Game may be set at 50 or 100 points.

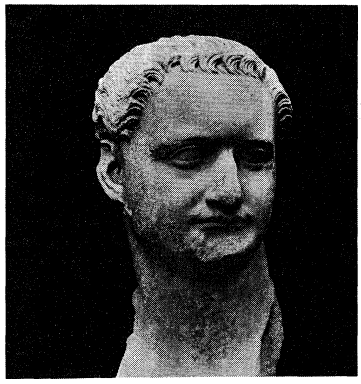
There are a number of variations on the game, including domino whist; matador, the object of which is to pose such a number as, added to an end, will make seven; and muggins.

dominus, plural DOMINI, in ancient Rome, "master," or "owner," particularly of slaves. The name became the official title for the emperor, beginning with Diocletian, who reigned from AD 284 to 305; and thus he and his successors are often referred to as the dominate (*dominatus*), as contrasted with the earlier principate of Augustus and his successors. Some earlier emperors, such as Caligula (reigned AD 37–41), however, had also used the title. By Trajan's day it was the common form of address to the emperor.

In the Latin Church, Dominus was used as the equivalent of the Hebrew Adonai and the Greek Kyrios, to refer to the Christian God. *Dominus* in medieval Latin referred to the "lord" of a territory or the overlord of a vassal. It was later used as a respectful form of address (Spanish *don,* Portuguese *dom*) and for the clergy (Italian *don*).

Domitian, Latin in full CAESAR DOMITIANUS AUGUSTUS, original name (until AD 81) TITUS FLAVIUS DOMITIANUS (b. Oct. 24, AD 51—d. Sept. 18, AD 96, Rome), Roman emperor (AD 81–96), known chiefly for the reign of terror under which prominent members of the Senate lived during his last years.

Titus Flavius Domitianus was the second son of the future emperor Vespasian and Flavia Domitilla. During the civil war of AD 69 over the imperial crown, Domitian remained unharmed in Rome, but on December 18 he took refuge in the Capitol with his uncle Flavius Sabinus, escaping into hiding when the Capitol was stormed by supporters of Vitellius. On the entry of his father's supporters into Rome two days later he was saluted as Caesar, and



Domitian, detail of a marble bust in the Palazzo dei Conservatori, Rome
Alinari—Art Resource/EB Inc.

he became praetor next year. He attempted to turn the repressive campaign of Petillius Cerialis in the Rhineland into a triumphal operation of his own; and for this and other excesses he is said to have required his father's pardon when the latter arrived at Rome in autumn AD 70. Domitian, however, was *princeps juventutis* (an imperial prince) and was consul six times in Vespasian's lifetime; moreover, it was recognized that he would eventually succeed his brother Titus, who had no son and was 11 years older than Domitian. On Vespasian's death, in June 79, Domitian expected the same position as Titus had received under Vespasian, in particular, tribunician power and some form of *imperium.* These were not granted, and Domitian was evidently antagonistic to his brother and is alleged to have hastened his death, which occurred on Sept. 13, 81.

As emperor, Domitian was hated by the aristocracy. From the Trajanic writers Tacitus and Pliny the Younger (Suetonius is less partisan) it is hard to disentangle stock vituperation from genuine belief, but it seems certain that cruelty and ostentation were the chief grounds of his unpopularity, rather than any military or administrative incompetence. Indeed, his strict control over magistrates in Rome and the provinces won Suetonius' praise. In his secretariat he used both freedmen and knights, some of whom retained their posts after his death; and his *consilium* of close advisers, including senators, involved no departure from precedent. In legislation he was severe, and he incurred censure for attempting to curb vices from which he himself was not immune. It might be fairer to criticize him for undue paternalism. An edict ordaining destruction of half the provincial vineyards was typical: it was designed to encourage the growing of grain and to limit the importing of wine into Italy (where, meanwhile, no increased output was permitted), but Domitian was unable to carry the matter through.

His military and foreign policy was not uniformly successful. Both in Britain and in Germany advances were made early in the reign, and the construction of the Rhine–Danube *limes* ("fortified line") owes more to Domitian than to any other emperor. But consolidation in Scotland was halted by serious wars on the Danube, where Domitian never achieved an entirely satisfactory settlement and, worse still, lost two legions and many other troops. This, though admitted even by Tacitus to be due to the slackness or rashness of his commanders, was naturally held against Domitian at Rome. It did not affect his popularity with the army, however, whose pay he had wisely raised by one-third in AD 84.

The real issue was his own constitutional and ceremonial position. He continued his father's policy of holding frequent consulates (he was consul *ordinarius* every year from 82 to 88); he became censor for life in 85, with consequent control over senatorial membership and general behaviour; he wore triumphal dress in the Senate; and he presided, wearing Greek dress and a golden crown, over four yearly games on the Greek model, with his fellow judges wearing crowns bearing his own effigy among effigies of the gods. A grave source of offense was his insistence on being addressed as *dominus et deus* ("master and god").

The execution of his cousin Flavius Sabinus in 84 was an isolated event, but there are hints of more general trouble about 87. The crisis came with the revolt of Antonius Saturninus, governor of Upper Germany, on Jan. 1, 89. This was suppressed by the Lower German Army, but a number of executions followed, and the law of *majestas* (treason) was later employed freely against senators. The years 93–96 were regarded as a period of terror hitherto unsurpassed.

Among Domitian's opponents was a group of doctrinaire senators, friends of Tacitus and Pliny and headed by the younger Helvidius Priscus, whose father of the same name had been executed by Vespasian. Their Stoic views were probably the cause of Domitian's expulsions of "philosophers" from Rome on two occasions. It is unlikely that he was carrying out any considered policy on the organization of thought any more than that his condemnation in 95 of his cousin Flavius Clemens for *atheotēs* ("irreligion") was part of a deliberate attack on Christianity.

Domitian's financial difficulties are a vexing question. Cruelty came earlier in his reign than rapacity, but eventually he regularly confiscated the property of his victims. His building program had been heavy: Rome received a new forum (later called Forum Nervae) and many other works. Then there were Domitian's new house on the Palatine and his vast villa on the Alban Mount. Meanwhile, the increased army pay was a recurrent cost. Probably only his confiscations averted bankruptcy in the last years. The conspiracy that caused his murder on Sept. 18, 96, was led by the two praetorian prefects, various palace officials, and the Emperor's wife Domitia Longina (daughter of Gnaeus Domitius Corbulo). Nerva, who took over the government at once, must clearly have been privy. The Senate was overjoyed at Domitian's death, but the army took it badly; and the next year they insisted on the punishment of those responsible.

(G.E.F.C.)

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Domitius Afer: *see* Afer, Domitius.

Domna, Julia (Roman empress): *see* Julia Domna.

Domnus (pope): *see* Donus.

domovoy, in Slavic mythology, a household spirit appearing under various names and having its origin in ancestor worship. A *domovoy* dwells in any number of places in each home: near the oven, under the doorstep, in the hearth. He never goes out beyond the boundaries of the household.

The *domovoy* is the guardian of the family and its wealth, but he is partial to conscientious and hard-working people. Any displeasure the *domovoy* feels with the actions of its family is displayed in troubles with the farm animals or in strange knocks and grating noises in the house. These last, however, could just be the *domovoy* amusing himself. He can, in any case, be easily placated.

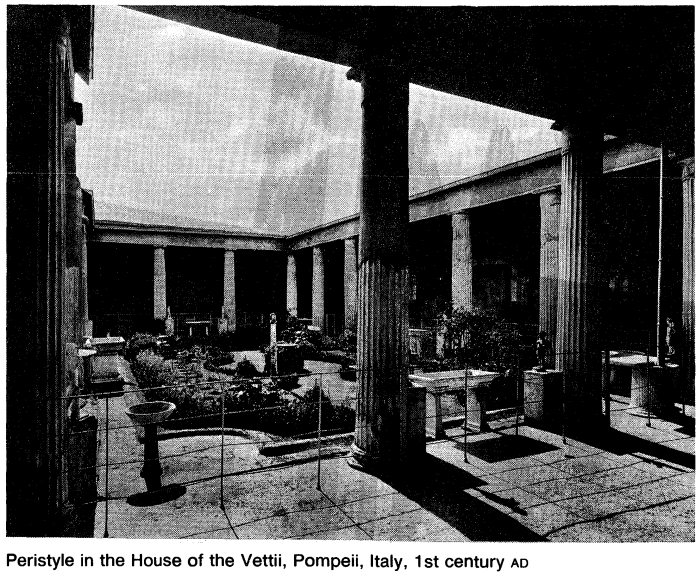
The *domovoy* sees to it that the various traditional proprieties are observed. He can foresee the future, and his groans and weeping or singing and jumping are interpreted as portents of evil or good. No household would consider moving to a new location without formally inviting the *domovoy* to join it.

Ḍomra (Indian caste): *see* Ḍom.

domus, plural DOMUS, private family residence of modest to palatial proportions, found primarily in ancient Rome and Pompeii. In contrast to the insula (*q.v.*), or tenement block, which housed numerous families, the domus was a single-family dwelling divided into two main parts, atrium and peristyle.

The more public functions and activities of the family took place in the atrium, generally a square or rectangular area subdivided around the perimeter into different spaces for conversation and relaxation; it was reached from the street through the prothyrum, an entrance passageway. Located between the atrium and peristyle was the tablinum, an open living room that could be curtained off from public view. A hallway, or fauces, was positioned to one side of the tablinum, to provide convenient access to the peristyle.

The concept of the atrium was derived from Etruscan domestic architecture, in which the atrium comprised the entire dwelling; the characteristic form of the peristyle was taken



Peristyle in the House of the Vettii, Pompeii, Italy, 1st century AD
Foto Vasari

from the Greek house of around the 2nd century BC.

The peristyle of the domus, typified by that of the House of the Vettii at Pompeii, contained the private living quarters of the family; clustered around its colonnaded court were the *oecus* (reception room), *cubiculai* (bedrooms), *alae* (recesses for private talk), and *tricliniai* (dining rooms), with different exposures that could be regulated according to the seasons. In the House of Pansa in Pompeii, the dining rooms were furnished with three couches, each seating three people, nine being the accepted number of guests for a Roman feast. Also in that domus a series of small upper-story rooms encircled the atrium and peristyle.

The Palatine Hill in Rome was celebrated for its palatial houses, among them the Domus Augustana; the Domus Augusti (Villa of Livia) of about 55 BC; and the Domus Tiberiana (destroyed AD 80), which became the residence of the emperors. Nero's opulent palace, the Domus Aurea (AD 64–68), was also located on the Palatine.

Domus Aurea: *see* Golden House of Nero.

Dôn, in Celtic mythology, leader of one of two warring families of gods; according to one interpretation, the Children of Dôn were the powers of light, constantly in conflict with the Children of Llyr, the powers of darkness. In another view, the conflict was a struggle between indigenous gods and those of an invading people. Although Dôn and other Welsh deities had Irish analogues (the Irish goddess Danu, *e.g.*), the stories surrounding them differed, and the Welsh mythology has only partially survived.

Dôn's children included Gwydion, a master of magic, poetry, and music and a warrior who clashed frequently with various gods, and Aranrhod, a sky goddess and symbol of fertility, who bore Gwydion twin sons: Dylan, a sea god, and Lleu Llaw Gyffes (Lleu of the Dexterous Hand), whom many scholars consider analogous to the Irish god Lug.

Don, River, river in England that rises at about 1,500 ft (460 m) in the Pennine range. It flows in a deeply entrenched course across the South Yorkshire coalfield past the city of Sheffield, where its basin forms the heart of the steelmaking district. From there the river flows northeastward past Doncaster, an ancient Roman crossing point and modern coal-mining centre, and the valley widens. The Don joins the Ouse at Goole after a course of about 70 mi (110 km).

Don, River, river in north central Scotland, rising on the slopes of Meikle Geal and flowing generally eastward parallel to the River Dee further south, and emptying into the North Sea at Aberdeen after a course of 82 mi (132 km). In its upper course it receives a number of short mountain streams, but in its lower stretches it flows more gently through a lowland area of agriculture and livestock-raising. The main river town above Aberdeen is Inverurie.

Don Juan, fictitious character who is a symbol of libertinism. Originating in popular legend, he was first given literary personality in the tragic drama *El burlador de Sevilla* (1630; "The Seducer of Seville"), attributed to the Spanish dramatist Tirso de Molina. Through Tirso's tragedy, Don Juan became a universal character, as familiar as Don Quixote, Hamlet, and Faust. Subsequently, he became the hero-villain of plays, novels, and poems; his legend was assured enduring popularity through Mozart's opera *Don Giovanni* (1787). The legend of Don Juan tells how, at the height of his licentious career, he seduced a girl of noble family and killed her father, who had tried to avenge her. Later, seeing a commemorative effigy on the father's tomb, he flippantly invited it to dine with him, and the stone ghost duly arrived for dinner as a harbinger of Don Juan's death. In the original Spanish tragedy, Don Juan's attractive qualities—his vitality, his arrogant courage, and his sense of humour—heighten the dramatic value of the catastrophe. The power of the drama derives from its rapid pace, the impression it gives of cumulative tension as Don Juan's enemies gradually hound him to destruction, and the awareness that the Don is goaded to defy even the ghostly forces of the unknown. In the end he refuses to repent and falls to eternal damnation.

"Come with Me to My Castle," illustration to Act I of Mozart's *Don Giovanni*, after a drawing by J.H. Ramberg

The Bettmann Archive

In the 17th century the Don Juan story became known to strolling Italian players, some of whom travelled to France with this theme in their repertoire of pantomime, and by the 19th century many foreign versions of the Don Juan legend existed. Along with Mozart's opera, other famous non-Spanish versions are Molière's *Le Festin de pierre* (1665; "The Stone Feast"), based on earlier French arrangements; Prosper Mérimée's short story "Les Ames du Purgatoire"; and the drama *Don Juan de Marana* (1836) by the elder Dumas. Early English versions—T. Shadwell's *The Libertine* (1676), for example—are considered uninspired, but later the character reappears with a new force in Byron's long satiric poem *Don Juan* (1819–24) and in George Bernard Shaw's drama *Man and Superman* (1903). Later Spanish versions retain Don Juan's likable qualities and avoid the calculated cynicism of certain foreign versions.

The highly popular *Don Juan Tenorio* (1844) of José Zorrilla y Moral, still traditionally performed in Spain on the eve of All Soul's Day (Halloween), borrowed lavishly from French sources. Zorrilla's play is said to sentimentalize the legend by furnishing a pious heroine and a serious love interest and by procuring Don Juan's repentance and salvation.

Don Pacifico Affair (1850), a quarrel between Great Britain and Greece, in which British acts antagonized France and Russia and caused controversy at home.

David Pacifico (known as Don Pacifico) was a Portuguese Jew who, having been born in Gilbraltar in 1784, was a British subject. After serving as Portuguese consul in Morocco (1835–37) and then as consul-general in Greece, he settled in Athens as a merchant. In 1847 his house was burned down in an anti-Semitic riot, the police standing quietly by. Pacifico demanded compensation from the Greek government and was supported by Britain's foreign secretary, Lord Palmerston. Palmerston sent a naval squadron to blockade the Greek coast (January 1850) and force the Greeks to meet Pacifico's demands. This brought protests from the French and the Russians, with whom Britain shared a protectorate of Greece. Nevertheless, the Greeks acceded to the payment of £4,000, though, because of the loss of some papers, a commission awarded Pacifico only £150. He moved to London, where he died on April 12, 1854.

The incident had its greatest effect in British internal politics. Palmerston's policy was censured by the House of Lords (June 18, 1850), but he won the support of the Commons on June 29. During his speech before the vote, he made his famous comparison between the British and Roman empires, saying that, just as a Roman could claim his rights anywhere in the world with the words "Civis Romanus sum" ("I am a Roman citizen"), "so also a British subject, in whatever land he may be, shall feel confident that the watchful eye and the strong arm of England will protect him against injustice and wrong."

Don Quixote, Spanish in full EL INGENIOSO HIDALGO DON QUIJOTE DE LA MANCHA, novel published in two parts (Part I, 1605; Part II, 1615) by Miguel de Cervantes, one of the most widely read classics of Western literature. Originally conceived as a comic satire against the chivalric romances then in literary vogue, it describes realistically what befalls an elderly knight who, his head bemused by reading romances, sets out on his old horse Rosinante, with his pragmatic squire Sancho Panza, to seek adventure. Widely and immediately translated (first English translation in 1612), the novel was a great and continuing success. Modern English translations include those by J.M. Cohen (1950) and Samuel Putnam (2 vol., 1959).

Don River, river of Soviet Europe, a historic and symbolic waterway of Russia, rising in the small reservoir of Shat near the city of Novomoskovsk, south of Moscow in the central Russian uplands and flowing for 1,162 mi (1,870 km) in a generally southerly direction until it enters the Gulf of Taganrog in the Sea of Azov.

The following article summarizes information about the Don River. For full treatment, *see* MACROPAEDIA: Europe.

The major tributaries are the Krasivaya Mecha, Sosna, Chir, and Donets (right bank) and the Voronezh, Khopër, and Manych (left bank). In its upper course the Don flows along the eastern edge of the central Russian heights through a narrow valley; in its middle course the valley widens to about 4 mi, and the river flows into the Tsimlyansk Reservoir, which dominates the Don's lower course. The Tsimlyansk Reservoir (156 mi long, 24 mi wide) has raised the level of the river by 80 ft, regularized the annual flow, and made the lower course a major transportation artery. The climate of the basin is moderately continental with average January temperatures of 12° to 18° F (−11° to −8° C) and July temperatures of 66° to 72° F (19° to 22° C); annual precipitation decreases from 22 in. (560 mm) in the north to 14 to 15 in. in the south. The Don is primarily fed by snow; it annually carries about 6,800,000 tons (6,200,000 metric tons) of dissolved mineral substances to the Sea of Azov. Most of the basin (163,000 sq mi [422,000 sq km]) is rich farm and timber land; an extensive network of canals provides irrigation in the lower course. The river carries cargoes of lumber, grain, building materials, and other bulk freight. Its delta has valuable

fish (pike, perch, carp, sturgeon) resources. The river is navigable (in the spring) as far as 990 mi from the Sea of Azov; straightening and dredging operations are necessary to maintain navigation in the upper reaches. The largest ports are Kalach-na-Donu, Tsimlyansk, and Rostov-na-Donu.

Donalbane (king of Scotland); *see* Donald Bane.

Donald I (d. 862), king of Alba, the united kingdom of the Picts and Scots (858–862), brother and successor of Kenneth I MacAlpin. Donald established an ancient corpus of laws and rights (known as the laws of Aed, or Aedh) that apparently included the custom of tanistry. According to this custom, the successor of a king was elected during his lifetime from the eldest and worthiest of his kin, often a collateral (brother or cousin) in preference to a descendant (son). The next king, Donald's brother Constantine I, succeeded in accordance with this custom.

Donald II (d. 900), king of the Scots (from 889), son of Constantine I and successor to Eochaid and Giric (reigned 878–889). His reign coincided with renewed invasions by the Danes, who came less to plunder and more to occupy the lands bordering Scotland and the Anglo-Saxon kingdoms. He was also embroiled in efforts to reduce the highland robber tribes. By one account he was slain at Dunnottar, meeting a Danish invasion; by another he died of infirmity brought on by his campaigns against the highlanders. He was succeeded by his cousin Constantine II.

Donald Bane, also spelled DONALDBANE, or DONALBANE, Bane also spelled BAN or BAIN (b. *c.* 1033—d. after 1097), king of Scotland from November 1093 to May 1094 and from November 1094 to October 1097, son of Duncan I.

Upon the death of his brother Malcolm III Canmore (1093) there was a fierce contest for the crown. Donald Bane besieged Edinburgh Castle, took it, and, with the support of the Celtic Scots and the custom of tanistry (*q.v.;* the Celtic system of electing kings or chiefs), he was king nominally for at least six months. He was expelled by Duncan II, son of Malcolm, assisted by English and Normans and some Saxons. Duncan's reign was equally short, for Donald Bane had his nephew slain and again reigned for three years.

These years saw the last attempt of the Celts to maintain a king of their race and a kingdom governed according to their customs. Edgar the Aetheling (*q.v.*), who had newly befriended the Norman king of England, led an army into Scotland, dispossessed Donald Bane, and advanced his nephew Edgar, son of Malcolm III, as sole king of the Scots.

Donaldson, Walter (b. Feb. 15, 1893, Brooklyn, N.Y., U.S.—d. July 15, 1947, Santa Monica, Calif., U.S.), U.S. lyricist, arranger, pianist, and prolific composer of popular songs for stage productions and films.

Donaldson began his career as a pianist for a music publisher. After 19 months spent entertaining troops at Camp Upton, New York, during World War I, he joined the new publishing firm of composer Irving Berlin. In 1928 he established his own music publishing company, Donaldson, Douglas and Gumble.

Donaldson's first success on Broadway was with "My Mammy," introduced by Al Jolson in the show *Sinbad* (1918), and he continued writing for Broadway revues for more than 25 years. The period 1925–28 was his most productive and lucrative. His most popular compositions include "My Buddy," "My Blue Heaven," "Yes Sir, That's My Baby," "Love Me or Leave Me," "Carolina in the Morning," "You're Driving Me Crazy," and his score for *Whoopee* (1928). He collaborated with many of the best known lyricists of his day, among them Gus Kahn, Sam M. Lewis, Joe Young, Edgar Leslie, Harold Adamson, and Johnny Mercer. Donaldson first contributed songs, incidental music, and arrangements to films in 1934 and worked on *The Great Ziegfeld* (1936), *Sinner Take All* (1936), *After the Thin Man* (1936), and *Saratoga* (1937), among others. His work was characteristically lighthearted or sentimental, and his lyrics frequently made use of the vernacular, as in his 1943 song "What's Buzzin', Cousin?"

donatário, the recipient of a *capitania* (captaincy), both a territorial division and a royal land grant in Portuguese colonies, especially Brazil. The Portuguese had used the captaincy system with success in the Madeira Islands and the Azores, and in 1533 King John III decided to employ it to consolidate Portuguese power in Brazil.

An elaborate set of regulations governed the system. In exchange for the land grant and certain tax immunities, the *donatário* was charged with the specific responsibilities of gathering settlers, caring for their spiritual welfare, and protecting them from attack, and with promoting agriculture and commerce. Most of the land of the captaincy, aside from the private grant of the *donatário,* was to be given to settlers. The *donatário* was to bear all the expenses of the captaincy himself. Each captaincy consisted of a portion of land from 25 to 60 or more leagues (75 to 180 or more miles) wide along the Brazilian coast and extending inland to the line (between 48° and 49° west of Greenwich) established by the Treaty of Tordesillas (1494), which divided Portuguese and Spanish colonial possessions.

The nearly monarchical powers theoretically possessed by the *donatário* were limited in practice by the difficulties in gaining actual control of his domain, of acquiring a sufficient labour force (enslavement of Indians was not easy, and black slaves were not imported in large numbers in the 16th century), of defending his captaincy from French incursions with almost no aid from the Portuguese government, and of mastering unruly colonists, most of whom were criminals or dissenters exiled from Portugal.

By 1549, of the 12 captaincies that had been set up in Brazil, only two showed a profit: Pernambuco, granted to Duarte Coelho Pereira, and São Vicente, granted to Martim Afonso de Sousa. To save the colony of Brazil, John III in 1549 dispatched Tomé de Sousa as captain general, along with a small band of Jesuits headed by Manuel da Nóbrega. Through their efforts and those of the succeeding captain general, Mem de Sá (1557–72), workable policies for the colony were formed and implemented, and vigorous attempts were made to gather the Indians into settlements. There were eight captaincies by 1580, and Brazil had become an economically viable, though not a wealthy, colony. Its capital was at Bahia. In time the *donatários* were supplanted by officials called captains or governors. By 1754 all the captaincies had been abolished.

Donatello (b. *c.* 1386, Florence—d. Dec. 13, 1466, Florence), master of sculpture in both marble and bronze, one of the greatest of all Italian Renaissance artists.

A good deal is known about Donatello's life and career, but little is known about his character and personality, and what is known is not wholly reliable. He never married and he seems to have been a man of simple tastes. Patrons often found him hard to deal with in a day when artists' working conditions were regulated by guild rules. Donatello seemingly demanded a measure of artistic freedom. Although he knew a number of Humanists well, the artist was not a cultured intellectual. His Humanist friends attest that he was a connoisseur of ancient art. The inscriptions and signatures on his works are among the earliest examples of the revival of classical Roman lettering. He had a more detailed and wide-ranging knowledge of ancient sculpture than any other artist of his day. His work was inspired

Equestrian statue of Gattamelata, bronze sculpture by Donatello, 1447–53; in the Piazza del Santo, Padua, Italy

Anderson—Alinari from Art Resource/EB Inc.

by ancient visual examples, which he often daringly transformed. Though he was traditionally viewed as essentially a realist, later research indicates he was much more.

Early career. Donatello (diminutive of Donnato) was the son of Niccolò di Betto Bardi, a Florentine wool carder. It is not known how he began his career, but it seems likely that he learned stone carving from one of the sculptors working for the cathedral of Florence about 1400. Some time between 1404 and 1407 he became a member of the workshop of Lorenzo Ghiberti, a sculptor in bronze who in 1402 had won the competition for the doors of the Florentine baptistery. Donatello's earliest work of which there is certain knowledge, a marble statue of David, shows an artistic debt to Ghiberti, who was then the leading Florentine exponent of International Gothic, a style of graceful, softly curved lines strongly influenced by northern European art. The "David," originally intended for the cathedral, was moved in 1416 to the Palazzo Vecchio, the city hall, where it long stood as a civic–patriotic symbol, although from the 16th century on it was eclipsed by the gigantic "David" of Michelangelo, which served the same purpose. Other of Donatello's early works, still partly Gothic in style, are the impressive seated marble figure of St. John the Evangelist for the cathedral facade and a wooden crucifix in the church of Sta. Croce. The latter, according to an unproved anecdote, was made in friendly competition with Brunelleschi, a sculptor and an architect.

The full power of Donatello first appeared in two marble statues, "St. Mark" and "St. George" (both completed *c.* 1415), for niches on the exterior of Or San Michele, the church of Florentine guilds ("St. George" has been replaced by a copy; the original is now in the Bargello). Here, for the first time since classical antiquity and in striking contrast to medieval art, the human body is rendered as a self-activating, functional organism, and the human personality is shown with a confidence in its own worth. The same qualities came increasingly to the fore in a series of five prophet statues that Donatello did beginning in 1416 for the niches of the campanile, the bell tower of the cathedral (all these figures, together with others by lesser masters, were later removed to the Museo dell'Opera del Duomo). The statues were of a beardless and a bearded prophet, as well as a group of Abraham and Isaac (1416–21) for the eastern niches; the so-called "Zuccone" ("pumpkin," because of its bald head); and the so-called "Jeremiah"

(actually Habakkuk) for the western niches. The "Zuccone" is deservedly famous as the finest of the campanile statues and one of the artist's masterpieces. In both the "Zuccone" and the "Jeremiah" (1427–35), their whole appearance, especially highly individual features inspired by ancient Roman portrait busts, suggests classical orators of singular expressive force. The statues are so different from the traditional images of Old Testament prophets that by the end of the 15th century they could be mistaken for portrait statues.

A pictorial tendency in sculpture had begun with Ghiberti's narrative relief panels for the north door of the baptistery, in which he extended the apparent depth of the scene by placing boldly rounded foreground figures against more delicately modelled settings of landscape and architecture. Donatello invented his own bold new mode of relief in his marbel panel "St. George Killing the Dragon" (1416–17, base of the St. George niche at Or San Michele). Known as *schiacciato* ("flattened out"), the technique involved extremely shallow carving throughout, which created a far more striking effect of atmospheric space than before. The sculptor no longer modelled his shapes in the usual way but rather seemed to "paint" them with his chisel. A blind man could "read" a Ghiberti relief with his fingertips; a *schiacciato* panel depends on visual rather than tactile perceptions and thus must be seen.

Donatello continued to explore the possibilities of the new technique in his marble reliefs of the 1420s and early 1430s. The most highly developed of these are "The Ascension, with Christ Giving the Keys to St. Peter," which is so delicately carved that its full beauty can be seen only in a strongly raking light; and the "Feast of Herod" (1433–35; Musée des Beaux-Arts, Lille, Fr.) with its perspective background. The large stucco roundels with scenes from the life of St. John the Evangelist (about 1434–37), below the dome of the old sacristy of S. Lorenzo, Florence, show the same technique but with colour added for better legibility at a distance.

Meanwhile, Donatello had also become a major sculptor in bronze. His earliest such work was the more than life-size statue of St. Louis of Toulouse (*c.* 1423) for a niche at Or San Michele (replaced half a century later by Verrocchio's bronze group of Christ and the doubting Thomas). Toward 1460 the "St. Louis" was transferred to Sta. Croce and is now in the museum attached to the church. Early scholars had an unfavourable opinion of "St. Louis," but later opinion held it to be an achievement of the first rank, both technically and artistically. The garments completely hide the body of the figure, but Donatello successfully conveyed the impression of harmonious organic structure beneath the drapery. Donatello had been commissioned to do not only the statue but the niche and its framework. The niche is the earliest to display Brunelleschi's new Renaissance architectural style without residual Gothic forms. Donatello could hardly have designed it alone; Michelozzo, a sculptor and architect with whom he entered into a limited partnership a year or two later, may have assisted him. In the partnership, Donatello contributed only the sculptural centre for the fine bronze effigy on the tomb of the schismatic pope John XXIII in the baptistery; the relief of the "Assumption of the Virgin" on the Brancacci tomb in S. Angelo a Nilo, Naples; and the balustrade reliefs of dancing angels on the outdoor pulpit of Prato Cathedral (1433–38). Michelozzo was responsible for the architectural framework and the decorative sculpture. The architecture of these partnership projects resembles that of Brunelleschi and differs sharply from that of comparable works done by Donatello alone in the 1430s. All of his work done alone shows an unorthodox ornamental vocabulary drawn from both classical and medieval sources and an un-Brunelleschian tendency to blur the distinction between the architectural and the sculptural elements. Both the Annunciation tabernacle in Sta. Croce and the "Cantoria" (the singer's pulpit) in the Duomo (now in the Museo dell'Opera del Duomo) show a vastly increased repertory of forms derived from ancient art, the harvest of Donatello's long stay in Rome (1430–33). His departure from the standards of Brunelleschi produced an estrangement between the two old friends that was never repaired. Brunelleschi even composed epigrams against Donatello.

During his partnership with Michelozzo, Donatello carried out independent commissions of pure sculpture, including several works of bronze for the baptismal font of S. Giovanni in Siena. The earliest and most important of these was the "Feast of Herod" (1423–27), an intensely dramatic relief with an architectural background that first displayed Donatello's command of scientific linear perspective, which Brunelleschi had invented only a few years earlier. To the Siena font Donatello also contributed two statuettes of Virtues, austerely beautiful figures whose style points toward the Virgin and angel of the Sta. Croce Annunciation, and three nude putti, or child angels (one of which was stolen and is now in the Berlin museum). These putti, evidently influenced by Etruscan bronze figurines, prepared the way for the bronze David, the first large-scale, free-standing nude statue of the Renaissance. Well proportioned and superbly poised, it was conceived independently of any architectural setting. Its harmonious calm makes it the most classical of Donatello's works. The statue was undoubtedly done for a private patron, but his identity is in doubt. Its recorded history begins with the wedding of Lorenzo the Magnificent in 1469, when it occupied the centre of the courtyard of the Medici palace in Florence. After the expulsion of the Medici in 1496, the statue was placed in the courtyard of the Palazzo Vecchio.

Whether the "David" was commissioned by the Medici or not, Donatello worked for them (1433–43), producing sculptural decoration for the Old Sacristy in S. Lorenzo, the Medici church. Works there included 10 large reliefs in coloured stucco and two sets of small bronze doors, which showed paired saints and apostles disputing with each other in vivid and even violent fashion.

Paduan period. In 1443 when Donatello was about to start work on two much more ambitious pairs of bronze doors for the sacristies of the cathedral, he was lured to Padua by a commission for a bronze equestrian statue of a famous Venetian condottiere, Erasmo da Narmi, popularly called Gattamelata ("the honeyed cat"), who had died shortly before. Such a project was unprecedented—indeed, scandalous—for since the days of the Roman Empire bronze equestrian monuments had been the sole prerogative of rulers. The execution of the monument was plagued by delays. Donatello did most of the work between 1447 and 1450, yet the statue was not placed on its pedestal until 1453. It portrays Gattamelata in pseudo-classical armour calmly astride his mount, the baton of command in his raised right hand. The head is an idealized portrait with intellectual power and Roman nobility. This statue was the ancestor of all the equestrian monuments erected since. Its fame, enhanced by the controversy, spread far and wide. Even before it was on public view, the King of Naples wanted Donatello to do the same kind of equestrian statue for him.

In the early 1450s, Donatello undertook some important works for the Paduan church of S. Antonio: a splendidly expressive bronze crucifix and a new high altar, the most ambitious of its kind, unequalled in 15th-century Europe. Its richly decorated architectural framework of marble and limestone contains seven life-size bronze statues, 21 bronze reliefs of various sizes, and a large limestone relief, "Entombment of Christ." The housing was destroyed a century later, and the present arrangement, dating from 1895, is wrong both aesthetically and historically. The majestic Madonna, with an austere frontal pose seemingly a conscious reference to an earlier venerated image, and the delicate, sensitive St. Francis are particularly noteworthy. The finest of the reliefs are the four miracles of St. Anthony, wonderfully rhythmic compositions of great narrative power. Donatello's mastery in handling large numbers of figures (one relief has more than 100) anticipates the compositional principles of the High Renaissance.

Donatello was apparently inactive during the last three years at Padua, the work for the S. Antonio altar unpaid for and the Gattamelata monument not placed until 1453. He had dismissed the large force of sculptors and stone masons used on these projects. Offers of other commissions reached him from Mantua, Modena, Ferrara, and even perhaps from Naples, but nothing came of them. Clearly, Donatello was passing through a crisis that prevented him from working. He was later quoted as saying that he almost died "among those frogs in Padua." In 1456 the Florentine physician Giovanni Chellini noted in his account book that he had successfully treated the master for a protracted illness. Donatello completed only two works between 1450 and 1455: the wooden statue "St. John the Baptist" in Sta. Maria dei Frari, Venice, shortly before his return to Florence; and an even more extraordinary figure of Mary Magdalen in the Florentine baptistery. Both works show new insight into psychological reality; Donatello's formerly powerful bodies have become withered and spidery, overwhelmed, as it were, by emotional tensions within. When the "Magdalen" was damaged in the 1966 flood at Florence, restoration work revealed the original painted surface, including realistic flesh tones and golden highlights throughout the saint's hair.

Late Florentine period. During Donatello's absence, a new generation of sculptors who excelled in the sensuous treatment of marble surfaces had arisen in Florence. Thus Donatello's wooden figures must have been a shock. With the change in Florentine taste, all of Donatello's important commissions came from outside Florence. They included the dramatic bronze group "Judith and Holofernes" (later acquired by the Medici and now standing before the Palazzo Vecchio) and a bronze statue of St. John the Baptist for Siena cathedral, for which he also undertook in the late 1450s a pair of bronze doors. This ambitious project, which might have rivalled Ghiberti's doors for the Florentine baptistery, was abandoned about 1460 for unknown reasons (most likely technical or financial). Only two reliefs for them were executed; one of them is probably the "Lamentation" panel now in the Victoria and Albert Museum, London.

The last years of Donatello's life were spent designing twin bronze pulpits for S. Lorenzo, and, thus, again in the service of his old patrons the Medici, he died. Covered with reliefs showing the passion of Christ, the pulpits are works of tremendous spiritual depth and complexity, even though some parts were left unfinished and had to be completed by lesser artists. (H.W.J./Ed.)

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both stimulating discussions of Donatello in the context of the art of his time; *Donatello e il suo tempo, Atti dell'VIII Convegno Internazionale di studi sul Rinascimento* (1968), an important collection of scholarly papers read at an international congress in Florence in 1966 to commemorate the 500th anniversary of Donatello's death; Manfred Wundram, *Donatello und Nanni di Banco* (1969), a controversial but fruitful analysis of Donatello's early work; G. Gaeta Bertela, *Donatello* (1978), a popular introduction with good colour reproductions.

Donati, Giovanni Battista (b. Dec. 16, 1826, Pisa—d. Sept. 20, 1873, Florence), Italian astronomer who, on Aug. 5, 1864, was first to observe the spectrum of a comet (Comet 1864 II). This observation indicated correctly that comet tails contain luminous gas and do not shine merely by reflected sunlight.

Between 1854 and 1864 he discovered six comets, one of which, first seen on June 2, 1858, bears his name. These discoveries led to his appointment as professor of astronomy and director of the observatory at Florence in 1864. He also contributed to early classification systems for stellar spectra. Donati was supervising the construction of a new observatory at Arcetri, near Florence, when he died.

Donatia, the only genus of the family Donatiaceae, of the bellflower order (Campanulales), containing two species of small cushion plants, native to Tasmania, New Zealand, and sub-Antarctic South America. The little plants form dense spirals of narrow, thick, leathery leaves.

Donatia flowers, borne singly at the ends of short stems, have 5 to 7 sepals and 5 to 10 petals. The top-shaped fruits contain a few fleshy seeds.

Donatio Constantini: *see* Constantine, Donation of.

Donation of Pepin: *see* Pepin, Donation of.

Donatist, a member of a Christian group in North Africa that broke with the Catholics in 312 over the election of Caecilian as bishop of Carthage; the name derived from their leader, Donatus (died *c.* 355). Historically, the Donatists belong to the tradition of early Christianity that produced the Montanist and Novatianist movements in Asia Minor and the Melitians in Egypt. They opposed state interference in church affairs, and, through the peasant warriors called Circumcellions, they had a program of social revolution combined with eschatological hopes. Martyrdom following a life of penance was the goal of the religiously minded Donatist. Despite almost continuous pressure from successive Roman, Vandal, and Byzantine rulers of North Africa, the Donatist Church survived until the extinction of Christianity in North Africa in the early Middle Ages.

The ultimate causes of the schism were both doctrinal and social. Throughout the 3rd century the prevailing tradition in the African Church had regarded the church as a body of the elect. This view, which was espoused by Cyprian and developed in response to earlier controversy, had as its corollary the belief that the validity of sacerdotal acts depended on the presence of the Holy Spirit in the minister and that a minister who was not in a state of grace could not administer a valid sacrament. At the same time, riches and sin had tended to become identified; mammon and the Roman world were equally to be shunned.

In 311 Caecilian was elected bishop, but he was opposed by many because he allowed himself to be consecrated by a *traditor* bishop (one who had surrendered copies of Scripture to the authorities during Emperor Diocletian's persecution of Christians, beginning in 303). The primate of Numidia, Secundus of Tigisi, who had acquired in the previous 40 years the right of consecrating the bishop of Carthage, arrived in Carthage with 70 bishops and in solemn council declared Caecilian's election invalid. The council then appointed a reader (lector), Majorinus, to replace Caecilian.

The new emperor, Constantine the Great, ordered arbitration of the controversy. A mixed commission of Italian and Gallic bishops under the presidency of Miltiades, bishop of Rome, found Caecilian innocent of all charges on Oct. 2, 313. Meantime, Majorinus had been replaced by Donatus, who appealed against Miltiades' judgment. Constantine summoned a council of bishops from the western provinces of the empire at Arles on Aug. 1, 314, and again Caecilian was upheld and his position strengthened by a canon that ordination was not invalid if it had been performed by a *traditor.* Despite further appeals by Donatus and his supporters, Constantine gave a final decision in favour of Caecilian in November 316.

The schism did not die out. Persecution from 317 to 321 failed, and in May 321 Constantine grudgingly granted toleration to the Donatists. The movement gained strength for several years, but in August 347 Emperor Constans I exiled Donatus and other leaders to Gaul, where Donatus died *c.* 355.

When Julian the Apostate became emperor in 361, the exiled Donatists returned to Africa and were the majority Christian party for the next 30 years. Their opponents, however, now led by St. Augustine of Hippo, gained strength, and in 411 a conference presided over by Augustine's friend the imperial tribune Marcellinus was held in Carthage. This council decided against the Donatists and for the Catholics. In 412 and 414 severe laws denied the Donatists civil and ecclesiastical rights; however, the Donatists expected hostility from the world as part of the natural order of things, and they survived into the 7th century.

Donatus, Aelius (fl. mid-4th century AD), famous grammarian and teacher of rhetoric at Rome, one of whose pupils became St. Jerome.

Donatus wrote a large and small school grammar, *Ars maior* and *Ars minor.* The latter, written for young students, gives, by question and answer, elementary instruction in the eight parts of speech. It remained in use throughout the Middle Ages, and its author's name in the forms *donat* and *donet* came to mean "grammar" or any kind of "lesson." The larger work, in three parts, deals with the elements of grammar, the eight parts of speech, and errors and beauties of language. Donatus has little claim to originality, but no grammar is cited so often, and many commentaries were written on it.

Donatus also wrote commentaries on Terence and Virgil. The former in its original form is lost, and the version that has survived lacks the notes on the *Hautontimorumenos* ("Self-Tormentor"). Donatus' valuable commentary was based on excellent sources and on careful study of Terence. It contains interesting notes on scenic representation and comparisons with Greek originals. Of the commentary on Virgil there survive only the preface and dedication, a life of Virgil, the introduction to the *Bucolics,* and quotations.

Aelius Donatus is to be distinguished from Tiberius Claudius Donatus, probably late 4th century AD, author of the *Interpretationes Vergilianae,* a commentary on the *Aeneid.*

Donau Glacial Stage, major division of early Pleistocene time and deposits in the Alpine region of Europe (the Pleistocene Epoch began about 2,500,000 years ago and ended about 10,000 years ago). The Donau Glacial Stage preceded the Donau-Günz Interglacial Stage and is represented by the Donau Gravels. The Donau Glacial is correlated with the Thurnian sequence of marine strata of Great Britain and the Eburon Glacial Stage of northern Europe.

Donau-Günz Interglacial Stage, major division of early Pleistocene time and deposits in the Alpine region of Europe (the Pleistocene Epoch began about 2,500,000 years ago and ended about 10,000 years ago). The Donau-Günz Interglacial, a period of relatively moderate climatic conditions, followed the Donau Glacial Stage and preceded the Günz Glacial Stage. It is correlated with the Antian sequence of marine deposits in Britain and the Waal Interglacial Stage of northern Europe.

Donbass, also spelled DONBAS (Soviet Union): *see* Donets Coal Basin.

Doncaster, town and district (borough), metropolitan county of South Yorkshire, England, occupying 225 sq mi (582 sq km) in the eastern third of the county. At its heart lies historic Doncaster town on the river Don on the site of a Roman station (Danum). In the Middle Ages Doncaster grew as the market town of a rich agricultural district. Its first royal charter was granted in 1194. In the 19th century it became an important railway junction with large locomotive works. In the 20th century, as coal-mining employment has shifted eastward, it has grown as the service centre for the new mining communities and has acquired a variety of new industries while retaining importance as an agricultural market. Its mansion house, dating from 1748, is one of three original mansion houses left in England. The St. Leger classic is run annually in September at the Doncaster racecourse. Pop. (1981 prelim.) town, 81,610; (1982 est.) district 288,700.

Doncaster, James Scott, earl of: *see* Monmouth, James Scott, duke of.

Donders, Frans Cornelis (b. May 27, 1818, Tilburg, Neth.—d. March 24, 1889, Utrecht), ophthalmologist, the most eminent of 19th-century Dutch physicians, whose investigations of the physiology and pathology of the eye made possible a scientific approach to the correction of refractive disabilities such as nearsightedness, farsightedness, and astigmatism.

Donders' interest in ophthalmology began in 1847 with a study of *muscae volitantes,* the problem of specks seen floating before the eye. This study resulted in his formulation of what is now known as Donders' law: the rotation of the eye around the line of sight is involuntary.

As professor of physiology at the University of Utrecht (1852–89), his research resulted in immediate improvements in diagnosis, operative treatment, and use of eyeglasses to correct impairments of vision. He found (1858) that hypermetropia (farsightedness) is caused by a shortening of the eyeball, so that light rays refracted by the lens of the eye converge behind the retina. He discovered (1862) that the blurred vision of astigmatism is caused by uneven and unusual surfaces of the cornea and lens, which diffuse light rays instead of

Donders, engraving by H. Dilcher after a drawing by F. Kriehuber, *c.* 1860

Archiv fur Kunst und Geschichte, West Berlin

focussing them. This last finding created the field of scientific clinical refraction.

Donders summarized his studies in *On the Anomalies of Accommodation and Refraction* (1864), the first authoritative work in the field.

Doneck (Ukrainian S.S.R.): *see* Donetsk.

Donegal, Irish DÚN NA NGALL (Fort of the Foreigners), most northerly county of Ireland, bounded on the west and north by the Atlantic Ocean, on the east by Lough (lake) Foyle and Northern Ireland, and on the south by Northern Ireland and County Leitrim, Ireland. Its land area is 1,865 sq mi (4,830 sq km). The small village of Lifford is the county town (seat). The rugged coast is heavily indented, in the north, with major inlets being Lough Swilly and Lough Foyle, between which is the Inishowen Peninsula. The chief rivers of the county are the Finn and Erne; the main mountain ranges are the Blue Stack, whose highest peak is Lavagh More (2,211 ft [674 m]), and Derryveagh, its highest peak being Errigal (2,466 ft [752 m]). Evidence of extensive glaciation exists. The climate is temperate, with warm summers and mild, moist winters.

The name was extended from the town of Donegal to the county, which was made a shire in 1585. The ancient name was Tyrconnell (Land of Conall). Conall, with his brother Eoghan, conquered northwestern Ulster *c.* 400 and founded the kingdom of Ailech; its capital was at the concentric stone fortress known as the Grianan of Ailech on a hill west of Londonderry, Northern Ireland. Eoghan took Tyrone and Inishowen for his share, and his descendants, the O'Neills, ruled central Ulster. Conall took Tyrconnell, in which his descendants, the O'Donnells, ruled. The remoteness of these areas enabled them to escape serious interference from the Anglo-Normans. After the defeat of the Irish cause in 1603, however, Hugh O'Neill and Rory O'Donnell took flight secretly to the Continent in 1607. The county was immediately included in the plan for the plantation of Ulster, and its history thereafter merged with that of Ireland.

Donegal's population is concentrated largely along the coasts and river valleys; the main towns are Donegal, Buncrana, Ballyshannon, and Letterkenny. The county, with the exception of the urban districts, is administered by a county council and county manager. The Foyle and Finn basins are intensively cultivated, but the rugged western seaboard is unsuitable. Agriculture consists of tillage and rearing of cattle, sheep, and poultry; the chief crops are oats and potatoes. Killybegs on the west coast is the main fishing port and a fish-processing centre. Salmon are caught in the Rivers Finn, Foyle, Erne, and Gweebarra. Tourism is important, based on the scenery, the many beaches, and the golf courses. In west Donegal, which remains an Irish-speaking region, woollen garments are made by hand, and at Convoy, Donegal tweeds are woven. Recent industrial development includes the introduction of carpet, fishing net, synthetic fibre, and garment manufacturing. No railway serves Donegal. Pop. (1981) 125,112.

Donelaitis, Kristijonas, also spelled KRISTIJONAS DUONELAITIS (b. Jan. 1, 1714, near Gumbinnen, East Prussia—d. Feb. 18, 1780, Tolmingkehmen), Lutheran pastor and poet who was one of the greatest Lithuanian poets and the first to be appreciated outside his country.

Donelaitis studied theology and classical languages at the University of Königsberg (1736–40) and in 1743 became pastor of the village of Tolmingkehmen, where he remained until his death.

His main work, *Metai* (1818; *The Seasons,* 1967), 2,997 lines in length, was written in hexameters, never before used in Lithuanian verse. It depicts realistically and in their own dialect the life of the serfs and the countryside of 18th-century Prussian Lithuania. The poem was first published in an incomplete edition with a German translation (*Das Jahr in vier Gesängen;* "The Year in Four Cantos") by Ludwig Rhesa in Königsberg in 1818. It has been translated into several other languages. His other literary works include six fables and a tale in verse, *Pričkaus pasaka apie lietuvišką svodbą* (1865; "Pričkus' Tale about a Lithuanian Wedding").

Donelson, Fort, in the U.S. Civil War, important Confederate stronghold captured by Union forces on Feb. 16, 1862, forcing a general Southern withdrawal along the Confederate western line of defense from Columbus, Ky., to Bowling Green. Ft. Donelson was an entrenched camp at Dover, Tenn., erected by Confederate forces to guard the lower Cumberland River and the water approach to Nashville. On Feb. 12, 1862, Union Gen. Ulysses S. Grant moved on the fort using the same combined army and navy tactics that had resulted in his capture of Ft. Henry on the Tennessee River six days earlier. Failing to break through the entrenched Union positions, the South elected to give up the defense. Although 3,000 Confederate troops escaped, 15,000 men under Gen. Simon B. Buckner were surrendered unconditionally. The fall of Ft. Henry and Ft. Donelson opened the way by river into Tennessee and forced the evacuation of such Southern strongholds as Columbus and Nashville.

Donen, Stanley (b. April 13, 1924, Columbia, S.C., U.S.), U.S. motion picture-director and choreographer whose inventive dance sequences infused musicals with a fresh vitality in the 1940s and '50s.

Donen began his career in New York City in the stage chorus of *Pal Joey* (1940), where he met Gene Kelly. Later, as an assistant dance director in Hollywood, he collaborated with Kelly on several spirited musicals. He helped choreograph such films as *Cover Girl* (1944) and *Anchors Aweigh* (1945) and then in 1949 co-directed *On the Town,* which was hailed as a major landmark in the evolution of musical comedy. Successfully blending reality and fantasy, it introduced a vivid showmanship to the genre. The two men also did *Singin' in the Rain* (1952), which combined dance parodies of Busby Berkeley and comic satire in a classic about early talkies, and *It's Always Fair Weather* (1955).

Without Kelly, Donen directed and produced other successes such as *Seven Brides for Seven Brothers* (1954), *Funny Face* (1957), *The Pajama Game* (1957), and *Damn Yankees* (1958). In the late 1950s he moved to Europe, where he made such films as *Indiscreet* (1958), *Charade* (1963), *Arabesque* (1966), *Bedazzled* (1967), *Two for the Road* (1967), and *Movie Movie* (1978).

Donets Coal Basin, Russian DONETSKY UGOLNY BASSEYN, byname DONBASS, or DONBAS, largest producing coalfield of the Soviet Union, lying in Voroshilovgrad and Donetsk *oblasti* (administrative regions), Ukrainian Soviet Socialist Republic, and in the adjoining Rostov *oblast* of the Russian S.F.S.R. The principal exploited area of the field covers nearly 9,000 sq mi (23,300 sq km) south of the Donets River, but coal deposits extend westward to the Dnepr River in the greater Donets Basin. During the 1960s some exploitation began in this western extension, especially in eastern Dnepropetrovsk *oblast.* Coal was first discovered in the Donets Basin in 1721, but exploitation did not begin until the early 19th century and became significant only after the first railway reached the area in 1869. Development in the last two decades of the 19th century was rapid, and by 1913 the Donets Basin was producing 87 percent of Russian coal. Despite erosion of its relative position by the development of new coalfields and despite setbacks in World War I, in the Russian Civil War following the October Revolution (1917), and in World War II, absolute coal production continued to increase until the 1970s, when production fell. By the early 1980s, annual production was again on the increase and had reached 204,000,000 tons, of which some 80,000,000 tons were coking coal. The region has more than 100 mining communities.

The Donets Basin still has large coal reserves, much of it of high quality. Proved reserves total 50,290,000,000 tons, with a further 63,490,000,000 tons probable reserves and 76,200,000,000 tons possible. Of the proved reserves, 23 percent are anthracite, concentrated chiefly at the eastern end of the field. The coal occurs in some 300 coal-bearing seams. A difficulty of the field is that seams are thin, averaging just under 3 ft (1 m), and only 40 are thick enough to be worked economically. Most thicker seams and those nearer the surface have been worked out, and mining is now deep—down to 2,000 ft (600 m) for lignite and 5,900 ft for higher quality bituminous and anthracite coals. Average mining depth, however, is 1,150–1,300 ft.

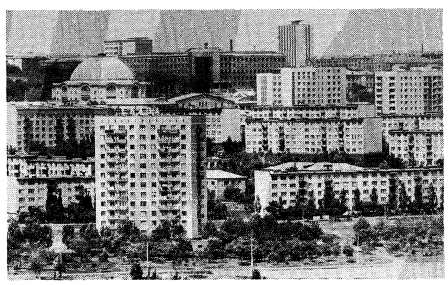
After several largely unsuccessful efforts to establish a metallurgical industry on the coalfield, an ironworks was set up in 1872 by a Welshman, John Hughes. During the 1880s the Donets Basin developed into the principal iron- and steel-producing region of the country; by 1913 it was making 74 percent of all Russian pig iron. World War II caused heavy damage to plants and towns but led to postwar reconstruction with larger and more modernized enterprises. The area remains the largest single producing area of iron and steel in the U.S.S.R. and is one of the world's major metallurgical and heavy industrial complexes. Iron ore is obtained from Krivoy Rog to the west and from Kerch in the Crimea; manganese is mined at Nikopol and Marganets on the Dnepr. The chief iron and steel towns of the basin, together with Voroshilovgrad, Kramatorsk, and other centres, have a range of large heavy-engineering industries. The chemical industry is well developed, based on coking by-products and rock salt mined in the Donets Basin near Artyomovsk; the main chemical towns are Artyomovsk and Slavyansk. Mercury is also mined in the Donets Basin, and cement making is important. In modern times, a wide range of light and consumer-goods industries have been introduced to diversify the economy and to supply the needs of the large urban populations. In 1982 the population of the three *oblasti* within which the Donets Basin lies was 12,205,000, of whom 10,020,000 were urban.

Donets River, Russian SEVERSKY DONETS, or SEVERNY DONETS, a tributary of the Don River, southern Russian Soviet Federated Socialist Republic. It is 650 mi (1,050 km) long and drains a basin of 39,000 sq mi (100,000 sq km). Rising in the Central Russian Upland, it flows south past Belgorod and to the east of Kharkov before swinging southeastward and following a sinuous course to join the Don below Konstantinovsk. Freeze-up lasts from early December to late March. The river flows along the north of the Donets Basin industrial region, which uses much of its water and causes severe pollution problems. A canal takes water from the river to Donetsk town. A water shortage in the river and industrial area led to the construction in the 1970s of a canal carrying additional supplies from the Dnepr to the Donets. Six weirs make navigation possible upstream to Donetsk in Rostov *oblast* (administrative region).

Donetsk, also spelled DONECK, *oblast* (administrative region) in the eastern part of the

Ukrainian Soviet Socialist Republic. It has an area of 10,250 sq mi (26,500 sq km). Formed in 1938 as Stalino *oblast,* it stretches from the Donets Ridge in the north, across the low, gently rolling Azov uplands and the level coastal plain to the Sea of Azov. There is little surface water, and many of the smaller streams dry out in summer; this, together with the heavy pollution of the Donets River, poses serious problems of water supply for industrial and domestic needs. The whole *oblast* is in steppeland, and the greater part is under the plow. The *oblast* (headquarters at Donetsk town) includes the western half of the Donets Basin coalfield and associated industrial area, a factor reflected in the exceptionally high proportion (90 percent) of urban dwellers living in 48 towns and 142 urban districts. Despite the overwhelming predominance of coal mining, iron and steel manufacture, heavy engineering, and chemicals in the economy, the *oblast* is important agriculturally, chiefly for winter wheat, corn (maize), and sunflowers. Market gardening is highly developed around the towns. Pop. (1983 est.) 5,252,000.

Donetsk, also spelled DONECK, formerly (until 1924) YUZOVKA and (1924–61) STALINO, city and administrative centre of Donetsk *oblast* (region), Ukrainian Soviet Socialist Republic, on the headwaters of the Kalmius River. In 1872 an ironworks was founded there by a



Donetsk, Ukrainian S.S.R.
Novosti Press Agency

Welshman, John Hughes (from whom the town's pre-Revolutionary name Yuzovka was derived), to produce iron rails for the growing Russian rail network. Later steel rails were made. The plant used coal from the immediate vicinity, and both coal mining and steel making developed rapidly. By 1914 there were 4 metallurgical plants, 10 coalpits, and a population of about 50,000. After the October Revolution (1917), Yuzovka was renamed Stalino and, in 1961, Donetsk. Heavy destruction in World War II led to postwar modernization and an increase in the scale of industry. Subsequent growth has been rapid and sustained. There are now more than 40 coalpits within the town limits. A major integrated coking, iron-smelting, and steel-making plant makes modern Donetsk one of the largest metallurgical centres of the U.S.S.R. Coke by-products are the basis of a chemical industry producing plastics. There are several heavy-engineering works, which produce, in the main, mining equipment. Refrigerators are manufactured, and there are food-processing and other light industries.

The necessity of avoiding areas subject to subsidence caused by mining has led to a patchy development of the densely built-up residential and factory areas and open spaces over the extensive area of the town's administrative limits (162 sq mi [420 sq km]). The principal street, from the railway station to the steelworks, is 5.5 mi (9 km) long, with the main shops, hotels, and administrative buildings. There are a university, polytechnic, medical and trade institutes, and over 30 scientific research establishments, including a branch of the Academy of Sciences of the Ukrainian S.S.R. Cultural amenities include several theatres and a philharmonic hall. Pop. (1983 est.) 1,055,000.

Dong (people): *see* Tung.

Dong Hai (China): *see* East China Sea.

Dong Nai, *tinh* (province), southern Vietnam, northeast of the Mekong delta. Created in 1976, it includes the former provinces of Phuoc Tuy, Long Khanh, and Bien Hoa as well as the Hoang Sa (Spratly archipelago). The 2,926-sq-mi (7,578-sq-km) province has rich agricultural land with rolling hills and plateaus that reach 2,625 ft (800 m) at the southern edge of the central highlands of the Chaîne Annamitique (Annamite Chain; Vietnamese Truong Son). Elevations gradually decrease to the south until, on the coast bordering the South China Sea, the province is quite flat. Extending into the province from the northeast, outliers of the Chaîne Annamitique rise to 1,654 ft and are inhabited by the Mon-Khmer-speaking Chrau people. Ho Chi Minh City (formerly Saigon) province-borough borders Dong Nai province on the west. The Song Dong Nai (Donnai River), a major affluent of the Song Sai Gon (Saigon River), forms the major drainage basin.

Although most of the province has only limited paddy, or lowland, rice, it is double cropped in the Song Dong Nai lowland. In addition to rice, sugarcane, tobacco, peanuts (groundnuts), and coconuts are grown. Cocoa, rubber, and oil-palm plantations have been developed. Timber is cut in the northern part of the province, and salt is collected from pans along the coast. Bien Hoa, the provincial seat, 19 mi (30 km) northeast of Ho Chi Minh City, is a major industrial centre and the site of a large airfield. The Thong Nhat (Reunification) Railroad, connecting Hanoi and Ho Chi Minh City, traverses the province east–west. Pop. (1979) 1,304,799.

Dong Nai River, also called DONNAI RIVER, Vietnamese SONG DONG NAI, river rising in the central highlands (Chaîne Annamitique; Vietnamese, Truong Son Range) of southern Vietnam, northwest of Da Lat, where it has rapids and is known as the Song Da Dung. It flows west and southwest for about 300 mi (480 km), joining the Song Sai Gon (Saigon River) southwest of Bien Hoa. At the rapids of Tri An, west of Dinh Quan, it is joined by the Song Be. The Da (river) Nhim, an important upper tributary, rises northeast of Da Lat on the Cao Nguyen (plateau) Lam Vien and has three sets of rapids and falls. Two of the cascades, Lien Khuong and Gu Gau, are below Phi Mum; the third, Pongour, just west of the river's junction with the Dong Nai, has been harnessed for hydroelectric power. The Dong Nai, or Donnai, gave its name to the Upper Donnai (Haute Donnai) province and plateau region of French colonial Vietnam.

Dong Qichang: *see* Tung Ch'i-ch'ang.

Dong Son culture, important prehistoric culture of Indochina; it is named for a village in northern Vietnam where many of its remains have been found. The Dong Son site shows that bronze culture was introduced into Indochina from the north, probably around 300 BC, the date of the earliest Dong Son remains. Dong Son was not solely a bronze culture; its people also had iron implements and Chinese cultural artifacts. Nevertheless, their bronze work, especially the production of ritual bronze kettle drums, was of a high order. The Dong Son people also are distinguished by their great stone monuments, built for religious functions, which are similar to monuments found in Polynesia.

The Dong Son were a seafaring people who apparently travelled and traded throughout Southeast Asia. They also cultivated rice and are credited with originating the process of changing the Red River Delta area into a great rice-growing region. The Dong Son culture, transformed by further Chinese and then Indian influence, became the basis of the general civilization of the region. Remnants of the culture have been found dating from as late as the 16th century, though most of it disappeared after the region was conquered by China in the 2nd century BC.

Dong Thap, *tinh* (province) in the Mekong delta region, southern Vietnam. It includes the former provinces of Kien Phong and Sa Dec, which were merged in 1976. The province is bordered by Kampuchea (Cambodia) on the northwest. It has a southeastern boundary following the Song (river) Tien Giang and (farther south) the Song Hau Giang (Bassac River), both branches of the lower Mekong. A former Khmer (Cambodian) district, Dong Thap was annexed by the Vietnamese in the 18th century. A considerable portion of the flat, 1,309-sq-mi (3,391-sq-km) province lies within the Dong Thap Muoi (Plain of Reeds); the whole of the province is subject to the summer monsoon flooding of the Mekong. Upstream, paddy rice is harvested, while single- and double-cropped rice predominate downstream. Other crops include tobacco, cotton, corn (maize), potatoes, mung beans, soybeans, sugarcane, and fruits; sawmilling and brick and tile making are other important economic activities. Silk weaving, fruit processing, and the making of fish sauce (*nuoc mam*) have been developed. The system of rivers, canals, and ditches favourable for raising and catching fish year-round enables the province to supply fish to neighbouring provinces and to Ho Chi Minh City (formerly Saigon). Cao Lanh, the provincial seat, trades in local rice. Thap Muoi Tang is an old Buddhist temple, with a pagoda 138 ft (42 m) tall, located in Hy Hoa village. Pop. (1979) 1,182,878.

Dong Zhongshu (Confucianist philosopher): *see* Tung Chung-shu.

Dongan, Thomas, 2ND EARL OF LIMERICK (b. 1634, Castletown, County Kildare, Ire.—d. Dec. 14, 1715, London), British colonial governor of New York under Charles II and James II.

A Roman Catholic and member of a royalist family, Dongan was exiled after the English Civil War (1642–52) and served in an Irish regiment of the French Army. Recalled to England in 1677, he served as lieutenant governor of Tangier from 1678 to 1680. As governor of New York (1682–88), he called the colony's first representative assembly, issued a "Charter of Liberties" providing for religious toleration, and pursued a policy of cooperation with the Iroquois Confederacy against the French. Dongan returned to England in 1691 and succeeded his brother as earl of Limerick in 1698.

Dongbei (China): *see* Manchuria.

Dongbei Pinyuan (China): *see* Manchurian Plain.

Dongen, Kees van, in full CORNELIS THEODORUS MARIE VAN DONGEN (b. Jan. 26, 1877, Delfshaven, Neth.—d. May 28, 1968, Monte Carlo, Monaco), Dutch-born French painter, one of the leading Fauvists after Matisse, particularly renowned for his sensuously rendered portraits of women.

Van Dongen was raised in a family of seamen and exhibited artistic leanings early in his youth. He attended the Royal Academy of Fine Arts of Rotterdam and moved to Paris at the age of 20. In the bohemian atmosphere of the Montmartre district, he worked as a house painter, an illustrator for satirical papers, and a café artist.

Having made the acquaintance of Matisse, he participated in 1905 in the famous Salon d'Automne, at which the Fauve (Wild Beast)

group was given its epithet. In 1907 he was contracted by Daniel Henry Kahnweiler, the dealer of Picasso, and his reputation grew.

In 1908 he was invited to join the German Expressionist group Die Brücke (The Bridge), centred at the time in Dresden. Van Dongen's candid, colouristic portrait style was immensely fashionable by the end of World War I. The figure of the thin, red-lipped, unmistakably aristocratic woman (as in "Woman with Jewels," 1905) became his rather chilling archetype. His portrait of Anatole France (1917) is particularly notable. He also painted numerous richly coloured seascapes and scenes of Paris in an assured, economical style.

Donglin (Chinese group): *see* Tung-lin.

Dongola (The Sudan): *see* Dunqulah.

Dongting Hu (China): *see* Tung-t'ing Lake.

Dönitz, Karl (b. Sept. 16, 1891, Grünaubei-Berlin, Ger.—d. Dec. 22, 1980, Aumühle, W.Ger.), German naval officer and creator of Germany's World War II U-boat fleet who for a few days succeeded Adolf Hitler as German head of state.

During World War I, Dönitz served as a submarine officer in the Black Sea and the Mediterranean. In the aftermath of Hitler's accession to power, despite the Versailles Treaty's absolute ban on German submarine construction, Dönitz clandestinely supervised the creation of a new U-boat fleet, over which he was subsequently appointed commander (1936). In the midst of World War II, in January 1943, he was called to replace Adm. Erich Raeder as commander in chief of the German Navy. His loyalty and ability soon won him the confidence of Hitler. On April 20, 1945, shortly before the collapse of the Nazi regime, Hitler appointed Dönitz head of the northern military and civil command. Finally—in his last political testament—Hitler named Dönitz his successor as president of the *Reich,* minister of war, and supreme commander of the armed forces. Assuming the reins of government on May 2, 1945, Dönitz retained office for only a few days. In 1946 he was sentenced to 10 years' imprisonment by the International Military Tribunal at Nürnberg. He was released from prison in 1956 and retired on a government pension. His memoirs were published in 1958.

Donizetti, (Domenico) Gaetano (Maria) (b. Nov. 29, 1797, Bergamo, Cisalpine Republic—d. April 8, 1848, Bergamo, Lombardy, Austrian Empire), Italian opera composer whose numerous operas in both Italian and French represent a transitional stage in operatic development between Rossini and Verdi.

Donizetti, portrait by Giovanni Carnevali; in the Museo Donizettiano, Bergamo, Italy

By courtesy of the Museo Donizettiano, Bergamo, Italy

Among his major works are *Lucia di Lammermoor* (1835), *La fille du régiment* (1840), and *La favorite* (1840). In his serious operas he developed considerably the dramatic weight and emotional content of the genre, and his comic operas have a sparkling wit and gaiety all their own.

Early life. The youngest of three sons of the caretaker of the *monte di pieta* (the municipal pawnshop), Donizetti began his musical studies with Giovanni Simone Mayr, a Bavarian priest who was musical director of Sta. Maria Maggiore, Bergamo's chief church, and also a successful composer of opera. As a choirboy Donizetti did not shine, but Mayr perceived in him a nascent musical ability and secured his entry into the Liceo Filarmonico (the music school) at Bologna, where he had a thorough training in fugue and counterpoint. His father hoped he would become a church composer, but, though he did compose a vast quantity of sacred music, his natural instinct was for the theatre.

Donizetti scored his first success with *Enrico di Borgogna,* which first appeared in 1818 at the Teatro San Luca, in Venice, and during the next 12 years he composed no fewer than 31 operas, most of them produced at Naples and now forgotten. In 1830 his *Anna Bolena,* produced in Milan, carried his fame abroad to all the European capitals and eventually across the Atlantic. Two years later he scored another lasting success with *L'elisir d'amore* (*The Elixir of Love*), a comedy full of charm and character with a libretto by Felice Romani, the best theatre poet of the day. *Lucrezia Borgia* (1833), also with a libretto by Romani, consolidated his reputation at La Scala in Milan and elsewhere. Like the opera composers Gioacchino Rossini and Vincenzo Bellini before him, he next gravitated to Paris, where his *Marino Faliero,* though not a failure, suffered from comparison with Bellini's *I Puritani,* produced a few weeks before. Donizetti then returned to Naples for the production of his tragic masterpiece, *Lucia di Lammermoor,* on Sept. 26, 1835.

In 1828 Donizetti had married Virginia Vasseli, the sister of one of his closest friends in Rome; they made their home in Naples. He was deeply devoted to her and never really recovered his spirits after her death, soon after the stillbirth of a son, in 1837. His distress was exacerbated by the fact that none of the three children born to them survived birth. It seems clear that syphilis, to which Donizetti himself later succumbed, was already taking its toll of his family.

Success in Paris. Donizetti continued to work in Naples until 1838, when municipal censors objected to the production of his *Poliuto,* which dealt with a Christian martyr, on the ground that the sacred subject was unsuitable for the stage. He thereupon returned to Paris, where the field had been cleared for him by Bellini's early death and Rossini's retirement. There he revived some of his best operas, though *Lucrezia Borgia* had to be withdrawn because of objections by Victor Hugo, on whose drama the libretto was based. *Poliuto* was produced in 1840 as *Les Martyrs* with a French text by Eugène Scribe. It was preceded two months earlier by the opéra comique *La fille du régiment* (*The Daughter of the Regiment*), which gained enormous popularity over the years through the performances of the leading sopranos of the day, including Jenny Lind, Adelina Patti, Marcella Sembrich, Emma Albani, and other divas of the 19th century. Later in the same year the Paris Opéra produced *La favorite,* Donizetti's first essay in French grand opera.

Bartolomeo Merelli, a fellow pupil of Donizetti, was now director of La Scala and also of the Kärnthnerthor Theater, in Vienna. He engaged Donizetti to compose an opera for La Scala. The work, *Maria Padilla,* was produced in 1841 only a few weeks before the famous premiere of Verdi's *Nabucco.* Merelli also commissioned an opera for his Viennese theatre. There, *Linda di Chamounix,* a romantic *opera semiseria,* was produced in 1842 and dedicated to the empress Maria Anna. Donizetti had already been brought to the notice of the emperor Ferdinand I by his chancellor, Prince Metternich, and had conducted Rossini's *Stabat Mater* in his presence. He now received the appointment of official composer to the Emperor, which obliged him to be in Vienna for six months in the year but left him free to work elsewhere during the rest. At the same time Rossini, who had always furthered Donizetti's interests in Paris and entrusted to him the first performance of his *Stabat Mater* at Bologna, urged him to undertake the vacant directorship of the Liceo in that city. But Donizetti felt that he could not undertake this responsibility and preferred to continue his profitable operatic career. Back in Paris, he produced at the Théâtre Italien the delightful and witty comic opera, *Don Pasquale.*

Physical breakdown. But Donizetti was already in the grip of his fatal disease. He produced his last important opera, *Dom Sébastien,* with a libretto by Scribe, at the Paris Opéra in 1843 under the strain of constant headaches and occasional lapses of mental capacity. He suddenly aged, lost his good looks and his equability of temper, which had hitherto seen him through the trials of operatic production. *Dom Sébastien,* though unfavourably reviewed in the press, was nonetheless a success with the public.

The remaining years were a story of degeneration into hopeless insanity. As a patient in a private asylum near Paris, he had considerable difficulties with the French police, who were supported by the doctors; he was at last taken home to Bergamo by his devoted nephew Andrea, son of his eldest brother. He lingered on until April 8, 1848, a victim of general paralysis of the syphilitic insane, deprived of willpower, speech, and physical control. It was a pitiable end for a gay and handsome man who, unlike Bellini, was never envious of the successes of other composers and at all times displayed an openhearted generosity. To the French composer Hector Berlioz, for example, whose criticisms in *Le Journal des Débats* were consistently hostile, he spontaneously sent a letter of introduction to Prince Metternich, when Berlioz was about to leave for Vienna.

Donizetti always won more favour with the public than with the critics. During his lifetime his success was enormous and the rewards considerable. His popularity continued until the end of the century, but by 1914 his operas had almost disappeared from the repertory, overshadowed by the more substantial masterpieces of Verdi and Richard Wagner. In the 1950s there was a revival of interest in his works, after which it seemed unlikely that, at least, *Lucia di Lammermoor, L'elisir d'amore,* and *Don Pasquale* would be allowed to pass into oblivion. (D.Hus.)

MAJOR WORKS. *Operas.* 75 including *Alfredo il Grande* (1823); *Emilia di Liverpool* (1824); *Le convenienze e le inconvenienze teatrali* (1827); *Il borgomastro di Sardaam* (1827); *La regina di Golconda* (1828); *Il giovedì grasso* (1828); *Il castello di Kenilworth* (after Scott, 1829); *Anna Bolena* (1830); *L'elisir d'amore* (1832); *Il furioso all'isola di San Domingo* (1833); *Torquato Tasso* (1833); *Lucrezia Borgia* (1833); *Maria Stuarda* (1834); *Gemma di Vergy* (1834); *Marino Faliero* (after Byron, 1835); *Lucia di Lammermoor* (after Scott, 1835); *Belisario* (1836); *Il campanello di notte* (1836); *Betly* (1836); *Pia de' Tolomei* (1837); *Roberto d'Evereux, Conte d'Essex* (1837); *Poliuto* (1840); *La fille du régiment* (1840); *La favorite* (1840); *Linda di Chamounix* (1842); *Don Pasquale* (1843); *Maria di Rohan* (1843); *Dom Sébastien, roi de Portugal* (1843).

Other works. Two oratorios, several cantatas, religious pieces, at least 20 string quartets, three string quintets, and numerous songs.

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donkey, also called BURRO, domestic ass belonging to the horse family, Equidae, and descended from the African wild ass (*Equus asinus; see* ass). It is known to have been used as a beast of burden since 4000 BC. The average donkey stands 101.6 centimetres (40 inches) at the shoulder, but different breeds vary greatly. The Sicilian donkey reaches only about 61 cm, while the large ass of Majorca stands at about 157.5 cm, and the American ass has been measured to 167.6 cm. In colour the donkey ranges from white to gray or black and usually has a dark stripe from mane to tail and a crosswise stripe on the shoulders. The mane is short and upright and the tail, with long hairs only at the end, is more cowlike than horselike. The very long ears are dark at the base and tip. Although slower than horses, donkeys are surefooted and can carry heavy loads over rough terrain. The mule (*q.v.*) is a hybrid, the offspring of the mating of a male (jackass, or jack) donkey and a female horse.

Although the names donkey and burro are interchangeable, the term burro is widely used in the southwestern U.S. to describe small donkeys, *burro* being the word for donkey in the Spanish language. Feral donkeys, found in various parts of the world, are descendants of escaped or abandoned domestic animals. In the western U.S., many authorities consider that the large population of feral burros is driving the desert bighorn sheep to extinction by competing for the limited resources of its very arid habitat.

donkey orchid, any of about 38 species of terrestrial plants, family Orchidaceae, that constitute the genus *Diuris.* One species is found in Java; the others are native to Australia.

A donkey orchid has grasslike leaves. The two upper petals on each flower resemble the ears of a donkey, and the greenish lateral sepals are long and drooping. The common donkey orchid (*Diuris longifolia*) bears from three to five flowers about 4 centimetres (1.5 inches) long. Other well-known species are cat's face (*D. filifolia*) and nanny-goat orchid (*D. laevis*).

Donkin, Bryan (b. March 22, 1768, Sandree, Northumberland, Eng.—d. Feb. 27, 1855, London), developer of a commercial application of the so-called Fourdrinier machine for making paper and inventor of the composition roller used in printing.

While serving as an apprentice to a papermaker, John Hall, in Dartford, Kent, Donkin was engaged to perfect a papermaking machine that had been devised in 1798 by Nicolas-Louis Robert of France and later patented in England by Henry and Sealy Fourdrinier. He completed the first practical Fourdrinier machine at Frogmore Mill, Hertfordshire, in about 1803 and in subsequent years constructed 191 more.

In 1812, using the ideas of the French inventor Nicolas-François Appert, who had devised a method for preserving food in stoppered bottles, he established a factory to produce and can vegetable soups and preserved meats for the Royal Navy. A year later Donkin and a printer developed a forerunner of the rotary press and a composition printing roller. Because the old flatbed press that moved back and forth could not print fast enough to produce large numbers of newspapers, the inventors arranged four trays, each containing a page of type, on the four sides of a revolving spindle. An important feature of the new machine was the use of inking rollers made of glue and treacle (composition). Although this machine eventually failed, composition rollers were widely adopted. After 1815 Donkin became a civil engineer in London, received two gold medals from the Society of Arts, and was a founder (1818) of the Institution of Civil Engineers.

Donleavy, J(ames) P(atrick) (b. April 23, 1926, Brooklyn, N.Y., U.S.), U.S.-born author of the lusty comic novel *The Ginger Man* (Paris, 1955; U.S., 1958), which introduced Dangerfield, the coarse, comic anti-hero. Donleavy is noted for his characters who display heroism in the face of a mad universe and remain deeply attached to life despite its flaws.

Donleavy served with the U.S. Navy during World War II; studied microbiology at Trinity College, Dublin; and became an Irish citizen in 1967. *A Singular Man* (1963), *The Saddest Summer of Samuel S.* (1966), and later works continued to develop the prose style of *The Ginger Man,* which is distinguished by alliteration and an original treatment of voice. Action occurs in the third person while thoughts are conveyed in the first, allowing the character to speak both as observer and observed. Later works include *The Onion Eaters* (1971), *A Fairy Tale of New York* (1973), *The Destinies of Darcy Dancer, Gentleman* (1977), *Schultz* (1979), and *Leila* (1983).

Dönme, also spelled DÖNMEH (Turkish: Convert), Jewish sect founded in Salonika in the late 17th century, after the conversion to Islām of Shabbetai Tzevi, whom the sectarians believed to be the Messiah. The Dönme, who numbered about 15,000 in the late 20th century, are found primarily in Istanbul, Edirne, and Izmir, Tur.

Shabbetai Tzevi had proclaimed himself the Messiah in 1648 and quickly gained financial support and a considerable following among Jews throughout the Holy Land, Europe, and North Africa. Early in 1666 he was arrested by Ottoman Turks and, faced with the choice of conversion or death, accepted Islām by the end of the year.

The Dönme believed that the conversion of Shabbetai Tzevi was a step in the fulfillment of the messianic prophecy. They therefore also converted to Islām, but secretly practiced various Judaic rites. Although they remained apart from the larger Jewish community, they preserved some knowledge of Hebrew, kept secret Hebrew names, forbade intermarriage with the Muslim population, and conducted their marriage and funeral rites in secret. As the Dönme remained secretive and lived in separate quarters, they were not generally noticed by the Muslims. Internally they split into a number of subsects, reflecting social distinctions and disputes over the successors to Shabbetai.

At the turn of the 20th century, the Dönme, well-represented in the professional classes, took active part in the Young Turk movement and the revolution of 1908. After the Greco-Turkish War of 1921–22, the central Dönme community of Thessaloníki was moved to Istanbul, and a gradual process of assimilation set in. Contact with Jews was lost, and the Dönme themselves resisted Jewish attempts to return them to Judaism.

Donnai River (Vietnam): *see* Dong Nai River.

Donnan, Frederick George (b. Sept. 5, 1870, Colombo, Ceylon—d. Dec. 16, 1956, Canterbury, Kent, Eng.), British chemist whose work was instrumental in the development of colloid chemistry.

Donnan was educated at Queen's College in Belfast, Ireland, and at the universities of Leipzig, Berlin, and London. From 1904 to 1913 he taught at the University of Liverpool, and from 1913 to his retirement in 1937 he was professor of chemistry at University College, London.

In 1911 Donnan studied the conditions under which equilibrium is established between two electrolytic solutions separated by a semipermeable membrane—that is, by a membrane through which the solvent and some, but not all, of the dissolved ions can pass. In the absence of such a membrane, the solvent and every species of dissolved ion will diffuse freely from each solution into the other, until the composition of the two solutions becomes the same. The semipermeable membrane, however, prevents the transfer of at least one ionic species, and the preservation of electrical neutrality limits the diffusion of that species' oppositely charged partner. Nevertheless, some movement of mobile ions does occur, and the compositions of the solutions change; as a result, the final distribution of the ionic species is unequal, and there is a measurable difference in the electric potential of the solutions on each side of the membrane. The nature of the equilibrium and the existence of the potential have both become associated with Donnan's name.

Donnay, Maurice(-Charles) (b. Oct. 12, 1859, Paris—d. March 31, 1945, Paris), French playwright whose dramas deal with love and adultery, social problems, and the manners of his time.

Donnay
Harlingue—H. Roger-Viollet

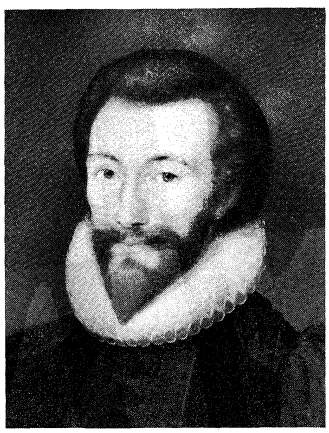
Donnay was born into a wealthy family and originally trained to be a civil engineer. His dramatic career began with monologues written for the literary cabaret Le Chat-Noir. He made his name in the theatre with *Amants* (1895; "Lovers"), one of his best plays and the first work of a series called "Théâtre d'Amour," which also includes *La Douloureuse* (1897) and *L'Affranchie* (1898), both of which are dramas about women whose loves are spoiled by lies. A second cycle of plays, including *Le Retour de Jérusalem* (1903) and *Les Éclaireuses* (1913), deals with current social problems; and another group of plays, including *La Chasse à l'homme* (1919) and *La Reprise* (1924), are comedies of manners, depicting France after World War I.

Among Donnay's other works are several autobiographical publications, including *Mon Journal, 1919-30* (1953). Donnay's *Théâtre* was published in 8 volumes (1908–27).

Donne, John (b. sometime between Jan. 24 and June 19, 1572, London—d. March 31, 1631, London), leading English poet of the Metaphysical school and dean of St. Paul's Cathedral, London (1621–31). He is noted not only for his secular poetry (written largely before his ordination in 1615) but also for his

religious verse and treatises and especially for his sermons, which rank among the best of the 17th century.

Early life. Donne was born of Roman Catholic parents. His mother, the daughter of John Heywood, epigrammatist and playwright, was a descendant of Henry VIII's chancellor, Sir Thomas More. Donne claimed, with reason, that no family had suffered more for its religious beliefs than hers. His father, descendant of an ancient Welsh family whose arms the poet bore, was a successful London merchant. Six months after his death in 1576 his widow married Dr. John Syminges, several times president of the Royal College of Physicians, who brought up the Donne children. According to Izaak Walton (whose charming *Life* of Donne was first published in 1640), Donne was educated at home by a Catholic tutor until, with his brother Henry, he matriculated at Hart Hall (later Hertford College), Oxford, in October 1584. After three years, according to Walton, Donne transferred to the University of Cambridge, though no surviving records confirm this. He did not take a degree from either university, however, for this would have required his accepting the Act of Supremacy and recognizing the Thirty-nine Articles of religion, to neither of which conditions, as a Catholic, he could subscribe. Extensive travels in Europe probably followed, but by May 1591 he was enrolled as a student of the law at Thavies Inn, whence he proceeded to Lincoln's Inn (May 6, 1592). In 1593 his brother Henry was arrested for harbouring a Catholic priest and died in prison of the plague. In June of the same year Donne, being now of age, received his portion of his father's estate. He remained at Lincoln's Inn until at least the end of 1594, having fulfilled the conditions necessary to proceed to final training for the profession of law. Like many others at that time, however, he regarded the Inns of Court only as a gateway to a state office and as a means of making contacts with men of affairs.



Donne, detail of an oil painting by an unknown artist after I. Oliver, *c.* 1616; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Early public career and poems. In 1596 Donne joined the gentlemen adventurers (many of them, like himself, aspirants to a position in public service) as a volunteer in the successful naval and military expedition against Cádiz. In the following year he took part in the Islands expedition, hunting for Spanish treasure ships in the Azores. One of his companions was Thomas Egerton, who recommended Donne to his father, Sir Thomas Egerton, lord keeper of the great seal. By the beginning of 1598 Donne had become a secretary to Sir Thomas in an office that was a recognized path to high public appointments. Sir Thomas thought well enough of Donne to send him into Parliament in 1601. He took no part in the debates or committees there, however, his function apparently being to keep his finger on the pulse of the House and report to his master. At this time began Donne's rejection of Catholicism.

Donne was well on the way to achieving his ambitions. He had also by this time written much of his poetry, most of it in imitation of ancient Latin poets: there were verse letters to male friends (the earliest dating from about 1592); five formal verse satires in the modes of Horace and Juvenal (*c.* 1593–98) and one canto of a satirical epic (*Metempsychosis,* 1601); a "book" of love-elegies in part modelled on Ovid's; and epigrams that to some extent imitated those of Martial. The classical models, however, are so transformed by the wit and daring of Donne's imagination that the verses are thoroughly original. By 1601 he had also composed numerous love lyrics in various moods, which are among his most famous poems. Such are the vigour, realism, and passion of his work at this period that they have sometimes been thought to reflect Donne's own youthful outlook and conduct. His contemporary, Sir Richard Baker, wrote of him as "not dissolute (*i.e.,* careless), but very neat; a great visitor of Ladies, a great frequenter of Plays, a great writer of conceited Verses." The moral fastidiousness and earnestness that Donne displayed throughout his life, however, make it difficult to believe that he was a youthful rake. His visits to the theatre in that great age of English drama reflected but one of the many aspects of literature and learning in which he interested himself. Walton emphasizes Donne's unusual studiousness throughout his life; and he was engaged, at least as early as 1593, in a deep consideration of the points at issue between the English and Roman churches. The "Ladies" he visited were doubtless noblewomen like those who were later to become his patrons.

His wit and charm made him a favourite with the ladies in the lord keeper's household. He was particularly attracted to Anne More, daughter of Sir George More of Loseley Park and niece and protégé of Egerton's second wife. Anne's father had brought her to London for the assembling of Parliament in 1601. She and Donne met secretly, and since there was little chance of winning the consent of so ambitious and important a man as Sir George, they agreed to marry without it, apparently early in December 1601. This was an offense against both civil and canon law, and Donne's risking so much for love was truly what Walton called "the great error of his life." When in February 1602 Donne told Sir George of the marriage, his irate father-in-law had the poet imprisoned for a time, persuaded Egerton to dismiss him, and brought the matter before the Court of High Commission. Though the commissioners judged the marriage valid, there now began for Donne a long and difficult period of unemployment, during which, however, his love for his wife never faltered.

Churchman and preacher. Donne first found shelter in the house of Lady Egerton's son, Sir Francis Wolley, at Pyrford, Surrey. Here he left his family for about a year (1605–06) while he travelled in France and Italy. From 1606 until 1611 he had his own house at Mitcham, south of London, and an apartment in London itself. For some time he seems to have assisted Thomas Morton (later bishop of Durham) in controversial tracts against the Catholics, more particularly in defense of King James I's exaction of the oath of allegiance as head of the Church of England. Donne's own contribution was an effective piece of propaganda in support of the King called *Pseudo-martyr* (1610), in recognition of which Oxford University conferred on him the degree of master of arts. An offshoot of the controversy was his satiric fantasy against the Jesuits, *Ignatius his Conclave* (published in Latin and in English in 1611).

Donne often felt despondent at the lack of direction in his life. He had thoughts even of suicide, but these were exorcised in a casuistical work, *Biathanatos* (written *c.* 1608, published 1646), in which he argued the grounds on which one could rightly take one's own life. More especially, he experienced a deep, personal religious struggle. Morton had more than once urged him to enter the ministry of the Church of England, most strongly in 1607, when he offered Donne a benefice he was himself vacating. Donne refused as being unworthy and as having no convincing vocation for holy orders. He tried unceasingly to secure secular employment but without success. By the time he had written *Pseudo-martyr,* moreover, King James made it clear that he wished Donne to enter the church and that he did not favour secular employment for him.

Donne had, of course, been for some time a convinced Anglican. In 1596–97 he had served a Protestant queen against her Catholic enemies, and he must have at least formally renounced Catholicism before he could enter Egerton's service. He eventually maintained that any church asserting the main tenets of the Christian religion was a true church; in "indifferent" matters (government, ritual, and so on) the practice of one's own nation should be followed. Though he never doubted the truth of Christianity, his lack of complete conviction concerning his own salvation persisted. His struggle for assurance is expressed in religious poems written between 1607 and 1613, which include some of the finest in English. Donne was able to support his growing family by means of the belated payment of his wife's dowry and by the patronage (after 1607) of Lucy Russell, countess of Bedford. To her and to other noble ladies he wrote characteristically original verse letters, and he composed elegies on the deaths of some of Lady Bedford's kinsfolk.

In 1611 Donne found another patron, Sir Robert Drury, with whom he toured in France and the Low Countries in 1611–12, who provided the Donne family with accommodations (until 1621) attached to the Drury residence in London. The death of Drury's young daughter, Elizabeth, in 1610 had called forth a funeral elegy from Donne; and in 1611 and 1612 he wrote *Anniversaries,* also in commemoration of her death, though here the theme is used mainly as a pretext for a profound satirical "anatomy" of a decaying world, a contemplation of the soul's flight to share the joys of heaven. Still seeking state employment, Donne wrote verses on the death of Prince Henry (1612) and on the marriage of Princess Elizabeth to Frederick V, elector of the Palatinate (1613). He sat in the "Addled" Parliament of 1614 and served on four select committees. He wrote an epithalamion (a nuptial poem) in celebration of the wedding of the notorious countess of Essex to the court favourite, Robert Carr, earl of Somerset, whom Donne had been cultivating for help in securing an official position. Late in 1614 a court post seemed at last within his grasp, but the King again refused to appoint Donne to any position outside the church. Convinced finally that he was called to the ministry at the hands of God's representative, the King, Donne completed studies in Greek and Hebrew, finished the *Essayes in Divinity,* and began a new career in the church.

He was ordained deacon and priest by Bishop John King on Jan. 23, 1615. Preferment soon followed. He was made a royal chaplain and received, at the King's command, the degree of doctor of divinity from the University of Cambridge. He occupied the rectory of Keyston, in Huntingdonshire (the King's gift), from 1616 until 1621; the rectory of Sevenoaks, in Kent (an unsolicited gift from

his old master, Egerton), from 1616; that of Blunham, in Bedfordshire, from 1622; and the vicarship of St. Dunstan-in-the-West, London, from 1624 until his death. He was scrupulous, however, in confining his tenure of those benefices that carried "cure of souls" to the two allowed by law to royal chaplains. From October 1616 he occupied the important post of reader (preacher and spiritual director) at Lincoln's Inn. His preaching soon developed great power and eloquence.

In August 1617, Donne's wife died in giving stillbirth to their 12th child. Her loss caused him great sorrow but also deepened the devotion and dedication of his religious life. For a long time after his bereavement Donne's health gave his friends concern, and in 1619 he was freed from his duties at Lincoln's Inn to go as chaplain with the embassy of James Hay, Viscount Doncaster, to the princes of Germany and Bohemia at the beginning of the period of history known as the Thirty Years' War. He returned to England early in 1620, and on Nov. 22, 1621, Donne was installed as dean of St. Paul's Cathedral. Many duties fell to him, and Donne was most conscientious in performing them. The register of his administration at St. Paul's proves his efficiency and integrity.

The death of King James in 1625 made little difference to Donne's status. The new king, Charles I, admired him as preacher and as poet. The only poems that Donne wrote after his ordination, however, were three fine "Hymns," two or three Holy Sonnets, and an elegy on the death of Lord James Hamilton. His creative talents were occupied almost wholly in preaching and in composing the prose *Devotions upon Emergent Occasions,* written during his recovery from a serious bout of relapsing fever (1624). He published only a few more important sermons; but in 1625, when he was sheltering in the house of Magdalen Herbert (Lady Danvers) from the severe plague that scourged London, and again in 1630, when he was trying to recover from his last illness at the home of his son-in-law, Donne transcribed from his notes more than 100 other sermons, which were published after his death by his son. His last years were saddened by the death of friends and patrons, of children (only six of whom survived their father), and, in January 1631, of his aged mother. Though emaciated by illness, Donne preached at court his last sermon (published posthumously as *Death's duell*) on Feb. 25, 1631; the next day he attended his last meeting of the governors of the Charterhouse. He conducted cathedral business for the last time on March 21. On March 31, 1631, Donne died, and on April 3 he was buried in his cathedral. According to Walton, Donne had caused a drawing to be made of himself in his shroud during his last illness; from this Nicholas Stone carved an effigy in white marble, which, alone of all the monuments, survived the destruction of old St. Paul's in the Great Fire of 1666 and which may still be seen in the south aisle of the present cathedral.

Posthumous reputation. When Donne published his *Anniversaries* he apologized to his friends for having "descended to print anything in verse," for, at the time in which he lived to print one's verses smacked of commercialism. Only one of his poems in English survives in his own handwriting; most were preserved in manuscript copies made by and passed among a relatively small but admiring coterie of poetry lovers. The contents of the first two (posthumous) editions of his *Poems* (1633, 1635), apart from the few already printed, were in fact derived from collections of such transcripts. The *Poems* were sufficiently popular to be published eight times within 90 years of Donne's death, but his work was not to the general taste of the next century, when he was regarded as a great but eccentric "wit." From the beginning of the 19th century, however, perceptive readers began to recognize Donne's poetic genius. In the 20th century his sermons as well as his poems have attracted great attention. As both poet and prose writer Donne has had an especially powerful influence on writers of the 17th and the 20th centuries, who have found stimulus in his fusion of witty argument with passion, his dramatic rendering of complex states of mind, his daring and unhackneyed images, and his ability (little if at all inferior to Shakespeare's) to make common words yield up rich poetic meaning without distorting the essential quality of English idiom.

(W.Mi.)

MAJOR WORKS. *Poems.* The two *Anniversaries* (*An Anatomie of the World* and *Of the Progres of the Soule;* 1611 and 1612) were published during Donne's lifetime. The first (incomplete) collection of his verse was published posthumously in 1633. To the period before Donne's marriage (1601) belong most of his satires and elegies and many of his songs and sonnets. To the period between his marriage and ordination (1615) belong the verse letters, the rest of the elegies and songs and sonnets, and the first religious verses. Among these works are many of Donne's finest poems, including (titles followed by first lines): "Song" ("Goe, and catche a falling starre"); "The good-morrow" ("I wonder by my troth, what thou, and I / Did, till we lov'd?"); "The Exstasie" ("Where, like a pillow on a bed"); "A Valediction: forbidding mourning" ("As virtuous men passe mildly away"); "The Baite" ("Come live with mee, and bee my love"); "The Sunne Rising" ("Busie old foole, unruly Sunne"); "The Canonization" ("For Godsake hold your tongue, and let me love"); "The triple Foole" ("I am two fooles, I know, / For loving, and for saying so"); "Twicknam garden" ("Blasted with sighs, and surrounded with teares"); "A nocturnall upon S. Lucies day . . . " ("Tis the yeares midnight, and it is the dayes"); "The Will" ("Before I sigh my last gaspe, let me breath"); "The Funerall" ("Who ever comes to shroud me, do not harme / Nor question much"); and "The Relique" ("When my grave is broke up again / Some second ghest to entertain"). To the period of Donne's life between 1607 and his death (1631) belong the Divine poems, including the Holy Sonnets (notably I, "Thou Hast made me"; VII, "At the round earth's imagin'd corners blow"; X, "Death be not proud"; XI, "Spit in my face yee Jewes"; XIV, "Batter my heart, three-person'd God"; XVIII, "Show me deare Christ, thy spouse"). Numbering per H.J.C. Grierson (see Bibliography below).

Prose. Donne's prose published during his lifetime includes *Pseudo-martyr* (1610); *Ignatius his Conclave* (1611; the Latin version, *Conclave Ignati,* had appeared that same year); *Devotions upon Emergent Occasions* (1624); *Foure Sermons on Speciall Occasions* (1625; reprinted with corrections and one further sermon, 1626); *Death's duell* (1630). Posthumous editions of Donne's prose include *Juvenilia* (1633); *LXXX Sermons* (1640); *Biathanatos* (1646); *Fifty Sermons* (1649); *Essayes in Divinity* (1651); *Letters to severall persons of honour* (1651); *Paradoxes, problems, essays, characters . . .* (1652); *XXVI Sermons* (1661). The principal editor of these writings was John Donne the younger.

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Donnelly, Ignatius (b. Nov. 3, 1831, Philadelphia—d. Jan. 1, 1901, Minneapolis, Minn., U.S.), U.S. novelist, orator, and social reformer; one of the leading advocates of the theory that Francis Bacon was the author of Shakespeare's plays.

Donnelly grew up in Philadelphia, where he became a lawyer. In 1856 he moved to Minnesota, where, with another ex-Philadelphian, John Nininger, he founded the boomtown Nininger City, intended as a cultural as well as an industrial centre. There he edited the erudite *Emigrant Aid Journal,* published in both English and German, to attract settlers. The scheme was successful at first, but a financial panic in 1857 caused abandonment of the town, leaving Donnelly as its only resident.

He entered politics, became an early supporter of the Republican Party, and served as lieutenant governor of Minnesota and as a U.S. congressman from 1863 to 1869. He left the Republicans in the 1870s and was active in several minority party movements representing the interests of small farmers and workmen. Returning to Nininger City, he edited a liberal weekly, the *Anti-Monopolist,* in which he attacked bankers and financiers, whom he regarded as public enemies. His first and most popular book was *Atlantis* (1882), which traced the origin of civilization to the legendary submerged continent of Atlantis. It was followed in 1883 by another work of speculation, *Ragnarok: The Age of Fire and Gravel,* which attempted to relate certain gravel and till deposits to an ancient near-collision of the Earth and a huge comet. In *The Great Cryptogram* (1888) and *The Cipher in the Plays and on the Tombstone* (1899), he attempted to prove that Bacon was the author of the plays attributed to Shakespeare by deciphering a code he discovered in Shakespeare's works. His deciphering also led him to ascribe the plays of Marlowe and the essays of Montaigne to Bacon. Donnelly's utopian novel *Caesar's Column* (1891), which predicted such developments as radio, television, and poison gas, portrays the United States in 1988 ruled by a ruthless financial oligarchy and peopled by an abject working class. It enhanced Donnelly's reputation with the Populist Party, which represented the discontented farmers of the West and which he helped found in 1892. At the time of his death, he was vice presidential candidate of a splinter party, the Middle Road Populists.

Donner, Georg Raphael (b. May 24, 1693, Esslingen, Austria—d. Feb. 15, 1741, Vienna), sculptor whose works marked the transition from the Baroque to the Neoclassical style.

In Heiligenkreutz in his youth to take holy orders, Donner met the sculptor Giovanni Giuliani and was encouraged to take up sculpture, working in Giuliani's studio and later entering the Vienna Academy. He lived in Salzburg for some years, later returning to Vienna, where he produced his masterpiece, the "Providence Fountain" on the Neuer Markt (New Market; 1738–39). The figures originally cast in lead, a technique favoured by

the artist, were replaced in 1873 by copies in bronze. Other Donner works are the Perseus and Andromeda fountain in the courtyard of the Vienna Rathaus and a statue of Emperor Charles VI in the Belvedere, Vienna. The refined form and clear outline of his sculpture contrasted with the exaggerated Baroque style of his contemporaries and predecessors and influenced his followers to adopt more classical conceptions.

Bronze figure from the Neuer Markt fountain, Vienna, by Georg Raphael Donner, 1739; in the Österreichische Galerie, Vienna

By courtesy of the Osterreichische Galerie, Vienna; photograph, Photo Meyer

Donner Pass, pass, in the Sierra Nevada of northern California, U.S., at an altitude of 7,085 ft (2,160 m), 35 mi (56 km) west-southwest of Reno, Nev. During the winter of 1846–47, George and Jacob Donner lost almost half of a party of more than 80 immigrants when they tried to cross the pass en route to the Sacramento Valley. The party was blocked by snow in the Sierra Nevada and, when their food ran out, some survived by eating the corpses of their fallen companions. The pass now represents the most important transmontane route (rail and highway) connecting San Francisco with Reno. It lies within the Tahoe National Forest, and Donner Memorial State Park is nearby.

Dono, Paolo di (Florentine painter): *see* Uccello, Paolo.

Donoso, José (b. Oct. 5, 1924, Santiago de Chile), Chilean novelist and short-story writer important in the development of the Latin American new novel.

After studying at the Pedagogical Institute of Santiago for three years, he completed his studies at Princeton University, where he received the B.A. degree in 1951. He taught at the Catholic University of Chile and the University of Chile in the 1950s and toward the end of the decade began to work as a journalist. After lecturing at the University of Iowa (1965–1967) he took up residence in Spain. His short-story collection *Veraneo y otros cuentos* ("Summer Vacation and Other Stories") was published in 1955. The short-story collection *El charleston* (*Charleston and Other Stories,* 1977) appeared in 1960.

Donoso's first novel, *Coronación* (1957; *Coronation,* 1965), established his reputation at home and abroad, and won him the William Faulkner Foundation Prize in 1962. The novel presents the moral collapse of an aristocratic family and suggests that an insidious loss of values is prevalent in all sectors of society. Donoso's second and third novels, *Este domingo* (1966; *This Sunday,* 1967) and *El lugar sin límites* (1966; *Hell Has No Limits,* 1972), depicted characters barely able to subsist in an atmosphere of desolation and anguish.

Donoso's masterpiece, *El obsceno pajaro de la noche* (1970; *The Obscene Bird of Night,* 1973), made him world famous. In it he presented a hallucinatory, often grotesque, world, and captured the fears, frustrations, dreams, and obsessions of his characters with profound psychological insight. *Historia personal del "boom"* (1972; *The Boom in Spanish American Literature: A Personal History,* 1977) is a series of essays interpreting the phenomenal success of the new Latin American novel. In the novella collection *Tres novelitas burguesas* (1973; "Three Bourgeois Novellas"; Eng. trans. *Sacred Families,* 1977) he employs fantastic elements to shed light on previously treated themes and situations. The novel *Casa de Campo* (1978; *A House in the Country,* 1984) examines in a Surrealist style the breakdown of social order in post-colonial Latin America.

Donoughmore Commission, committee sent by the British government to Ceylon in 1927 to examine the Ceylonese constitution and to make recommendations for its revision. The commission's recommendations, reluctantly accepted by Ceylonese political leaders, served as the basis for the new constitution of 1931.

Two of the most important reforms that were suggested concerned elections and electorates. The previous communal electorates, which had been intended to safeguard the rights of minority groups in Ceylon, were abolished. In their place territorial constituencies were substituted, on the grounds that the continued existence of communal electorates would encourage a spirit of divisiveness among the Ceylonese people. The minority groups were unhappy with this change. One of these groups, the Tamils, boycotted the first elections under the new constitution.

The new constitution also extended the franchise to all adults, with only a residence qualification (in order to exclude the many Indian migrant labourers in Ceylon). The middle-class Ceylonese political leaders were opposed to this provision, but the British felt that it would encourage these very leaders to pay more attention to the needs of the people. The third group of recommendations concerned the nature of the representative institutions to be established. An assembly, or state council (composed of territorially elected members), with both legislative and executive powers was established. This assembly was to have significant financial and revenue powers; but a number of important executive functions, such as management of the public service, defense, foreign affairs, and the administration of justice, were to be performed by three British officials nominated by the governor of Ceylon. Further, the governor was given wide veto powers over decisions of the assembly, although he was expected to use them with discretion. The new constitution, which endured until 1946, proved unsatisfactory to the Ceylonese and was, for its duration, the object of constant criticism.

Donovan, William J(oseph), byname WILD BILL DONOVAN (b. Jan. 1, 1883, Buffalo, N.Y., U.S.—d. Feb. 8, 1959, Washington, D.C.), American lawyer, soldier, and diplomat who directed (1942–45) the U.S. Office of Strategic Services (OSS) during World War II.

Donovan began the practice of law in Buffalo in 1907. In 1916 he served in the New York National Guard on the Mexican border and in World War I he was in France with the 165th Infantry Regiment (formerly the celebrated New York 69th). He advanced to the rank of colonel and was awarded the Congressional Medal of Honor. In 1922 he was appointed U.S. district attorney for western New York. He served as assistant attorney general in the Justice Department from 1924 to 1929. During the 1930s he returned to the practice of law but maintained his political connections both in the United States and abroad. Pres. Franklin D. Roosevelt, in 1940–41, asked Donovan to draft plans for the creation of a central intelligence service for the United States. Donovan was appointed coordinator of information on July 11, 1941. On June 13, 1942, he was named chief of the newly created OSS. This military agency was charged with collecting foreign intelligence and carrying out counterpropaganda and covert action operations; it conducted operations throughout the world, except for Latin America and Gen. Douglas MacArthur's Pacific command, and was most active in Europe.

Donovan was made a brigadier general in 1943. Although he was foremost among the advocates of a peacetime central intelligence service, he declined any role in the Central Intelligence Agency (CIA), which was created in 1947. He served as U.S. ambassador to Thailand in 1953–54.

Donus, also spelled DOMNUS (b. Rome—d. April 11, 678, Rome), pope from 676 to 678. Elected (August 676) to succeed Adeodatus II, Donus ended a schism created by Archbishop Maurus of Ravenna (whose plan was to make Ravenna ecclesiastically independent) by receiving the obedience of Maurus' successor Reparatus. Donus is said to have dispersed the Monasterium Boetianum, a monastery of Syrian Nestorians. Noted for his restoration of churches, he was buried in St. Peter's.

Dooārs (India): *see* Duārs.

doodle, absent-minded scrawl or scribble, usually executed in some unexpected place, such as the margin of a book or manuscript or a blotting pad when the doodler is preoccupied with some other activity, such as attending a meeting or lecture. The word is supposed to have gained currency because of its use in the film *Mr. Deeds Goes to Town* (1936), though the practice of course is much older, doodles being found in medieval manuscripts, as well as in the notebooks of Leonardo da Vinci and on the margins of manuscripts written by Fyodor Dostoyevsky.

The increasing preoccupation in the 20th century with manifestations of the unconscious and the desire to interpret them both as art forms and as clues to the nature of personality have led to considerable interest in doodles. The Surrealist method of automatic drawing was used by Max Ernst, Salvador Dalí, and André Masson, and Jackson Pollock, an Abstract Expressionist, did a series of drawings that were used as an element in his psychoanalysis. *See also* graffito.

Dooley, Thomas Anthony (b. Jan. 17, 1927, St. Louis, Mo.—d. Jan. 18, 1961, New York City), "jungle doctor" whose lectures and books recounted his efforts to supply medical aid to peoples of less developed countries, mainly in Southeast Asia.

A graduate of St. Louis University medical school (M.D. 1953), he was serving with the U.S. Navy as a medical officer when the end of French rule in Indochina in 1954 resulted in of an independent but divided Vietnam. Volunteering for duty in the American effort to evacuate refugees from North to South Vietnam, Dooley instituted rigorous public-health measures and organized the processing of more than 600,000 Vietnamese for evacuation between September 1954 and May 1955.

He published a popular account of the operation, *Deliver Us from Evil* (1956), and left active service to lecture in the United States. He

used proceeds from lectures and book sales to establish a small hospital in Nam Tha, northern Laos. After another American lecture tour and the publication of *The Edge of Tomorrow* (1958), Dooley helped found the Medical International Corporation (Medico) to provide medical teams and hospital facilities in eight less developed nations, most of them in Southeast Asia.

Dooley was highly regarded in the United States, but some of his colleagues in Asia regarded him as an egotist who allowed medical services to deteriorate while he engaged in self-promotion. He wrote *The Night They Burned the Mountain* (1960) to answer such criticism. He returned to Laos from the United States after surgery for a malignant tumour in 1959, but he did not survive a recurrence of the illness.

Doolin, Bill, byname of WILLIAM DOOLIN (b. 1863—d. 1896, Oklahoma, U.S.), Western outlaw who led a gang through robberies in Oklahoma and east Texas, 1892–95.

A member of the Dalton brothers (*q.v.*) gang, he alone missed the bloody ambush of the Coffeyville, Kan., bank robbery; his horse had pulled lame long before reaching town. Thereafter, he built his own gang, robbing stagecoaches, banks, and trains. One by one, lawmen tracked the members down. Doolin, escaping arrest in 1895, tried to retire to a small Oklahoma farm; the next year he was discovered by Marshal Heck Thompson and shotgunned to death.

Doolittle, Hilda, byname H.D. (b. Sept. 10, 1886, Bethlehem, Pa., U.S.—d. Sept. 27, 1961, Zürich), American poet, known initially as an Imagist. She was also a translator, novelist-playwright, and self-proclaimed "pagan mystic."

Doolittle's father was an astronomer at the University of Pennsylvania, and she was reared in the strict Moravian tradition of her mother's family. She went to Europe in 1911, and she remained abroad, except for brief visits, for the remainder of her life. William Carlos Williams was an early acquaintance, and, while at Bryn Mawr in 1905–06, she met and, for a brief time, became engaged to Ezra Pound. She was married to Richard Aldington from 1913 to 1938. Her friends included D.H. Lawrence, Marianne Moore, T.S. Eliot, Amy Lowell, the Sitwells, and Bryher (Winifred Ellerman), with whom she had a lifelong association.

H.D.'s first book of poetry, *Sea Garden* (1916), was followed by *Hymen* (1921), *Heliodora and Other Poems* (1924), *Red Roses for Bronze* (1929), and *Trilogy* (1944–46). The *Collected Poems of H.D.* (1925 and 1940), *Selected Poems of H.D.* (1957), and *Collected Poems 1912–1944* (1983) secured her position as a major 20th-century poet. She won additional acclaim for her translations (*Choruses from the Iphigeneia in Aulis and the Hippolytus of Euripides* [1919] and *Euripides' Ion* [1937]), for her verse drama (*Hippolytus Temporizes* [1927]), and for such prose works as *Palimpsest* (1926), *Hedylus* (1928), and *The Gift* (1982). Several of her books were autobiographical—including *Bid Me to Live* (1960), *Tribute to Freud* (1974), and *End to Torment* (1979).

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Doolittle, James H(arold), byname JIMMY DOOLITTLE (b. Dec. 14, 1896, Alameda, Calif., U.S.), American aviator and army general who led a strike force of 16 B-25 bombers in a raid on Tokyo just four months after the Japanese attack on Pearl Harbor.

Doolittle was reared in California and Alaska and educated at Los Angeles Junior College (1914–16) and the University of California School of Mines (1916–17). As an army enlistee during World War I, he became an expert aviator and flight instructor. He stayed in the Army Air Corps after the war, was promoted to first lieutenant in 1920, and also studied at the Massachusetts Institute of Technology (Cambridge, Mass.), where in 1925 he received a doctorate in advanced engineering.

Doolittle remained in the Army Air Corps until 1930, demonstrating, testing, and racing aircraft. Upon resigning his commission, he took charge of the aviation department of the Shell Oil Company. While serving as a consultant to the government and the military, he continued to race aircraft, setting a world high-speed record in 1932.

With the outbreak of World War II, Doolittle returned to active duty in the Army Air Force. On April 18, 1942, he commanded a bombing mission that began on the deck of the aircraft carrier *Hornet*. Sixteen B-25s struck Tokyo, Yokohama, and other Japanese cities. The planes then proceeded westward, and most of the crews arrived safely behind friendly lines on the Chinese mainland. While the raid had no decisive strategic effect on the war, it greatly bolstered U.S. morale.

Doolittle, by then a brigadier general, received the Congressional Medal of Honor for his execution of the raid and, soon afterward, promotion to major general. He continued to lead air operations during the war, on the European, North African, and Pacific fronts, winning promotion to lieutenant general in 1944. He commanded the 8th Air Force in its attacks on Germany during 1944–45. After the war he returned to Shell Oil and to many advisory positions in both the public and private sectors. In retirement after 1959, Doolittle remained active in the aerospace industry.

Doon DE MAYENCE, hero baron of the medieval epic poems in Old French known as *chansons de geste,* which together form the core of the Charlemagne legends. Doon's story is told in a chanson belonging to a cycle called, after him, *Geste de Doon de Mayence.* This cycle tells of Charlemagne's rebellious barons and contains the stories of heroes such as Girart de Roussillon, Raoul de Cambrai, Renaud de Montauban, and Ogier the Dane, all of whom are represented as opposing Charlemagne (though the Emperor's name is probably often used to stand for his weaker successor, Louis). The chanson dealing with Doon himself first gives a romantic account of his childhood; the second half, describing his wars in Saxony, may have a historical basis.

door, barrier of wood, stone, metal, glass, paper, leaves, hides, or a combination of materials, installed to swing, fold, slide, or roll in order to close an opening to a room or building. Early doors, used throughout Mesopotamia and the ancient world, were merely hides or textiles. Doors of rigid, permanent materials appeared simultaneously with monumental architecture. Doors that opened onto important chambers were often made of stone or bronze.

Stone doors, usually hung on pivots, top and bottom, were often used on tombs. A marble, paneled example, probably from the time of Augustus, was found at Pompeii; a Greek door (*c.* AD 200) from a tomb at Langaza, Tur., has been preserved in the museum at Istanbul.

The use of monumental bronze doors is a tradition that has persisted into the 20th century. The portals of Greek temples were often fitted with cast-bronze grills; the Romans characteristically used solid bronze, double doors. They were usually supported by pivots fitted into sockets in the threshold and lintel. The earliest large examples are the 24-foot (7.3-metre) double doors of the Roman Pantheon. The Roman paneled design and mounting technique continued in Byzantine and Romanesque architecture. The art of casting doors was preserved in the Eastern Empire, the most notable example being double doors (*c.* 838) of the Hagia Sophia cathedral in Constantinople (now Istanbul). In the 11th century bronze castings from Constantinople were imported into southern Italy. Bronze doors were introduced into northern Europe when Charlemagne installed a Byzantine pair (cast *c.* 804) for the cathedral at Aachen. The first bronze doors to be cast in one piece in northern Europe were made for the cathedral of Hildesheim (*c.* 1015). They were designed with a series of panels in relief, establishing a sculptural tradition of historical narrative that distinguishes Romanesque and, later, bronze doors.

Hollow casting of relief panels was revived in the 12th century in southern Italy, notably by Barisanus of Trani (cathedral doors, 1175), and carried northward by artists such as Bonanno of Pisa. In 14th-century Tuscany the principal examples are the pairs of sculptured, paneled bronze doors on the Florentine Baptistery; the Gothic south doors (1330–36) are by Andrea Pisano, and the north doors (1403–24) by Lorenzo Ghiberti. Ghiberti's east doors (1425–52) have come to be known as the "Gates of Paradise" ("Porta del Paradiso"). Bronze doors with relief panels by Antonio Filarete were cast for St. Peter's, Rome. Bronze doors were not generally used in northwestern Europe until the 18th century. The first monumental bronze doors in the United States were erected in 1863 in the Capitol at Washington, D.C.

The wooden door was doubtless the most common in antiquity. Archaeological and literary evidence indicate its prevalence in Egypt and Mesopotamia. According to Pompeiian murals and surviving fragments, contemporary doors looked much like modern wood-paneled doors; they were constructed of stiles (vertical beams) and rails (horizontal beams) framed together to support panels and occasionally equipped with locks and hinges. This Roman type of door was adopted in Islāmic countries. In China and Japan the wooden door usually consisted of two panels, the lower one solid and the upper one a wooden lattice backed with paper.

The typical Western medieval door was constructed of vertical planks backed with horizontals or diagonal bracing. It was strengthened with long iron hinges and studded with nails. In domestic architecture, interior double doors appeared in Italy in the 15th century and subsequently in the rest of Europe and the American colonies. The paneled effect was simplified until, in the 20th century, a single, hollow-core, flush panel door has become most common.

There are, however, several types of specialized modern doors. The louvered (or blind) door and the screen door have been used primarily in the United States. The Dutch door, a door cut in two near the middle, allowing the upper half to open while the lower half remains closed, descends from a traditional Flemish-Dutch type. The half door, being approximately half height and hung near the centre of the doorway, was especially popular in the 19th-century American West.

Glazed doors, dating from the 17th century, first appeared as window casements extended to the floor. French doors (double glazed) were incorporated into English and American architecture in the late 17th and 18th centuries. At about this time, the French developed the mirrored door.

Other types of 19th- and 20th-century innovations include the revolving door, the folding door, the sliding door inspired by the Japanese shoji, the canopy door (pivoting at the top of

the frame), and the rolling door (of tambour-like construction), also opening to the top.

Door Peninsula, body of land, northeastern Wisconsin, U.S., between Green Bay and Lake Michigan. About 80 miles (130 km) long and 25 miles (40 km) wide at its base and tapering northward to a point, it is crossed east–west by a waterway at Sturgeon Bay. The peninsula includes Door county (formed 1851), comprising the northern area, Kewaunee (1852), and parts of Brown (1818) and Manitowoc (1836) counties at the base. Communities on the peninsula include Egg Harbor, Ellison Bay, Jacksonport, Baileys Harbor (oldest village in Door county, founded 1851), Ephraim, Fish Creek, Sister Bay, Sturgeon Bay, and Washington (on Washington Island, off the tip of the peninsula).

Door Peninsula, which was visited in the 17th century by French traders and missionaries, now is a year-round vacation area. Cherry-growing and tourism are the major industries. At the tip of the peninsula between Washington Island and the peninsula is a hazardous strait known as La Porte des Mortes (French: "Death's Door"), whence the name of Door county and Door Peninsula.

Consult the INDEX *first*

Doorman, Karel (Willem Frederik Marie) (b. April 23, 1889, Utrecht, Neth.—d. Feb. 27, 1942, Java Sea), Dutch rear admiral who commanded a combined American, British, Dutch, and Australian (ABDA) naval force on a virtual suicide mission in World War II. Its purpose was to halt the Japanese naval invasion of the Netherlands East Indies.

A navy officer since 1910, Doorman served first in the Netherlands East Indies; during and after World War I, he helped develop the Dutch naval air force. Returning to the East Indies in 1937 as commander of the naval air force, in 1940 he became commander of the entire Dutch fleet in the East Indies. On Feb. 25, 1942, he was appointed tactical commander of the combined ABDA fleet that was ordered by ABDA commander General Sir Archibald P. Wavell to defend the Java Sea against the Japanese invasion fleet. Though greatly outnumbered, his 13-ship fleet sank many Japanese ships in a futile attempt to stop the invasion of Java. Allied naval resistance collapsed, however, when he went down with his flagship, *De Ruyter*. His rallying cry, "Ik val aan, volgt mij" ("I attack, follow me," sometimes given as "All ships follow me"), served as a battle slogan during the remainder of World War II.

Doornik (Belgium): *see* Tournai.

doorstop, usually decorative and invariably heavy object used to prevent doors from swinging shut. Doorstops came into use about 1775 following the introduction of the rising butt, a type of door hinge designed to close a door automatically. Many took the form of figures of famous persons, such as Napoleon, Shakespeare, Wellington, Gladstone, and Disraeli. Animal forms were also popular.

The most common material used for making doorstops was metal, generally cast with a flat, normally hollow, back, but in some early examples cast in the round. Brass, usually lacquered, was popular until about 1850. Cast-iron stops were made from about 1820, and soon production in this material reached large proportions, paint or a bronzed finish being the usual decoration. A handle or some other means of lifting the stop easily were commonly incorporated in the design. Also known are doorstops in earthenware and a few in glass made in Bristol.

dopamine, also called HYDROXYTYRAMINE, a nitrogen-containing organic compound formed as an intermediate compound from dihydroxyphenylalanine (dopa) during the metabolism of the amino acid tyrosine. It is the precursor of the hormones epinephrine and norepinephrine. Dopamine also functions as a neurotransmitter—primarily by inhibiting the transmission of nerve impulses—in the substantia nigra, basal ganglia, and copus striatum of the brain. A deficiency of dopamine results in Parkinson's disease (*q.v.*).

dopant, any impurity deliberately added to a semiconductor for the purpose of modifying its electrical conductivity. The most commonly used semiconductors are the elements silicon and germanium, which form crystalline lattices in which each atom shares one electron with each of its four nearest neighbours. If a small proportion of the atoms in such a lattice is replaced by atoms such as phosphorus or arsenic, which have five electrons available for bond formation, the extra electron of each foreign atom becomes available for electrical conduction; the semiconductor is said to be doped with phosphorus or arsenic, which are called donor atoms; and the semiconductor is classed as *n*-type (*n* for negative, because the charge carriers are electrons, which are negatively charged particles).

Doping with atoms such as gallium, which has only three electrons available, creates a positively charged defect, or hole, in the bonding arrangement. Conduction can occur by migration of the positively charged site through the crystal lattice, and a semiconductor doped with an atom of this type, an acceptor atom, is called *p*-type.

doppelgänger (German: "double goer"), in German folklore, a wraith or apparition of a living person, as distinguished from a ghost. The concept of the existence of a spirit double, an exact but usually invisible replica of

Doppelgänger theme shown in "How They Met Themselves," oil painting by Dante Gabriel Rossetti; in the Fitzwilliam Museum, Cambridge, Cambridgeshire

By courtesy of the Syndics of the Fitzwilliam Museum, Cambridge, Cambridgeshire

every man, bird, or beast, is an ancient and widespread belief. To meet one's double is a sign that one's death is imminent. The doppelgänger became a popular symbol of horror literature, and the theme took on considerable complexity. In *The Double* (1846), by Fyodor Dostoyevsky, for example, a poor clerk, Golyadkin, driven to madness by poverty and unrequited love, beholds his own wraith, who succeeds in everything at which Golyadkin has failed. Finally the wraith succeeds in disposing of his original. An earlier, well-known story of a doppelgänger appears in the novel *Die Elixiere des Teufels,* 2 vol. (1815–16; "The Devil's Elixir"), by the German writer of fantastic tales E.T.A. Hoffmann.

Doppler, Christian (b. Nov. 29, 1803, Salzburg, Austria—d. March 17, 1853, Venice), Austrian physicist who first described how the observed frequency of light and sound waves is affected by the relative motion of the source and the detector. This phenomenon became known as the Doppler effect.

Educated at the Polytechnical Institute in Vienna, Doppler became director of the Physical Institute and professor of experimental physics of the University of Vienna in 1850. His earliest writings were on mathematics, but in 1842 he published *Über das farbige Licht*

Doppler, lithograph by Franz Sir after a drawing by Anton Machek

By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

der Doppelsterne ("Concerning the Coloured Light of Double Stars"), which contained his first statement of the Doppler effect. He theorized that since the pitch of sound from a moving source varies for a stationary observer, the colour of the light from a star should alter, according to the star's velocity relative to Earth.

Doppler effect, the apparent difference between the frequency at which sound or light waves leave a source and that at which they reach an observer, caused by relative motion of the observer and the wave source. This phenomenon is used in astronomical measurements, in Mössbauer effect studies, and in radar and modern navigation. It was first described (1842) by Austrian physicist Christian Doppler.

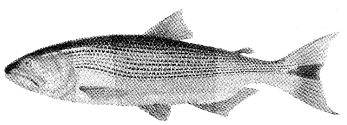
The following is an example of the Doppler effect: as one approaches a blowing horn, the perceived pitch is higher until the horn is reached and then becomes lower as the horn is passed. Similarly, the light from a star, observed from the Earth, shifts toward the red end of the spectrum (lower frequency or longer wavelength) if the Earth and star are receding from each other and toward the violet (higher frequency or shorter wavelength) if they are approaching each other. The Doppler effect is used in studying the motion of stars and to search for double stars and is an integral part of modern theories of the universe. *See also* red shift.

Dor, also spelled DORA, modern settlement and ancient port in northwestern Israel, on the Mediterranean coast, south of Haifa. Ancient Dor was a strategic site on the Via Maris, the historic road that ran largely along the Palestine coast. Ruins found at the site date back to the Late Bronze Age (1500–1200 BC), and Dor is mentioned in Egyptian texts of the 11th century. It was an administrative division (Hebrew *napha,* or *nafa*) of Solomon's kingdom under the governorship of his son-in-law, Ben-abinadab (1 Kings 4:11). Passing to the northern Kingdom of Israel after Solomon's death, it was taken by the Assyrians (8th century), and later by the Persians; it was a possession of Ashmanezer, king of Sidon, a

Persian vassal. During the Hasmonean revolt, the city (the name of which had been Hellenized to Dora) was besieged by the Seleucid king Antiochus VII Sidetes (reigned 139/138–129 BC; I Maccabees 15:12–13, 25). Pompey took Dor in 64 BC and gave it civic autonomy. In ancient and classical times, Murex snails were hunted there for making the famous Tyrian purple dye. The port was rebuilt by the crusaders, who called it Chateau de Merle, but it was destroyed in 1291 after the Mamlūk conquest from Egypt.

The site was excavated in the 1920s and again in the 1950s; the ruins of the ancient harbour, amphitheatre, parts of a Byzantine church (6th century AD), and the crusader fort can be seen. The Arab village of Ṭanṭūra on the site was taken by the Israel Defense Forces in May 1948; the modern Israeli settlement of Dor was established there the following year by Greek-Jewish immigrants. Just north is the kibbutz of Naḥsholim, settled in 1948. Offshore are three rocky islets constituting an Israeli nature reserve. The Dor coast, with its fine beaches and hot springs, was developed as a tourist site. Pop. (1983) 177.

dorado (*Salminus maxillosus*), powerful game fish of the characin family, Characidae, found in South American rivers. The dorado is golden, with red fins and with lengthwise rows of dots on its body, and superficially resembles a salmon. It reaches a length of about 1



Dorado (*Salminus maxillosus*)

Painted especially for *Encyclopaedia Britannica* by Tom Dolan, under the supervision of Loren P. Woods, Chicago Natural History Museum

m (39 inches) and a weight of more than 18 kg (40 pounds).

The name dorado (Spanish for "golden") is sometimes given to related species of *Salminus;* it is also another name for the dolphin and for oceanic fish of the family Coryphaenidae.

Dorat, Jean, Dorat also spelled DAURAT, Latin AURATUS (b. 1508, Le Dorat, near Limoges, Fr.—d. Nov. 1, 1588, Paris), French humanist, a brilliant Hellenist, one of the po-

Dorat, detail of a drawing by an unknown artist; in the Bibliothèque Nationale, Paris

Giraudon—Art Resource/EB Inc.

ets of the Pléiade, and their mentor for many years.

Dorat belonged to a noble family; after studying at the Collège de Limoges, he became tutor to the pages of Francis I. He tutored Jean-Antoine de Baïf, whose father he succeeded as director of the Collège de Coqueret. There, besides Baïf, his pupils included Pierre de Ronsard, Rémy Belleau, and Pontus de Tyard. Joachim du Bellay was added to this group by Ronsard, and these five young poets, under the direction of Dorat, formed a society for the reform of French language and literature. They increased their number to seven with the dramatist Étienne Jodelle and named themselves La Pléiade, in emulation of the seven Greek poets of Alexandria. The election of Dorat as their president proved his personal influence, but as a writer of French verse he is the least important of the seven.

Dorat stimulated his students to intensive study of Greek and Latin poetry, while he himself wrote incessantly in both languages. He is said to have composed more than 15,000 Greek and Latin verses.

His influence and fame as a scholar extended to England, Italy, and Germany. In 1556 he was appointed professor of Greek at the Collège Royal, a post that he held until he retired in 1567. He published a collection of the best of his Greek and Latin verse in 1586.

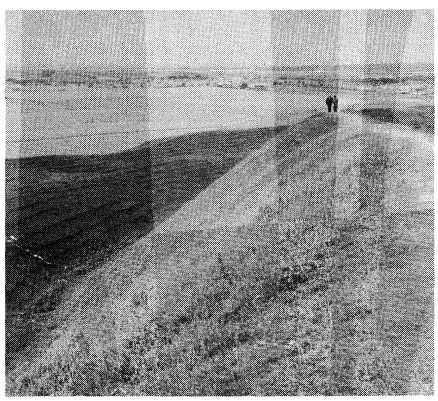
Dorati, Antal (b. April 9, 1906, Budapest—d. Nov. 13, 1988, Gerzensee, near Bern, Switz.), Hungarian-born American conductor notable for his promotion of 20th-century music, particularly that of Béla Bartók.

The son of musicians, he entered at age 14 the Liszt Academy in Budapest, where he studied with Bartók, Zoltán Kodály, and Leo Weiner. He read philosophy at Vienna University and upon graduation became a private coach at the Budapest Royal Opera. His conducting debut took place there in 1924. In 1928 he became assistant conductor of the Dresden Opera and in 1929 became musical director at Münster Opera. From 1933 to 1941 he conducted and toured extensively with the Ballets Russes de Monte Carlo.

After his American debut in 1937 with the National Symphony of Washington, D.C., Dorati developed a marked ability to build and reorganize orchestras. From 1941 to 1945 he was music director of the newly formed American Ballet Theater. He went on to conduct the Dallas Symphony Orchestra (1945–49), the Minneapolis Symphony Orchestra (1949–60), the BBC Symphony Orchestra (1963–66), the Stockholm Philharmonic (1966–70), the Washington National Symphony (1970–77), the Royal Philharmonic Orchestra (1975–78), and the Detroit Symphony Orchestra (1977–81). He became an American citizen in 1947. Dorati's many recordings include the complete Joseph Haydn symphonies (with the Philharmonia Hungarica). Throughout his career he broadened his orchestra's repertoires, promoting modern music and commissioning new works. *Notes of Seven Decades,* his autobiography, was published in 1979.

Dorchester, town ("parish"), West Dorset district, county of Dorset, England, on the River Frome.

The ancient town (then known as Durnovaria) was a sizable Roman British centre, and many remains of the period (including mosaics and ruined villas) have been found. In the south, an amphitheatre at Maumbury Rings dates from pre-Roman times; Maiden Castle (2 miles [3 km] southwest), a vast earthwork encircled by entrenchments and ramparts and occupying more than 120 acres (50 hectares), was the site of important settlement from Neolithic times into the Iron Age.



Trench and rampart of Maiden Castle, southwest of Dorchester, Dorset, England

The J. Allan Cash Photolibrary

As early as the 10th century, the town had a mint. By 1086 it was a royal borough, and a castle had been built by the 12th century; the Franciscan priory, founded before 1331, is thought to have been constructed from its ruins. The first charter of incorporation was dated 1610. In 1834 the Tolpuddle martyrs were sentenced in the town for administering illegal oaths concerning trade union activities. The writer Thomas Hardy was born near Dorchester, the "Casterbridge" of his Wessex novels.

The cloth industry flourished in the 16th century, and serge was manufactured in the 17th. The town has been noted for its ale since the 1600s. Dorchester now functions as a market town and serves an extensive rural area. Agricultural machinery, printing, and leatherworking are local specialities. Pop. (1981) 14,225.

Dorchester (of Dorchester), Guy Carleton, 1st Baron (b. Sept. 3, 1724, Strabane, County Tyrone, Ire.—d. Nov. 10, 1808, Stubbings, Berkshire, Eng.), soldier-statesman who, as governor of Quebec before and during the American Revolutionary War, succeeded in reconciling the British and French and in repulsing the invasion attempts of Continental forces.

Carleton was commissioned an ensign in the British army in 1742, becoming a lieutenant colonel in 1757. Two years later he took part in the expedition against Quebec as quartermaster general under General James Wolfe; he was wounded at the Battle of the Plains of Abraham. After two years as lieutenant governor of the province of Quebec, Carleton became governor (1768–78). His conciliatory policy toward the French-Canadian landowners and clergy was confirmed by the British Parliament's enactment of the Quebec Act of 1774, which, though it postponed the advent of representative government in Quebec, later formed the basis for the French-Canadians' political and religious rights.

After helping to repel the Continental Army's invasion of Canada (1775–76), Carleton had a disagreement with the secretary of state for the colonies and retired. Four years later (in 1782) he was appointed commander in chief of British forces in North America. As governor in chief of British North America (1786–96), he promoted the Constitution Act of 1791, which helped develop representative institutions in Canada at a time when the French Revolution was threatening governments elsewhere. He retired to private life in England in 1796. He had been knighted in 1779 and created a baron in 1786.

Dordogne, *département,* Aquitaine *région,* southwestern France, created chiefly from the ancient *pays* (district) of Périgord. It has an area of 3,498 square miles (9,060 square km) and essentially comprises the limestone plateaus of the Petits Causses that rise gradually to the northeast where they meet the last outliers of the Massif Central at an elevation of about 1,300 feet (400 m). The valleys of the rivers flowing out of these highlands widen gradually as they descend to the west. The seven rivers of Dordogne, including the Isle, which crosses it from northeast to southwest, and the Dordogne, which gives it its name, have scenic valleys that support the cultivation of wheat, corn (maize), potatoes, tobacco, and fruit. Chestnut and oak predominate in its forests, and walnuts, about one-third of France's output, are grown extensively for oil. The climate in the valleys is mild and humid but more rigorous in the east.

The valley of the Vézère, in the southeast, is one of the earliest known cradles of human habitation. Caves at Les Eyzies-de-Tayac and Lascaux contain some of the world's best prehistoric drawings and paintings, although their preservation is now in question because of algal growth on the paintings resulting from the installation of lights for tourists. The number of châteaus—about 1,000—exceeds that of any other *département.* Many date from the 13th and 14th centuries, when the Dordogne was the frontier region in the wars between England and France. Medieval towns, including Périgueux (*q.v.*), the capital, Sarlat, and Brantôme, are among the most picturesque in France. The area is a centre of tourism and gastronomy (*e.g.,* the truffles of Périgord, the pâté de foie gras). There is some light industry (wood, paper, shoes) in the towns. The *département* is divided into four *arrondissements*—Périgueux, Bergerac, Nontron, and Sarlat—and is in the educational division of Bordeaux. Pop. (1982) 377,356.

Dordogne River, river in southwestern France, rising in the Massif Central and flowing west for 293 mi (472 km) to Bec d'Ambès, north of Bordeaux, where it unites with the Garonne to form the Gironde Estuary; its drainage basin is about 9,300 sq mi (24,000 sq km). Its headwaters, rising at a height of more than 5,600 ft (1,700 m) on the Puy de Sancy, are formed by the Dore and Dognon rivers. After a torrential descent the Dordogne flows through the spa resorts of Le Mont Dore and La Bourboule, in the Puy de Dôme *département.* After passing through the Avèze gorges, the river forms a lake 11 mi (18 km) long above the hydroelectric dam of Bort. It is dammed again four more times as it flows through the Dordogne gorges to Argentat (Corrèze *département*), below which it is joined by a number of tributaries. Skirting Souillac (Lot *département*), it traverses the Dordogne *département,* where it receives the Vézère, on the banks of which are Montignac, Lascaux, and Les Eyzies-de-Tayac (famous for their prehistoric caves, which with other caves have become a classic ground for the study of Paleolithic man). Entering the Gironde *département,* the Dordogne receives the Isle at Libourne before flowing northwest to join the Garonne. There is much river traffic along the last 112 mi of its course.

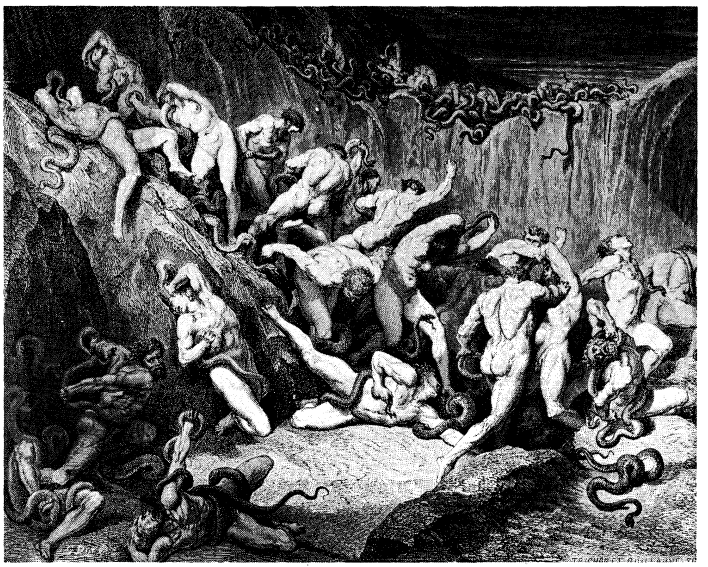
Dordrecht, also called DORT, or DORDT, *gemeente* (municipality), Zuidholland *provincie* (province), southwestern Netherlands, at the divergence of the Merwede, Noord, Oude Maas (Old Meuse), and Dordtse Kil rivers. Founded in 1008, it was the residence of the counts of Holland until 1203 and was first chartered in 1220. It was fortified in 1271, and, although severely damaged by flood in 1421, it was one of the most prosperous medieval ports in the Netherlands until it was surpassed by Rotterdam and Amsterdam. In 1572 it was captured by the Sea Beggars (Netherlands rebels against Spain) and was the scene of the first assembly of the United Provinces. It was the seat (1618–19) of the important Synod of Dort, an international assembly of the Reformed Church (for which it had declared in 1572).

Many of its medieval houses, courtyards, gates (*e.g.,* Groothoofdspoort), quays, and canals have survived to contrast with spacious modern housing areas. The 14th-century Grote Kerk (Church of Our Lady) has a massive tower, finely carved choir stalls, and a notable pulpit. The 17th-century painters Aelbert Cuyp, Ferdinand Bol, and Nicolaes Maes were born in Dordrecht, and the town museums have collections of paintings by old Dutch masters and local medieval antiquities. Johan de Witt, a 17th-century grand pensionary of Holland, and his brother Cornelis were natives of the town.

Still an active port, with a busy timber trade, Dordrecht has diversified industries that include shipbuilding, metallurgical and chemical works, and a large electric power station. It is also a centre for aquatic sports. Pop. (1983 est.) 107,612; Dordrecht-Zwijndrecht metropolitan area, 198,600.

Doré, (Paul-)Gustave (b. Jan. 6, 1832, Strasbourg, Fr.—d. Jan. 23, 1883, Paris), French printmaker, one of the most prolific and successful book illustrators of the late 19th century, whose exuberant and bizarre fantasy created vast dreamlike scenes widely emulated by Romantic academicians.

In 1847 he went to Paris and from 1848 to 1851 produced weekly lithographic caricatures for the *Journal pour Rire* and several albums of lithographs (1847–54). His later fame rested on his wood-engraved book illustrations. Employing more than 40 woodcutters, he produced over 90 illustrated books. Among his finest were an edition of the *Oeuvres de Rabelais* (1854), *Les Contes drolatiques* of Balzac (1855), the large folio Bible (1866), and the *Inferno* of Dante (1861). He also painted many large compositions of a religious or historical character and had some success as a sculptor; his work in those media, however, lacks the spontaneous vivacity of his illustrations.



Engraving from Dante's *Inferno* by Gustave Doré, 1861
By courtesy of the Bibliotheque Nationale, Paris

Dorgan, Thomas Aloysius, pseudonym TAD (b. April 29, 1877, San Francisco—d. May 2, 1929, Great Neck, N.Y., U.S.), U.S. journalist, boxing authority, and cartoonist.

At an early age he joined the art department of the *San Francisco Bulletin,* where he worked as a cartoonist and comic artist. In 1902 he was employed by William Randolph Hearst, becoming a political cartoonist of the *New York Journal.* Dorgan did not continue as a political cartoonist, however, but began to concentrate his interests on sports, particularly boxing. His sketches of fighters and commentaries were widely syndicated throughout the country, his pen name Tad (the initials of his name) becoming well known.

Dorgan also developed comic-strip characters, such as "Silk Hat Harry" and "Judge Rummy," which he used in his daily cartoons.

Dorgon, temple name (Wade–Giles romanization) CH'ENG-TSUNG, canonized name (Wade–Giles) HUANG-TI (b. Nov. 17, 1612, Yenden, Manchuria—d. Dec. 31, 1650, Kharahotu), prince of the Manchu people of Manchuria who played a major part in founding the Ch'ing (Manchu) dynasty in China. He was the first regent for the first Ch'ing emperor, Shun-chih.

Dorgon was the 14th of the 16 sons of Nurhachi, founder of the Manchu state, who in 1616 proclaimed himself emperor of China but died in 1626 before making good his claim to the Imperial title. Under his successor, Abahai (Nurhachi's eighth son), Dorgon received the title of an Imperial prince, *hosoi beile.* He distinguished himself in the wars against the Chahar Mongols that began in 1628 and was elevated to prince of the first degree (*jui ch'in-wang*). Dorgon commanded one of the two army groups that breached the Great Wall and sacked 40 cities in the Chinese provinces of Hopeh and Shantung during Abahai's campaigns to subjugate China in 1638–39. He also participated in the capture of the cities of Sung-shan and Chin-chou that resulted in a significant expansion of Manchu authority.

On Abahai's death in 1643, Dorgon was nominated his successor but declined, reportedly because of loyalty to the dead emperor. Instead, he and the older prince Jirgalang became regents for Abahai's five-year-old son, Fu-lin. The fact that Dorgon executed two princes when he discovered their plot to put him on the Imperial throne is characteristic of the high moral standards for which he is praised by historians.

When in April 1644 the troops of the Chinese rebel Li Tzu-ch'eng conquered Peking (the capital of China then ruled by the Ming dynasty), Dorgon, on the advice of a Chinese counsellor, led an expeditionary force into China. His former principal enemy, the Chinese general Wu San-kuei, joined forces with him rather than allow Li Tzu-ch'eng to establish his own dynasty, and the combined armies inflicted a heavy defeat on Li Tzu-ch'eng's troops. Dorgon entered Peking in June 1644, but the last Ming emperor had already hanged himself in April. After pursuing the fleeing troops of Li Tzu-ch'eng, Dorgon turned his attention to the stabilization of his administration, prudently enlisting the cooperation of several outstanding Chinese experts. He established Peking as the capital and, adopting many Chinese customs, laid the basis for Manchu rule in China.

The youthful Fu-lin entered Peking on Oct. 19, 1644, and 11 days later was proclaimed emperor (the first of the Ch'ing dynasty) under the name Shun-chih. In 1644 Dorgon subdued the provinces of Shensi, Honan, and Shantung; Kiangnan, Kiangsi, Hopeh, and part of

Chekiang followed in 1645; and the provinces of Szechwan and Fukien were added in 1646. Rebellious Ming troops were pushed back into the southwestern provinces of the country, and Dorgon suppressed revolts of the Mongolian tribes in Central Asia.

He took over the highly developed administrative system of his Chinese predecessors, reengaging Chinese experts and recruiting new civil servants through the proven method of selection and examination. Adam Schall von Bell, a German Jesuit missionary, served him as mathematician, director of the Imperial Board of Astronomy, and adviser on the manufacture of artillery. All these measures contributed to the generally favourable acceptance of the new dynasty, notwithstanding the forcible expropriation of land and the introduction of Manchurian customs, such as the pigtail.

Relegating Prince Jirgalang to the functions of assistant prince regent, Dorgon in 1644 began to gather more and more power in his hands, even venturing to impose humiliations on his nephew Haoge and other imperial princes who opposed him. Receiving the title of imperial father regent in 1648, he personally led the campaign against a rebellious Chinese general in Shansi. He also designed the plans for the construction of his own palaces in Jehol; here he intended to spend his remaining years as feudal overlord, but he died on Dec. 31, 1650, during a hunt at Kharahotun, near the Great Wall. He was posthumously proclaimed emperor and given the temple name of Ch'eng Tsung.

Dorgon's sudden death created confusion and disorder in the empire. Since he had left no male heirs, disturbances broke out, especially among the corps of the white banner unit that had been under his command. Internal shifts on the political scene brought his former enemies to power; they had succeeded in obtaining the promulgation of an imperial decree of March 1651 declaring that Dorgon had been a usurper. He was posthumously deprived of his princely rank, along with other honours; his relationship to the imperial house was disavowed; and a petition of two officials attempting to redeem his reputation was rejected. Only after the Ch'ien-lung emperor, in 1773, honoured Dorgon's services in establishing the new dynasty and restored his neglected grave was Dorgon finally fully rehabilitated. (M.Gi.)

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Doria FAMILY, also spelled D'ORIA, leading family in the political, military, and economic life of Genoa, from the 12th century onward.

Apparently of feudal origin, from Liguria and Provence, the Dorias first appeared in Genoese records early in the 12th century. Ansaldo Doria was elected consul of the commune of Genoa in 1134 and took part in several embassies and military expeditions. His son Simone served six consulships between 1175 and 1188, and one of Simone's sons, Andrea, married into Sardinia's ruling family, the Torres, launching Doria fortunes in that island. By this time the Dorias had long been leaders of the Ghibelline (imperial) political faction.

In 1270 Andrea's grandson Oberto Doria (died 1295) and Oberto Spinola, member of another great Genoese family, inaugurated a series of two-man governments headed by their families, with dictatorial powers as captains of the people. Ruling for 15 years during what has been termed the golden age of the Genoese medieval commune, Oberto Doria was a hero of the decisive Battle of Meloria (1284) against Pisa, in which 250 members of the Doria family are said to have participated.

Members of the Doria family played an important role in the Genoese Crimean colony of Caffa and in the empire of Trebizond, south of the Black Sea. Domenico Doria, traveler and cartographer, was appointed in 1285 by the Mongols as their ambassador to Europe.

In the 14th century several other members of the Doria and Spinola families served as cocaptains of the people. After a popular revolution that led to the institution of a doge, the Dorias were excluded from government office (1339–1528) but provided many military leaders for Genoa in its perennial struggle with Venice.

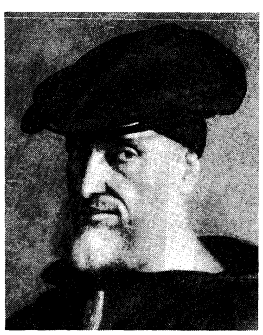
In the 16th century the emergence of the greatest member of the family, Andrea Doria, opened a new period in the history of Genoa and of the Dorias, bringing them once more to the political fore. Giovanni Andrea (1539–1606), Andrea's grandnephew, was his lieutenant and heir, serving as Genoese admiral against the Turks in the War of Cyprus (1570–71). He took part victoriously in the Battle of Lepanto (1571), which ended the threat of Turkish supremacy in the eastern Mediterranean.

In the 16th and 17th centuries the Dorias continued to furnish military men, principally to Spain, while becoming the richest family in Genoa. In the period of the "aristocratic republic" (1528–1797) inaugurated by Andrea Doria, the family contributed six doges as well as many ambassadors and prelates.

Doria, Andrea (b. Nov. 30, 1466, Oneglia, Duchy of Milan [Italy]—d. Nov. 25, 1560, Genoa), Genoese statesman, condottiere (mercenary commander), and admiral who was the foremost naval leader of his time.

A member of an ancient aristocratic Genoese family, Doria was orphaned at an early age and became a soldier of fortune. He first served Pope Innocent VIII (reigned 1484–92) when Genoa had fallen prey to the quarrels of rival families. An extremely able soldier, he was successively hired by King Ferdinand I and his son Alfonso II of Naples and by various Italian princes. From 1503 to 1506 he helped his uncle Domenico quell the Corsican revolt against Genoan rule.

Deciding to try his fortunes on the seas, Doria outfitted eight galleys and patrolled the Mediterranean, fighting the Ottoman Turks and the Barbary pirates, augmenting both his reputation and his fortune. He scored a brilliant victory over the Turks at Pianosa in 1519. After the Holy Roman emperor Charles V's forces had taken Genoa (1522) and deposed the pro-French faction there, Doria entered the service of Francis I of France, who was fighting Charles V in Italy. As admiral of the French Mediterranean fleet, Doria compelled the emperor's army to raise the siege of Marseille in 1524. After the French defeat at Pavia (1525), at which Francis was taken prisoner by imperial forces, Doria served Pope Clement VII.



Doria, detail of a portrait by Sebastiano del Piombo; in the Doria Palace, Rome

Alinari—Art Resource/EB Inc.

When Francis was freed (1527), Doria rejoined the French forces, which helped him capture Genoa from the imperial forces. But Doria soon became disillusioned both with French policies towards Genoa and with Francis' intentions towards himself, and so he transferred his services to Charles V. In September 1528 Doria and his forces drove the French out of Genoa and were triumphantly received by the city. Charles V bestowed riches and honours upon him, naming him grand admiral of the imperial fleet and prince of Melfi.

As the new ruler of Genoa, Doria eliminated the factions that had plagued the city and constituted a new oligarchic form of government composed of the city's principal aristocratic families. (His reformed constitution for Genoa would last until 1797.) From 1528 until his death, Doria exercised a predominant influence in the councils of the Genoese republic. As imperial admiral he commanded several naval expeditions against the Turks, taking Coron (Koróni) and Patras (Pátrai) and aiding in the capture of Tunis (1535). Charles V found Doria an invaluable ally in his wars with Francis and used the former's services to extend his domination over the whole Italian peninsula.

Although he was 78 when peace was established between Francis and Charles in 1544, Doria still did not retire. He had made many enemies among the pro-French families in Genoa, and in 1547 the Fieschi family undertook a plot against the Doria family that achieved the murder of Doria's nephew Giannettino. (*See* Fieschi, Gian Luigi.) The conspirators were defeated, however, and Doria punished them with great vindictiveness. Other plots against him and his family followed, but all failed.

Age did not lessen Doria's energy, and at age 84 he sailed against the Barbary pirates. When a new war broke out between France and Spain, he fought the French, who had seized Corsica, then administered by the Genoese bank of San Giorgio. He retired to Genoa in 1555, passing command of his fleet to his grandnephew Giovanni Andrea Doria.

One of the last great condottieri, Doria had many of the faults of his profession: he was greedy, conceited, vindictive, unscrupulous, cruel, and authoritarian. Yet he was also a fearless and untiring military commander who was endowed with outstanding tactical and strategic talents. He was genuinely devoted to his native city of Genoa, whose liberty he secured from foreign powers and whose government he reorganized into an effective and stable oligarchy.

Dorian, any member of a major division of the ancient Greek people, distinguished by a well-marked dialect and by their subdivision, within all their communities, into the "tribes" (*phylai*) of Hylleis, Pamphyloi, and Dymanes. These three tribes were apparently quite separate in origin from the four tribes found among the Ionian Greeks. The Dorian people are traditionally acknowledged as the conquerors of the Peloponnese (in the period 1100–1000 BC).

In Greek tradition, the Dorians were thought to have gained their name from Doris, a small district in central Greece. According to this tradition, the sons of Heracles, the Heraclidae, were driven from their homeland in the Peloponnese by Eurystheus of Mycenae. The Heraclidae took refuge with Aegimius, the king of Doris. Several generations later, the Heraclid brothers Temenus, Aristodemus, and Cresphontes led the "Dorians" back in a successful invasion of the Peloponnese and thus recovered their heritage.

In actual fact, the origins of the Dorians are necessarily obscure, but it appears they orig-

inated in northern and northwestern Greece, *i.e.*, Macedonia and Epirus. From there they apparently swept southward into central Greece and then into the southern Aegean area in successive migrations beginning about 1100 BC, at the end of the Bronze Age. The invading Dorians had a relatively low cultural level, and their only major technological innovation was the iron slashing sword. The Dorians swept away the last of the declining Mycenaean and Minoan civilizations of southern Greece and plunged the region into a dark age out of which the Greek city-states began to emerge almost three centuries later.

The migrating Dorians settled chiefly in the southern and eastern Peloponnese, establishing strong centres in Laconia (and its capital, Sparta), Messenia, Argolís, and the region of the Isthmus of Corinth. They also settled the southern Aegean islands of Melos, Thera, Rhodes, and Cos, along with the island of Crete. In fact, the Dorians reached as far east as the cities of Halicarnassus and Cnidus on the coast of mainland Anatolia (now southwestern Turkey). A great wave of renewed colonization beginning in the 8th century BC brought Dorian settlers to the island of Corcyra (modern Corfu), to Syracuse, Gela, and Acragas (now Agrigento) in Sicily, to Taras (now Taranto) in Italy, and to Cyrene in North Africa, as well as to scattered sites in the Crimea and along the Black Sea. Sparta, Corinth, and Argos were among the most important cities of Doric origin.

Doric was one of the major dialects of the classical Greek language, along with the Ionic-Attic, Aeolic, and Arcado-Cypriot dialect groups. But because the Ionic-Attic dialect of Athens dominated Greek culture from the 5th century BC, very little remains of ancient writings in pure Doric dialect.

The Dorian peoples had a seminal influence on the later development of Greek art. Indeed, the crowning achievements of Greek art and architecture from the 5th century BC arose from the combination of the art of the Doric peoples (with its restraint, power, and monumentality) and that of the Ionian peoples (with its grace, elegance, and ornateness). The massive and simple Doric order of architecture earned its name from its origin in the Doric-populated cities of the southern Aegean. The choral lyrics in Greek tragedy were also a Doric invention.

Politically, the Dorian centres took two different courses of development. In Corinth, Rhodes, Argos, and various other mercantile-oriented city-states, the Dorian invaders, though at first reserving political power unto themselves, eventually merged with the conquered indigenous peoples of their regions. In Sparta and the island of Crete, by contrast, the Dorians kept power to themselves and constituted themselves into a ruling military class. These militarized Dorian aristocracies deliberately "froze" an archaic form of society (and sacrificed most of their cultural and artistic promise in the process) in order to maintain dominance over a larger population of serfs.

Dorian mode, in music, first of the eight medieval church modes. *See* church mode.

Doric order, one of the orders of classical architecture, characterized by a simple and austere column and capital. *See* order.

Dorion, Sir Antoine Aimé (b. Jan. 17, 1818, Sainte-Anne-de-la-Pérade, Lower Canada [now Quebec, Can.]—d. May 31, 1891, Montreal), statesman and jurist, joint premier of the united province of Canada with George Brown in August 1858 and with John Sandfield Macdonald in 1863–64.

Dorion was called to the bar in 1842 and was made queen's counselor in 1863. He entered politics in 1854 as member from Montreal of the legislature of the united province of Canada. He became leader of the Rouges, or young Liberals, of Canada East (formerly Lower Canada, now in Quebec), working for reform. He gained a reputation for forthright expression of his opinions, especially in criticizing Conservative "deviousness." His solution to the question of representation by population for Canada East and Canada West (now in Ontario) in the provincial legislature in 1856 was to recommend federation.

Dorion, 1874
By courtesy of the Public Archives of Canada

In August 1858 Dorion formed a dual administration with George Brown of Canada West, but they resigned after three days. The alliance lost Dorion much support from the French Canadians, and he was defeated in Montreal but elected for Hochelaga. In 1862 he helped form the John Sandfield Macdonald–Louis Victor Sicotte government, becoming provincial secretary; and in 1863–64 he was premier with John Sandfield Macdonald.

In the 1860s Dorion came to be a strong critic of Confederation, fearing for the liberties of the French Canadians; but he accepted the Dominion of Canada when it was created in 1867. Dorion served as dominion minister of justice (1873–74) in Alexander Mackenzie's Liberal administration. He was appointed chief justice of Quebec in 1874, having acquired a great reputation in law. He was knighted in 1877.

Doris, the alleged mother country of the Dorian conquerors of the Peloponnese. It was a small district in central Greece, lying between Mounts Oeta (modern Oiti) and Parnassus and consisting of a narrow valley nowhere exceeding 4 miles (6 km) in breadth, with only four small townships. Doris had some importance because it commanded the road from Heraclea in Trachis to Amphissa, but its history is mainly made up of minor wars with its equally petty neighbours. In 457 BC the Spartans, admitting the claim of Doris to be the Dorian metropolis, sent an army to help it against the Phocians, and they sent another one to help it against the Oetaeans in 426. Except for mention of its cantonal league in 196 BC, Doris passed early out of recorded history.

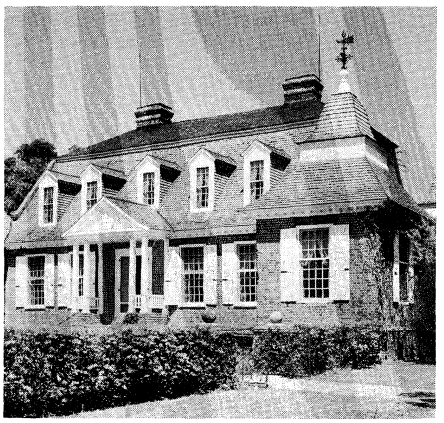
Dorking, market town, Mole Valley district, county of Surrey, England, southwest of London. It is situated in the valley of the River Mole, between the escarpment of the chalk hills of the North Downs and the wooded heights of Leith Hill. Dorking is noted for the beauty of its countryside. The nature reserves of Holmwood Common and Box Hill in the North Downs belong to the National Trust (a British conservation body). Several fine mansions are in the vicinity of the town, notably Leith Hill Place and Polesden Lacey. Another mansion of the district is Deepdene, which has associations with Benjamin Disraeli, the 19th-century statesman. With excellent access to London, Dorking has developed as a residential town. Pop. (1981) 14,830.

dormancy, a state of reduced metabolic activity adopted by many organisms under conditions of environmental stress or, often, as in winter, when such stressful conditions are likely to appear. *See* diapause; hibernation.

dormancy (botany): *see* afterripening.

dormer, in architecture, a vertical window that projects from a sloping roof and usually illuminates a bedroom. The term derives from the Latin *dormitorium,* "sleeping room." Dormers are set either on the face of the wall or high upon the roof, and their roofs may be gabled, hipped, flat, or with one slope. A small dormer in a roof or a spire is called a lucarne.

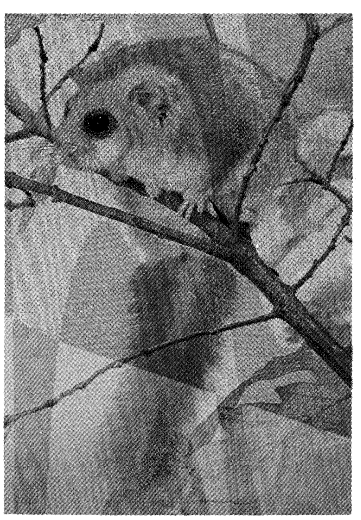
Simple dormers, frequently constructed in several rows, characterize the steep roofs of Teutonic countries. In the late Gothic and early Renaissance periods, more elaborate masonry dormers were designed that extended up from the wall line of the building and were richly decorated.



Dormers on Mulberry Plantation, Berkeley county, S.C., 1714
Wayne Andrews

Similar elaborate dormers, usually with gabled roofs, characterize the Tudor work in England and Scotland and the French château from the time of Louis XII to that of Louis XIV. Dormers continued to be used throughout the 17th and 18th centuries and were especially popular in revival-style buildings of the 19th and 20th centuries.

dormouse, any of the 20 species of small rodents in the seven genera of the family Gliridae (order Rodentia). Six genera of dormice are distributed through Eurasia and northern Africa, and one, *Graphiurus,* occurs in sub-Saharan Africa. Dormice are generally squirrel-like, with large eyes, soft fur, rounded ears, and well-haired, sometimes bushy, tails. Like squir-



Edible dormouse (*Glis glis*)
Schunemann—Bavaria-Verlag

rels, they are typically arboreal and sit up to eat. Unlike most squirrels, they are nocturnal.

Dormice live in trees, bushes, and rock walls, and in nests of plant material. They eat fruit, nuts, birds' eggs, and some insects and small animals, and they sometimes damage orchard crops by eating only a small portion of each fruit. Dormice are proverbially regarded as extremely sleepy animals. Many do sleep for long periods. The edible and common dormice (*Glis glis* and *Muscardinus avellanarius*), for example, accumulate a large amount of fat in the fall and sleep much of the winter, rousing occasionally to eat food they have stored. Members of these two species may remain dormant from September or October to April. Dormice breed once, sometimes twice, yearly; the female bears two to nine young after about three or four weeks' gestation.

The edible dormouse, largest of the dormice, is gray and attains a maximum length of about 20 cm (8 inches) excluding its 15-centimetre (6-inch) tail. Also known as the fat dormouse, it was prized as food by the ancient Romans, who raised it in special enclosures (gliraria). The common dormouse, or hazel mouse, is a small dormouse 5 to 10 cm (2 to 4 inches) long without the tail. It is tawny brown with a white throat and white toes. Other species include the garden dormouse, or lerot (*Eliomys quercinus*), a gray or brown dormouse with a black stripe on each side of its face; the tree dormouse (*Dryomys nitedula*), a small, bushy-tailed, reddish brown dormouse; the Japanese dormouse (*Glirulus japonicus*), a chipmunk-like species with a dark stripe from head to tail; and a number of African dormice (*Graphiurus*), which are forest dwellers and are usually gray or brownish.

The spiny dormouse (*Platacanthomys lasiurus*) is a rodent similar to the dormouse and lives in rocky areas in southern India. Reddish brown and 13 to 21 cm (5 to 8 inches) long without the long tail, it has flattened spines mixed in with the hairs of its back. The spiny dormouse inhabits tree hollows and feeds on plants. Its nearest living relative is the Chinese pygmy dormouse, or blind mouse (*Typhlomys cinereus*), a small, mouselike, gray rodent about which little is known. The affinities of these two rodents are disputed. Some authorities place them in the family Cricetidae, others in a family of their own, Platacanthomyidae.

For the desert dormouse, a possible relative of the true dormice, *see* Selevin's mouse.

Dornberger, Walter Robert (b. Sept. 6, 1895, Giessen, Ger.—d. June 27, 1980, Baden-Württemberg, W.Ger.), engineer who directed construction of the German V-2 rocket during World War II.

Dornberger enlisted in the German army in 1914 and was commissioned the next year. After being captured by the French, he was released in 1919 and retained in the small army permitted Germany under the terms of the Versailles treaty. He was sent by the army in 1925 to the School of Technology in Charlottenberg; there Dornberger specialized in ballistics and earned an M.A. degree in 1930. He was assigned to the development of rocket weapons, a category not prohibited by the Versailles settlement, but had to struggle to obtain recognition for his efforts. In the summer of 1932, however, he was placed in charge of Research Station West at Kummersdorf, a few miles south of Berlin, where, with Wernher von Braun, he began to perfect the rocket engine. In May 1937 the staff was moved to Peenemünde, where the A series of rocket missiles was built; the A-4 rocket developed there later became widely known in its military form as the V-2 and was the forerunner of all postwar space vehicles.

After World War II, Dornberger, who had attained the rank of lieutenant general, spent two years in England as a prisoner, then emigrated to the United States in 1947, where he worked as an adviser on guided missiles for the United States Air Force. In 1950 he became a consultant to the Bell Aircraft Corporation and in 1954 wrote *V-2,* his reminiscences. During his association with Bell, Dornberger participated in the Air Force–NASA project Dyna-Soar, which was eventually transmuted into the space shuttle program. Dornberger retired in 1965.

Dornbirn, town, Vorarlberg *Bundesland* (federal state), western Austria, on the Dornbirner Stream, in the Rhine River valley at the foot of the Bregenzer Forest, just south of Bregenz. First mentioned as Torrinpuirron in 895, it belonged to the counts of Montfort from the late 12th century until it passed to Austria in 1380. It received town status in 1901. Notable landmarks are the Neoclassical parish church (1493) with a detached belfry and the Rotes Haus ("Red House"; 1639). The town has a regional nature museum. Dornbirn is the principal centre of the Austrian cotton textile industry; other economic activities include brewing, the manufacture of electrical machinery and generators, and the working of iron, wood, and plastic. It is the site of an annual international trade fair. Pop. (1987 est.) 38,641.

Consult the INDEX *first*

Dorner, Isaak August (b. June 20, 1809, Neuhausen, Württemberg [Germany]—d. July 8, 1884, Wiesbaden, Ger.), German Protestant theologian who sought to interpret Kantian and post-Kantian thought in terms of traditional Lutheran doctrine. The best known of the English translations of his many works is *History of the Development of the Doctrine of the Person of Christ,* 5 vol. (1861–63). Among the English versions of Dorner's writings that strove to mediate the liberal–conservative controversy within 19th-century German Protestantism are *History of Protestant Theology,* 2 vol. (1871), *System of Christian Doctrine,* 4 vol. (1880–82), and *System of Christian Ethics* (1887).

Dornier, Claudius, English CLAUDE DORNIER (b. May 14, 1884, Kempten, Bavaria [Germany]—d. Dec. 5, 1969, Zug, Switz.), pioneer German aircraft designer and builder.

Dornier completed his education in 1907 at Munich's technical college and three years later began working for Ferdinand, Graf von Zeppelin, at the Zeppelin airship factory at Friedrichshafen. In 1911 he designed the first all-metal plane, and Zeppelin permitted him to found a separate division of the company, the Dornier aircraft works at Friedrichshafen. Wooden and metal fighters designed by Dornier were used by Germany in World War I, after which he assumed full control of his aircraft factory.

During the 1920s he built widely used seaplanes, and in 1929 he introduced the Do X, at the time the world's largest aircraft. With a wingspan of 157 feet (48 m) and length of 130 feet (40 m), the Do X was powered by 12 engines and carried 169 passengers; in 1931 it flew from Germany to New York City. Because of its great cost, however, the Do X was abandoned. During World War II the Dornier 17, a twin-engined bomber, was a standby of the Luftwaffe. Construction of aircraft in postwar Germany was forbidden by the Allies, so Dornier established a factory in Spain. Shortly after the lifting of the Allied ban in 1955, he opened a factory near Munich to construct the Dornier 27, a light, general-purpose transport; the Dornier 31, a STOL aircraft; and the Dornier 32, a collapsible helicopter.

Dorotheus (fl. first half of the 6th century AD), jurist, one of the principal codifiers of Roman law under the emperor Justinian I.

Dorotheus helped to compile the Digest, or Pandects (published in 533), and the second edition of the Codex Constitutionum (published in 534). With Tribonian (Tribonianus), head of the Digest's compilers, and Theophilus, he also prepared the Institutes (533) as an introduction to the Digest. Fragments of his Index (542), a commentary on the Digest, are preserved in the 9th-century law code called the Basilica. Dorotheus taught jurisprudence in the school of Roman law at Berytus, Syria (now Beirut, Lebanon), at that time probably the best law school in the eastern Roman Empire.

Dorpat (Estonian S.S.R.): *see* Tartu.

Dörpfeld, Friedrich Wilhelm (b. March 8, 1824, Wermelskirchen, Rhine Province, Prussia [Germany]—d. Oct. 27, 1893, Ronsdorf, Ger. [now Wuppertal, Ger.]), German educator who adapted Johann Friedrich Herbart's ideas to elementary school use and emphasized the social aspects of traditional school subjects.

After attending the Mörs teachers' seminary, Dörpfeld joined the faculty of a school in Barmen. He remained there for 30 years, also serving as principal. He was the father of Wilhelm Dörpfield.

Though a Herbartian educator, Dörpfeld placed much greater emphasis than Herbart on the social side of education. He viewed sociology as a subject not so much to be taught for itself but rather to affect the teaching of history, geography, and other subjects. Schools, Dörpfeld believed, should be self-governing communities, free from control of both church and state in internal affairs.

Dörpfeld retired in 1880 and spent his final years writing. His most significant work was *The Connection Between Thought and Memory* (1886).

Dörpfeld, Wilhelm (b. Dec. 26, 1853, Barmen, Rhenish Prussia [now Wuppertal, Ger.]—d. April 25, 1940, Leukas, Greece), German archaeologist and authority on Greek architecture who excavated the Mycenaean palace at Tiryns (modern Tirins, Greece) and continued the excavation of the famed German archaeologist Heinrich Schliemann at Hisarlık, Tur., the site of ancient Troy.

After working with archaeologist Ernst Curtius on the excavation of ancient Olympia, he joined Schliemann at Troy (1882–90) and brought a new systematic efficiency to Schliemann's efforts. Together they numbered the successive levels of occupation I–IX. He went with Schliemann to Tiryns in 1884 and in 1885 took charge of excavation, uncovering the first fairly well-preserved Mycenaean palace of the 2nd millennium BC. In his own excavation of Troy (1893 and 1894), he concentrated on the edge of the site and uncovered Middle and Late Bronze Age ruins. He associated the destruction of Priam's Troy with level VI, though later study indicated it more likely was level VIIa. He prepared detailed architectural plans of level VI and in *Troja und Ilion,* 2 vol. (1902; "Troy and Ilium"), formulated a chronology for all levels of the site. He served as secretary of the German Archaeological Institute, Athens, from 1887 to 1911. Dörpfeld suggested in *Alt-Ithaka,* 2 vol. (1927; "Ancient Ithaca"), that modern Leukas was the Ithaca of the *Odyssey.* He also published *Alt-Athen und seine Agora,* 2 vol. (1937–39; "Ancient Athens and Its Marketplace").

Dorr, Thomas Wilson (b. Nov. 5, 1805, Providence, R.I., U.S.—d. Dec. 27, 1854, Providence), American lawyer and constitutional reformer in Rhode Island who led the Dorr Rebellion of 1842.

As a member of the state legislature (from 1834), he failed in his reform efforts. In 1841 he organized the People's Party, which called a

convention, adopted a new constitution, held elections, and, on May 3, 1842, installed Dorr as governor. The pre-existing government did not recognize him, and Rhode Island for a time had two administrations. Minor armed clashes occurred. Tried for treason, Dorr was sentenced (1844) to life imprisonment, but he was released a year later.

Dorsale Guineénne (western Africa): *see* Guinea Highlands.

Dorset, county of southwestern England, bordered by the English Channel (south); the counties of Devon and Hampshire (west and east, respectively); and by Somerset and Wiltshire (north). In the local government reorganization of 1974, the county received part of Hampshire. Its area is 1,025 sq mi (2,654 sq km). Urban development along the coastline is divided into the four districts (boroughs) of Christchurch, Bournemouth, Poole, and farther to the west, Weymouth and Portland. The rest of the county, mainly rural, is divided into West Dorset, North Dorset, Purbeck (incorporating the Isle of Purbeck), and Wimborne (*qq.v.*), which includes part of the New Forest.

Chalk uplands cross into Dorset from adjoining Wiltshire. As the North Dorset Downs, they stretch through the county to beyond the historic town of Dorchester; as the South Dorset Downs, they form a narrow band of chalk terrain eastward to Swanage. Between these two areas of chalk is a triangular zone of lower-lying land developed on various sands and clays and forming an extension of the Hampshire basin. This area is drained in the west by the Rivers Frome and Piddle into Poole Bay and in the east by the Rivers Avon and Stour. To the north and west of the North Dorset Downs, along the county's border with Devon and Somerset, is found a somewhat similar band of mixed terrain developed on various sands and clays. This northern part is largely drained into Christchurch Bay by the Stour and its tributaries.

Prehistoric man was active on the chalk uplands of Dorset. There are abundant monuments of Neolithic, Bronze, and Iron Age dates. One monument that seems to have been occupied throughout prehistoric times is Maiden Castle just outside Dorchester, the main town in Roman times. The area subsequently became part of the West Saxon Kingdom, and as Wessex it has been immortalized in the writings of Thomas Hardy. In the 19th century the county was the scene of the Tolpuddle martyrs' historic stand for organized labour.

Agriculture remains the major user of land, though not the major employer of labour. On the chalk uplands large farms concentrate on dairy farming and the cultivation of barley. In the mixed sand and clay terrain farms are smaller, and agricultural enterprises are mixed. Pig and poultry production is carried on, as is some horticulture. Forestry now plays an important role, with most of the woodland owned by the Forestry Commission. Portland stone and Purbeck marble are renowned as building stone. There is also one of the few remaining mines in the country for ball clay, which is important in the ceramics industry and is still taken to Staffordshire. Limited supplies of petroleum and natural gas are found in the Kimmeridge area on the coast.

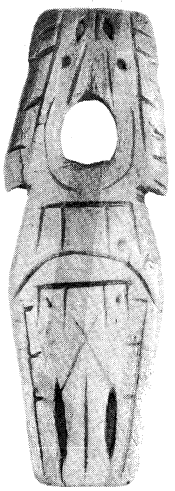
Tourism has played an increasing role in the economy. Bournemouth has been used as a holiday resort since 1879, and Weymouth and Portland attract large numbers of tourists as well. Manufacturing is important in parts of Poole and Bournemouth and includes pottery and brick production, engineering, electronics, and pharmaceutical products and chemicals. Pop. (1984 est.) 617,800.

Dorset, Edmund Beaufort, 1st earl of: *see* Somerset, Edmund Beaufort, 1st duke of.

Dorset, Henry Beaufort, 2nd earl of: *see* Somerset, Henry Beaufort, 2nd duke of.

Dorset, Henry Grey, 3rd marquess of: *see* Suffolk, Henry Grey, duke of.

Dorset culture, prehistoric culture of Greenland (Kalâtdlit-Nunât) and the Canadian eastern Arctic as far south as Newfoundland between approximately 800 BC and AD 1300. Its name comes from excavations made at Cape Dorset at Baffin Island. There are several theories about the origin of Dorset culture: that it originated in Alaska or another part of the western Arctic; that it derived from or was strongly influenced by certain archaic or woodland Indian cultures farther south; or that it was a basically Eskimo culture that developed *in situ* in the Canadian eastern Arctic from a culture called Pre-Dorset, with little Indian influence. Skeletal remains seem to be of the Eskimo type.



Stylized ivory amulet from the late Dorset culture in Newfoundland or Ungava Peninsula, Quebec
By courtesy of the Museum of the American Indian, New York City

The Dorset people depended primarily on such sea mammals as the seal and walrus but also fished and hunted land mammals and birds. Small hand sleds were used because dogs and dogsleds were unknown; the bow drill, a typical Eskimo implement, was also lacking. Settlements, located on coasts, generally consisted of semi-subterranean houses and large meeting houses. Skin-covered tents were probably used during the summer. Evidence suggests that the Dorset people were seasonal nomads who traveled in small groups.

Dorset harpoon heads and foreshafts, knives, lamps, and chipped-stone implements were distinctive. Ornaments were made of bone, ivory, or wood, occasionally engraved. Small ivory or bone animal and human figures, which were sometimes naturalistic and sometimes stylized or grotesque, may have been used as amulets or as a form of hunting magic.

It is not certain when Dorset culture disappeared, but it was after the arrival of Thule migrants (*see* Thule culture) from Alaska, for there are indications of contact between the two groups. Climatic changes may have contributed to the decline of Dorset culture. The extent to which the Dorset influenced historic Canadian and Greenland cultures is questionable; some later types of tools derived from this culture, and a group of Eskimos (who survived in this area until 1903) may have been descendants of the Dorset people.

Dorsey, George A(mos) (b. Feb. 6, 1868, Hebron, Ohio, U.S.—d. March 29, 1931, New York City), early U.S. ethnographer of North American Indians, especially the Mandan tribe. His investigations of the Plains Indians included early population accounts of the area. He is best known for his last work, *Man's Own Show; Civilization* (1931), as well as for his popular anthropology text, *Why We Behave Like Human Beings* (1925).

In 1894 Dorsey received the first Ph.D. in anthropology to be awarded in the United States, receiving it from Harvard University, where he taught until 1896, when he joined the staff of the Field Museum of Natural History in Chicago. Dorsey also advised Pres. Woodrow Wilson on Spanish affairs during the Paris Peace Conference of 1919.

Dorsey, James Owen (b. Oct. 31, 1848, Baltimore—d. Feb. 4, 1895, Washington, D.C.), U.S. ethnologist known principally for his linguistic and ethnographic studies of the Siouan Indians.

Dorsey was ordained a deacon of the Protestant Episcopal Church in 1871, when he missioned to the Ponca tribe in the Dakota Territory. Adept in classical linguistics, he quickly learned the Ponca language, but illness forced him to return to Baltimore. When the Bureau of American Ethnology was established (1879), Dorsey, one of its first members, was sent to Nebraska to study the Omaha tribe. Despite ill health, he was a diligent worker, studying, among the Siouan stock, the Osage, Kansa, and Dakota tribes. He also studied the Athabascan, Takelman, Kusan, and Yakonan stocks of Oregon. His works include *Omaha Sociology* (1884), *Osage Traditions* (1888), and *Siouan Sociology* (1897). He edited the *Dakota-English Dictionary* and *Dakota Grammar, Texts, and Ethnography, by Stephen Return Riggs* (1893), both of which have remained classics in their field.

Dorsey, Jimmy and Tommy, bynames of JAMES DORSEY and THOMAS DORSEY (respectively b. Feb. 29, 1904, Shenandoah, Pa., U.S.—d. June 12, 1957, New York City; b. Nov. 19, 1905, Shenandoah, Pa.—d. Nov. 26, 1956, Greenwich, Conn.), brothers who separately and together were leaders of large popular dance orchestras in the United States.

The sons of a music teacher, both benefitted from early instruction, becoming prominent in white jazz circles. Jimmy, the first to emerge and the more active jazzman, remained a prolific technician on both his instruments, the clarinet and the alto saxophone; by 1927 he was a star soloist. Tommy, who began by doubling on trombone and trumpet, soon gave up the latter; by 1930 he was a successful free-lance musician noted for the sweetness of tone in his trombone playing. In 1933 they formed an orchestra together. Both brothers enjoyed immense success as leaders of their own orchestras, drifting far from their jazz beginnings. In 1953 they amalgamated again. Some critics regarded their work as superior popular music rather than authentic jazz.

Dorsey, Thomas Andrew (b. July 1, 1899, Villa Rica, Ga., U.S.), American songwriter, singer, and pianist whose many up-tempo blues arrangements of gospel hymns earned him the title of "Father of Gospel Music."

The son of a revivalist preacher, he was influenced in childhood by blues pianists in the Atlanta, Ga., area and worked in secular "hokum" music as composer, arranger, pianist, and vocalist from 1910 through 1928. In 1916 he moved to Chicago, where he attended the College of Composition and Arranging. In the 1920s he toured with Ma Rainey and his own bands, often featuring the slide guitarist Tampa Red.

From 1929 on Dorsey worked exclusively within a religious setting, consciously applying blues melodies and rhythms to spiritual concerns. Dozens of his optimistic and sentimental songs became gospel standards, notably "Precious Lord, Take My Hand" (1932). He recorded extensively in the early 1930s, publishing his own sheet music and lyrics. From

1932 Dorsey was choral director of the Pilgrim Baptist Church in Chicago. He founded the National Convention of Gospel Choirs and Choruses in Chicago in 1933, serving as its president for 40 years. He stopped recording in 1934 but toured widely into the 1940s. Thereafter, though he continued writing, he concentrated on lecturing and administrative duties.

Dorsten, city, North Rhine-Westphalia *Land* (state), northwestern Germany. It lies on the Lippe River and the Wesel-Datteln Canal. A village in Roman times, Dorsten was chartered by the archbishops of Cologne in 1251 and fortified in the 14th century. As a monastic centre it was a stronghold of the bishops. After 1802 it passed to the dukes of Arenberg who held it as a fief of Prussia after 1815. The city developed industrially with the advent of the railway in 1899 and the opening of the first coal mine in 1911. The northernmost city of the Ruhr industrial region, it was badly damaged by bombing during World War II. Surviving buildings include a Franciscan monastery (1488), the old city hall (1597; now a local museum), a boys' school (1642), and an Ursuline nunnery. The city was enlarged by nearly two-thirds in 1975 by the annexation of Wolfing, Lembeck, and other neighbouring towns. There are collieries, coal-gas works, an iron foundry, quartz works, and textile, wire, and furniture factories. Pop. (1989 est.) 75,518.

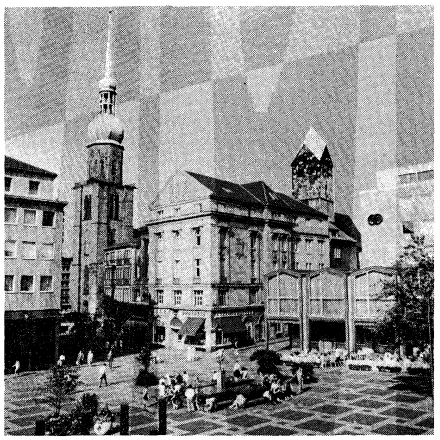
Dort, Synod of, assembly of the Reformed Church of the Netherlands that met at Dort (in full Dordrecht) from Nov. 13, 1618, to May 9, 1619. The synod tried to settle disputes concerning Arminianism (*q.v.*). In 1610 the Dutch followers of Jacobus Arminius presented to the States General a Remonstrance in five articles that contained their theological views; thus, Dutch Arminians were also called Remonstrants. They rejected the strict Calvinist doctrine of predestination, the doctrine that God elects or chooses those who will be saved. Those who opposed the Remonstrants were the Gomarists, the followers of Franciscus Gomarus, a Dutch theologian who upheld a rigid Calvinism and had carried on a theological controversy with Arminius.

The synod was attended by Gomarist Dutch delegates and also by delegates from Reformed churches in Germany, Switzerland, and England. Though it was originally intended that the synod would bring agreement on the doctrine of predestination among all the Reformed churches, in practice this Dutch synod was mainly concerned with problems facing the Reformed Church of the Netherlands.

The opening sessions dealt with a new Dutch translation of the Bible, a catechism, and the censorship of books. The synod then called upon representatives of the Remonstrants to express their beliefs. The Remonstrants refused to accept the rules established by the synod and were eventually expelled.

The synod then studied the theology of the Remonstrants and declared that it was contrary to Scripture. The canons of Dort were produced; they discussed in detail in five sections the errors of the Remonstrants that were rejected as well as the doctrines that were affirmed. The doctrines affirmed were that predestination is not conditional on belief; that Christ did not die for all; the total depravity of man; the irresistible grace of God; and the impossibility of falling from grace. These canons of Dort, along with the Belgic Confession and the Heidelberg Catechism, remain the theological basis of the Reformed Churches in the Netherlands and of the Christian Reformed Church in North America.

Dortmund, city, North Rhine-Westphalia *Land* (state), northwestern Germany, with extensive port installations at the head of the Dortmund-Ems Canal. First mentioned as Throtmanni in 885, it became a free imperial city in 1220 and later joined the Hanseatic League. Its far-ranging trade connections made it so prosperous in the 14th century that the English crown was pledged to its merchants as security for loans several times. Its prosperity declined after the Thirty Years' War, and when it lost its imperial rights in 1803 its population numbered only about 4,000. The development of coal mining and iron-ore mining in the 19th century and the completion of the canal (1899) stimulated rapid growth, and Dortmund is now a major transportation and industrial centre of the Ruhr.



Steeples of the Marienkirche (left) and the Reinoldikirche (right), across the square in the city centre, Dortmund, Ger.
Archiv fur Kunst und Geschichte, Berlin

Extensive destruction in World War II led to planned reconstruction on modern lines. Four medieval churches—Propsteikirche, Reinoldikirche, Marienkirche, and the Petrikirche—have been restored, and the city retains four moated castles and the ruins of Saxon and Carolingian fortresses. Notable examples of modern architecture are the synagogue (1956) and the Westfalenhalle (Westphalia Hall; 1952), one of Europe's largest halls, which is used for conventions, exhibitions, and sporting events. Dortmund has many educational institutions, including the Max Planck Institute for Industrial Physiology and for the Physiology of Nutrition; the Institute for Spectrochemistry and Spectroanalysis; Münster University's Social Research Institute; and schools for social studies, journalistic research, mountaineering, mining, teachers' training, and adult education as well as several museums. The Museum of Art and Culture houses the "Dortmund treasure," a cache of more than 400 gold coins. The University of Dortmund was founded in 1966.

Steel, coal, and beer are the city's principal products. Dortmund also has a large wholesale fruit and vegetable market, and its bridge-building firms operate worldwide. Pop. (1989 est.) 587,328.

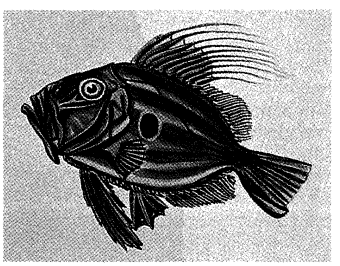
Dortmund-Ems Canal, German DORTMUND-EMS-KANAL, important commercial canal in Germany linking the Ruhr industrial area with the North Sea near Emden. It extends from Dortmund (south) to the junction with the Rhein-Herne Canal; floating docks and locks are there. Just north, it crosses the Lippe-Seitenkanal (Lippe Lateral Canal). These connections provide links between the Rhine and the North Sea entirely within German territory. It then runs northeast and north through the canalized bed of the Ems River. Chief imports passing southward are iron ore, grain, and sugar; products sent downstream (northward) include coal, coke, stone, and gravel. The canal was opened in 1899 and is about 167 miles (269 km) long.

Dörtyol, town, southern Turkey, at the head of the Gulf of Iskenderun. The town's importance lies in its function as a terminal where Mediterranean tankers can be loaded with oil transported from the petroleum fields of western Asia. A pipeline, 40 inches (100 cm) in diameter and about 600 miles (1,000 km) in length, carries oil to the seaport from the Kirkūk oil fields of Iraq. When the pipeline opened in the spring of 1977, it carried 200,000 barrels of crude oil per day. Early in 1978 it was shut down because of a Turkish–Iraqi disagreement over payments for the oil, and, though it was later reopened it still operated well below capacity. Some 300 miles (500 km) of pipeline also connect the port with the petroleum fields of Batman in southeastern Turkey, east of Diyarbakır. In the Dörtyol hinterland are forests, cotton fields, and citrus orchards. Pop. (1980) 25,905.

Dorval, city, Montréal region, southern Quebec province, Canada, on Île de Montréal (Montreal Island). It is a southwestern suburb of Montreal city facing Lac Saint-Louis, an extension of the St. Lawrence River. Offshore to the south is Île Dorval, a summer resort. Dorval International Airport, replacing an earlier one at Saint-Hubert, has itself been superseded by Mirabel International Airport. The area was settled by the Sulpicians, a society of French priests who built a fort and mission on the site about 1670. The community was named after Jean Baptiste Bouchard (called Dorval), a French landowner. Inc. town, 1903; city, 1956. Pop. (1981) 17,722.

dory, also called JOHN DORY, any of several marine fishes of the family Zeidae (order Zeiformes), found worldwide in moderately deep waters. The members of the family are large-mouthed fish, deep-bodied but thin from side to side.

Zeus faber, a food fish of the Atlantic and Mediterranean, is one of the better known species. It ranges from the shore to waters about 200 metres (650 feet) deep and reaches a maximum length of about 90 centimetres (3 feet). Grayish, with a distinctive, yellow-ringed black spot on each side, it has long pelvic fins; long, filamentous, dorsal-fin spines; and rows of spines on the belly and at the bases of the dorsal and anal fins. A similar species, *Z. japonicus,* is found in the Pacific.



Dory (*Zeus faber*)
Painting by Karen Allan

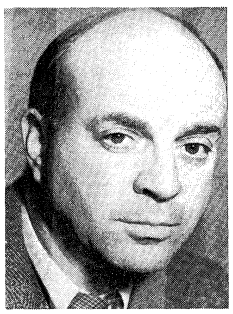
dory, small boat with pointed ends and high, flaring sides. A dory may be up to 22 feet (7 metres) long and commonly has a narrow, V-shaped stern and a narrow, flat bottom. It is a seaworthy boat that can be rowed, engine-driven, or sailed; it is used extensively by New England fishermen.

The dory skiff is shorter and has lower sides and a square stern but otherwise resembles the dory.

Dos Hermanas, town, Sevilla province, in the autonomous community (region) of Andalusia, southern Spain. It lies southeast of Seville city between the Guadaira and Guadalquivir rivers. The town was founded by Ferdinand III of Castile at the time of his conquest of Seville (1248) and named Dos Hermanas

("two sisters") for the sisters of his lieutenant, Gonzalo Nazareno. Olives are the main agricultural product of the district, which also has a hemp industry and limestone quarries. Pop. (1981) 57,357.

Dos Passos, John (Roderigo) (b. Jan. 14, 1896, Chicago—d. Sept. 28, 1970, Baltimore), U.S. writer, one of the major novelists of the post-World War I "lost generation," whose reputation as a social historian and as a radical critic of the quality of American life rests primarily on his trilogy *U.S.A.*



Dos Passos

By courtesy of the National Archives, Washington, D.C.

The son of a wealthy lawyer of Portuguese descent, Dos Passos graduated from Harvard University (1916) and volunteered as an ambulance driver in World War I. His early works were basically portraits of the artist recoiling from the shock of his encounter with a brutal world. Among these was the bitter antiwar novel *Three Soldiers* (1921).

Extensive travel in Spain and other countries while working as a newspaper correspondent in the postwar years enlarged his sense of history, sharpened his social perception, and confirmed his radical sympathies. Gradually, his early subjectivism was subordinated to a larger and tougher objective realism. His novel, *Manhattan Transfer* (1925), is a rapid-transit rider's view of the metropolis. The narrative shuttles back and forth between the lives of more than a dozen characters in nervous, jerky, impressionistic flashes.

The execution of the Anarchists Nicola Sacco and Bartolomeo Vanzetti in 1927 profoundly affected Dos Passos, who had participated in the losing battle to win their pardon. The crisis crystallized his image of the United States as "two nations"—one of the rich and privileged and one of the poor and powerless. *U.S.A.* is the portrait of these two nations. It consists of *The 42nd Parallel* (1930), covering the period from 1900 up to the war; *1919* (1932), dealing with the war and the critical year of the Treaty of Versailles; and *The Big Money* (1936), which races headlong through the boom of the '20s to the bust of the '30s. Dos Passos reinforces the histories of his fictional characters with a sense of real history conveyed by the interpolated devices of "newsreels," artfully selected montages of actual newspaper headlines and popular songs of the day. He also interpolates biographies of such representative members of the establishment as the automobile maker Henry Ford, the inventor Thomas Edison, Pres. Woodrow Wilson, and the financier J.P. Morgan. He further presents members of that "other nation" such as the Socialist Eugene V. Debs, the economist Thorstein Veblen, the labour organizer Joe Hill, and the Unknown Soldier of World War I. Yet another dimension is provided by his "camera-eye" technique: brief, poetic, personal reminiscences.

U.S.A. was followed by a second, less ambitious *District of Columbia* trilogy (*Adventures of a Young Man,* 1939; *Number One,* 1943; *The Grand Design,* 1949), which chronicles Dos Passos' further disillusion with the labour movement, radical politics, and New Deal liberalism. The decline of his creative energy and the increasing political conservatism evident in these works became even more pronounced in subsequent works. At his death at 74, his books scarcely received critical attention.

Dōshō (b. 629, Kawachi province, Japan—d. 700, Japan), Japanese priest who helped introduce Buddhism into his country.

Dōshō served as a temple priest at Gangō-ji, one of the great temples at Nara, until he left for China in about 653. There he studied for eight years under the Buddhist monk Hsüan-tsang (Xüan-zang), the founder of the Wei-shih (Ideation Only, or Consciousness Only) school, which was derived from the Indian Yogācāra (also called Vijñānaváda) philosophy and stressed the idea that the world is but a representation of the mind. Dōshō returned to Japan and introduced the doctrines of the Wei-shih school. It is generally believed he founded the school known as Hossō (Chinese, Fa-hsiang), which continues the Wei-shih philosophy.

Dōshō established a centre on the grounds of the Gangō-ji where he instructed his disciples, and for 10 years he travelled around Japan to preach his doctrines. At his death, according to his wishes, his body was cremated, and he is the first person known to have been cremated in Japan.

Dōshun (Japanese scholar): *see* Hayashi Razan.

dosimeter, instrument that measures exposure to ionizing radiation over a given period. There are three types of dosimeters worn by persons who work with or near sources of radiation. The film badge is the most popular and inexpensive. In it, photographic or dental X-ray film, wrapped in light-tight paper, is mounted in plastic. Badges are checked periodically, and the degree of exposure of the film indicates the cumulative amount of radiation to which the wearer has been exposed. Thermoluminescent dosimeters are nonmetallic crystalline solids that trap electrons when exposed to ionizing radiation and can be mounted and calibrated to give a reading of radiation level. The ion-chamber dosimeter, like the thermoluminescent one, is reusable, but it is self-reading for immediate determination of exposure.

Dosítheos, Latin DOSITHEUS (b. May 31, 1641, Aráchova, Greece—d. Feb. 8, 1707, Constantinople), patriarch of Jerusalem, an important church politician and theologian of the Greek Church who staunchly supported Eastern orthodoxy over Roman Catholicism. Ordained deacon in 1652, he became archdeacon of Jerusalem in 1661. He subsequently was made archbishop of Caesarea Palestinae (now Ḥorbat Qesari, Israel) in 1666 and patriarch of Jerusalem in 1669.

Through correspondence and extensive journeys Dosítheos became involved in the state of the Eastern Church in the Balkans, Georgia, and the Ukraine. To prevent Protestantism from influencing the Greek Church, in 1672 he convoked the Synod of Jerusalem, which is considered to be the most important Orthodox Eastern Church council in modern times. The Synod supported Dosítheos by condemning the doctrines, which Patriarch Cyril Lucaris of Constantinople had set forth in his *Confession of Faith* (1629). Rejecting unconditional predestination and justification by faith alone, Dosítheos' synod was the culmination of a controversy started by Cyril's plan to reform the Orthodox Church on Calvinistic lines.

His relations with the Russian tsar Peter I the Great (to whom he wrote many letters) were strained because of Peter's church reforms, particularly the abolition of the patriarchate of Moscow and subjection of the Orthodox Church of Russia to the state. Dosítheos failed to make Peter intercede for the Eastern churches in the peace treaty with Turkey in 1702.

Dosítheos' extensive writings are largely compilations from the Greek Fathers. They were directed against the Roman Catholic Church and the Eastern Catholics—*i.e.,* those Eastern churches that joined with Rome. His *History of the Patriarchate of Jerusalem* filled 12 volumes and was posthumously published in 1715.

Dosso, *département,* southwestern Niger, West Africa, with an area of 11,970 sq mi (31,002 sq km). It is bounded by the *départements* of Niamey (northwest) and Tahoua (east) and the countries of Nigeria (southeast) and Benin (south). The Niger River, flowing in a southeasterly direction, separates Dosso from Benin; the Bosso and the Maouri, seasonal tributaries of the Niger in Dosso *département,* flow in fertile valleys (*dallols*). Precipitation decreases from more than 32 in. (800 mm) annually in the Niger River basin in the south to 18 in. (450 mm) annually in the north. The economy is chiefly based on multi-crop subsistence farming and sedentary livestock breeding (cattle, sheep, goats, horses). Millet, sorghum, peanuts (groundnuts), and beans are the chief crops; sweet potatoes, corn (maize), sugarcane, cassava, and cotton are also grown. Permanent cropland is chiefly confined to the Niger valley, the Nigerian border, and the *dallols*. Dosso *département* was established as a cereal, peanut (groundnut), and cotton-growing region by the government under a national campaign to popularize sedentary farming amongst the Fulani nomads. Industries are limited to peanut shelling, brickmaking, leather tanning, and pottery making; fishing is important in the Niger River. The forests of Gaya in the extreme south, along the banks of the Niger, are largely used for firewood and fuel for cooking. The principal inhabitants of the *département* (all of whom are sedentary farmers) include the Zerma (west), Hausa (east), and Songhai (south). Dosso town, the *département* seat and traditional headquarters of the Zerma people, is connected by road to Niamey in the west and Tahoua in the northeast. There is an airfield at Dosso. Pop. (1977) town, 9,917; *département,* 692,811.

Dosso Dossi, original name GIOVANNI LUTERO, or LUTERI (b. 1479–90, Mantua?, March of Mantua—d. 1542, Ferrara, Duchy of Ferrara), late Italian Renaissance painter, the leader of the Ferrarese school in the 16th century. He is first recorded in 1512, in Mantua, but by then he must have been in Venice and absorbed the art of Giorgione, whose style dominates Dosso's "Nymph and Satyr" (Pitti Palace, Florence). He may also

"The Sorceress Circe," oil painting by Dosso Dossi, *c.* 1530; in the Borghese Gallery, Rome

SCALA—Art Resource/EB Inc.

have seen some of the early works of Titian. His style was founded on the romantic approach to landscape, which reached its highest expression in Giorgione's "Tempest," but Dosso also added something of Titian's richness and a personal quality of fantasy, which reflects his knowledge of the works of the Ferrarese painters Cosmè Tura, Francesco del Cossa, and Ercole de' Roberti. He settled in Florence in 1517 and must have come once more under the influence of Titian, whose early mythologies were painted for Dosso's own patron Alfonso I of Ferrara. There is no evidence that Dosso ever went to Rome, but he was certainly acquainted with Raphael's work by 1520, and the tension of Raphael's later style was the final influence on Dosso. In his later works there is an unearthly light falling on melancholy figures arranged in a romantic dreamland. Dosso was the friend of the great Ferrarese poet Ariosto, who celebrated him in *Orlando Furioso* as one of the nine greatest living painters; and Dosso's most famous work, "The Sorceress Circe" (*c.* 1530; Borghese Gallery, Rome), has been seen as almost an illustration to Ariosto.

Dōst Moḥammad Khān (b. 1793, Afghanistan—d. June 9, 1863, Herāt), ruler of Afghanistan (1826–63) and founder of the Bārakzay dynasty, who maintained Afghan independence during a time when the nation was a focus of political struggles between Great Britain and Russia.

Dōst Moḥammad was one of a number of sons of Pāyenda Khān, head of the Bārakzay clan. In 1816 the clan rose in rebellion against the Afghan ruler Maḥmūd Shāh, who had put to death his prime minister, a member of the clan. Following eight years of civil war, the clan claimed victory. Dōst Moḥammad emerged as its most powerful member, and he ascended the throne in 1826.

With Great Britain and Russia manoeuvring for influence in Afghanistan, Dōst Moḥammad was forced to balance his nation between the two great powers. He also sought to recover territory lost from the central government's control during the civil war. The British, feeling that Dōst Moḥammad was either hostile to them or unable to resist Russian penetration, moved to take a direct role in Afghan affairs. First they negotiated unsatisfactorily with Dōst Moḥammad, and then they gave military support to an exiled Afghan ruler, Shāh Shojā'. In 1839 they tried to use British troops to place Shojā' on the throne at the capital in Kābul; this action resulted in the First Anglo-Afghan War (1839–42). Dōst Moḥammad surrendered to British forces following the capture of his family in 1840.

The position of Shojā' and the British forces in Kābul, however, deteriorated rapidly. Shojā' was killed in a rebellion, and British troops were massacred as they attempted to retreat from the city. After the British departed in 1843, Dōst Moḥammad was restored to the throne. He then tried with some success to regain control of outlying sections of the country. He also reached an accommodation with the British, signing treaties of friendship in 1855 and 1857. In June 1863 his forces, under the command of his son-in-law, captured the city of Herāt, and Dōst Moḥammad died there a few days later.

Dostoyevsky, Fyodor (Mikhaylovich), Dostoyevsky also spelled DOSTOEVSKY (b. Nov. 11 [Oct. 30, old style], 1821, Moscow—d. Feb. 9 [Jan. 28, O.S.], 1881, St. Petersburg, Russia), Russian novelist, journalist, and short story writer whose psychological penetration into the darkest recesses of the human heart, together with his unsurpassed moments of illumination, have had a profound and universal influence on the 20th-century novel.

A brief account of the life and works of Fyodor Dostoyevsky follows; for a full biography, *see* MACROPAEDIA: Dostoyevsky.

Dostoyevsky was graduated as a military engineer, but he resigned his commission to devote himself to writing. *Poor Folk* (1846) was followed by other novels and stories of St. Petersburg life. In 1849, for his participation in a radical intellectual discussion group, Dostoyevsky was sentenced to death. The sentence was commuted to imprisonment in Siberia, and *The House of the Dead* (1861–62) is a fictionalized account of these experiences. Released in 1854, he married (1857), travelled in Europe, and, with his brother, founded a magazine, *Epokha,* in which *Notes from the Underground* (1864) appeared. *Crime and Punishment,* the first of his major novels, was published in 1866. In the next year he entered into his happy second marriage to Anna Snitkina. Other novels followed, including *The Idiot* (1868–69) and *The Possessed* (1869–72). By the time he published his last work, *The Brothers Karamazov* (1879–80), often considered his masterpiece, he was recognized in his own country as one of its greatest writers.

dōtaku, thin, elongated bell-shaped bronze forms, evidence of a short-lived bronze culture, localized in the centre of Japan, from the middle Yayoi period (*c.* 250 BC–*c.* AD 250) into the Tumulus period (*c.* AD 250–*c.* 500). *Dōtaku* are sometimes decorated with domestic and hunting scenes delineated in thread relief in a geometric, linear style; others may be decorated with a lattice or lacework pattern.

They range in height from 5 inches (13 centimetres) to 53 inches (135 centimetres). Some of the *dōtaku,* or bronze bells, may have been used as percussion instruments, but it is more likely that they were nonfunctional emblems used by clan chieftains who ruled over the agricultural communities.

Dothan, city, Houston and Dale counties, seat (1903) of Houston County, southeastern Alabama, U.S. Originally settled as Poplar Head in 1858, the name was changed to Dothen and officially renamed Dothan (for a biblical location) in 1911. It is primarily a farm-trade centre of the wire grass region, with small diversified industries, and is the site of the National Peanut Festival (October). George C. Wallace State Community College is located there. Inc. 1885. Pop. (1980) 48,750.

dotterel, any of several species of birds of the plover family, Charadriidae (order Charadriiformes), especially the Eurasian dotterel (*Eudromias morinellus*). The Eurasian dotterel is mottled brown above, with a broad, white eye stripe and a narrow, white band separating its breast, which is gray, from its russet-coloured belly. It is about 20 centimetres (8 inches) long. It nests in tundra and in mountains

Eurasian dotterel (*Eudromias morinellus*)
John Markham

across Eurasia to western Alaska and as far south as Britain and the Balkans, migrating to northern Africa and the Middle East. The male undertakes most of the nesting duties.

Several plovers of the genus *Charadrius* are called dotterels in Australia, as is *C.* (sometimes *Pluviorhynchus*) *obscurus* in New Zealand. Two dotterels, the tawny-throated (*Oreopholus ruficollis*) and the rufous-chested (*Zonibyx modestus*), are found in southern South America.

Peltohyas australis is a courser (family Glareolidae) sometimes called the Australian, or inland, dotterel.

Dottore (Italian: Doctor), also called GRATIANO, stock character of the Italian theatrical form known as the commedia dell'arte, who was a loquacious caricature of pedantic learning. The Dottore's professional affiliation was imprecise. He was at times a legal scholar, ready with advice for any occasion, whose bungled and inept courtroom arguments were

"Biancolelli as Dottore," oil painting by unknown artist, 17th century; in the Museo Teatrale alla Scala, Milan

By courtesy of the Museo Teatrale alla Scala, Milan; photograph, Foto Marzari

the basis for comic dialogues; at other times he was a physician armed with a huge syringe and a roster of preposterous cures for any ailment; he also could be a rhetorician or grammarian. At times the Dottore wore a half mask; at other times he supplemented his own features with cheek padding and a large false nose. His dress was a short black cloak, doctor headdress (a soft, round velvet cap worn by doctors of secular faculties), and a white neck ruff. When he appeared as a physician, he wore a large turned-up hat and was called Dottore Balanzone Lombardi, after two famous 16th-century actors of this part.

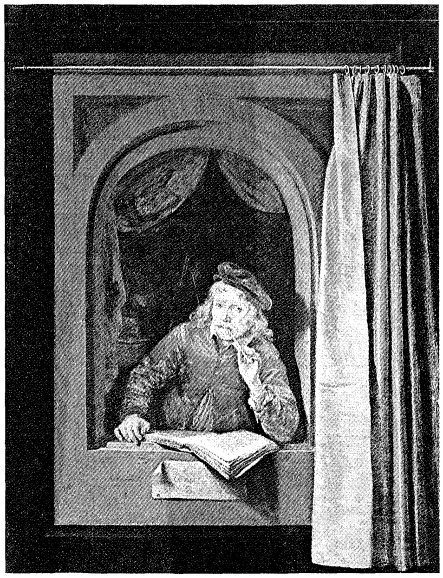
Dottore's contribution to the action of the play consisted of a kind of ineffectual wandering about while talking continuously. His long-winded disquisitions, scholarly puns, and malapropisms were spoken in a jargon of Latin jumbled with local dialect.

dou (Chinese vessel): *see* tou.

Dou, Gerrit, Gerrit also spelled GERARD (b. April 7, 1613, Leiden, Neth.—d. Feb. 9, 1675, Leiden), Dutch Baroque painter, leading artist of the school of Leiden, especially known for his domestic genre paintings and portraits.

He was first trained by his father, a glazier and glass engraver. From 1628 to 1631 he studied with Rembrandt, adopting the master's choice of subject matter and his use of impasto, careful draftsmanship, and dramatic treatment of light and shadow; *e.g.,* "Rembrandt's Mother" (*c.* 1630; Rijksmuseum, Amsterdam). After Rembrandt left Leiden in 1631, his influence on Dou gradually weakened. Dou continued to paint on wood in a small scale, often enclosing his works in spe-

cially made cases, which he decorated. The portraits of his Rembrandtesque phase gave way to a predominance of domestic genre subjects, rich in accessory details. His colours



Dou, self-portrait, oil on panel; in the Rijksmuseum, Amsterdam

By courtesy of the Rijksmuseum, Amsterdam

became cooler and his technique more highly refined. The enamel-smooth surfaces of his works are equaled by only a few contemporary painters of still life in the 17th-century Netherlands. Still life itself plays an important role in Dou's work: for example, his kitchen scenes are often crowded with vegetables, poultry, and utensils—as in "The Young Mother" (1658; Mauritshuis, The Hague). His most characteristic device is the painted "frame within the frame," or pictures where the viewer looks through a grayish stone window into a domestic interior—*e.g.,* "A Poulterer's Shop" (National Gallery, London). After 1650 he painted many nocturnal scenes lit by candlelight—*e.g.,* "Night-School" (*c.* 1660; Rijksmuseum). Dou's jewellike effects and his laboriously perfected style in the hands of his numerous followers often became an empty and tedious accomplishment.

Douai, also spelled DOUAY, town, northern France, in the Nord *département,* Nord-Pas-de-Calais region. It is situated in flat country on the Scarpe River, 24 miles (39 km) south of Lille, and 13 miles southwest of the Belgian border. Although severely damaged in World Wars I and II, Douai has many houses dating from the 18th century, when the town was almost completely rebuilt. It is the coal-mining centre of northern France and has important chemical and engineering works. Other industries include mining and the manufacture of railway equipment. The original university, founded in 1562, was transferred to Lille in 1887, but Douai retains the aspect of a university town because of its numerous educational establishments. The magnificent Gothic belfry, built in 1380, is 130 feet (40 m) high and has a carillon of 49 bells, installed in 1954 to replace the one destroyed by the Germans during World War I. The church of Notre-Dame was badly damaged in 1944, but the 13th-century nave has been restored. The Carthusian monastery, La Chartreuse (16th–18th century), houses a museum, which has a fine collection of 16th-century paintings. During the Middle Ages, Douai was ruled successively by the counts of Flanders and the dukes of Burgundy, Austria, and then Spain. In 1667 Louis XIV captured the town, and it was ceded to France the following year by the Treaty of Aix-la-Chapelle. The town was almost completely destroyed during the sieges of 1710 and 1712, was partly burned in 1918, and suffered greatly during World War II. It has received some recent industrial development, with the siting of a national printing facility and an automobile plant. Pop. (1982) 41,576.

Douai, Merlin de: *see* Merlin, Philippe-Antoine, Comte.

Douai-Reims Bible, also called REIMS-DOUAI BIBLE, also spelled RHEIMS-DOUAY, English translation of the Latin Vulgate Bible produced by Roman Catholic scholars in exile from England at the English College in Douai (then in the Spanish Netherlands but now part of France). The New Testament translation was published in 1582 at Rheims, where the English College had temporarily relocated in 1578. The Old Testament was translated shortly afterward, but not published until 1609–10, in Douai.

A group of former Oxford men, among them William Cardinal Allen, Gregory Martin (the chief translator), and Thomas Worthington, who provided the Old Testament annotations, was instrumental in its production. They undertook the work—initiated by Allen—in order to provide English-speaking Roman Catholics with an authoritative Roman Catholic version of the Bible, as an alternative to the several Protestant translations then in existence. Roman Catholic practice theretofore had effectively restricted personal use of the Bible, in the Latin Vulgate, to the clergy. The version contained many polemic notes protesting Protestant heresies. Bishop Richard Challoner issued a series of revisions (1749–72) intended to make the translation more easily understandable, and subsequent editions were based upon this revision well into the 20th century.

Douala (people): *see* Duala.

Douala, chief port of Cameroon, west central Africa. It is situated on the southeastern shore of the Wouri River estuary, on the Atlantic coast about 130 miles (210 km) west of Yaoundé. The Wouri Bridge, 5,900 feet (1,800 m) long, joins Douala to the banana port of Bonabéri and carries both road and rail traffic to western Cameroon. The city is connected by road to all major towns in Cameroon; has rail links to Kumba, Nkongsamba, Yaoundé, and Ngaoundéré; and is served by an international airport.

Douala served as the capital of the German Kamerun protectorate from 1901 to 1916. It again served as the capital of Cameroon in 1940–46.

With its mixture of traditional, colonial, and modern architecture, Douala has grown rapidly since World War II and is the most populous city in the republic. Western-style residential areas alternate with neighbourhoods inhabited by unskilled migrants from rural Cameroon and other African countries.

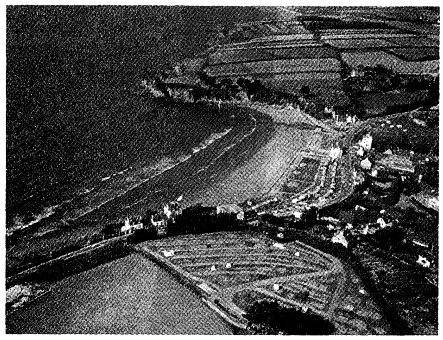
One of the major industrial centres of central Africa, Douala houses breweries, textile factories, and palm-oil, soap, and food-processing plants. It also produces building materials, metalwork, plastics, glass, paper, bicycles, and timber products. Other activities include boat and ship repairing, railway engineering, and radio assembly. Offshore reserves of natural gas had not been exploited by the mid-1980s.

Douala's deepwater port handles most of the country's overseas trade. It has special installations for handling timber products, bananas, gasoline, and bauxite, as well as fishing facilities.

Douala houses a branch (economics) of the University of Yaoundé; a variety of commercial, agricultural, and industrial schools; and research institutes for health, forestry, textile, oilseed derivatives, and meteorology. A museum and a handicraft centre encourage the production and preservation of Cameroonian art. Pop. (1985 est.) 852,705.

Douarnenez, town, Finistère *département,* Bretagne region, western France, at the mouth of Pouldavid Estuary on the Baie de Douarnenez, an inlet of the Atlantic, northwest of the city of Quimper.

Douarnenez is associated in Breton folklore with the legendary city of Ys, which was believed to lie beneath the waters of the bay, and also with the medieval story of Tristan, lover of Iseult, for whom the island astride the estuary (Île Tristan, formerly Île Saint-Tutuarn for the priory founded there in 1118) is named. The church of Ploaré has a Gothic steeple



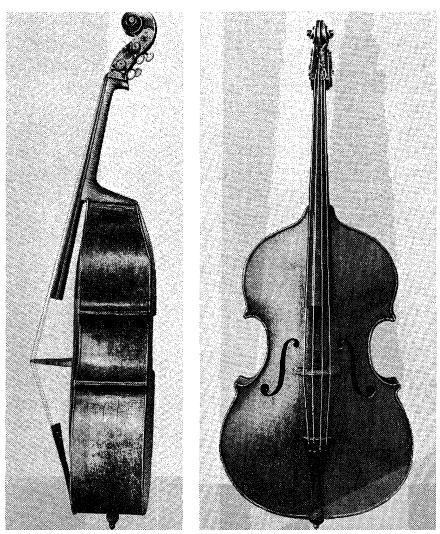
The bay and town of Douarnenez, Fr.

Club Iris

(1548–86), and the chapels of Saint-Michel, Sainte-Hélène, and Sainte-Croix date from the 16th and the 17th century. Douarnenez is a fishing port with fish-processing, net-making, and boatbuilding industries. Pop. (1982) 16,-638.

double-aspect theory (philosophy): *see* identity theory.

double bass, also called CONTRABASS, STRING BASS, BASS, BASS FIDDLE, or BULL FIDDLE, stringed musical instrument, the lowest-pitched member of the violin family, sounding an octave lower than the cello. It has two basic designs—one shaped like a viol (or viola da gamba) and the other like a violin—but there are other designs, such as that of a guitar. It varies considerably in size, the largest normally being not taller than 6 feet (1.8 m) overall. The body itself, without the neck, may be up to 4.5 feet (1.4 m) for a full-size instrument, about 3.8 feet (1.15 m) for a three-quarter size, and only slightly larger than a cello for the small chamber bass, or *bassetto.*



Double bass, viol-shaped, side and front views

EB Inc.

A double bass is usually strung with four heavy strings pitched E_1–A_1–D–G; a fifth string is occasionally added—in jazz band basses, at the top of the register to allow high notes to be played more easily; in symphony orchestra basses, below the E string, tuned to C. Many basses, rather than having a fifth string, lower the compass by an extension to the E string that runs along the scroll at the end of the neck. The string is either provided with keys that sound E♭, D, D♭, and C or clamped to sound E when the lower notes are not needed.

Two styles of bass bow are currently used: the short and narrow French bow (like a violin bow), held palm downward, and the broader German bow (like a viol bow), held palm upward. The double bass is also played pizzicato (by plucking with the fingers)—occasionally in symphonic orchestras and almost always in jazz and dance bands.

Forms of the double bass date from the late 15th or early 16th century and were in common use by the 18th. Ludwig van Beethoven and later composers gave the bass increased importance in the symphony orchestra. Beethoven's friend Domenico Dragonetti and the conductor Serge Koussevitzky, both skilled bassists, composed concertos for the instrument.

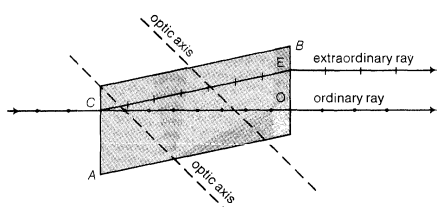
In jazz ensembles the bass forms part of the rhythm section and is also used as a melody instrument.

double coconut (palm): *see* coco de mer.

double jeopardy, in law, protection against the use by the state of certain multiple forms of prosecution.

In general (in countries observing the rule of double jeopardy), a person cannot be convicted twice for the same crime based on the same conduct. If a person robs a bank, he cannot twice be convicted of robbery for the same offense. Nor can he be convicted of two different crimes based upon the same conduct unless the two crimes are defined so as to prohibit conduct of significantly different kinds. Thus, a man cannot be convicted of both murder and manslaughter for the same killing, but he can be convicted of both murder and robbery if the murder arose out of the robbery. The defense of double jeopardy also prevents the state from retrying a person for the same crime after he has been acquitted. Nor can the state voluntarily dismiss a case after trial has begun in order to start over. Acquittal in one state or nation does not, however, always bar trial in another.

double refraction, also called BIREFRINGENCE, an optical property of most crystals in which a single ray of light entering a crystal is split into two rays, each traveling in a different direction. One of the rays (called the extraordinary ray) will be bent, or refracted, even when the original ray falls on a face of the crystal at right angles to it. The original ray is not divided, however, if it enters a crystal parallel to the crystal's axis of symmetry, which is known as the crystallographic axis. This direction is called the optic axis and is represented by any imaginary line drawn through the crystal parallel to the crystallographic axis.



Double refraction through a calcite crystal

All transparent crystals except those of the cubic system exhibit the phenomenon of double refraction: some well-known examples are calcite, ice, mica, quartz, sugar, and tourmaline. If a pencil mark is covered with a piece of glass, only one image will be seen; but if a calcite crystal oriented in a certain direction is substituted, two marks will be observed; or, if a parallel beam of light falls on a crystal at right angles, two illuminated spots will be seen on the screen, and, when the crystal is rotated about the beam as an axis, one spot will revolve about the other, which remains stationary. The Figure shows double refraction in a calcite crystal. A principal section of the crystal (so-called because it is perpendicular to one of the faces and contains the optic axis) is represented by *AB*. An incident ray is seen to split into the ordinary ray *CO* and the extraordinary ray *CE* upon entering the crystal face at *C*.

In double refraction, the refractive index (a number that determines the angle of bending, specific for each medium) is constant for one of the rays, called the ordinary ray, regardless of the direction it takes, whereas the refractive index varies according to the direction taken by the extraordinary ray. Such crystals as calcite have a so-called negative birefringence if the index of refraction for the extraordinary ray is at its minimum at right angles to the optic axis, whereas such crystals as quartz have a positive birefringence if the index of refraction for the extraordinary ray is at its maximum. Because the speed of light waves in a substance is equal to their speed in vacuum divided by the index of refraction for that wavelength, an extraordinary ray moves faster than the ordinary ray in calcite than in quartz. The ordinary ray and extraordinary ray are polarized, vibrating only in planes; and these planes are at right angles to each other, the ordinary ray being distinguished by its vibrating in a direction perpendicular to the optic axis.

double star: *see* binary star.

double sugar (biochemistry): *see* disaccharide.

double vision, also called DIPLOPIA, perception of two images of a single object, most commonly caused by temporary or permanent paralysis of eye muscles.

Normal binocular vision results from the fusion by the brain of slightly different images from each eye. Points on the retina of each eye correspond to points on the opposite retina. When one of the extraocular muscles of one eye is paralyzed, the image of an object falls on the retina at a point different from that where the same image is projected on the retina of the opposite eye, and there is a noncorrespondence of images.

The particular muscle that is paralyzed determines the orientation of the double image. Objects that are near at hand are frequently seen in crossed images; that is, the image received by the left eye appears to the right of the image from the right eye. Farther objects are also doubled, but the images bear the appropriate relationship to each other. Generally, the image from the paralyzed eye is less distinct than that from the normal eye because the paralysis makes proper focusing difficult. The two images can also be distinguished by placing a coloured filter over one eye.

Double vision may be among the first symptoms of botulism and also occurs in other infections, in head injuries, and in nerve palsies or muscle disorders. The most common ocular muscle disease causing double vision is myasthenia gravis, in which diplopia may be the first symptom. The disease later affects other muscles as well. Double vision also occurs in benign ocular myasthenia, which resembles myasthenia gravis but does not spread to other muscles.

Doubleday, Abner (b. June 26, 1819, Ballston Spa, N.Y., U.S.—d. Jan. 26, 1893, Mendham, N.J.), U.S. Army officer and, according to some authorities, the original inventor of baseball.

Doubleday attended school in Auburn and Cooperstown, N.Y., and in 1838 he was appointed a cadet in the U.S. Military Academy (graduating in 1842). He was an artillery officer in the Mexican War and fought in the Seminole War in Florida (1856–58). While stationed at Fort Sumter, S.C., he commanded the gunners that fired the first shots by the North in the American Civil War. He fought at Bull Run (second battle), Antietam, Fredericksburg, and Gettysburg. He held the temporary rank of major general of volunteers in 1862–63, received the permanent rank of colonel in 1867, and retired from the army in 1873.

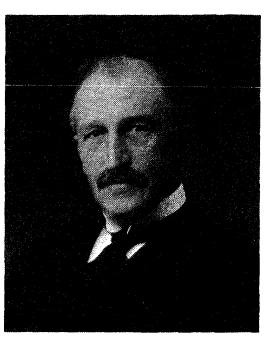
Abner Doubleday
Culver Pictures

In 1907 a commission appointed by Albert G. Spalding published its conclusion that Doubleday formulated the essential rules of baseball in the summer of 1839 at Cooperstown, N.Y., where he was an instructor in a military preparatory school. Hence Cooperstown was chosen as the site of the National Baseball Hall of Fame and Museum. Doubleday was not in Cooperstown in 1839.

The Spalding Commission's finding that the national game was of purely American origin was discredited by subsequent inquiries confirming baseball's evident connection with the older English game variously called rounders, feeder, or base ball.

Doubleday, Frank Nelson (b. Jan. 8, 1862, Brooklyn, N.Y., U.S.—d. Jan. 30, 1934, Coconut Grove, Fla.), American publisher and founder of the book-publishing firm Doubleday & Company, Inc.

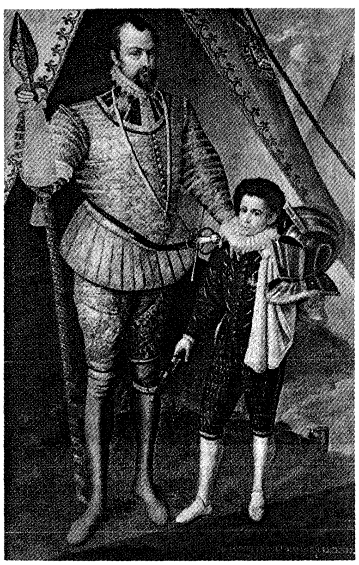
At the age of 15 he quit school to work for Charles Scribner's Sons, publishers, and he became manager of *Scribner's Magazine* when it was begun in 1886. In 1897, with Samuel S. McClure, he founded the Doubleday & McClure Company, the publishing house that later (1900) became Doubleday, Page & Company with Walter Hines Page as a partner. Doubleday built Country Life Press at Garden City, N.Y., in 1910 and established a chain of more than 30 book shops. In 1927


Frank Nelson Doubleday
By courtesy of Doubleday and Company, Inc.

Doubleday and Page absorbed the George H. Doran Company and was known as Doubleday, Doran & Company until 1946, when it became simply Doubleday & Company, Inc.

Inspired by the initials F.N.D., one of Doubleday's authors, Rudyard Kipling, gave Doubleday the nickname by which he became widely known, "Effendi," the Turkish word meaning "Master." Other Doubleday authors included Joseph Conrad, O. Henry, Booth Tarkington, Edna Ferber, and Selma Lagerlöf. Doubleday wrote *A Plain American in England* (1910) under the pseudonym Charles T. Whitefield.

doublet, chief upper garment worn by men from the 15th to the 17th century. It was a close-fitting, waisted, padded jacket worn over a shirt. Its ancestor, the gipon, was a tunic worn under armour, and at first it came down almost to the knees. The civilian doublet at



Man and boy wearing doublets, "Ambrose Dudley, Earl of Warwick," oil painting c. 1580, artist unknown; in the collection of the Marquess of Bath, England

By courtesy of the Marquess of Bath, England

first had skirts but gradually lost them. It had no collar until 1540, allowing the shirt to be seen at the neck; the shirt was also visible through slashes or pinking in the material.

The sleeves, which at first were sometimes plain and close-fitting, became wide, padded, and slashed with complex designs. Detachable sleeves were worn after 1540. The doublet fastened down the front with buttons, hooks, or laces in the 16th century, though earlier it was hooked out of sight at the side.

The height and narrowness of the waist varied from country to country, as did the materials, which included rich fabrics such as velvet, satin, and cloth of gold. An extreme fashion, the peascod, or goose-bellied doublet, came to England from Holland in the 1570s; it was padded to a point at the waist and swelled out over the girdle. It survives in the traditional costume of Punch.

A gown or cloak might be worn over the doublet by the elderly or in cold weather. In the 16th century it could be worn partly open, requiring a stomacher or placard underneath. But in England in Elizabethan times a man was fully suited in doublet and hose. The two parts of his suiting were joined by points, ties threaded through opposing eyelets in each garment.

Doubs, *département,* Franche-Comté region, eastern France, on the Swiss frontier, created from the Alsatian principality of Montbéliard (*q.v.*) and part of the historic province of Franche-Comté (*q.v.*). It has three *arrondissements,* Besançon, Montbéliard, and Pontarlier, and is in the educational division of Besançon. Doubs has an area of 2,019 sq mi (5,228 sq km). The Doubs River, which gives the *département* its name, makes a loop round Besançon (*q.v.*), its capital, while the Ognon River forms the northwestern border, which also is crossed northeast–southwest by four parallel chains of the Jura Mountains. The highest and most easterly chain contains Mont d'Or (4,790 ft [1,460 m]).

The climate is cold and rainy, with generally severe winters. Snow usually lies from six to eight months on the upper regions, which are barren or covered with vast fir forests and have good pasturelands. All varieties of cereals, as well as vegetables, fruits, and vines, are grown on the plains. Cooperative factories produce large quantities of Gruyère cheese.

The *département* is largely rural. Most of the towns are in or near the Doubs Valley, in which the major industries (watches, hardware, motor vehicles, textiles, food) are situated. The northern part of the *département* is almost entirely dominated by the automobile industry at Montbéliard, which employs specialized manpower from as far as 50 mi (80 km) away. Pontarlier, another but more traditional industrial centre (distilleries, cheese, hosiery, sawmills) in the mountain region, lies in the upper Doubs Valley. Tourism is well developed. Pop. (1982) 477,163.

Doubs River, river in eastern France. The river justifies its Latin name, Dubius, by its erratic course, rising near Mouthe in the Jura Mountains (in the Doubs *département*) at a height of 3,074 ft (937 m) and following a course 267 mi (430 km) long to flow into the Saône at Verdun-sur-le-Doubs, only 56 mi to the west. Where not canalized, the river is navigable for only a few miles above its mouth, where it flows northeastward toward the Rhine and doubles back on itself. In its upper course it is partly a torrent. It forms the Lac de Saint-Point before passing Pontarlier, and then is a waterfall (Saut du Doubs) at the Lac des Brenets, after which it flows for some 20 mi through gorges. After making a short incursion into Swiss territory, it has a hairpin bend at Saint-Ursanne before flowing westward through Saint-Hippolyte. Coursing northward, it bends sharply below Montbéliard, where it is joined by the Rhine-Rhône Canal. It flows southwestward to Besançon, capital of the Doubs *département,* looping round the centre of the city, to join the Saône after crossing Dole.

doubt, methodic (Cartesian philosophy): *see* methodic doubt.

Doudart de Lagrée, Ernest-Marc-Louis (de Gonzague) (b. March 31, 1823, Saint-Vincent-de-Mercuze, Fr.—d. March 12, 1868, T'ung-ch'uan, Yunnan Province, China), French explorer and diplomat who secured French hegemony over Cambodia.

Doudart de Lagrée entered the French Navy in 1845. In 1863 he became the first French representative to Cambodia, when he was sent from Saigon, in Vietnam, to Oudong to urge King Norodom (*q.v.*) to accept French protection. Cambodia was shared as a vassal by Siam and Vietnam, and the Siamese seemed ready to invade the country. Norodom's position was also threatened by his two half brothers, Sisowath and Si Votha (*qq.v.*). The former hesitated to make an open challenge, but the latter went into dissidence in 1860. As the French representative in Cambodia, Doudart gained Norodom's reluctant agreement to a treaty of protection in 1863, threatening to depose Norodom in the following year when the Cambodian king seemed ready to return himself to Siamese (Thai) protection. The French justified their actions in Cambodia by claiming to have succeeded to Vietnam's role as one of Cambodia's suzerains.

Doudart became a commander in the French Navy in 1864 and was appointed French resident at Phnom Penh. In 1866 he led a geographic survey and exploration of the Mekong River into Laos and China. He died in northern Yunnan.

Dougga (Tunisia): *see* Thugga.

dough, mixture of flour and liquid with other ingredients, such as leavening agents, shortening, sugar, salt, eggs, and various flavouring materials, used to make baked products. A similar mixture, in more liquified form, is known as batter.

Doughs are thick and plastic and may be shaped, kneaded, and rolled. They are elastic, allowing much expansion during baking, the degree of elasticity depending upon the amount of elastic protein, or gluten, provided by the flour employed. Doughs are used to make breads and pastries. Sweet doughs, used for such products as coffee cakes and Danish pastries, are richer than bread doughs; they contain larger amounts of shortening, milk, and sugar and various spices, nuts, and fruits.

Doughs used for flatbreads and most piecrusts are unleavened and do not expand. Puff pastes, used for patty shells and napoleons (pastry layers filled with custard or whipped cream), and authentic Danish pastries are made of alternating dough and shortening layers that are rolled until the layers are quite thin, producing flaky, tender pastry. At high altitudes, ingredient proportions may require alteration, with reduced leavening and increased liquid compensating for differences in atmospheric pressure that lower the boiling point of the liquid and cause dough to rise more rapidly.

Dougherty, Walter Hampden (American actor): *see* Hampden, Walter.

Doughty, Charles Montagu (b. Aug. 19, 1843, Theberton Hall, Leiston, Suffolk, Eng.—d. Jan. 20, 1926, Sissinghurst, Kent), British traveller, widely regarded as one of the greatest of all Western travellers in Arabia.

After attending London and Cambridge universities, he travelled widely in Europe, Egypt, the Holy Land, and Syria. He began his journey to northwestern Arabia at Damascus in 1876 and proceeded southward with pilgrims headed for Mecca as far as Madā'in Ṣāliḥ. There he studied monuments and inscriptions left by the ancient Nabataean civilization. His observations were published by Ernest Renan. On the latter part of his journey, however, which included visits to Taymā', Ḥā'il, 'Unayzah, at-Tā'if, and Jidda, he made his most important geographical, geological, and anthropological observations.

In 1888 he published *Travels in Arabia Deserta,* which won little recognition at the time, though it eventually came to be regarded as a masterpiece of travel writing. In it he was more concerned with producing a monument of what he considered to be pure English prose than with recording information. The Elizabethan style in which it is cast succeeds in conveying the feeling of his remote and lonely wandering. Doughty himself, however, attached more importance to his epic and dramatic poetry. These works include *The Dawn in Britain,* 6 vol. (1906), *The Clouds* (1912), and *Mansoul* (1920).

Douglas, municipal borough and capital, since 1869, of the Isle of Man, one of the British Isles. It lies on the island's east coast, 80 mi (130 km) northwest of Liverpool (across the Irish Sea). Low hills encircle the town, penetrated by the valley of the combined Dhoo (Manx, "dark") and Glass (Manx, "light") rivers, from which it takes its name.

Douglas grew rapidly in the 18th century as a result of the smuggling trade and by 1850 was a popular watering place. The Tynwald,

or Manx Parliament, and the House of Keys, one of its legislative branches, are situated in the Legislative Buildings, built (1894) on Prospect Hill. The Tynwald Court is composed of the two legislative branches—the House of Keys and the Legislative Council—sitting in joint session, but voting separately. The town's primary occupations are tourism, light precision engineering, brewing, and mineral water works. At the mouth of the rivers is the harbour, which can be viewed from a two-mile promenade circling it; 7 mi (11 km) southwest is a civil airport.

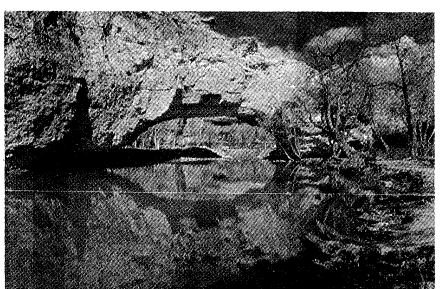
Of interest are the Tower of Refuge, built in 1832 on the dangerous Conister, or St. Mary's Rock, in Douglas Bay; Castle Mona (1804); and the Manx Museum. The Tourist Trophy motorcycle races and international cycle races are held each June; the Manx Grand Prix race is in September. The Manx Electric Railway connects Douglas with Ramsey and the summit of Snaefell (2,034 ft [620 m]). The Isle of Man Steam Railway connects Douglas with Port Erin. Pop. (1981) 19,944.

Douglas, suburb of Juneau (*q.v.*), Alaska, U.S.

Douglas, city, Cochise County, in Sulphur Springs Valley, southeastern Arizona, U.S. A port of entry (on the Mexican border), it is separated from Agua Prieta by International Avenue. It was founded *c.* 1900 as a copper-smelting centre and was named for James Douglas, president of the Phelps Dodge (mining) Corporation. Irrigation development, enabling cattle raising and farming, broadened its economy. It now serves as an import point for eastern Sonora, Mex. Immediately west is Cochise College (1964). Inc. 1905. Pop. (1980) 13,058.

Douglas, city, seat (1858) of Coffee County, south central Georgia, U.S. Founded in 1858 and named for U.S. Sen. Stephen A. Douglas of Illinois, it is the trading centre for a five-county area and is one of the state's most important tobacco markets. Forestry, livestock and poultry raising, and the manufacture of mobile homes and clothing are other economic activities. South Georgia College, established there in 1906, is the state's oldest state-supported junior college. Inc. town, 1895; city, 1897. Pop. (1980) 10,980.

Douglas, town, seat (1887) of Converse County, east central Wyoming, U.S., on the North Platte River, 52 mi (84 km) east of Casper. Founded in 1886 with the arrival of the railroad, it was first called Tent Town but was renamed to honour Stephen A. Douglas, Lincoln's political opponent. It is a trade



Ayres' Natural Bridge, near Douglas, Wyo.
Milt and Joan Mann from CameraMann

centre for a livestock, grain, poultry, and petroleum region and the home of the annual Wyoming State Fair. Nearby are the restored site of Ft. Fetterman, built in 1867 during the Sioux wars, and Ayres' Natural Bridge, a 100-ft (30-m) arch spanning La Prele Creek. A division of the Medicine Bow National Forest is across the river to the south, and the Thunder Basin National Grassland lies to the north. Inc. 1886. Pop. (1970) 2,677; (1980) 6,030.

Douglas, EARLS OF, titled Scottish nobility, in branches of the Douglas family, grouped below chronologically and indicated by the symbol •.

• **Douglas, William Douglas, 1st earl of,** also called EARL OF MAR (b. *c.* 1327—d. May 1384, Douglas, Lanarkshire, Scot.), Scottish lord of the Douglases, prominent in the dynastic and English wars of the 14th century.

The son of Sir Archibald Douglas (d. 1333), regent of Scotland, who was killed at the Battle of Halidon Hill, he was educated in France and returned to Scotland in 1348. He killed his kinsman and godfather, Sir William (*c.* 1300–53), the knight of Liddesdale, in Ettrick Forest (1353) and acquired part of Liddesdale. His marriage (1357) with Margaret, sister and heiress of Thomas, 9th earl of Mar, brought him the estates and earldom of Mar (1374), and he was created earl of Douglas in January 1358. He joined King David II in proposing a treaty (1363–64) with England, which would substitute for Robert the Stewart (afterward Robert II) an English prince as heir to the Scottish throne. David was seeking a remission of his ransom, William the return of his family's English estates. On the accession (1371) of Robert II he was nevertheless reconciled and was appointed warden of the marches.

• **Douglas, James Douglas, 2nd earl of** (b. *c.* 1358—d. August 1388, Otterburn, Roxburghshire, Scot.), Scottish leader in wars against the English in the late 14th century.

Son of the 1st earl, William Douglas, he married (1371 or 1373) Isabel, daughter of King Robert II. He invaded England (1388), besieged Newcastle for three days, and captured the pennon of Sir Henry Percy ("Hotspur") in single combat. Percy sought revenge in the Battle of Otterburn (August 1388), which is celebrated in English ballad as "Chevy Chase" and Scottish ballad as "Battle of Otterburn." The Scots were victorious, and Percy and his brother were captured; but James was killed. He left no legitimate male issue, but his illegitimate sons William (d. *c.* 1421) and Archibald (d. *c.* 1456) founded the families of Douglas of Drumlanrig and Douglas of Cavers.

• **Douglas, Archibald Douglas, 4th earl of,** DUC (duke) DE TOURAINE, byname TYNEMAN (b. *c.* 1369—d. Aug. 17, 1424, Verneuil, Fr.), Scottish commander in the Scottish and French wars with the English in the early 15th century.

Son of the 3rd earl, Archibald the Grim, he married Margaret, daughter of the future Robert III of Scotland. As master of Douglas (1400) he defeated Sir Henry Percy ("Hotspur") and George Dunbar, earl of March near Preston, and acquired the lands that March thus forfeited. When the other lands were restored (1409) he retained the lordship of Annandale. Archibald was, with the regent, Robert, duke of Albany, suspected of compassing the Duke of Rothesay's death (March 1402) while he was in their custody at Falkland; but both were declared guiltless by Parliament.

In a raid upon England Archibald was captured by Percy at the Battle of Homildon Hill (September 1402); he fought with his captors against Henry IV at the Battle of Shrewsbury (1403) and was taken prisoner by the English king. He was allowed to visit Scotland several times after 1405, negotiating between the Scots and English for the release of the Scots king James I, who had been captured by the English (1406) while sailing to France. Archibald was finally freed in 1413.

He commanded a contingent of 10,000 Scots sent to help the French king Charles VII against the English and was made lieutenant general of the French army. Archibald received the peerage-duchy of Touraine with remainder to his male heirs. He was killed fighting against John, duke of Bedford, at the Battle of Verneuil and was buried in Tours cathedral.

• **Douglas, William Douglas, 8th earl of** (b. *c.* 1425—d. Feb. 22, 1452, Stirling, Stirling, Scot.), prominent Scottish lord during the reign of James II of Scotland.

The so-called Black Douglases, of whom the 8th earl was a member, had lost their lands through accusations of treason; but the Earl recovered Galloway and Wigtown by marriage with his cousin, the heiress Margaret Douglas, the "Fair Maid of Galloway." The estate of Bothwell was granted to him by James II, with whom he at first stood in high favour.

In 1450, however, James II raided the Earl's lands during his absence on a pilgrimage to Rome; their relations seemed outwardly friendly, however, until 1452, when the King invited Douglas to Stirling Castle under a safe-conduct—in itself, however, a proof of strained relations. There James demanded the dissolution of a league into which Douglas had entered with Alexander Lindsay, the "Tiger," 4th earl of Crawford. On Douglas' refusal the King murdered him with his own hands, the courtiers helping to dispatch him.

• **Douglas, James Douglas, 9th earl of** (b. 1426—d. July 14, 1488, Lindores Abbey, Fife, Scot.), last of the first line of the earls of Douglas, caught in the internal wars of Scotland and the intrigues with the English.

He at first attempted to avenge the murder of his brother, the 8th earl; but, deserted by his allies, he was obliged to submit to King James II (August 1452). To keep the family estates together, he obtained a dispensation to marry his brother's widow, Margaret, the "Fair Maid of Galloway."

He openly accused the King of the murder of his brother (1454) and led 40,000 men against him. Meanwhile another branch of the family, known as the Red Douglases, had risen to importance and supported the King against their chief. Douglas, again deserted by his allies, fled to England; he was attainted (June 1455) and his wife divorced him. The lordship of Douglas was granted to the Earl of Angus.

Douglas, who had long intrigued with the Yorkist faction in England, was favoured by Edward IV of England, who sent him (1461) to make a treaty with John, earl of Ross and lord of the Isles, against the Scottish king, who had given asylum to the fugitive English king Henry VI. Douglas was captured while raiding southern Scotland (1484) and relegated to Lindores Abbey, Fife, where he died four years later.

Douglas, Archibald: *see* Douglas, Archibald Douglas, 4th earl of; Angus, Archibald Douglas, 6th earl of; Angus, Archibald Douglas, 8th earl of.

Douglas, Clifford (Hugh) (b. Jan. 20, 1879, Stockport, Cheshire, Eng.—d. Sept. 29, 1952, Dundee, Scot.), British economist and originator of the theory of Social Credit (*q.v.*).

He began a career in engineering and management, but society's failure to utilize modern technology fully stimulated his interest in economic theories. These were expounded (1919) in *The New Age,* the socialist publication of Alfred Richard Orage, and in Douglas' first book, *Economic Democracy* (1920). His basic idea was that the remedy for the chronic deficiency of purchasing power in the economy would be the issuance of additional money to consumers, or of subsidies to producers, in order to liberate production from the price system. Douglas' ideas attracted considerable public attention in the early 1920s, but the only extensive following was in Al-

berta, Canada, where the Social Credit Party was founded in 1935. The party dominated the province's politics until 1971, but Douglas' principles were virtually abandoned in the late 1930s.

Douglas, David (b. 1798, Scone, Perthshire, Scot.—d. July 12, 1834, Sandwich [Hawaiian] Islands), Scottish botanist who was a traveller and botanical collector in North America and for whom the Douglas fir (*Pseudotsuga menziesii,* or *P. douglasii*) and the primrose genus *Douglasia* are named.

After serving as a gardener at the Botanical Garden at Glasgow, Douglas went to the U.S. as a botanical collector for the Royal Horticultural Society. His first trip was to the Oregon Territory in 1823; he later made several other scientific journeys, especially to the North American Far West. In 1825 he went to British Columbia and travelled inland to Hudson Bay, which he reached in 1827; he discovered many new animal and plant species along the way, including the Douglas fir. From 1830 to 1834 he explored California and the Fraser River region. He introduced some 50 new trees and shrubs and about 100 herbaceous plants into England during his career.

Douglas, Donald (Wills) (b. April 6, 1892, Brooklyn, N.Y., U.S.—d. Feb. 1, 1981, Palm Springs, Calif.), U.S. aircraft designer who founded the Douglas Aircraft Company.

Douglas assisted Jerome C. Hunsaker in building the first wind tunnel, at the Massachusetts Institute of Technology, Cambridge

Donald Douglas, 1970
By courtesy of the McDonnell Douglas Corporation

(1914–15), and was chief engineer for the Glenn L. Martin Company before organizing his own firm in 1920. His early government contracts included an order for the Douglas World Cruiser biplanes. Two of the four planes that set out on the first around-the-world flight, on April 6, 1924, completed the trip on September 28. The prototype DC-1 commercial transport (flown July 1933) and the production model DC-2 were succeeded (1935) by the larger and more powerful DC-3 (military designation C-47 [Dakota]). The four-engined DC-4 (military versions, Air Force C-54 and Navy R5D-1) and the DC-6 and DC-7 series were commercially successful.

During World War II, Douglas manufactured the A-20 (Havoc) and A-26 (Invader) light bombers and the SBD (Dauntless) dive bomber. Postwar aircraft include the DC-8, DC-9, and DC-10 jet transports and the A-4 (Skyhawk) attack bomber. In 1957 he resigned as president of Douglas Aircraft but remained as chairman of the board of directors and chief executive officer until 1967, when the company became a division of McDonnell Douglas Corporation.

Douglas, Gawin, Gawin also spelled GAVIN (b. 1475?—d. September 1522, London), Scottish poet and first British translator of the *Aeneid.* As a bishop and a member of a powerful family, he also played an important part in a troubled period in Scottish history.

Four surviving works attributed to Douglas reflect his moral earnestness and his command of difficult metrical forms. They are: a long poem, *Conscience;* two moral allegories, *The Palice of Honour* and *King Hart;* and the *Aeneid. The Palice of Honour* (1501), a dream allegory on the theme "where does true honour lie," extols a sterner rhetorical virtue than the young poet was to exemplify in his own subsequent career. *King Hart* (uncertainly ascribed to Douglas) describes vigorously and graphically the progress of Hart (the human soul) from a youthful enslavement to pleasure through the inevitable assaults of conscience, age, and death. Douglas' last literary work was the first direct translation of the whole *Aeneid* to be made in Britain.

After the Battle of Flodden (1513), in which James IV of Scotland was killed, creating a struggle for power between rival Scottish factions, Douglas abandoned his literary career for political activities. The marriage of the King's widow, Margaret Tudor, sister of Henry VIII, to Douglas' nephew invested the Douglas family with an almost royal dignity and aligned them with the pro-English faction in Scotland. Douglas became bishop of Dunkeld and the Queen's chief adviser and involved himself in a series of intrigues to advance her cause and the power of his family, which led ultimately to his downfall. In 1521 he was forced by political enemies to flee to England, where he remained in exile until his death in London from the plague. In his last years he found comfort in his friendship with an Italian Humanist, Polidoro Vergilio.

Though his work stands on the threshold of Renaissance Humanism, Douglas' heritage as a poet and translator is medieval. In his rendering of the *Aeneid* he shows a scholarly concern with the technique of translation and sensitivity to linguistic differences, but he is medieval in the casual way he brings his original up to date, and in the absence of "classical" diction and gravity of tone. Each book has an original prologue that is a notable piece of writing.

Douglas, George, pseudonym of GEORGE DOUGLAS BROWN (b. Jan. 26, 1869, Ochiltree, Ayrshire, Scot.—d. Aug. 28, 1902, London), Scottish novelist who was instrumental in the realistic literature movement of the early 20th century. Educated at Glasgow University and Balliol College, Oxford, he was a brilliant student who won many awards. After graduation in 1895 he travelled to London to write for metropolitan newspapers, eventually becoming a publisher's reader.

Douglas' novel *The House With the Green Shutters* (1901), one of the first literary works to forego romance or adventure, received much attention for its realistic study of contemporary Scottish life. Another novel, *Love and a Sword* (1899), was not nearly so influential. He died suddenly, at the height of his career.

Douglas, James: *see* Douglas, James Douglas, 2nd earl of; Douglas, James Douglas, 9th earl of; Morton, James Douglas, 4th earl of.

Douglas, James (b. Nov. 4, 1837, Quebec—d. June 25, 1918, New York City), Canadian-born U.S. mining engineer, industrialist, and philanthropist who contributed greatly to the industrial growth and welfare of the U.S. Southwest.

He attended the University of Edinburgh for two years, studying medicine and theology. He then returned to Canada, graduating in 1858 from Queen's University, Kingston, Ont., where he was later chancellor.

James Douglas, oil painting by E.W. Grier, 19th century; in a private collection
By courtesy of the Phelps Dodge Corp.

With T. Sterry Hunt (1826–92), he invented the Hunt–Douglas process for extracting copper from its ores. In 1875 he became superintendent of the Chemical Copper Company, Phoenixville, Pa., where he installed the first commercial electrolytic plant for refining copper. Six years later, the metal dealers Phelps, Dodge and Company of New York employed him to examine copper mines in Arizona, leading to the acquisition of mines at Bisbee and Morenci. These mines were the beginning of the Copper Queen Consolidated Mining Company, of which Douglas became president. Later, the company acquired other mines and built the El Paso and Southwestern Railroad. Douglas encouraged radium-ore mining and presented more than three grams of radium to General Memorial Hospital, New York City, stimulating later cancer research by that institution. From 1899 to 1901 he was president of the American Institute of Mining Engineers; from 1916 until his death he was chairman of the board of directors of the Phelps Dodge Corporation.

Douglas, Sir James, byname BLACK DOUGLAS (b. *c.* 1286—d. Aug. 25, 1330, Spain), lord of the Douglas family and champion of Robert de Bruce (King Robert I of Scotland).

Son of Sir William Douglas (d. *c.* 1298), who was captured by the English and died in the Tower of London, Sir James was educated in Paris and returned home to find an Englishman, Robert de Clifford, in possession of his estates. He joined Robert de Bruce, attending his coronation at Scone (March 1306) and sharing his wanderings in the Highlands after their defeat at the Battle of Methven (June 1306). The following year they separated, Sir James returning to the south of Scotland, when he three times attacked his own castle at Douglas, finally destroying it. His assault made on Palm Sunday, March 19, 1307, is known as the "Douglas Larder." His many successful raids on the English won him the dreaded name of the "Black Douglas." Through the capture of Roxburgh Castle (1313) by the stratagem of disguising his men as black oxen, he secured Teviotdale; and at the Battle of Bannockburn (June 1314) he commanded the left wing with Walter the Steward. He invaded Yorkshire (1319) with Thomas Randolph, earl of Moray, defeating an English army assembled at Myton-upon-Swale. Shortly before peace was finally concluded, he nearly captured Edward III in a daring night attack on the English camp in Weardale (August 1327).

Before his death (1329) Bruce asked Sir James to carry his heart to the Holy Land in redemption of his unfulfilled crusading vow; Sir James set out (1330), bearing the embalmed heart in a silver casket, but he fell that year fighting against the Moors in Spain.

Douglas, Sir James (b. Aug. 15, 1803, Demerara, British Guiana—d. Aug. 2, 1877, Victoria, B.C., Can.), Canadian statesman known as "the father of British Columbia." He be-

came its first governor when it was a newly formed wilderness colony.

Douglas joined the Hudson's Bay Company in 1821 and rose to become senior member of the board, in charge of operations west of the Rocky Mountains. After the establishment of the southwestern boundary with the United States, he moved the company's headquarters from Oregon to Vancouver Island in 1849. As governor (1851–64) of Vancouver Island when gold was discovered on the Fraser River in 1858, he extended his authority to the mainland in order to preserve Britain's foothold on the Pacific in the face of an influx of settlers from the United States. His action was approved by the British government, which then created the colony of British Columbia. Douglas became its governor in 1858 after severing his connection with the Hudson's Bay Company. He was knighted in 1863 and retired in 1864.

Douglas, Keith Castellain (b. Jan. 20, 1920, Royal Tunbridge Wells, Kent, Eng.—d. June 9, 1944, Normandy, Fr.), British poet who is remembered for his irony, eloquence, and fine control in expressing the misery and waste of war, to which he was to fall victim.

Douglas' education at Oxford University was cut short by the outbreak of war. By 1941 he was serving as a tank commander in North Africa, where some of his most powerful poems were written (*Alamein to Zem-Zem,* 1946). He was moved back to Britain in 1944 to take part in the D-Day invasion; he fell in combat in Normandy on his third day there. His posthumous *Collected Poems* (1951) enhanced his reputation as a war poet, but in 1964 Ted Hughes's edition of Douglas' *Selected Poems* established him as a poet of universal significance.

Douglas, Margaret: *see* Lennox, Margaret Douglas, countess of.

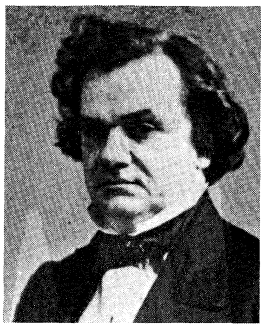
Douglas, (George) Norman (b. Dec. 8, 1868, Thüringen, Austria—d. Feb. 9, 1952, Capri, Italy), essayist and novelist who wrote of southern Italy, where he lived for many years, latterly on the island of Capri—the setting of his most famous book, *South Wind.* All his books, whether fiction, topography, essays, or autobiography, have a charm arising from Douglas' uninhibited expression of a bohemian, aristocratic personality. His prose is considered somewhat near the perfection of the conversational style.

Douglas was born of an old Scottish landowning family, which had intermarried with German aristocrats, and he attended the *Gymnasium* at Karlsruhe, Ger., where he showed a precocious gift for both languages and natural science. He entered the British Foreign Office in 1893 but spent only about three years on diplomatic service (in Russia), after which he travelled widely in India, Italy, and North Africa.

His first notable book was *Siren Land* (1911) and his first popular success the satirical novel *South Wind* (1917). Perhaps the richest of his books is *Old Calabria* (1915) and the most self-revealing, his informal autobiography *Looking Back* (1933).

Douglas, Stephen A(rnold) (b. April 23, 1813, Brandon, Vt., U.S.—d. June 3, 1861, Chicago), U.S. politician, leader of the Democratic Party, and orator who espoused the cause of popular sovereignty in relation to the issue of slavery in the territories before the American Civil War (1861–65). He was re-elected senator from Illinois in 1858 after a series of eloquent debates with the Republican candidate, Abraham Lincoln, who defeated him in the presidential race two years later.

Douglas left New England at the age of 20 to settle in Jacksonville, Ill., where he quickly rose to a position of leadership in the Illinois Democratic Party. In 1843 he was elected to the U.S. House of Representatives; one of its youngest members, Douglas gained early prominence as a dedicated worker and gifted speaker. Heavyset and only five feet four inches tall, he was dubbed the "Little Giant" by his contemporaries.



Stephen Douglas, detail of a photograph by Case and Getchell, *c.* 1861

By courtesy of the Chicago Historical Society

Douglas embraced a lifelong enthusiasm for national expansion, giving consistent support to the annexation of Texas (1845), the Mexican War (1846–48), taking a vigorous stance toward Great Britain in the Oregon boundary dispute (1846), and advocating both government land grants to promote transcontinental railroad construction and a free homestead policy for settlers.

Douglas was elected in 1846 to the U.S. Senate, in which he served until his death; there he became deeply involved in the nation's search for a solution to the slavery problem. As chairman of the Committee on Territories, he was particularly prominent in the bitter debates between North and South on the extension of slavery westward. Trying to remove the onus from Congress, he developed the theory of popular sovereignty (originally called squatter sovereignty), under which the people in a territory would themselves decide whether to permit slavery within their region's boundaries. Douglas himself was not a slaveholder, though his wife was. He was influential in the passage of the Compromise of 1850 (which tried to maintain a congressional balance between free and slave states), and the organization of the Utah and New Mexico territories under popular sovereignty was a victory for his doctrine.

The climax of Douglas' theory was reached in the Kansas–Nebraska Act (1854), which substituted local options toward slavery in the Kansas and Nebraska territories for that of congressional mandate, thus repealing the Missouri Compromise of 1820. The act's passage was a triumph for Douglas, although he was bitterly condemned and vilified by antislavery forces. A strong contender for the Democratic presidential nomination in both 1852 and 1856, he was too outspoken to be chosen by a party that was still trying to bridge the sectional gap.

The Supreme Court struck indirectly at popular sovereignty in the Dred Scott Decision (1857), which held that neither the Congress nor territorial legislatures could prohibit slavery in a territory. The following year Douglas engaged in a number of widely publicized debates with Lincoln in a close contest for the Senate seat in Illinois, and although Lincoln won the popular vote, Douglas was elected 54 to 46 by the legislature. In the debates, Douglas enunciated his famous "Freeport Doctrine," which stated that the territories could still determine the existence of slavery through unfriendly legislation and the use of police power, in spite of the Supreme Court decision. As a result, Southern opposition to Douglas intensified, and he was denied reappointment to the committee chairmanship he had previously held in the Senate.

When the "regular" (Northern) Democrats nominated him for president in 1860, the Southern wing broke away and supported a separate ticket headed by John C. Breckinridge of Kentucky. Although Douglas received only 12 electoral votes, he was second to Lincoln in the number of popular votes polled. Douglas then urged the South to acquiesce in the results of the election. At the outbreak of the Civil War, he denounced secession as criminal and was one of the strongest advocates of maintaining the integrity of the Union at all costs. At Pres. Lincoln's request, he undertook a mission to the Border States and to the Northwest to rouse Unionist sentiments among their citizenry. Douglas' early and unexpected death was partly the result of these last exertions on behalf of the Union.

Douglas, Thomas: *see* Selkirk, Thomas Douglas, 5th earl of.

Douglas, William: *see* Angus, William Douglas, 10th earl of; Douglas, William Douglas, 1st earl of; Douglas, William Douglas, 8th earl of.

Douglas, William O(rville) (b. Oct. 16, 1898, Maine, Minn., U.S.—d. Jan. 19, 1980, Washington, D.C.), public official, legal educator, and associate justice of the U.S. Supreme Court best known for his consistent and outspoken defense of civil liberties. His 36½ years of service on the Court constituted the longest tenure in U.S. history.

The son of a Presbyterian minister, Douglas moved with his family first to California and then to Washington. His father died when William was a small child, and his mother then settled the family in Yakima, Wash. Although Douglas contracted polio as a youth, he escaped permanent paralysis and developed what would become a lifelong love of the outdoors through his self-imposed regimen of exercise during recovery.

After graduating from Whitman College (Walla Walla, Wash.) in 1920, Douglas briefly taught school. Resolving to enter law school, he worked his way across the country in 1922 and enrolled at Columbia University Law School, where he later edited the law review.

In 1925, Douglas was graduated second in his class from Columbia and shortly thereafter joined a Wall Street law firm to learn the intricacies of financial and corporate law. He left the firm one year later to teach law at Columbia, and a year after that he joined the law faculty at Yale, where he taught until 1936.

In 1934, after having worked with the Department of Commerce on bankruptcy studies, Douglas directed a study for the Securities and Exchange Commission (SEC) on the reorganization of bankrupt corporations. He became a member of the SEC in 1936, and in 1937 he was appointed chairman of the commission. In this capacity he engineered the reorganization of the nation's stock exchanges, instituted measures for the protection of small investors, and began government regulation of the sale of securities.

During his tenure with the SEC, Douglas became a friend and adviser of Pres. Franklin Roosevelt. When Justice Louis Brandeis retired from the Supreme Court in February 1939, Roosevelt nominated Douglas to fill the vacancy. Following his confirmation by the Senate, Douglas took his seat on April 17, 1939, becoming at 40 years of age the second youngest Supreme Court justice in U.S. history.

Although responsible for writing many of the opinions in complicated financial cases, Douglas became most famous for his pronouncements on civil liberties. Like his fellow justice and close friend Hugo Black, Douglas was an absolutist on the guarantees of freedom in the

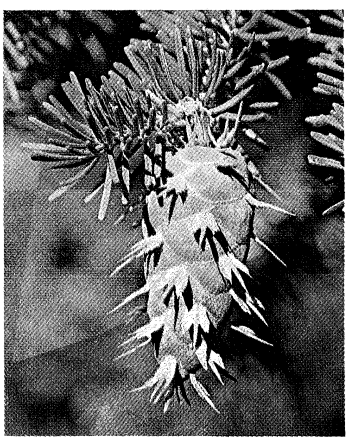
Bill of Rights. He rejected government limitations on free speech, and he was an outspoken defender of an unfettered press. His total opposition to any form of censorship made him a frequent target for criticism from political conservatives and religious fundamentalists.

Douglas also strove to insure the protection of the constitutional rights of the criminally suspect, and he took a leading part in the Court's decisions that curbed coerced confessions, buttressed the accused's right against self-incrimination, and strengthened prohibitions against illegal searches.

Felled by a stroke on Dec. 31, 1974, Douglas struggled to overcome its debilitating effects and returned briefly to the bench before retiring on Nov. 12, 1975. Throughout his judicial career Douglas remained a prolific writer, especially on conservation, history, politics, and foreign relations; his books include *Of Men and Mountains* (1950) and *A Wilderness Bill of Rights* (1965).

Douglas DC-3 (U.S. aircraft): *see* DC-3.

Douglas fir, any of about six species of coniferous evergreen timber trees comprising the genus *Pseudotsuga* of the family Pinaceae, native to western North America and eastern Asia. A Douglas fir has long, flat, spirally arranged needles that grow directly from the branch. Each yellow- or blue-green needle has a short stalk at the base and a grooved upper surface. Winter buds are brown, shiny, and pointed. The hanging, oblong cones have three-pointed bracts (outer cone scales). Cones mature in one season and retain their scales when they fall.



Cone of a Douglas fir (*Pseudotsuga menziesii*)
Grant Heilman—EB Inc.

The North American tree commonly known as Douglas fir is *P. menziesii* (*P. douglasii* by some authorities). It has several forms, one with reflexed bracts, that sometimes are considered to be separate species. Douglas fir may grow to 75 metres (250 feet) tall, and 2.4 m (8 ft) in diameter. It is one of the best timber trees in North America, as well as a popular ornamental and Christmas tree, and is used for reforestation along the Pacific Coast. The first seeds are produced at about 25 years, with large crops every five to seven years. Bigcone Douglas fir (*P. macrocarpa*), a smaller species important only for erosion control, bears cones 10 to 15 centimetres (about 4 to 6 inches) long.

Douglas-Home, Sir Alec, also called (1951–63) ALEXANDER FREDERICK DOUGLAS-HOME, 14TH EARL OF HOME, or (from 1974) ALEXANDER FREDERICK DOUGLAS-HOME, BARON HOME OF THE HIRSEL OF COLDSTREAM (b. July 2, 1903, London), British foreign secretary from 1960 to 1963, prime minister from Oct. 19, 1963, to Oct. 16, 1964, and, after the fall of his ministry, Conservative opposition spokesman in the House of Commons on foreign affairs.

As Lord Dunglass, the courtesy title he held until he succeeded in 1951 to the earldom of Home, he sat in the House of Commons as a Unionist (1931–45, 1950–51). He served as parliamentary private secretary to Prime Minister Neville Chamberlain (1937–39), undersecretary of state for foreign affairs in Winston Churchill's "caretaker" government (May–July 1945), minister of state for Scotland (1951–55), secretary of state for Commonwealth relations (1955–60), deputy leader (1956–57) and leader (1957–60) of the House of Lords, and lord president of the council (1957–60) before his term as foreign secretary. In October 1963 he disclaimed his peerages for life, took the name Sir Alec Douglas-Home, and succeeded Harold Macmillan as prime minister during a Conservative Party crisis, the most spectacular feature of which was an adultery scandal involving John Dennis Profumo, secretary of state for war from 1960 to 1963.

Admittedly having slight knowledge of economics, Sir Alec as prime minister was unable to improve the deteriorating British balance of payments situation. He antagonized numerous Conservatives by inducing the House of Commons to pass legislation against price-fixing. Both as foreign secretary and as prime minister, he gained U.S. approval for his firm but not truculent anti-Communism. As chairman of the Commonwealth Prime Ministers' Conference (July 1964), he achieved some compromise between extremist views on racial problems. Throughout his ministry he was faced with the prospect of a forthcoming general election, which took place on Oct. 15, 1964, and brought a Conservative defeat. He was succeeded (July 1965) as party leader by the future prime minister Edward Heath. In December 1974 he was created a life peer, Baron Home of the Hirsel of Coldstream. In 1976 he published his autobiography, *The Way the Wind Blows.*

Douglas-Home
Keystone

Douglas scale, either of two arbitrary series of numbers from 0 to 9, used separately or in combination to define qualitatively the degree to which the ocean surface is disturbed by fresh waves (sea) generated by local winds, and by decaying waves, or swell, propagated from their distant wind sources (*see* Table). The scales were devised in 1921 by the British Navy captain H.P. Douglas and were adopted by the International Meteorological Conference in Copenhagen in 1929.

(Combined) Douglas sea and swell scale

sea		swell									
			low		moderate			heavy			
		no swell 0	short or average 1	long 2	short 3	average 4	long 5	short 6	average 7	long 8	confused swell 9
0	calm	00	01	02	03	04	05	06	07	08	09
1	smooth	10	11	12	13	14	15	16	17	18	19
2	slight	20	21	22	23	24	25	26	27	28	29
3	moderate	30	31	32	33	34	35	36	37	38	39
4	rough	40	41	42	43	44	45	46	47	48	49
5	very rough	50	51	52	53	54	55	56	57	58	59
6	high	60	61	62	63	64	65	66	67	68	69
7	very high	70	71	72	73	74	75	76	77	78	79
8	precipitous	80	81	82	83	84	85	86	87	88	89
9	confused	90	91	92	93	94	95	96	97	98	99

Douglass, Andrew Ellicott (b. July 5, 1867, Windsor, Vt., U.S.—d. March 20, 1962, Tucson, Ariz.), U.S. astronomer and archaeologist who established the principles of dendrochronology (the dating and interpreting of past events by the analysis of tree rings). He coined the name of that study when, while working at the Lowell Observatory, Flagstaff, Ariz. (1894–1901), he began to collect tree specimens, believing that variations in the width of tree rings would show a connection between sunspot activity and the terrestrial climate and vegetation.

Douglass taught astronomy (from 1906) and dendrochronology (from 1936) at the University of Arizona and directed that university's Steward Observatory, Tucson (1918–38). Among his achievements in astronomy was the first photograph of the zodiacal light. He was also an authority in the study of Mars.

Douglass, Frederick, original name FREDERICK AUGUSTUS WASHINGTON BAILEY (b. Feb. 7, 1817, Tuckahoe, Md., U.S.—d. Feb. 20, 1895, Washington, D.C.), escaped slave whose oratorical and literary brilliance thrust him into the forefront of the U.S. Abolition Movement. The first black citizen to hold high rank in the U.S. government, he became one of the most eminent human rights leaders of the 19th century.

Separated as an infant from his slave mother (he never knew his white father), Frederick lived with his grandmother on a Maryland plantation until, at the age of eight, his owner sent him to Baltimore to live as a house servant with the family of Hugh Auld, whose wife defied state law by teaching the boy to read. But Auld declared that learning would make him unfit for slavery, and Frederick was forced to continue his education surreptitiously with the aid of schoolboys in the street. Upon the death of his master, he was returned to the plantation as a field hand at 16. Later, he was hired out in Baltimore as a ship caulker. He tried to escape with three others in 1833, but the plot was discovered before they could get away. Five years later, however, he fled to New York City and then to New Bedford, Mass., where he worked as a labourer for three years, eluding slave hunters by changing his name to Douglass.

At a Nantucket, Mass., anti-slavery convention in 1841, Douglass was invited to describe his feelings and experiences under slavery. These extemporaneous remarks were so poignant and naturally eloquent that he was unexpectedly catapulted into a new career as agent for the Massachusetts Anti-Slavery Society. From then on, despite heckling and

mockery, insult, and violent personal attack, Douglass never flagged in his devotion to the Abolitionist cause.

To counter skeptics who doubted that such an articulate spokesman could ever have been a slave, Douglass felt impelled to write his autobiography in 1845, revised and completed in 1882 as *Life and Times of Frederick Douglass.* Douglass' account became a classic in American literature as well as a primary source about slavery from the bondsman's viewpoint. To avoid recapture by his former owner, whose name and location he had given in the narrative, Douglass left on a two-year speaking tour of Great Britain and Ireland. Abroad, Douglass helped to win many new friends for the Abolition Movement and to cement the bonds of humanitarian reform between the continents.

Douglass returned with funds to purchase his freedom and also to start his own antislavery newspaper, the *North Star* (later *Frederick Douglass's Paper*), which he published from

Frederick Douglass

By courtesy of the Holt-Messer Collection, Schlesinger Library, Radcliffe College, Cambridge, Mass.

1847 to 1860 at Rochester, N.Y. The Abolition leader William Lloyd Garrison disagreed with the need for a separate, black-oriented press, and the two men broke over this issue as well as over Douglass' support of political action to supplement moral suasion. Thus, after 1851 Douglass allied himself with the faction of the movement led by James G. Birney. He did not countenance violence, however, and specifically counselled against the raid on Harpers Ferry, Va. (October 1859).

During the Civil War (1861–65) he became a consultant to Pres. Abraham Lincoln, advocating that former slaves be armed for the North and that the war be made a direct confrontation against slavery. Throughout Reconstruction (1865–77), he fought for full civil rights for freedmen and vigorously supported the women's rights movement.

After Reconstruction, Douglass served as assistant secretary of the Santo Domingo Commission (1871), and in the District of Columbia he was marshal (1877–81) and recorder of deeds (1881–86); finally, he was appointed U.S. minister and consul general to Haiti (1889–91).

Douhet, Giulio (b. May 30, 1869, Caserta, Italy—d. Feb. 15, 1930, Rome), Italian army general and the father of strategic air power.

Trained as an artillery officer, from 1912 to 1915 Douhet served as commander of the Aeronautical Battalion, Italy's first aviation unit. Largely because of his efforts, the three-engine Caproni bomber was ready for use by the time Italy entered World War I. He soon grasped the potential of air power and at every opportunity expounded his theories. His severe criticism of the conduct of the war resulted in his court-martial, imprisonment, and retirement. But investigation of the Italian defeat at Caporetto in 1917 justified his criticisms; his conviction was reversed, and he was appointed head of the aviation service.

Douhet's most noted book is *Il dominio dell'aria* (1921; *The Command of the Air,* 1942). He challenged the violent opposition it aroused until strategic air power became an accepted part of military thinking. Although technological developments have made some of his ideas obsolete, his theory of the important role of strategic bombing in disorganizing and annihilating an enemy's war effort was incorporated into future military plans of Italy and the United States. He further advocated the creation of an independent air force, the reduction of land and sea forces, and the unification of the armed forces. Controversial though his ideas were, many were adopted, in part at least, by the major powers before and during World War II.

Doukas FAMILY (Byzantine family): *see* Ducas family.

doulcemele (musical instrument): *see* dulce melos.

Doulton ware, English pottery established in 1815 by John Doulton at Lambeth, London, in association with John Watts and known as Doulton and Watts. The company became Doulton and Co. (Ltd.) about 1858 and remained so until the factory closed in 1956.

Doulton was known chiefly for its utilitarian stoneware and earthenware until about 1871, when students of the Lambeth School of Art began decorating Doulton salt-glazed brown stoneware. The students' work may be considered not only a source of renewed interest in ornamental stoneware but also the first noteworthy example of artist-pottery in England. Hannah Barlow and her brother and sister, Arthur and Florence, along with Frank Butler, Emily Edwards, and George Tinworth were among the artists who worked in the Doulton studio. The practice was continued into the 20th century, and it led to the development of similar projects at other English potteries.

In about 1877–78 Doulton of Lambeth bought the earthenware factory of Pindar, Bourne and Company at Burslem, Staffordshire. The name was retained until 1882 when it was changed to Doulton and Company, Ltd. This Doulton enterprise became well known for its fine porcelains, which were especially successful in the United States and Canada. In 1901 the company was authorized by King Edward VII to market its products as Royal Doulton (the royal mark appeared in 1902). Since October 1955 the official name of the firm has been Doulton Fine China, Ltd. It was appointed supplier to Queen Elizabeth II in 1968.

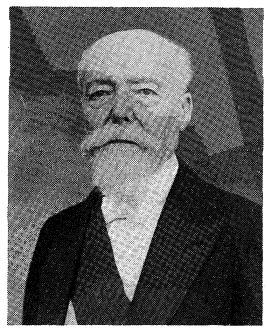
doum nut, also spelled DHOUM NUT, the nut of the doum palm (*Hyphaene thebaica*), native to Upper Egypt, Sudan, Kenya, and Tanzania. Also called the gingerbread palm, the 15.2-metre (50-foot) tree has a slender trunk and smooth branches, each tipped with a rosette of small, stiff, green, fanlike leaves.

The flavour of the red-orange fruit is frequently likened to that of gingerbread. The nut is eaten raw, and the rind from the seeds is made into sweetmeats and molasses. The ground nuts are used to dress wounds. Vegetable ivory, the hard, white part of the nut, takes a high polish and is used as a substitute for ivory, especially in the manufacture of buttons. Leaves of the doum palm are used for cordage, mats, and inferior paper. Doum nuts have been found in 5,000-year-old Egyptian tombs.

Doumer, Paul (b. March 22, 1857, Aurillac, Fr.—d. May 6, 1932, Paris), the 13th president of the French Third Republic whose term was cut short by an assassin's bullet.

In 1889 Doumer was elected as a Radical deputy from the Yonne *département,* and his reputation as a fiscal expert led to his appointment (1895) as minister of finance in the Cabinet of Léon Bourgeois. Unsuccessful in his efforts to introduce a national income tax, he was appointed governor general of Indochina the following year.

Doumer was one of the most active and, from the French point of view, effective gover-



Doumer, *c.* 1930

H. Roger-Viollet

nors general of Indochina. Unlike many of his predecessors and successors he occupied his post for a sustained period (1897–1902) and had clearly defined aims. His most important achievements were to strengthen the hold of the governor general over the administrators at the head of the various components of Indochina and to place the colonial economy on a sound basis. While this latter development was welcomed by the French, it involved rigorous imposition of taxes on the local population, which caused deep resentment.

Doumer returned to the Chamber of Deputies in 1902 and then moved to the Senate (1912) as representative of Corsica. In 1903 he wrote *L'Indochine française* and in 1906 *Le Livre de mes fils* ("The Book of My Sons"). From 1927 to 1931 he was president of the Senate and chairman of the important budget commission. In addition, he served as finance minister in the Briand cabinets of January 1921 to January 1922 and December 1925 to March 1926.

Doumer's election to the presidency on May 13, 1931, was popularly received and he successfully weathered ministerial crises caused by the deaths of André Maginot and Aristide Briand. He was fatally shot by a Russian anarchist, Pavel Gorgulov.

Consult the INDEX *first*

Doumergue, Gaston (b. Aug. 1, 1863, Aigues-Vives, Fr.—d. June 18, 1937, Aigues-Vives), French political figure whose term as 12th president of the Third Republic was marked by nearly constant political instability.

After service as an official in Indochina and Africa (1885–93), Doumergue was elected as a

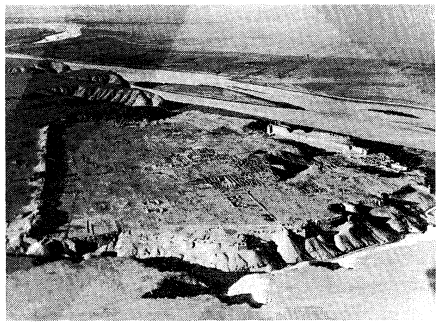
Doumergue, *c.* 1923

H. Roger-Viollet—Harlingue

Radical-Socialist member of the Chamber of Deputies from Nîmes (1893). In June 1902, he was appointed to the first of his 11 ministerial posts. In 1910 he was elected to the Senate. Three years later (Dec. 13, 1913), he formed his own Cabinet, and, although it collapsed within seven months, he remained in various ministerial positions until March 1917. He then returned to the Senate and was its president until his election to the presidency of the republic on June 13, 1924.

Doumergue's presidential victory came as a rebuff to the Cartel des Gauches, a coalition of leftist parties, which had just won a substantial parliamentary victory. Hence, his term was marked by constant ministerial problems—there were 15 different cabinets—as well as severe social tensions caused by the beginning of the Great Depression. In February 1934, three years after he left the presidency, Doumergue was called upon to form a new government, but his plans for a Union Nationale, a broad-based coalition of all parties, and constitutional reforms were unsuccessful. He resigned Nov. 8, 1934, and retired completely from political life.

Doura-Europus, also spelled DURA-EUROPUS, ruined Syrian city, located in the Syrian desert in Dayr az-Zawr *muḥāfaẓah* (governorate). Excavations were carried out first by Franz Cumont (1922–23) and later by M. Rostovtzev (1928–37). Doura was originally a Babylonian town, but it was rebuilt as a military colony about 300 BC by the Seleucids and given the alternative name of Europus after the native city in Macedonia of its reputed founder, Seleucus I Nicator. About 100 BC it fell to the Parthians and became a prosperous caravan city. It was annexed by the Romans in AD 165; under them it was a frontier fortress. Shortly after AD 256 it was overrun and destroyed by the Sāsānians.



The excavated site of Doura-Europus
By courtesy of Dura-Europos Publications

The remains at Doura-Europus give an unusually detailed picture of the everyday life there; and the inscriptions, reliefs, and architecture provide abundant information about the fusion of Greek and Semitic culture. A synagogue and a church, both of the 3rd century AD, were found to contain extensive wall paintings and thus are important for the study of Jewish and early Christian art and architecture.

dourine, venereal disease of horses, caused by the protozoan *Trypanosoma equiperdum.* The disease, which involves paralysis, is incurable. Serum tests have largely eradicated it in advanced countries, where a positive test requires the destruction of the animal. *See also* trypanosomiasis.

Douris, also spelled DURIS (fl. early 5th century BC), Greek vase painter of the early Classical period, known for his fine draftsmanship and crisp, clear lines. He worked in both the red- and black-figure styles, and he decorated his vases with many themes. He frequently selected themes popular during the Archaic period, for example, the Golden Fleece, but reinterpreted them to make them more relevant to his time.

"Jason Being Disgorged by a Dragon," interior of a kylix by Douris, *c.* 480–470 BC; in the Vatican Museum
By courtesy of the Vatican Museum

Douris was a prolific painter whose signature has been identified on about 40 vases. More than 200 vase paintings have been attributed to him; most are decorated in the red-figure style, though some are black-figure. (Red-figure style has red figures painted against a black glazed background; black-figure style is the opposite.) A cup, now in the Louvre, Paris, of "Eos Embracing Her Dead Son Memnon" is frequently attributed to Douris. Other vessels that Douris is believed to have painted include a psykter (cooler) of "Drunken Silenus," now in the British Museum; an "Ajax and Ulysses," now in Vienna; and a "School Interior," now in Berlin. It is possible that some of Douris' paintings may reflect the now lost monumental mural paintings of Classical Greece.

Douro River, Latin DURIUS, Spanish DUERO, third longest river of the Iberian Peninsula, draining a catchment area of 30,539 sq mi (79,096 sq km). Rising in the Sierra (mountains) de Urbión in Spain, the river crosses the Numantian Plateau in a pronounced bend and flows generally westward for 556 mi (895 km) across Spain and northern Portugal to the Atlantic Ocean at Foz do Douro. As far as Aranda de Duero, Spain, it is narrowly confined by its banks; it then widens across the broad plains of Old Castile. Beyond Zamora the river narrows again, and when it reaches the Portuguese border (which it follows for 70 mi), it plunges about 1,250 ft (380 m) within 30 mi in a series of gorges and rapids. In Portugal, between Peso da Régua and Porto (Oporto), it has considerable barge traffic, taking the wine from the port-wine area to Vila Nova de Gaia; from Pedorido to Porto there is some coal traffic. The river mouth is silted, and the artificial port of Leixões (erected in 1892 and further developed in 1916) has grown up to the north of the estuary. The major tributaries, the Esla, Pisuerga, and Arlanzón, all in Spain, flow from the wetter northern zone; the southern tributaries are less important.

Terraced hillside in Portugal above the Douro River
Ronny Jaques—Photo Researchers

Since the 1930s the Douro has been harnessed extensively for hydroelectric power and irrigation. An ambitious international project, completed in October 1964, supplies cheap electric power both for irrigation and for the development of large iron-ore deposits at Torre de Moncorvo, Portugal.

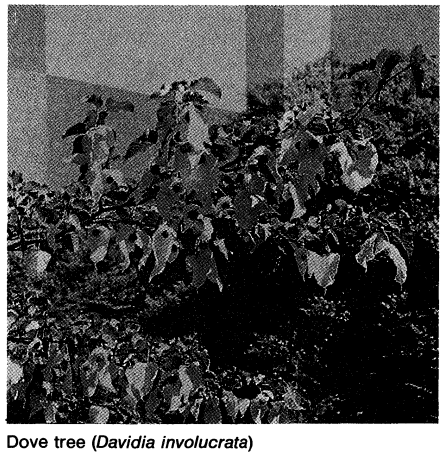
douroucouli (monkey): *see* durukuli.

Dousa, Janus: *see* Does, Johan van der.

dove, any of certain birds of the pigeon family, Columbidae (order Columbiformes). The names pigeon and dove are often used interchangeably. Although "dove" usually refers to the smaller, long-tailed members of the pigeon family, there are exceptions: the domestic pigeon (*q.v.*), a rather typical pigeon, is frequently called the rock dove and is the bird portrayed and called the "dove of peace." The common names of these birds do not necessarily provide any information about their biological relationships. *See* pigeon.

Dove, Arthur Garfield (b. Aug. 2, 1880, Canandaigua, N.Y., U.S.—d. Nov. 23, 1946, Huntingdon, N.Y.), U.S. painter, one of the earliest nonobjective artists. He began his career as a magazine illustrator, but after meeting Alfred Stieglitz he gave up conventional painting and turned to abstract art. In 1910 he had his first exhibition with Stieglitz in New York. His art employed soft masses of an organic character, muted in colour, and amorphous; in his "Foghorns" he used such shapes to give visual expression to the aural sensation of muffled booming. Despite their nonobjective character, his paintings often suggest the cursive qualities of landscape and the forms of nature. Dove also created many fine collages, incorporating fragments of commonplace subjects in a symbolic expression combining homely sentiment with touches of irony.

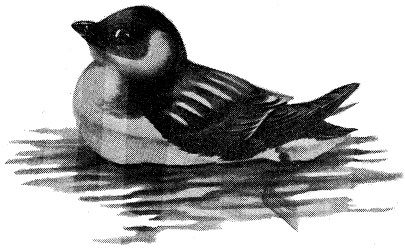
dove tree, also called HANDKERCHIEF TREE (*Davidia involucrata*), small flowering tree, constituting the family Davidaceae, valued for its showy creamy bracts (modified leaves) sur-



Dove tree (*Davidia involucrata*)
A.J. Huxley—EB Inc.

rounding the flowers. Native to southwestern China, it has been introduced elsewhere. Pyramidal in shape, with large bright-green leaves, it is especially impressive in bloom. Each terminal flower head is about 2 centimetres (¾ inch) across and is subtended by two large bracts, one up to 16 cm long and the other half as long.

dovekie, also called LITTLE AUK (*Alle alle*), small, black and white seabird of the North Atlantic. The dovekie belongs to the family Alcidae (order Charadriiformes). It is about 20 centimetres (8 inches) long, with a short



Dovekie (*Alle alle*) with winter plumage
Painting by H. Jon Janosik

bill. Its legs and wings are short, and its feet are webbed. It is a proficient diver, feeding on fish, mollusks, and crustaceans. Dovekies breed on rocky coasts and islands of the Arctic Ocean, from Greenland to Novaya Zemlya, U.S.S.R. They nest in large colonies, each breeding pair laying a single egg in a rock cranny on a hillside, or, on peaty ground, in a burrow.

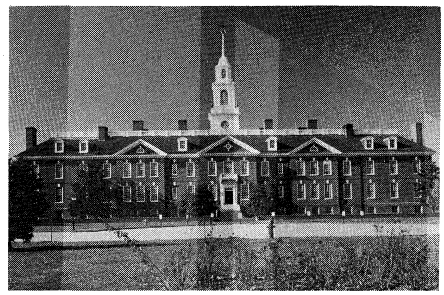
Dover, district, eastern part of the county of Kent, England, on the Strait of Dover. Its area is 120 sq mi (312 sq km). The history and economy of the district reflect its location as the part of England closest to France. Through the district pass major routes from London to Belgium and France. The old ports of Sandwich, Deal, and Dover are the principal towns. White chalk cliffs line much of the coast. Pop. (1982 est.) 102,800.

Dover, town and seaport on the Strait of Dover, county of Kent, England, situated at the mouth of a valley in the chalk uplands that form the famous white cliffs.

A pre-Roman settlement existed on the site, and, as Dubris, the place was important for Roman traffic with the European mainland. In the 4th century AD it was guarded by a fort as part of the defenses of the Saxon Shore. The castle, 375 ft (114 m) above sea level and from which on a clear day the coast of France can be seen, dominates the town below. Within its precincts are a Roman lighthouse, the ancient fortress Church of St. Mary in Castro, remains of the Saxon stronghold, and the massive Norman keep. During the 11th century it was made one of the Cinque Ports (*q.v.*). Dover claims to be a Saxon borough by "prescription," without a formal charter of incorporation.

During World War II the town was shelled from France and bombed from the air, but the shattered seafront was subsequently redeveloped. Dover is the foremost passenger port in the United Kingdom, with a harbour of more than 600 ac (240 ha); it is the principal cross-Channel ferry port. Some light industries have become important. Pop. (1981 prelim.) 32,843.

Dover, city, capital (1777) of Delaware, U.S., city, seat of Kent County, in the east central portion of the state on the St. Jones River. It was laid out in 1717 as the site for a county courthouse and jail on the order (1683) of William Penn and named for the English city. Colonial buildings clustered around the Green include the Old State House (rebuilt 1787–92), which served as the Capitol building until

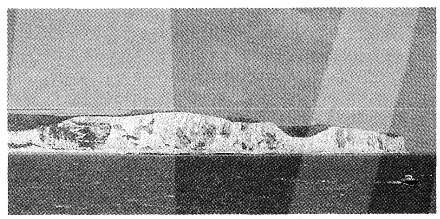


Legislative Hall, keystone of the capitol buildings group, Dover, Del.
Milt and Joan Mann from CameraMann

1933 when the main state offices were transferred to nearby Legislative Hall. King Charles II's original royal grant and William Penn's deeds to Delaware (1682) from James, duke of York, are displayed in the Hall of Records. The mansion (1740) of John Dickinson, "penman of the Revolution," is preserved, and the Delaware State Museum occupies a Presbyterian church (1790). Dover is a farm trade centre with some light industries. It is the seat of Delaware State College (1891) and Wesley College (1873). Dover Air Force Base, established during World War II, is now the principal air cargo terminal for the Military Air Transport Service. Inc. town, 1829; city, 1929. Pop. (1980) 23,512.

Dover, city, seat (1769) of Strafford County, southeastern New Hampshire, U.S., at the falls (a 33-ft [10-m] drop) of the Coheco River near its junction with the Piscataqua River, just northwest of Portsmouth. Originally settled in 1623 by fishermen and traders, it was first known as Bristol. A second settlement was made at nearby Dover Neck, or Point, in 1633. The town was an independent entity before 1642, when it voluntarily submitted to the jurisdiction of Massachussetts. Dover was a target for Indian attacks from about 1675 to 1725, the worst occurring on June 28, 1689. The town developed around the Point and its shipbuilding interests, but as manufacturing grew in the 18th and 19th centuries the centre gradually shifted northward. Diversified industries now include the manufacture of textiles, shoes, chemicals, plastics, and electronic equipment. The Woodman Institute has natural science and colonial exhibits. Inc. city, 1855. Pop. (1980) city, 22,377; metropolitan area (SMSA), 163,880.

Dover, Strait of, French PAS DE CALAIS, Latin GALLICUM FRETUM, a narrow water passage separating England (northwest) from France (southeast) and connecting the English Channel (southwest) with the North Sea (northeast). The strait is 18 to 25 mi (30 to 40



Strait of Dover with the White Cliffs
Ace Williams—Shostal/EB Inc.

km) wide, and the depth ranges from 120 to 180 ft (35 to 55 m). Until the comparatively recent geologic past (*c.* 5000 BC), the strait was an exposed river valley, thus making England an extension of the European continent. Because of the prevailing winds, the main flow of water through the strait is from the southwest, but a persistent northeast wind can reverse the current. The White Cliffs on the British side, composed of soft chalk, are receding due to erosion. Although it is one of the world's busiest seaways, a strict system of traffic lanes and navigation information became mandatory only in 1977. The chief ports include Dover and Folkestone (England) and Calais and Boulogne (France). Much of the regular passenger service is carried by hovercraft. A rail-tunnel project across the bottom of the strait, first proposed in 1856, is again under consideration.

The Strait of Dover was the scene of several historic naval battles, notably the first major repulse by the English of the Spanish Armada (1588). During World War I, Boulogne was a major army base, and Dover was the headquarters for the "Dover patrol," which protected shipping in the strait. In 1940, the Allied troops evacuating from Dunkirk (Dunkerque, Fr.) crossed the strait to Dover. The name Dover originally meant "the waters" or "the stream."

Dover, Treaty of (1670), pact by which Charles II of England promised to support French policy in Europe in return for a French subsidy that would free him from financial dependence on Parliament.

There were actually two treaties of Dover in 1670: one, which was secret (and known to only two of Charles's councillors) was concerned with the conversion of England to the Roman Catholic faith, which was favoured by Charles II; and the other, which was formal, was concerned with an Anglo-French military and naval alliance designed to subjugate the United Provinces of the Netherlands, which was desired by Louis XIV. The secret treaty—in the negotiation of which Charles's sister Henrietta Anna, duchesse d'Orléans, was deeply involved—was concluded on June 1 (May 22, old style). By it, Charles II was to recieve £200,000 in money and the support of 6,000 French troops, if needed, so that he might declare himself a Roman Catholic, and a further £300,000 a year to enable him to join a war against the Dutch. Among other clauses it was stipulated that England would support any claims that Louis might get to the Spanish succession. To allay suspicion, the formal treaty was concluded through the ordinary diplomatic channels on December 31 (December 21, old style), omitting all mention of religion.

The conversion clause never came into effect, for Louis XIV was really interested only in war, and Charles II's ambition was not so much the restoration of the Catholic religion as the establishment of the monarchical power that he thought Catholicism would secure. Charles came to promote that religion instead by a policy of religious toleration.

Dovrefjell, mountainous plateau, south central Norway. Extending about 100 mi (160 km) from east to west and about 40 mi from north to south, it is centred about 70 mi southeast of the town of Kristiansund. Composed mainly of layered metamorphic rocks (gneiss and schist), the plateau covers parts of the Sør-Trøndelag, Hedmark, Møre og Romsdal, and Oppland *fylker* (counties). The Dovrefjell is bounded on the west by Romsdalsfjorden, on the south by Gudbrandsdalen (Gudbrand's Valley), on the southeast by the Rondane Mountains, on the east by Østerdalen (Eastern Valley), and on the north by the Trollheimen Mountains. The highest peaks are Snøhetta (7,500 ft [2,286 m]) and Skrimkolla (6,181 ft). The high plateau is traversed from south to north by the main rail and by road links between Oslo and Trondheim. Some of the peaks are centres of winter sports activities.

Dovzhenko, Aleksandr (Petrovich) (b. Sept. 11 [Aug. 30, old style], 1894, Sosnitsy, Ukraine, Russia—d. Nov. 26, 1956, Moscow), a motion-picture director who brought

international recognition to the Soviet film industry during the 1930s. His films, in which emotional intensity and mystical symbolism took precedence over narrative structure, often concerned the Russian Civil War (1918–20) and the collectivization period (late 1920s to early 1930s).

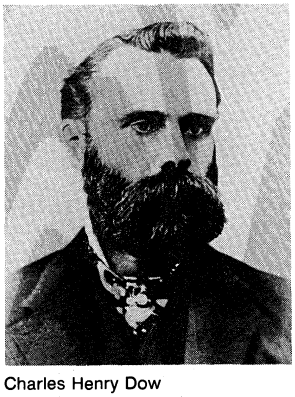
Dovzhenko
Tass—Sovfoto

Dovzhenko was born a Ukrainian peasant. After graduating from a teacher's college, he became a political cartoonist for a Ukrainian newspaper. He also studied painting under the German Expressionist artist Erich Heckel. He began his film career in 1926 and made his directorial debut with the short subject *Yagodki lyubvi* (1926; "The Fruits of Love"). *Zvenigora* (1928), his first important film, is a lyrical biography of the Ukrainian people from their Viking origins to the Revolution; *Arsenal* (1929) deals with a hero of allegorical stature confronted with the forces of the Revolution; *Zemlya* (1930; *The Earth*), denounced as "counterrevolutionary," interprets in sensitive visual symbolism the almost mystical closeness of the Ukrainian peasant to his land. Other well-known films were *Ivan* (1932); *Aerograd* (also known as *Frontier,* 1935), dealing with the establishment of an airfield in a remote Siberian outpost; *Shchors* (1939), the story of a Ukrainian revolutionary commander, which won him the first of two Stalin prizes (1941, 1949); and *Michurin* (1946; *Life in Blossom*).

Dovzhenko wrote an autobiographical novel, *Zacharovana Desna* (*The Enchanted*), and numerous short stories.

Dow, Charles Henry (b. Nov. 6, 1851, Sterling, Conn., U.S.—d. Dec. 4, 1902, Brooklyn, N.Y.), U.S. financial journalist and a founder of Dow Jones & Company, a financial news service whose compilation in 1884 of the first average of U.S. stock prices developed into what is known as the Dow Jones averages. This was an original contribution to stock market methodology.

In his twenties Dow took up journalism, moving to New York City in 1880 to become a reporter for a financial news service. In 1882 Dow and Edward D. Jones (1856–1920) founded Dow Jones & Company, a firm that delivered bulletins, called "flimsies," or "slips," to Wall Street financial houses by messenger. The last delivery of the day included a news sheet that was the forerunner of the *Wall Street Journal*, which was first published July 8, 1889. Dow made his reputation as a financial expert, when he was the paper's first editor (1889–1902), and his writings for it form the basis for the "Dow theory" in market analysis. He was a member of the New York Stock Exchange (1885–91) and a partner in the brokerage firm of Goodbody, Glyn & Dow.



Charles Henry Dow
By courtesy of Dow Jones & Company, Inc.

Dow, Herbert Henry (b. Feb. 26, 1866, Belleville, Ont., Can.—d. Oct. 15, 1930, Rochester, Minn., U.S.), pioneer in the U.S. chemical industry.

Having received a B.S. degree from the Case School of Applied Science in Cleveland (1888), he concentrated on deriving the maximum value from brines (concentrated solutions of salts and water) and discovered that the brines of Canton, Ohio, and Midland, Mich., were rich in bromine. He developed and patented electrolytic methods for extracting bromine from brine and in 1890 organized the Midland Chemical Company, the first company to use successfully the direct current generator in the U.S. chemical industry.

He founded the Dow Process Company (1895) to produce caustic soda and sodium hypochlorite at Navarre, Ohio. His Dow Chemical Company (1897) at Midland absorbed the two earlier companies. Dow's products from brine found application in insecticides and pharmaceuticals. His studies of magnesium alloys culminated in the company Dowmetal. He introduced automatic processing to produce magnesium sulfate (Epsom salts) from ocean brines. Dow produced the first synthetic indigo in the U.S. (1916) and was the first important producer of iodine. He eventually was granted more than 100 patents as his company became one of the world's leading chemical manufacturers.

Dow, Neal (b. March 20, 1804, Portland, Me., U.S.—d. Oct. 2, 1897, Portland), U.S. politician and temperance advocate whose Maine Law of 1851 presaged national prohibition in the U.S.

His Quaker parents and his own observations as Portland city overseer of the poor, as well as the excess of drunkenness that was then commonplace, influenced his attitude toward liquor. He organized the Maine Temperance Union in 1838. As mayor of Portland (1851–58), he wrote a state prohibition law and secured its passage (June 2, 1851) to replace a weaker statute of 1846, for which he also had been partly responsible. In 1857 he visited England, where he lectured widely to temperance groups. After serving in the U.S. Civil War he resumed his temperance activities, and in 1880 ran for president of the U.S. as the candidate of the Prohibition Party. His autobiography, *The Reminiscences of Neal Dow, Recollections of Eighty Years,* was published posthumously in 1898.

Dow Chemical Company, major U.S. chemical company, manufacturing chemicals for industrial and home use. Dow home products include plastic wrap and Styrofoam plastic foam. Headquarters are in Midland, Mich.

In 1892 Henry Dow of Midland founded the Midland Chemical Company. Five years later he started Dow Chemical to build a bleach plant to use the wastes from Midland Chemical. The company also extracted bromides, chlorides, magnesium, and calcium from nearby brine deposits. In 1900 the two companies were combined and grew to become the present Dow Chemical Company. Although the company has continued to extract raw materials from the Midland brine deposits it also consumes massive amounts of oil, petroleum, and natural gas.

Dow products have often been the subject of public attention. The company made mustard gas, a toxic blistering agent used in chemical warfare, during World War I. During the Vietnam War, the company produced napalm, a jellied incendiary reported to have been used indiscriminately against civilians and soldiers. Dow also was one of several makers of Agent Orange, an herbicide containing the toxic substance dioxin, which brought about a series of postwar lawsuits, since it was believed the chemical caused cancer in Vietnam war veterans and birth defects in veterans' children. In 1984 Dow and the other chemical companies settled a class-action lawsuit out of court by agreeing to establish a $180,000,000 fund for the use of the veterans and their families.

The company operates major plants in the United States and abroad, and markets its products worldwide. In addition to familiar consumer products, it manufactures a broad range of industrial chemicals and metals, plastics and packaging materials, and bioproducts.

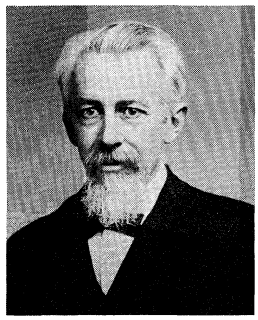
Dow Jones average, stock price average computed by Dow Jones & Company. The averages are among the most commonly used indicators of general trends in the prices of stocks and bonds in the United States. Dow Jones & Company, a financial news publisher, began computing a daily industrials average in 1897, using a list of 12 stocks and dividing their total price by 12. The list of stocks has since been broadened, and the divisor has been adjusted to compensate for stock splits, stock substitutions, and significant dividend changes. Thus, the averages are no longer arithmetic means but are averages in the sense of indicators of general market price trends. The most commonly quoted is the industrial average, based on the prices of 30 selected industrial stocks. The other Dow Jones averages published include one based on 20 transportation stocks, one based on 15 utility stocks, a composite based on all 65 stocks, and several bond averages.

Dowa, administrative headquarters of Dowa District, Central Region, Malaŵi, in the centre of the Dowa Highlands, a region of cool climate and perennial water supply. The district (1,250 sq mi [3,237 sq km]) comprises wooded highlands in the east and the undulating grasslands of the Central Region Plateau in the west and north. The dense population on the fertile land around the town produces tobacco, cotton, and corn (maize). Pop. (1977) town, 1,962; district, 247,603.

Dowa Highlands, also called CHITEMBWE-MWERA HIGHLANDS, central Malaŵi, rectangular formation covering an area of about 360 sq mi (930 sq km); they comprise rolling hills crowned by high ridges that reach maximum heights at the Dowa (5,570 ft [1,698 m]) and Ntchisi (5,430 ft) peaks. The highlands are bounded on three sides by steep slopes, forming the Great Rift Valley wall to the east and overlooking the Bua and Lilongwe valleys to the north and south, respectively. Their western limit is marked by a series of hills leading onto the central plains. Mountain streams form a radial drainage pattern contributing to the Lilongwe and Bua rivers and Lake Nyasa; the eastern streams have periods of heavy flood. The highland's red loam soils support woodland.

Dowager, Empress: *see* Tz'u-hsi.

Dowden, Edward (b. May 3, 1843, Cork, County Cork, Ire.—d. April 4, 1913, Dublin), Irish critic, biographer, and poet, outstanding for his work on Shakespeare. Educated at Queen's College, Cork, and Trinity College, Dublin, he became professor of English



Dowden
BBC Hulton Picture Library

literature at Trinity in 1867 and lectured at Oxford (1890–93) and Cambridge (1893–96). His *Shakspere: A Critical Study of His Mind and Art* (1875) was the first book in English to attempt a unified and rounded picture of Shakespeare's development as an artist, studying him in terms of successive periods.

In addition to numerous other works on Shakespeare, Dowden is remembered for his *Life of Shelley* (1886). He also was among the first to appreciate Walt Whitman and became his good friend.

Dowding, Hugh Caswall Tremenheere Dowding, 1st Baron (b. April 24, 1882, Moffat, Dumfriesshire, Scot.—d. Feb. 15, 1970, Tunbridge Wells, Kent, Eng.), British air chief marshal and head of Fighter Command dur-

Dowding
Camera Press

ing the Battle of Britain (1940) in World War II; he was largely responsible for defeating the German Air Force in its attempt to gain control of British skies in preparation for a German invasion of England.

A squadron commander in the Royal Flying Corps in World War I, Dowding remained in the new Royal Air Force. After serving in command, staff, and training positions in Britain and Asia, he became chief of the newly created Fighter Command in 1936. He vigorously promoted the development of radar and the Spitfire and Hurricane fighters that contributed significantly to the defeat of the Luftwaffe during the Battle of Britain. Although the Fighter Command was outnumbered, Dowding's strategic and tactical skill enabled it to retain air superiority and thwart Germany's aims. He retired in November 1942 and was created baron the next year.

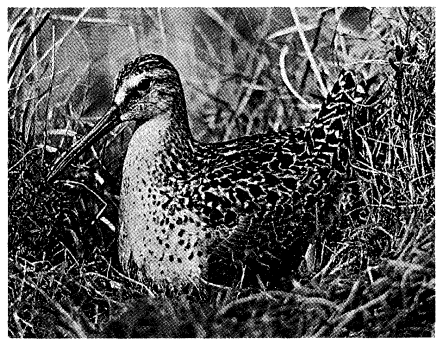
Dowie, John Alexander (b. May 25, 1847, Edinburgh—d. March 9, 1907, City of Zion, Ill., U.S.), U.S. evangelist and faith healer who founded the Christian Catholic Church and the City of Zion.

Dowie moved with his family to Australia as a boy but returned to Edinburgh to study theology. He entered the Congregational ministry in 1870 as a pastor in Alma, Australia, and spent the next several years campaigning against the use of tobacco and alcohol. From a personal experience of healing he developed an interest in spiritual healing and eventually founded the International Divine Healing Association.

In 1888 he went to the U.S. After receiving little attention in San Francisco, he settled in Chicago. There he became increasingly successful as an evangelist and healer and won every one of nearly a hundred suits brought against him by doctors and clergymen who opposed his practices. In 1896 he founded the Christian Catholic Church, which emphasized spiritual healing but otherwise differed little from the more millennialist of the Protestant churches. In 1901 he established the City of Zion on the shore of Lake Michigan, about 40 miles north of Chicago, with about 5,000 of his followers. In the same year he proclaimed himself Elijah the Restorer and, later, First Apostle of the church. He ruled the community as a theocracy, forbade physicians' offices, dance halls, theatres, drugstores, and smoking and drinking. Various industries were begun and the town prospered, with Dowie in sole control of the businesses. Zion's commercial success was increasingly jeopardized, however, by Dowie's several expensive and futile trips, first to New York to convert the city in 1903 and next to Mexico to establish the "Zion Paradise Plantation." Opposition to his fiscal irresponsibility (and to alleged polygyny) led to his removal in 1906 and his replacement by Wilbur Voliva, a trusted friend whom he had earlier named temporary head of the church.

dowitcher, any of three species of shorebirds belonging to the genus *Limnodromus*, family Scolopacidae. The dowitcher has a chunky appearance and a long bill like a snipe and, in breeding plumage, has reddish underparts, giving rise to the alternative names red-breasted snipe and robin snipe (given also to the knot). It has a white rump and lower back.

Dowitchers flock on mudflats or sandbars; they fly in tight formations and, after landing, pause awhile before spreading out to feed. They nest in bogs from northeastern Siberia to Hudson's Bay and winter on coasts from the southern U.S. to northern South America. The



Short-billed dowitcher (*Limnodromus griseus*)
A.A. Allen—Bird Photographs, Inc.

long-billed dowitcher (*L. scolopaceus*), about 30 centimetres (12 inches) long including the bill, has a more northwesterly breeding range than the short-billed dowitcher (*L. griseus*), which is about the same size except for the bill. There is also an Asian species, called the Asiatic dowitcher (*L. semipalmatus*).

Dowlaiswaram, town, East Godāvari district, northeastern Andhra Pradesh state, southern India, on the Godāvari River Delta. Dowlaiswaram is located at the source of the great delta, and a dam 2 mi (3.2 km) long crosses the river at this point, supplying canals that irrigate 1,000,000 ac (400,000 ha). Rice fields, gardens, and villages are scattered over the deltaic region that surrounds the mainly agricultural town. Pop. (1981) 25,983.

Dowland, John (b. 1562/63, County Dublin, Ire., or Westminster, London—d. Jan. 21, 1626, London), English composer, virtuoso lutenist, and skilled singer, one of the most famous musicians of his time.

Nothing is known of Dowland's childhood, but in 1580 he went to Paris as a "servant" to Sir Henry Cobham, the ambassador to the French court. In 1588 he received a bachelor of music degree from Oxford, and one from Cambridge before 1597. His conversion to Roman Catholicism, he believed, caused his rejection for a post as a court lutenist in 1594. After that disappointment he left England to travel on the Continent. He visited the Duke of Brunswick at Wolfenbüttel and the Landgrave of Hesse at Kassel and was received at both courts with esteem. His travels also took him to Nürnberg, Florence, Genoa, and Venice; in 1597 he returned to England.

In 1598 Dowland became lutenist to Christian IV of Denmark, but he was dismissed for unsatisfactory conduct in 1606. Between 1609 and 1612 he entered the service of Theophilus, Lord Howard de Walden, and in 1612 he was appointed one of the "musicians for the lutes" to James I.

Working during a time of musical transition, Dowland, though a respecter of tradition, absorbed many of the new ideas he encountered on the Continent. His 88 lute songs (printed 1597–1612) particularly reflect those influences. The early songs are presented with an alternative version for four voices. Although melodically enchanting, they show simple strophic settings, often in dance forms, with an almost complete absence of chromaticism. Later, in such through-composed songs as "In darkness let me dwell" (1610), "From Silent Night," and "Lasso vita mia" (1612), the Italian declamatory style, chromaticism, and dissonance are introduced; no alternative four-voice versions are given.

Dowland composed about 90 works for solo lute; many are dance forms, often with highly elaborate divisions to the repeats. His famous *Lachrimae,* or *Seaven Teares Figured in Seaven Passionate Pavans* (1604), became one of the most widely known compositions of the time. In his chromatic fantasies, the finest of which are "Forlorne Hope fancye" and "Farewell," he developed this form to a height of intensity unequalled by any other writer for the Renaissance lute. His compositions also include several psalm harmonizations and sacred songs printed in contemporary music books.

Down, former (until 1973) county, eastern Northern Ireland. It was bounded by Belfast Lough (inlet of the sea; north), the Irish Sea (east), Carlingford Lough (south), former County Armagh (west), and former County Antrim (northwest).

Down had an area of 952 sq mi (2,466 sq km), and it had three areas of high ground. In the south, the Mourne Mountains (Slieve Donard, 2,796 ft [852 m]) are composed of Eocene (38,000,000-year-old) granite; and in the centre are the Caledonian granite mountains of Ballynahinch (Slieve Croob, 1,755 ft). The land falls westward to the Newry Basin and the River Bann and eastward to the Ards Peninsula, enclosing Strangford Lough (inlet of the sea), a large tidal inlet. A belt of glacially deposited ovoid hills (drumlins) extend westward from former central County Down. The basic geology is Silurian, with much slate and sandstone. The climate is temperate, rainfall varying from 65 in. (1,650 mm) a year in the Mournes to less than 35 in. in the east and north. Although soils of the southern slopes in the north are very fertile, a shallow stony loam predominates.

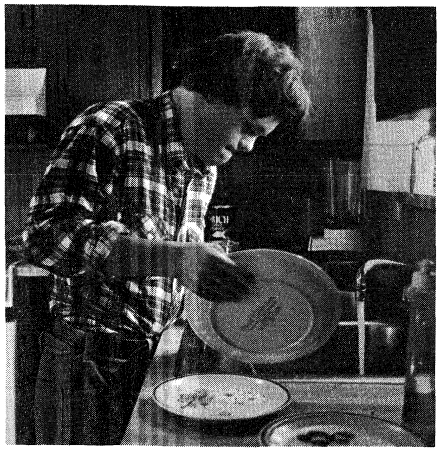
Evidence of prehistoric settlement is found in the Giant's Ring, south of Belfast. There a cromlech, or circle of stones, stands enclosed by a broad rampart; and near Newcastle there

is a well-preserved souterrain, or underground chamber. At Saul, St. Patrick began his mission in Ireland (AD 432), and a monastic school flourished at Bangor from the 6th century. The saint's well and bath houses are preserved at Struell near Downpatrick, and a boulder marks his reputed grave in the grounds of Downpatrick Cathedral. Dromore is the ancient ecclesiastical capital of Down. In the late 12th century, Down was invaded by the Anglo-Norman John de Courci; many of the mounds forming the bases of his forts remain. Numerous castles fringe the eastern part of the county (*e.g.*, a Norman castle of Dundrum and Jordan's Castle at Ardglass). Although English influence declined in the late Middle Ages, it lingered on the peninsula of Lecale, between Dundrum and Downpatrick. In later Tudor times, parts of Down were colonized by English and Scottish adventurers; and, though the county was not included in the Plantation of Ulster scheme during the reign of James I, there was a large influx of Scottish colonists in the 17th century. In the 1973 administrative reorganization of Northern Ireland, the county was divided into the districts of Banbridge, Down, Ards, and North Down, and portions of Castlereagh, Lisburn, Craigavon, and Newry and Mourne districts.

Down, Irish AN DÚN, district, Northern Ireland. Formerly within County Down, Down was established in 1973 as a district covering 249 square miles (646 square km) on Northern Ireland's eastern coast, fronting Strangford Lough (inlet of the sea) and the Irish Sea. It is bordered by the districts of Ards to the north; Castlereagh, Lisburn, and Banbridge to the west; and Newry and Mourne to the south. Extreme southern and western Down is mountainous; the dome-shaped Mourne Mountains reach an elevation of 2,789 feet (850 m) at Slieve Donard on the Down–Newry and Mourne border. Most of the district is covered by clusters of drumlins (oval mounds of glacial till). The area was invaded by the Anglo-Norman John de Courci in the late 12th century, and the town of Downpatrick was his stronghold until 1203. The Downpatrick (Protestant) Cathedral is reputedly built over the burial site of St. Patrick, who began his mission in Ireland (AD 432) in the nearby village of Saul.

Down is a rich agricultural district; the chief crops are oats, barley, wheat, and hay. Livestock raising (sheep and pigs) is also important. Downpatrick is the district's market and administrative seat and has some textile industry, while Ballynahinch, located farther west, has agricultural machinery and metal-fabrication industries. Newcastle in the south and Killyleagh in the east are popular seaside resorts. Tollymore Park, about 1,200 acres (500 hectares) of forest on the slopes of the Mourne Mountains in southern Down, was the first such park established in Northern Ireland (1955). Pop. (1985 est.) 55,400.

Down syndrome, also called DOWN'S SYNDROME, TRISOMY 21, or (formerly) MONGOLISM, congenital disorder caused by an extra chromosome on the chromosome 21 pair, thus giving the person a total of 47 chromosomes rather than the normal 46. Persons born with Down syndrome are characterized by several of the following: broad, flat face; short neck; up-slanted eyes, sometimes with an inner epicanthal fold; low-set ears; small nose and enlarged tongue and lips; sloping underchin; poor muscle tone; mental retardation; heart or kidney malformations or both; and abnormal dermal ridge patterns on fingers, palms, and soles. The mental retardation seen in persons with Down syndrome is usually moderate, though in some it may be mild or severe. Congenital heart disease is found in



Teenager with Down syndrome
© Bruce Roberts—Photo Researchers

about 40 percent of people with Down syndrome.

Most persons with Down syndrome have one excess chromosome associated with the chromosome 21 pair—a condition known as trisomy. Almost all individuals with Down syndrome have this trisomy, but a small number (perhaps 4 percent) have an abnormality called translocation, in which the extra chromosome in the 21 pair breaks off and attaches itself to another chromosome. The cause of the chromosomal abnormalities in Down syndrome remains unknown.

Down syndrome occurs in about 1 in every 800 live births. The incidence of the disorder increases markedly in the offspring of women over the age of 35. This is illustrated by the fact that Down syndrome's incidence in the offspring of young women is only about 1 in 1,000, while its incidence in those of women over age 40 is about 1 in 40. Down syndrome can be diagnosed prenatally by the presence of the abnormal chromosome in samples of fetal cells taken from the amniotic fluid.

With modern medical care, most persons with Down syndrome—except those with major heart defects that cannot be corrected by surgery—live into adulthood. They do have a shorter life expectancy (55) than normal adults, though, because they develop the degenerative conditions of old age prematurely. Because persons with Down syndrome are mentally retarded to varying degrees, some never become independently self-supporting. The majority can, however, be taught to contribute usefully in the home or in a sheltered working or living environment after they are grown.

downhill skiing, ski race for speed on an adjusted downhill track that is marked by gates

Skier in downhill race at Innsbruck, Austria, 1964
D.P.A.—Pictorial Parade

formed by paired poles set at least 8 m (26 feet) apart through which the racer has to pass. Contestants make at least one practice run, then compete singly in an order set by previous performance. The one who completes the course in the shortest time is the winner.

For men's international championship events, the downhill course is 2.4 to 5 km (1.5 to 3 miles) long, with a vertical descent of up to 1,000 m (3,280 feet) and terrain of a steepness and difficulty appropriate to the skill and endurance of the competitors. For women the course is 1.6 to 2.5 km (2.5 to 4 miles) long. Courses are not in terms of length but of time—*e.g.*, a two-minute downhill. The average winning speed is 64 to 80 km (40 to 50 miles) per hour. Speeds over 160 km (100 miles) per hour are achieved on special short courses, but these events are not rated as official downhill races. The downhill probably demands the most courage of all the Alpine events, which are so called since they originated in the rugged Alps range of Europe.

For world champions, *see* Sporting Record: *Skiing*. For Olympic champions, *see* Olympic Games.

Downing, Andrew Jackson (b. Oct. 30, 1815, Newburgh, N.Y., U.S.—d. July 28, 1852, vicinity of Yonkers, N.Y.), horticulturist, landscape gardener, and architect, the first great landscape designer in the United States.

Downing was born into horticulture, his father being a nurseryman. After finishing his schooling at 16, he worked in his father's nursery and gradually became interested in landscape gardening and architecture. He began writing on botany and landscape gardening and then undertook to educate himself thoroughly in these subjects.

His first book, *A Treatise on the Theory and Practice of Landscape Gardening, Adapted to North America* (1841), established him as a national authority on that subject and went through numerous editions (the last was printed in 1921). In *Cottage Residences* (1842) he applied the principles of landscape and architectural design to the needs of more modest homeowners. His *The Fruits and Fruit Trees of America* (1845), written with his brother Charles, was the most complete treatise of its kind yet written and led to Downing's becoming the editor of a new periodical, the *Horticulturist,* a post that he retained until his death. Downing's *The Architecture of Country Houses, Including Designs for Cottages, Farm Houses, and Villas* (1850) long remained in general use.

While traveling in Europe in 1850, Downing entered into a partnership with the English architect Calvert Vaux, and upon their return to the United States the two men designed a number of estates, both houses and grounds, in New York's Hudson River valley and Long Island. By now recognized as the foremost American landscape designer of his day, Downing was commissioned in 1851 to lay out the grounds for the Capitol, the White House, and the Smithsonian Institution in Washington, D.C. Downing's plans for this project had to be carried out by his successors, however, because he drowned in a steamboat accident in the vicinity of New York Harbour.

Downing, Sir George (b. 1623, Dublin, Ire.—d. July 1684, Cambridgeshire, Eng.), English diplomat and financial administrator who helped precipitate two wars with the Dutch and who instituted major reforms in public finance. Downing Street, London, where the residence of the British prime minister is located, is named for him.

The son of a Puritan lawyer, Downing was one of the first graduates of Harvard College, Cambridge, Mass. He served in the Parliamentary army during the English Civil Wars and was a member of Parliament during Oliver Cromwell's Protectorate, but in 1660 he supported the restoration of the Stuart

monarchy. In 1661 King Charles II made him envoy to Holland, England's commercial rival. The Second Dutch War of 1665–67 was partially the result of Downing's diplomatic intransigence. As a member of the House of Commons in 1665, he was responsible for a proviso to a subsidy bill (*i.e.*, a bill whereby Parliament granted funds to the king for special needs) which stipulated that the funds be used solely for the war—a case that marked the effective beginning of the process of using funds solely for the specific purposes stated in the legislative appropriation. Downing's appointment as secretary of the newly formed treasury commission in 1667 enabled him to introduce new accounting procedures that left a lasting mark on the British treasury. In 1671 Downing was sent to Holland with instructions to provoke another conflict. His behaviour so infuriated the Dutch that he fled for his life, but Charles had him imprisoned briefly for deserting his post. After his release he continued to hold high financial offices until his death.

Downpatrick, Irish DÚN PÁDRAIG, town and seat, Down district (established 1973), formerly in County Down, Northern Ireland. Downpatrick is located where the River Quoilé broadens into its estuary in Strangford Lough (inlet of the sea). The town takes its name from *dún* (fortress) and from its association with St. Patrick. It is the Dun-da-leth-glas (Fortress of the Two Broken Fetters) of Irish chroniclers. Formerly a MacDunleary stronghold, it was seized in 1177 by the Anglo-Norman adventurer John de Courci and served as his headquarters until 1203. At nearby Saul, St. Patrick began his mission in Ireland in 432 and is reputedly buried in the grounds of the Church of Ireland Cathedral, which was built in 1790. The town is a market centre and has the county administrative offices. The remains of the Cistercian Inch Abbey, founded by De Courci in 1180, are 2 miles (3 km) north. Pop. (1981) 8,245.

Downs, rounded and grass-covered hills in southern England that are typically composed of chalk. The name comes from the Old English *dūn* ("hill"). The main areas of chalk downs lie in Berkshire, Wiltshire, and northern Hampshire, with spurs running eastward into West Sussex, Surrey, and Kent. Chalk hills of similar type are called Wolds in Lincolnshire and in Yorkshire.

Because of the porous nature of chalk, the Downs' summits are dry in summer, and tree growth is normally slow, even if undisturbed. Regeneration has been prevented by sheep grazing. The Downs were formerly well wooded, but now only scattered woodlands of beech, yew, juniper, and box are found.

The Downs are notable for their evidence of prehistoric occupation, including figures of horses cut out of turf; ridge and scarp-foot trackways that focus on megalithic monuments, such as Avebury and Stonehenge in Wiltshire; innumerable burial mounds or barrows; defensive earthworks; and ring encampments, such as Maiden Castle in Dorset.

The characteristic bare and rounded summits of the Downs, where uncultivated, have a springy turf of fescue grass with a distinctive vegetation, including rare orchids, and fauna of snails and insects. Mechanical plows have now made it possible to cultivate all but the steepest slopes of downs, however, and on many downs crops or manured leas have replaced the turf on which flocks of sheep used to graze.

downslope wind: *see* katabatic wind.

downy mildew, disease of plants, especially in cool humid regions, caused by several fungi, including species of *Basidiophora, Bremia, Peronospora, Phytophthora, Plasmopara, Pseudoperonospora,* and *Sclerospora.* White, gray, bluish, or violet downy patches of mildew form mostly on the undersides of leaves in damp weather. Pale-green to yellow or brown areas usually develop on the upper leaf surface opposite the downy growth. Affected leaves often wilt, wither, and die early. Stems, flowers, and fruits are sometimes infected. Seedlings may wilt and collapse. Garden plants, bush fruits, vegetables, and certain trees, shrubs, field crops, and weeds are susceptible.

Downy mildew can be avoided by rotating annual flowers and vegetables and by avoiding overwatering, overcrowding, and poorly drained soil. Other avoidance measures are growing resistant varieties, sowing disease-free seed, removing diseased parts and crop refuse, eliminating weeds, and maintaining balanced soil fertility. The application of copper, maneb, or zineb is effective against many downy mildews, but the amount of residue on vegetables must be considered.

dowry, the property that a wife or a wife's family give to her husband upon marriage. Dowries have a long history in Europe, India, Africa, and other parts of the world.

One of the basic functions of a dowry has been to serve as a form of protection for the wife against ill treatment by her husband. A dowry used in this way was actually a conditional gift to the husband that had to be restored to the wife or her family if the husband divorced his wife or committed some grave offense against her. Such dowries were frequently land or some other form of real property and were made inalienable by the husband, though he might otherwise use and profit from them during marriage.

A dowry can also serve to help a new husband discharge the responsibilities that go with marriage. This function assumed special importance in societies where marriages were regularly made between very young people; the dowry made it possible for the new husband to establish a household, which he otherwise would not have had the economic resources to do. Another function of a dowry in some societies has been to provide the wife with a means of support in case of her husband's death. In this latter case the dowry is a substitute for a compulsory share in the succession or the inheritance of the husband's landed property.

In many premodern societies the dowry serves as a reciprocal gesture by the bride's family to the groom's kin for the expenses incurred by the latter in payment of the bride-price (*q.v.*). These exchanges are not purely economic; they serve to ratify the marriage and consolidate friendship between the two families.

In Europe, the dowry has frequently served not only to enhance the desirability of a woman for marriage but also to build the power and wealth of great families and even to determine the frontiers and policies of states. The use of dowries has tended to disappear in industrial societies, however, as indeed it did in Europe in the 19th and 20th centuries.

dowsing, in occultism, use of a forked piece of hazel, rowan, or willow wood or of a Y-shaped metal rod or of a pendulum suspended by a nylon or silk thread, in an attempt to detect such hidden substances as water, minerals, treasure, archaeological remains, and even dead bodies. The practice seems to have first come into vogue in the European Middle Ages.

The dowser in his search grasps the rod (itself called a dowser) by its two prongs and appears to receive transmissions from the hidden object that cause involuntary muscular contractions, which in turn make the rod bend or quiver violently. Some dowsers claim to be able to detect buried substances merely by passing a dowsing rod over a map of the area where the substance lies hidden. The term divining rod, sometimes used to describe the forked instrument, is frowned upon by dowsers because divination is not considered part of the process.

Dowsing
By courtesy of the Library of Congress, Washington, D.C.

Dowson, Ernest (Christopher) (b. Aug. 2, 1867, Lee, Kent, Eng.—d. Feb. 23, 1900, Lewisham, London), one of the most gifted of the circle of English poets of the 1890s known as the Decadents.

As a boy Dowson lived an unsettled life. In 1886 he entered Queen's College, Oxford, but left in 1888 when a decline in his father's fortunes obliged him to work at his father's dock in the Limehouse district in London. Dowson was an active member of the Rhymers' Club, a group of "decadents" that included William Butler Yeats, Arthur Symons, and Aubrey Beardsley. In 1891 he met the woman of his life and the inspiration for most of his poetry, Adelaide Foltinowicz, a waitress in her parents' restaurant in Soho, near London. In that same year he published his best-known poem "Non Sum Qualis Eram Bonae sub Regno Cynarae," popularly known from its refrain as "I have been faithful to thee, Cynara, in my fashion." Adelaide, who was 12 years old

Dowson, portrait by Charles Conder; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

when they met, declined his offer of marriage, but he remained faithful to her, in his fashion, for the next six years, drowning the pain of his unrequited love with wine and women and demanding as time went on "madder music and stronger wine."

In 1894 his father died, his mother committed suicide, and Dowson discovered the symptoms of his tuberculosis. In 1897 Adelaide married one of her father's waiters; after that, Dowson lived mostly in France, supporting himself by ill-paid translations. He was discovered wretched and penniless, addicted to absinthe, and ill, by a friend, R.H. Sherard, who brought him back to London, where he died in Sherard's house.

Dowson published two novels in collaboration with Arthur Moore, *A Comedy of Masks* (1893) and *Adrian Rome* (1899), and a book of short stories, *Dilemmas* (1895), but his reputation rests on his poetry, *Verses* (1896) and *Decorations* (1899). His lyrics, marked by meticulous attention to melody and cadence, are polished and often charming. W.B. Yeats acknowledged that much of his own technical development was due to Dowson, whose influence can also be traced in the early work of Rupert Brooke.

doxology, an expression of praise to God. In Christian worship there are three common doxologies:

1. The greater doxology, or Gloria in Excelsis, is the Gloria of the Roman Catholic and Anglican masses, and in its hundreds of musical settings it is usually sung in Latin. It is used in the Roman Catholic liturgy in a contemporary translation and is used liturgically, often in older translations, in many Anglican, Lutheran, and other Protestant worship services. The Latin text, from the *Roman Missal,* follows:

Gloria in excelsis Deo. Et in terra pax hominibus bonae voluntatis. Laudamus te. Benedicimus te. Adoramus te. Glorificamus te. Gratias agimus tibi propter magnam gloriam tuam. Domine Deus, Rex caelestis, Deus Pater Omnipotens. Domine Fili unigenite Jesu Christe. Domine Deus, Agnus Dei, Filius Patris. Qui tollis peccata mundi, miserere nobis. Qui tollis peccata mundi, suscipe deprecationem nostram. Qui sedes ad dexteram Patris, miserere nobis. Quoniam tu solus sanctus. Tu solus Dominus. Tu solus altissimus, Jesu Christe. Cum sancto Spiritu, in gloria Dei Patris. Amen.

The modern Roman Catholic English version reads as follows:

Glory to God in the highest, and peace to his people on earth.
Lord God, heavenly King,
almighty God and Father,
we worship you, we give you thanks,
we praise you for your glory.
Lord Jesus Christ, only Son of the Father,
Lord God, Lamb of God
you take away the sin of the world:
have mercy on us;
you are seated at the right hand of the Father:
receive our prayer.
For you alone are the Holy One,
you alone are the Lord,
you alone are the Most High,
Jesus Christ,
with the Holy Spirit
in the glory of God the Father. Amen.

2. The lesser doxology, or Gloria Patri, is used in most Christian traditions at the close of the psalmody:

Glory be to the Father, and to the Son, and to the Holy Spirit, as it was in the beginning, is now, and ever shall be, world without end. Amen.

3. Metrical doxologies are usually variations upon the Gloria Patri. The most familiar in English is one by the 17th-century Anglican bishop and hymn writer Thomas Ken:

Praise God, from whom all blessings flow;
Praise him, all creatures here below;
Praise him above, ye heavenly host;
Praise Father, Son, and Holy Ghost. Amen.

Most Protestant churches use this form, often in conjunction with the presentation of tithes and offerings.

Doyle, Sir Arthur Conan (b. May 22, 1859, Edinburgh—d. July 7, 1930, Crowborough, Sussex, Eng.), writer best known for his creation of the detective Sherlock Holmes—one of the most vivid characters in English fiction. Holmes's friend, the good-hearted but comparatively obtuse Dr. Watson, and the detective's principal enemy, the archcriminal Professor Moriarty, also have taken on an uncanny life that persists beyond the page. In New York the Baker Street Irregulars and in London the Sherlock Holmes Society peruse

Sir Arthur Conan Doyle, detail of a portrait by H.L. Gates, 1927; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Holmesiana with a cultist fervour, and similar groups exist on the Continent. The brilliantly eccentric hero, in deerstalker or dressing gown, has been portrayed in a variety of media and has put the author's other works—chiefly historical romances—somewhat in the shade.

Conan Doyle practiced medicine until 1891 after graduating from the University of Edinburgh, and the character of Holmes, who first appeared in *A Study in Scarlet* (1887), partly derives from a teacher at Edinburgh noted for his deductive reasoning. Short stories about Holmes began to appear regularly in the *Strand Magazine* in 1891 and later made up several collections. Conan Doyle wearied of him and devised his death in 1893—only to be forced by public demand to restore him ingeniously to life.

Conan Doyle was knighted in 1902 for his work with a field hospital in Bloemfontein, S.Af., and for other activities concerning the South African (Boer) War. After the death of his son from wounds incurred in World War I, he dedicated himself to the cause of spiritualism.

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

Doyle, Richard (b. September 1824, London—d. Dec. 11, 1883, London), caricaturist, painter, and illustrator who, together with his father, John (1797–1868), introduced into British art a moderate style of caricature, opposed to the savage satire of James Gillray and Thomas Rowlandson.

A student of his father, Doyle regularly contributed (from 1843) decorations, theatre sketches, and political caricatures to *Punch.* The cover he designed for that publication was used for more than a century. Because of the magazine's anti-Catholic statements, he resigned in 1850, devoting himself to painting watercolours and to book illustrations (Thackeray's *Newcomes,* 1854–55; Dickens' Christmas books). His best-known collections of cartoons are: *Manners and Customs of Ye Englyshe* (1849) and *Bird's Eye Views of Society* (1864).

D'Oyly Carte, Richard: *see* Carte, Richard D'Oyly.

dozer: *see* bulldozer.

Dózsa Rebellion (1514), unsuccessful peasant revolt in Hungary, led by nobleman György Dózsa (1470–1514), that resulted in a reduction of the peasants' social and economic position.

During the reign of King Vladislas II (1490–1516), royal power declined in favour of the magnates, who used their power to curtail the peasants' freedom. When the cardinal Tamás Bakócz called for volunteers to go on a crusade against the Turks (April 16, 1514), about 100,000 discontented peasants joined the army. Dózsa, after having won a reputation for valour in the Turkish wars, was appointed leader. Although the crusade was suspended on May 23, the peasants, without food or clothing, began to voice grievances against landlords, and refused to disperse or reap the fields at harvesttime. The army announced its intention to overthrow the nobility and end oppression of the lower classes.

The rebellious peasants then attacked their landlords, burning hundreds of manor houses and castles and murdering thousands of nobles. They captured the fortresses of Arad, Lippa, and Világos, threatened Buda, and laid siege to Temesvár. But at Temesvár they were defeated by János Zápolya, *voivode* (governor) of Transylvania and future king of Hungary (reigned 1526–40). Dózsa and his chief lieutenants were captured and on July 20 Dózsa was executed. By October 1514 the remnants of the rebel army had been crushed, and the Diet of 1514 condemned the entire peasant class to "real and perpetual servitude" and bound it permanently to the soil. It also increased the number of days the peasants had to work for their lords, imposed heavy taxes on them, and ordered them to pay for the damage caused by the rebellion.

Dozy, Reinhart Pieter (Anne) (b. Feb. 21, 1820, Leiden, Neth.—d. April 29, 1883, Leiden), Dutch Arabist, best remembered for his monumental *Histoire des musulmans d'Espagne, jusqu'à la conquête de l'Andalousie par les Almoravides, 711–1110* (1861; *Spanish Islam,* 1913). Dozy, of French Huguenot ancestry, spent 33 years (from 1850) as professor of history at the University of Leiden. His history, a graphically written account of Moorish dominion in Spain that shed new light on many obscure points, long remained the standard work on the subject.

DQ Herculis (astronomy): *see* Nova Herculis.

Drâa, Oued, also spelled OUED DRA, intermittent stream (wadi) of southern Morocco. Rising from two headstreams, Dadès and Imini, in the Haut (High) Atlas mountains of central Morocco, it flows southeastward to Tagounit, hence it courses southwestward, forming much of the Algerian–Moroccan frontier, to the Atlantic near Cap Drâa. Of its total length of 700 mi (1,100 km), the longest of any Moroccan river, all but the headstreams and upper course are usually dry. Ouarzazate and Zagora are important riverine oases.

Drabble, Margaret (b. June 5, 1939, Sheffield, Yorkshire, Eng.), English writer of novels that are skillfully modulated variations on the theme of a girl's development toward maturity through her experiences of love, marriage, and motherhood.

The daughter of a judge, Margaret Drabble began writing after leaving Cambridge University. The central characters of her novels—*The Summer Bird-cage* (1963), *The Garrick Year* (1964), *The Millstone* (1965), *The Needle's Eye* (1972), *The Realms of Gold* (1973), *The Ice Age* (1977), *The Middle Ground* (1980)—although widely different in character and circumstance, are shown in situations of tension and stress that are the necessary conditions for their moral growth.

Drač (Albania): *see* Durrës.

Dracaena, genus of ornamental foliage plants in the family Agavaceae, consisting of about 50 to 80 species native primarily to the Old World tropics. Most species have short stalks and narrow, sword-shaped leaves, but some have taller stalks and resemble trees with crowns of leaves. The small flowers are red, yellow, or green. The berrylike fruit contains one to three seeds.

Dracaena
B. Alfieri from the Natural History Photographic Agency—EB Inc.

Dracaena sanderiana, with white-edged leaves, and *D. fragrans,* with yellow leaf edges or white stripes, are commonly cultivated as houseplants. The dragon tree (*D. draco*) of the Canary Islands, an ornamental tree with orange fruit, can grow 18 metres (60 feet) tall and 6 m wide. The trunk contains a red gum, called dragon's blood, that was formerly used in medicines.

drachma, silver coin of ancient Greece and the monetary unit of modern Greece. Its name derives from the Greek verb "to grasp," and its original value was equivalent to that of a handful of arrows. The early drachma had different weights in different regions. From the 5th century BC, Athens gained commercial preeminence, and the Athenian drachma became the foremost currency. One drachma equalled 6 oboli; 100 drachmas equalled 1 mine; and 60 mine equalled 1 Attic talent.

As a result of the conquests of Alexander the Great, the Athenian drachma came to be the monetary unit of the Hellenistic world. In time, silver coins of one drachma and its multiples were debased, and progressively higher proportions of copper were admixed. The drachma also became the prototype of an Islamic coin—the dirhem.

When Greece attained its independence from Turkey in 1828, the phoenix was introduced as the monetary unit, but it was replaced in 1833 by the drachma, divided into 100 lepta.

Drachmann, Holger Henrik Herholdt (b. Oct. 9, 1846, Copenhagen—d. Jan. 14, 1908, Hornbæk, Den.), writer, most famous for his lyrical poetry, which placed him in the front rank of late-19th-century Danish poets.

The son of a physician, Drachmann studied painting and also began to write. A visit to

Drachmann
Nordisk Pressefoto

London in 1871 awakened an interest in social problems, and after his return he joined the new radical movement of which Georg Brandes was the central figure. *Digte* (1872), collected poems, expressed his social theories.

He established his position as the greatest poet of the Danish modern movement of his time with such collections as *Dæmpede Melodier* (1875; "Muted Melodies"), *Sange ved Havet* ("Songs by the Sea") and *Venezia* (both 1877), and *Ranker og Roser* (1879; "Weeds and Roses"). The prose *Derovre fra Grænsen* (1877; "From Over the Border") and the verse fairy tale *Prinsessen og det Halve Kongerige* (1878; "The Princess and Half the Kingdom"), showed a patriotic and romantic trend that brought him into conflict with the Brandes group. About 1880 he adopted a conservative standpoint opposed to naturalism, but toward the end of the 1880s he returned to an individualist, antibourgeois position.

Drachmann's output was of great variety, including verse, short stories, novels, and plays, but his lyric verse is of major importance. He forsook classical prosody for a freer metre and a lively rhythm, reflecting the cadences of natural speech. Apart from his love poetry, his favourite subjects are the sea and its life. The best later collections are *Gamle guder og nye* (1881; "Old and New Gods"), *Sangenes bog* (1889; "The Book of Songs"), and *Den hellige ild* (1899; "The Holy Flame"). His novels are often partly autobiographical, the characters being artists or writers, as in the most important, *Forskrevet,* 2 vol. (1890; "Pledged"), in which his own personality is seen split into its bourgeois and bohemian components. Among his plays the fantasy *Der var Engang* (1885; "Once upon a Time") was a favourite, chiefly because of Peter Lange-Müller's music.

Drachten, chief town of Smallingerland *gemeente* (municipality), Friesland *provincie* (province), northwestern Netherlands, on the Wijde Ee waterway, part of the canal system that flows into the larger Prinses Margriet Canal to the northwest. The surrounding area consists of lowlands; there are forests at nearby Beetsterwaag, and peat moors are found southwest of Drachten. Formerly a village specializing in peat digging and dairy farming, Drachten has become an industrial centre producing electrical goods, transport equipment, machinery, chemicals, and furniture. Natural gas reserves are found to the northeast. Historic features of the town include an 18th-century church and the Bleekershûs Museum, which contains sculptures and the first film projector used in The Netherlands. The Eenei (or Zuartendijitster) is a defense works located near Drachten that Peter Stuyvesant (1610–72) supposedly used as a model for a fort that he built at New Amsterdam (New York). Drachten lies at the junction of highways extending between Groningen and Sneek and between Leeuwarden and Hijkersmilde. An airport is located near the town. Pop. (1982 est.) mun., 50,402.

Draco, also spelled DRACON (fl. *c.* 7th century BC), Athenian lawgiver whose harsh code (*c.* 621) punished both trivial and serious crimes in Athens with death—hence the continued use of the word draconian to describe repressive legal measures.

The six junior archons (*thesmotetai*), or magistrates, are said by Aristotle to have been instituted in Athens after 683 to record the laws. If this is correct, Draco's code was not the first reduction of Athenian law to writing, but it may have been the first comprehensive code or a revision prompted by some particular crisis. The code was later regarded as intolerably harsh, punishing trivial crimes with death; it was probably unsatisfactory to contemporaries, since Solon, who was the archon in 594 BC, later repealed Draco's code and published new laws (*see* Solon's laws) retaining only Draco's homicide statutes. A decree of 409/408 BC orders the public inscription of this murder law, which is partly extant. Later authors refer to other laws of Draco, which may be genuine; but the constitution ascribed to Draco in chapter 4 of the *Constitution of Athens* by Aristotle is certainly a later fabrication.

Draco, genus of the lizard family Agamidae, commonly referred to as the flying lizard because scaly membranes between the forelegs and hindlegs allow it to glide from tree to tree. There are more than 15 species, which occur in the forests of southeastern Asia and the East Indies.

Draco species are usually green with dull-coloured cross bars, and their "wings" are brightly coloured (*e.g.,* orange with black spots). The membranes are supported by ribs that grow away from the body. At rest, the ribs and membranes fold against the sides of the body.

Dracontius, Blossius Aemilius (fl. 5th century AD), the foremost Christian Latin poet of Africa who lived at the time of the literary revival that took place under Vandal rule in the latter part of the 5th century.

At Carthage Dracontius received the traditional rhetorical education and practiced as a lawyer. Though his family was initially favoured by the Vandals, he eventually suffered imprisonment and confiscation of his property on account of a poem in which he praised the Emperor rather than the Vandal king Gunthamund (484–496).

Dracontius' earlier verse is represented by the *Romulea,* a collection of nine pieces principally on mythological themes, forming the basis for philosophical argument. The highly rhetorical flavour of these poems reappears in his elegiac *Satisfactio,* a plea for pardon addressed to Gunthamund during his imprisonment, and is evident even in his most religious poem, *De laudibus dei.* This last poem, his most important work, comprises 2,327 hexameters in three books: Book I describes the Creation and Fall, and the evidence for immortality; Book II treats the benevolence of God as shown by the preservation and redemption of the world; and Book III is concerned with the dealings of God with man. The account of the Creation was separately circulated in the Middle Ages under the title *Hexaëmeron.* Dracontius shows wide familiarity with pagan Latin literature and with the Bible.

Dracunculus medinensis: *see* guinea worm.

draft (armed forces): *see* conscription.

draft (finance): *see* bill of exchange.

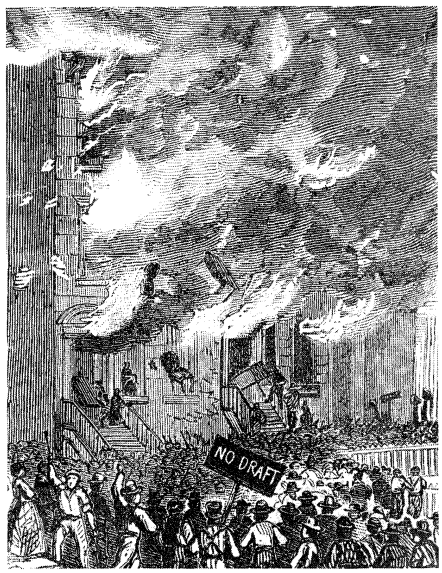
draft animal, any domesticated animal used in drawing heavy loads. Draft animals were in common use in Mesopotamia before 3000 BC for farm work and for pulling wheeled vehicles. Their use spread to the rest of the world over the following 2,500 years. While cattle, usually in teams, have been used most often as draft animals, horses and donkeys have supplanted them in many areas. Some horses—such as the Belgian horse, the Clydesdale, the Suffolk, the Shire, and the Percheron (*qq.v.*)—have been bred to serve as draft animals; they weigh more than 1,600 pounds (726 kg) and stand at least 16 hands high. The Asian buffalo, however, is probably the most important draft animal in the world today. About 78 million of them, of many different species, do draft work. The role of draft animals in agriculture in less developed regions of the world continues because of the advantages they offer: their feed is easily grown and commonly available, little maintenance is required; their manure is a valuable resource for the farmer; and the animal itself may become a source of food or other products at the end of its useful life.

A harness is necessary in using a draft animal efficiently. Such harnesses must allow the transfer of the animal's muscle power to the task at hand. With oxen and similar animals a yoke that rests on the back of the animal is used to attach the harness, while with horses and other equines a rigid, padded collar is used. The harness itself may be a simple arrangement of ropes connecting the yoke or collar to a plow, or it may be a complex arrangement of strapping to support the shafts of a cart, wagon, carriage, or sled

and to allow the animal to pull the vehicle in comfort, either singly or in concert with others. Long teams of draft animals, used in pairs and numbering as many as 24 animals, were common in the 19th century for pulling especially heavy loads, such as large machine parts or bulk commodities.

In many places the use of mixed teams, as with one horse and one mule or one ox and one cow hitched in tandem, has been common among small farmers. Draft animal power has also been used to pump water, thresh grain, draw barges, and haul logs out of forests in lumbering operations. In addition to bovine and equine species, reindeer, elephants, camels, llamas, sheep, goats, and dogs have been used as draft animals.

Draft Riot of 1863, major four-day eruption of violence in New York City resulting from deep worker discontent with the inequities of conscription during the U.S. Civil War. Although labouring people in general supported the Northern war effort, they had no voice in Republican policy and occasionally deserted from the army or refused reenlistment. Because of their low wages, often less than $500 a year, they were particularly antagonized by the federal provision allowing more affluent



Rioting in Lexington Avenue, New York City, following the first published draft call, 1863

By courtesy of the Library of Congress, Washington, D.C.

draftees to buy their way out of the Federal Army for $300. Minor riots occurred in several cities, and when the drawing of names began in New York on July 11, 1863, mobs (mostly of foreign-born, especially Irish, workers) surged onto the streets assaulting residents, defying police, attacking draft headquarters, and burning buildings. Property damage eventually totalled $1,500,000.

The New York draft riot was also closely associated with racial competition for jobs. Northern labour feared that emancipation of slaves would cause an influx of Negro workers from the South, and employers did in fact use black workers as strikebreakers during this period. Thus the white rioters eventually vented their wrath on the homes and businesses of innocent Negroes, and Civil War freedmen's associations were forced to send aid to their brethren in New York. (This racial ill feeling in the ranks of urban labour persisted into the second half of the 20th century.) The four-day draft riot was finally quelled by police cooperating with the 7th N.Y. Regiment, which had been hastily recalled from Gettysburg, and the drawing of names proceeded on August 19 without incident.

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

drafting, also spelled DRAUGHTING, also called ENGINEERING DRAWING, graphical representation of structures, machines, and their component parts that communicates the engineering intent of a technical design to the craftsman or worker who produces the product.

A brief treatment of drafting follows. For full treatment, *see* MACROPAEDIA: Drafting.

The first recognized formal treatise on engineering drawing is *La Géométrie descriptive* (1801), by Gaspard Monge; in it Monge developed the theory of projecting views of an object onto three mutually perpendicular coordinate planes (such as are formed by the front, top, and side of a cube), and then revolving the horizontal (or top) and profile (side) planes into the same planes as the vertical (front) plane. His theory is the basis for all orthographic (mutually perpendicular) projection drawing, in which any object can be viewed from any direction.

Most engineering drawings are made with instruments and therefore are called mechanical drawings. Drafting instruments include pencils, T-squares and triangles, compasses, protractors, and a drawing board. In orthographic projection drawing, views of an object are placed on a drawing in sequence of adjacent sides of the object. The object is viewed with a point of sight (or vanishing point) set at infinity, making the visual rays, or lines of sight, from the eye to the object parallel. The principal views are the top (or bottom), front (or rear), and right side (or left side); auxiliary views can be taken from any direction. Views are most commonly arranged by the third-angle projection system, in which the top view is drawn in a location vertically above the front view, and the side view is placed horizontally in direct line with the front view.

Orthographic projections may contain conventional graphic symbols to represent standard features of objects, such as threads or machine parts. The drawings may show sectional views of an object, made by passing a cutting plane through the object's interior; and they may indicate the object's dimensions and tolerances.

In pictorial orthographic projections the object is seen approximately as it would be seen by the eye. In the axonometric type, the line of sight is inclined to the principal faces and principal axes of the object, and all dimensions in the direction of the principal axes are foreshortened. In the oblique type, the view is projected on a picture plane set at an angle other than 90 degrees with the visual rays. The picture plane usually is parallel to one principal face, and the face shows true size and shape of the object. The perspective type of pictorial projection is the most realistic of mechanical drawings. The view is projected on a picture plane, and visual rays are not parallel but recede and converge at a finite point of sight.

In architectural and structural drawings a separate sheet is used for each plan view or building elevation, and the individual parts of a structure are shown in assemblage. Most architectural and structural drawings are third-angle projections.

Charts and graphs are simple pictorial representations drawn to illustrate the relationship of a group of facts, statistics, or records. Categories include line graphs, polar charts, bar charts, circle charts, flow charts, and nomographs.

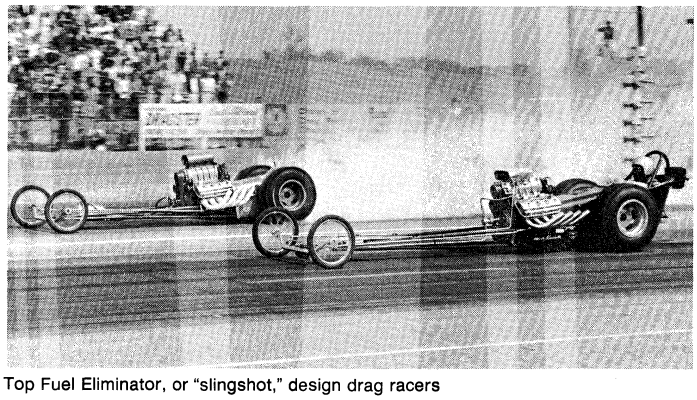
Original engineering drawings generally are preserved intact and reproductions are made for further handling. Reproduction methods include the blueprint process, which produces a print of white lines on a dark-blue background; the diazo process, which provides prints with black, blue, or red lines on a white background; and the microfilm process, in which drawings are reproduced on film at as little as one-eighth to one-fortieth the original size.

drafting (fibre preparation): *see* drawing.

drag-gshed (in Buddhism): *see* dharmapāla.

drag racing, form of motor racing popular in the United States in which two contestants race side by side from a standing start over a flat, straight, measured one-quarter-mile course; the first to the finish line is the winner. Both elapsed time and finishing speed are usually recorded. Competitions are run as a tournament, with losers eliminated and winners competing against others in their class until only one is left undefeated. Drag racing is practiced with nearly every variety of motor vehicle, including boats, but most frequently with automobiles; it originated in the southern California deserts in the 1920s. Its two major U.S. organizations, the National Hot Rod Association (NHRA) and the American Hot Rod Association (AHRA), were formed in the early 1950s.

Most top-level drag-racing competition is professional. Cars compete in a great variety of classes according to degree of modification, type of fuel, and other specifications. The fastest are the Top Fuel Eliminators, called "rails," or "slingshots." They are built with a light, tubular metal chassis and use cycle-type wheels in front and very wide, slick-tread tires in back. Engines (one or two) are placed as far to the rear as practicable, with the driver enclosed in a protective cage just behind or ahead of the engine. Top Fuel cars burn a special mixture other than commercial pump gasoline (petrol), such as methanol and nitromethane. Top Gas cars are similar to Top Fuel cars but use commercial gasoline and are a fraction of a second slower.



Top Fuel Eliminator, or "slingshot," design drag racers

By courtesy of the National Hot Rod Association

"Funny" cars are highly modified dragsters covered by a fibreglass copy of a late-model production car body. They are restricted to one engine but are otherwise unlimited and are nearly as fast as Top Fuel racers.

Standard production cars, with varying degrees of modification, compete in most other classes, many of which are nonprofessional. For drag racing's place in the history of automobile racing; *see* automobile racing.

Drăgăşani, Battle of (June 19, 1821), military engagement in which the Ottoman Turks defeated the forces of the Greek revolutionary society Philikí Etaireía and ended the first insurrection of the Greek War of Independence. Intending to overthrow Ottoman rule in the Balkans and to establish an independent Greek state, Philikí Etaireía sent the Sacred Battalion, under Alexander Ypsilantis, into the Danubian principalities to lead an uprising there. The Turkish Army, however, destroyed the Greek force at Drăgăşani, 90 miles (145 kilometres) west of Bucharest, and Ypsilantis fled. The battle marked the end of his leadership but otherwise had little effect on the Greek independence movement, which had launched another rebellion in the Morea.

Drago, Luis María (b. May 6, 1859, Buenos Aires—d. June 9, 1921, Buenos Aires), statesman and author of the Drago Doctrine, which opposed the forcible collection of debts through military intervention in any South American republic.

A member of a distinguished Argentine family, Drago began his career as a newspaper editor. He later served as Argentine financial officer and then as minister of foreign affairs (1902). At that time, when Great Britain, Germany, and Italy were seeking to collect the public debt of Venezuela by force, he wrote to the Argentine minister in Washington setting forth his doctrine.

Drago represented Argentina at the Hague Peace Conference in 1907 and two years later served on the arbitration tribunal that decided the famous North Atlantic Coast Fisheries case (1910) between Britain and the U.S. He died shortly after he had been invited by the League of Nations to draft the statute of the Permanent Court of International Justice.

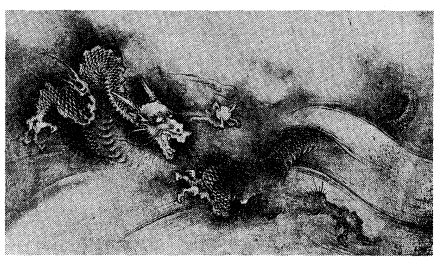
dragoman, Arabic TARJUMĀN, Turkish TERCÜMAN, official interpreter in countries where Arabic, Turkish, and Persian are spoken. Originally the term applied to any intermediary between Europeans and Middle Easterners, whether as a hotel tout or as a traveller's guide, but there developed the official dragomans of foreign ministries and embassies, whose functions at one time included the conduct of important political negotiations. In the latter sense the dragoman has, essentially, ceased to exist, especially since the passing of the Ottoman Empire, although in the latter part of the 20th century many embassies in the Arab world still employed an interpreter-courier known as a kavass (Turkish *kavas*; Arabic *qawwās*), used largely for ceremonial purposes.

The original employment of dragomans in the Ottoman government arose from religious scruples against the use of the language of a non-Muslim people. Ottoman political relations compelled the sultan's ministers to use interpreters, who rapidly acquired a very considerable political influence. The first chief dragoman of the Ottoman government was Panayotis Nikousia. Alexander Mavrokordatos, who succeeded Nikousia, negotiated the Treaty of Carlowitz (1699) for the Ottoman Empire and became very prominent in the development of Ottoman policy.

Similarly, foreign emissaries employed their own dragomans as confidential intermediaries between their missions and the Ottoman government. In 1877 Great Britain inaugurated a system for the selection and training of British-born dragomans, and most European powers eventually followed.

The functions of the chief dragoman were essentially political in character. The subordinate dragomans transacted less important business, including, generally, all matters in which the interests of foreign citizens were involved. The high esteem in which the dragomans were held by most foreign powers was demonstrated by the fact that they were often elevated to the most important diplomatic posts. The more important consulates in the Ottoman provinces were also provided with dragomans, whose duties were of a similar if less important nature. Banks, railway companies, and financial institutions employed dragomans to facilitate their business relations with Ottoman officials.

dragon, legendary monster usually conceived as a huge, bat-winged, fire-breathing, scaly lizard or snake with a barbed tail. The belief in these creatures apparently arose without the slightest knowledge on the part of the ancients of the gigantic, prehistoric, dragon-like reptiles. In Greece the word *drakōn,* from which the English word was derived, was used originally for any large serpent (*see* sea serpent), and the dragon of mythology, whatever shape it later assumed, remained essentially a snake.



Dragon, detail of "Nine Dragons," handscroll, ink and slight colour on paper by Ch'en Jung, Chinese, 1244; in the Museum of Fine Arts, Boston

By courtesy of the Museum of Fine Arts, Boston, Francis Gardner Curtis Fund

In general, in the Middle Eastern world, where snakes are large and deadly, the serpent or dragon was symbolic of the principle of evil. Thus, the Egyptian god Apepi, for example, was the great serpent of the world of darkness. But the Greeks and Romans, though accepting the Middle Eastern idea of the serpent as an evil power, also at times conceived the *drakontes* as beneficent powers—sharp-eyed dwellers in the inner parts of the Earth. On the whole, however, the evil reputation of dragons was the stronger, and in Europe it outlived the other. Christianity confused the ancient benevolent and malevolent serpent deities in a common condemnation. In Christian art the dragon came to be symbolic of sin and paganism and, as such, was depicted prostrate beneath the heels of saints and martyrs.

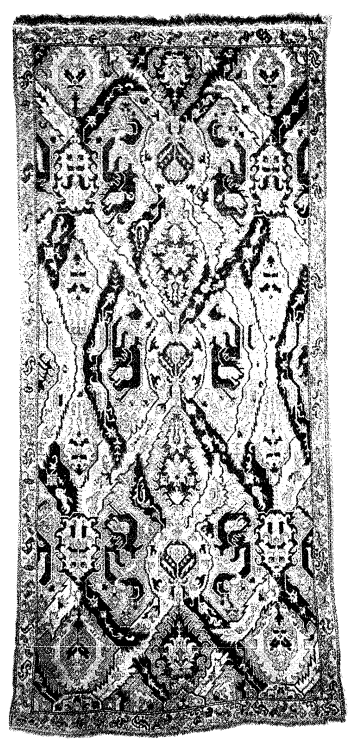
The dragon's form varied from the earliest times. The Chaldean dragon Tiamat had four legs, a scaly body, and wings, whereas the biblical dragon of Revelation, "the old serpent," was many-headed like the Greek Hydra. Because they not only possessed both protective and terror-inspiring qualities but also had decorative effigies, dragons were early used as warlike emblems. Thus, in the *Iliad,* King Agamemnon had on his shield a blue three-headed snake, just as the Norse warriors in later times painted dragons on their shields and carved dragons' heads on the prows of their ships. In England before the Norman Conquest, the dragon was chief among the royal ensigns in war, having been instituted as such by Uther Pendragon, father of King Arthur. In the 20th century the dragon was officially incorporated in the armorial bearings of the prince of Wales.

In the Far East, the dragon managed to retain its prestige and is known as a beneficent creature. The Chinese dragon, *lung* (*q.v.*), represented yang, the principle of heaven, activity, and maleness in the yin-yang (*q.v.*) of Chinese cosmology. From ancient times, it was the emblem of the Imperial family, and until the founding of the republic (1911) the dragon adorned the Chinese flag. The dragon came to Japan with much of the rest of Chinese culture, and there (as *ryū* or *tatsu*) it became capable of changing its size at will, even to the point of becoming invisible. Both Chinese and Japanese dragons, though regarded as powers of the air, are usually wingless. They are among the deified forces of nature in Taoism.

The term dragon has no zoological meaning, but it has been applied in the Latin generic name *Draco* to a number of species of small lizards found in the Indo-Malayan region. The name is also popularly applied to the giant monitor, *Varanus komodoensis,* discovered on Komodo, in Indonesia.

Dragon rug, any of the most numerous group of the Kuba carpets and a great favourite among rug fanciers because of striking design and colouring. The basic pattern—great, irregular, jagged bands that form an ogee lattice—is closely related to that of the Vase carpets of Kerman, upon which they were probably based.

Early examples are narrow for their length, with a single-stripe border, as in the Vase carpets. In the lattice, fantastic palmettes and other blossoms mask intersections; and in the spaces between the bands appear such figures as deformed Chinese dragons, flaming lions,



Dragon rug from the Caucasus, late 17th century; in the Philadelphia Museum of Art

By courtesy of the Philadelphia Museum of Art, Sharples Collection; photograph, Otto E. Nelson—EB Inc.

and, in some cases, fawns, onagers (wild asses), ibex, and cranes. Upon the bands themselves may be distorted figures of pheasants and ducks, together with the Chinese *chi,* or cloud knot. The earliest rugs are drop repeats, but soon diagonal repeats and design offsets also appear. At first, the layouts were directional, but many later rugs have forms oriented to-

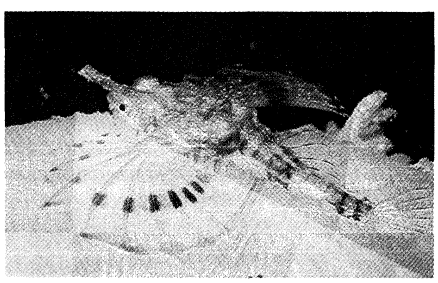
ward both ends. In later examples, all beasts but the dragon have disappeared or survive merely as indistinguishable bits of colour. All but the newest Dragon rugs are entirely of wool.

dragon worm: *see* guinea worm.

dragonet, any of about 40 species of exclusively marine fishes in the family Callionymidae (order Perciformes), found in warm temperate or tropical areas. Most species occur in the Indo-Pacific region, although representatives such as the spotfin dragonet (*Callionymus agassizi*) are also found in the Atlantic Ocean. This species has been taken from depths greater than 450 metres (1,500 feet).

The name dragonet is derived from the characteristically large and elongated fins, lips, and eyes of this relatively small fish (less than 20 centimetres [8 inches] long), giving it a formidable appearance. Dragonets are scaleless. The males may be brightly coloured during breeding season. Most species are bottom dwellers, frequently burying themselves in sand in shallow areas. Many are found in deep waters. The eggs are unusual in that they are pelagic, floating in the open water until they hatch.

dragonfish, also called SEA MOTH, any of about five species of small marine fishes com-



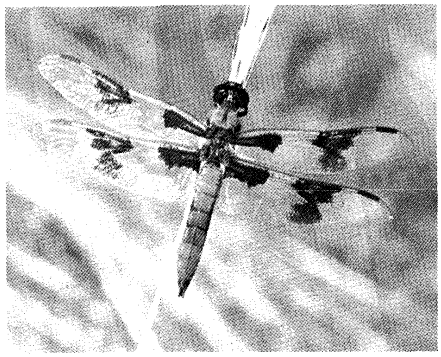
Dragonfish (*Pegasus papilio*)
Douglas Faulkner

prising the family Pegasidae and the order Pegasiformes. Dragonfish are found in warm Indo-Pacific waters. They are small (to about 16 centimetres [6½ inches] long), elongated fish encased in bony rings of armour. The armour is fused on the head and body but not on the tail, which is thus flexible. The pectoral fins are large, horizontal, and winglike; the pelvic fins consist of a few fingerlike rays. The mouth is small and toothless and is placed below an elongated, bony snout.

Little is known about the natural history of the dragonfish. Their relationships to other fish groups are also in doubt. One of the best known dragonfish is *Pegasus volitans,* a blue-eyed, brown or deep-red fish found from India to Australia.

dragonfly, also called DARNER, DARNING NEEDLE, DEVIL'S ARROW, or DEVIL'S DARNING NEEDLE, any member of the insect suborder Anisoptera, order Odonata, characterized by four large, many-veined, membranous wings that, when at rest, are held horizontally and at right angles to the longitudinal body axis rather than vertically (as in members of the other suborder, Zygoptera, or damselflies). It is agile, with bulging eyes that often occupy most of the head, and has a wingspan of up to 16 centimetres (about 6 inches). It is one of the fastest flying and most predacious insects: in 30 minutes it can eat its own weight in food. It is also known as the devil's darning needle following the superstition that it may sew up the eyes, ears, and mouth of a sleeping child.

Dragonflies, along with damselflies, exhibit unusual mating behaviour. They differ from



Dragonfly (*Libellula forensis*)
E.S. Ross

most insects by having the male copulatory organs at the front part of the abdomen rather than at the end. Dragonflies often fly in tandem during the transfer of sperm; many pairs remain in this position until after the female has laid her eggs. The aquatic nymph, or naiad, propels itself by expelling water through gills in the rectum.

dragonhead, either of two genera of plants, *Dracocephalum* and *Physostegia,* both belonging to the mint family (Lamiaceae), order Lamiales. The about 45 species of *Dracocephalum,* all native in temperate Eurasia except for one in North America, have two-lipped flowers, lobed at the base and the upper lip, resembling fanciful heads of dragons. In North America *D. parviflorum* produces a dense spike of blue flowers at the top of its 60-centimetre- (2-foot-) high stem.

The related false dragonheads, or obedient plants (*Physostegia*), with 15 species are na-

Dragonnead (*Dracocephalum virginianum*)
B.M. Shaub

tive to North America. The best known is *P. virginiana,* which has large, pink, bell-like flowers on slender spikes.

dragon's blood, red resin obtained from the fruit of several palms of the genus *Daemonorops* and used in colouring varnishes and lacquers. Once valued as a medicine in Europe because of its astringent properties, dragon's blood now is used as a varnish for violins and in photoengraving for preventing undercutting of the printing surface during etching.

Daemonorops draco, a rattan palm native to Malaysia and Indonesia, produces much of the dragon's blood of commerce. Other sources are *Dracaena cinnabari* of the island of Socotra, east of Somalia; *Dracaena draco* of the Canary Islands; and *Croton draco* of Mexico, where it is used locally to heal wounds and as an astringent.

dragon's-mouth, also called BOG PINK, or WILD PINK, (*Arethusa bulbosa*), one of two plant species of the orchid genus *Arethusa,* family Orchidaceae. Dragon's-mouth is found only in North American bogs; the other species exists only in marshy areas of Japan.

A reddish-pink dragon's-mouth flower has

Dragon's-mouth (*Arethusa bulbosa*)
John Kohout—Root Resources

three erect sepals and a purplish-blotched lip that curves downward. The upper surface of the lip is covered with a thick tissue bearing many yellowish, purple-tipped hairs. A hood arches over the lip. The stem is about 30 centimetres (12 inches) tall and bears one long, sharp-pointed leaf after the flowering season.

Dragon's Mouths, Spanish BOCAS DEL DRAGÓN, channel of the southeastern Caribbean Sea, between Punta (point) Peñas, the eastern end of the Península de Paria, Venezuela, and the northwest extremity of the island of Trinidad. The channel, about 12 mi (20 km) wide, separates Trinidad from mainland South America at this point; to the south lies the broad Gulf of Paria. The channel is named from its many teeth-like rocky islets; both these islets and the strong current of the channel have long been dangers to navigation.

dragoon, in late 16th-century Europe, a mounted soldier who fought as a light cavalryman on attack and as a dismounted infantryman on defense. The terms derived from his weapon, a species of carbine or short musket called the dragoon. Dragoons were organized not in squadrons but in companies, and their officers and noncommissioned officers bore infantry titles. From the early wars of Frederick II the Great of Prussia in the 18th century, dragoon has referred to medium cavalry. The light cavalry of the British army in the 18th and early 19th centuries was for the most part called light dragoon. The term and function disappeared as the cavalry did in the 20th century.

drainage, in agriculture, the artificial removal of water from land; drainage is employed in the reclamation of wetlands, in the prevention of erosion, and as a concomitant of irrigation in the agriculture of arid regions.

A brief treatment of drainage follows. For full treatment, *see* MACROPAEDIA: Farming and Agricultural Technology.

Drainage is an ancient practice, but apparently until recent times it was regarded as less important than irrigation. The first drains were most likely ditches for channelling floodwaters back to the rivers. The addition of linings of less porous materials greatly improved drainage efficiency. The most significant 20th-century development in drainage technology was the application of land-grading techniques to facilitate uniform runoff.

Land may be smoothed with proper slopes and ditches so as to remove excess water before it enters the soil and thus prevent erosion, leaching of nutrients, and standing pools of water on the surface, and to permit early spring planting. If carefully planned, this smoothing also can prepare the land for surface irrigation, thus serving two purposes by one earth-moving operation. After excess water enters the soil, its removal is an expensive and specialized undertaking that is not directly connected with irrigation, although it sometimes may be necessary for irrigated land. Modern drainage systems may be divided into two categories, surface and subsurface. The typical surface system consists of field drains, field ditches, a main collection ditch, and an outlet. As the term implies, a surface system is designed to remove water that collects on top of the soil. Surface drainage is especially important for soils that absorb water slowly. The field drains vary in configuration according to topography, parallel drains being indicated for uniform surfaces and site-specific ones for areas of uneven accumulation.

Subsurface drainage systems consist of small conduits, a submain, a main, and an outlet. The conduits, equivalent to the field drains in a surface system, collect the water in the soil and drain it into the larger arteries.

Factors determining the most efficient drainage system design for a particular property include soil type, land configuration, amount and pattern of rainfall, and types of crops to be grown. Soils of high sand or silt content are generally suited to subsurface drainage, while soils of high clay content generally require surface systems.

drainage basin, also called CATCHMENT AREA, or WATERSHED, area from which all precipitation flows to a single stream or set of streams. For example, the total area drained by the Mississippi River constitutes its drainage basin, whereas that part of the Mississippi River drained by the Ohio River is the Ohio's drainage basin. The boundary between drainage basins is a drainage divide: all the precipitation on opposite sides of a drainage divide will flow into different drainage basins.

A drainage basin provides a limited surface area within which physical processes pertinent to the general hydrology may be considered. The climatic variables and the water and sediment discharge, water storage, and evapotranspiration may be measured; from these measurements, denudation rates and moisture and energy balances may be derived, each of which is useful in the consideration and understanding of landscape formation.

Drake, Edwin Laurentine (b. March 29, 1819, Greenville, N.Y., U.S.—d. Nov. 8, 1880, Bethlehem, Pa.), driller of the first productive oil well in the United States.

A railway conductor in New Haven, Conn., Drake bought a small amount of stock in the Pennsylvania Rock Oil Company, which gathered oil from ground-level seepages at Titusville, Pa., for medicinal uses. In Titusville on business, Drake studied the techniques of drilling salt wells. With the encouragement of George H. Bissell, a local landowner who was aware of the younger Benjamin Silliman's report of the potential value of petroleum, Drake persuaded the company to lease its land for drilling operations. He began drilling in 1858 and struck oil at a depth of 69 feet (21 metres) on Aug. 28, 1859. With the spread of Drake's drilling techniques, Titusville and other northwestern Pennsylvania communities became boom towns. Drake failed to patent his drilling methods, however, and later lost his money in oil speculation. After 10 years of poverty, he was finally pensioned by the Pennsylvania legislature.

Drake, Sir Francis (b. *c.* 1540–43, Devonshire, Eng.—d. Jan. 28, 1596, at sea, off Puerto Bello, Panama), English admiral who circumnavigated the globe (1577–80), played an important role in defeating the Spanish Armada (1588), and was the most renowned seaman of the Elizabethan Age.

Sir Francis Drake, oil painting by an unknown artist; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Early life. Born on the Crowndale estate of Lord Francis Russell, second earl of Bedford, Drake was the son of one of the latter's tenant farmers. His father was an ardent Protestant lay preacher, an influence that was to have an immense effect on Drake's character. His detestation of Catholicism had its origins not only in his father's teaching but in his own early experiences, when his family had to flee the West Country during the Catholic uprising of 1549. They made their way to Kent in southeastern England and, in exchange for their former country cottage home, found lodging in one of the old naval hulks that were moored near Chatham on the south bank of the Thames Estuary. Had he stayed in Devon he might have become a yeoman farmer, but his family's poverty drove him to sea while he was still a boy. When Drake was about 13 years old, he was apprenticed to a small coastal vessel plying between North Sea ports. Thus, sailing one of the harshest stretches of water in the world, he learned early how to handle small vessels under arduous conditions. The knowledge of pilotage he acquired during these years was to serve him in good stead throughout his life. The old sea captain left Drake his ship when he died, so that Drake, thereafter, became his own master.

Drake might have spent all his life in the coastal trade but for the happy accident that he was related to the powerful Hawkins family of Plymouth, Devon, who were then embarking on trade with the New World—the New World that, as Drake never forgot, had been given by Pope Alexander VI to the kingdom of Spain. When he was about 23, dissatisfied with the limited horizons of the North Sea, he sold his boat and enlisted in the fleet belonging to the Hawkins family. Now he first saw the ocean swell of the Atlantic and the lands where he was to make his fame and fortune.

Voyages to the West Indies. On a voyage to the West Indies, as second in command, Drake had his first experience of the Spaniards and of the way in which foreigners were treated in their realms; their cargoes, for example, were liable to be impounded. At a later date he referred to some "wrongs" that he and his companions had suffered—wrongs that he was determined to right in the years to come. His second voyage to the West Indies, this time in company with John Hawkins, ended disastrously at San Juan de Ulúa off the coast of Mexico, when the English seamen were treacherously attacked by the Spanish and many of them killed. Drake returned to England in command of a small vessel, the "Judith," with an even greater determination to have his revenge upon Spain and the Spanish king (Philip II). Although the expedition was a financial failure, it served to make Drake's reputation, for he had proved himself an outstanding seaman. People of importance, including Queen Elizabeth I, who had herself invested in the venture, now heard his name. In the years that followed he made two expeditions in small boats to the West Indies, in order "to gain such intelligence as might further him to get some amend for his loss. . . ." In 1572—having obtained from the Queen a privateering commission, which amounted to a license to plunder in the King of Spain's lands—Drake set sail for America in command of two small ships, the "Pasha," of 70 tons, and the "Swan," of 25 tons. He was nothing if not ambitious, for his aim was to capture the important town of Nombre de Dios, Panama. Although himself wounded in the attack, he and his men managed to get away with a great deal of plunder—the foundation of his fortune. Not content with this, he went on to cross the Isthmus of Panama. Standing on a high ridge of land, he first saw the Pacific, that ocean hitherto barred to all but Spanish ships. It was then, as he put it, that he "besought Almighty God of His goodness to give him life and leave to sail once in an English ship in that sea." His name as well as fortune was established by this expedition, and he returned to England both rich and famous. Unfortunately, his return coincided with a moment when Queen Elizabeth and King Philip II of Spain had reached a temporary truce. Although delighted with Drake's success in the empire of her great enemy, Elizabeth could not officially acknowledge it. Drake, who was as politically discerning as he was navigationally brilliant, saw that the time was inauspicious and sailed with a small squadron to Ireland, where he served under the Earl of Essex, who was then engaged in suppressing a rebellion in that strife-torn land. This is an obscure period of Drake's life, and he does not emerge into the clear light of history until two years later.

Circumnavigation of the world. In 1577 he was chosen as the leader of an expedition intended to pass around South America through the Strait of Magellan and to explore the coast that lay beyond. The object was to conclude trading treaties with the people who lived south of the Spanish sphere of influence and, if possible, to explore an unknown continent that was rumoured to lie far in the South Pacific. The expedition was backed by the Queen herself. Nothing could have suited Drake better. He had official approval to benefit himself and the Queen, as well as to cause the maximum damage to the Spaniards. It was now that he met the Queen for the first time and heard from her own lips that she "would gladly be revenged on the King of Spain for divers injuries that I have received." He set sail in December with five small ships, manned by fewer than 200 men, and reached the Brazilian coast in the spring of 1578. His flagship, the "Pelican," which Drake later renamed "The Golden Hind," was only about 100 tons. It seemed little enough with which to undertake a venture into the domain of the most powerful monarch and empire in the world.

Upon arrival in South America, it was discovered that there was a plot against Drake, and its leader, Thomas Doughty, was tried and executed. Drake was always a stern disciplinarian, and he clearly did not intend to continue the venture without making sure that all his small company were loyal to him. Two of his smaller vessels, having served their purpose as store ships, were then abandoned, after their provisions had been taken aboard the others, and, on Aug. 21, 1578, he entered

the Strait. It took 16 days to sail through, after which Drake had his second view of the Pacific Ocean—this time from the deck of an English ship. Then, as he wrote, "God by a contrary wind and intolerable tempest seemed to set himself against us." During the gale, Drake's vessel and that of his second in command had been separated; the latter, having missed a rendezvous with Drake, ultimately returned to England, presuming that the "Hind" had sunk. It was, therefore, only Drake's flagship that made its way into the Pacific and up the coast of South America. He passed along the coast like a whirlwind, for the Spaniards were quite unguarded, having never known a hostile ship in their waters. He seized provisions at Valparaíso, attacked passing Spanish merchantmen, and captured two very rich prizes. "The Golden Hind" was below her watermark, loaded with bars of gold and silver, minted Spanish coinage, precious stones, and pearls, when he left South American waters to continue his voyage around the world. Before sailing westward, however, he sailed to the north as far as 48° N, on a parallel with Vancouver, to seek the Northwest Passage back into the Atlantic. The bitterly cold weather defeated him, and he coasted southward to anchor just north of modern San Francisco. He named the surrounding country New Albion and took possession of it in the name of Queen Elizabeth. In his search for a passage around the north of America he was the first European to sight the west coast of what is now Canada.

In July 1579 he sailed west across the Pacific and after 68 days sighted a line of islands (probably the remote Palau group). From there he went on to the Philippines, where he watered ship before sailing to the Moluccas. There he was well received by the local sultan and appears to have concluded a treaty with him giving the English the right to trade for spices. Drake's deep-sea navigation and pilotage were always excellent, but in those totally uncharted waters his ship struck a reef. He was able to get her off without any great damage and, after calling at Java, set his course across the Indian Ocean for the Cape of Good Hope. Two years after she had nosed her way into the Strait of Magellan, "The Golden Hind" came back into the Atlantic with only 56 of the original crew of 100 left aboard.

On Sept. 26, 1580, Francis Drake brought his ship into Plymouth Harbour. She was laden with treasure and spices, and Drake's fortune was permanently made. He thus became the first captain ever to sail his own ship around the world—the Portuguese navigator Ferdinand Magellan having been killed before completing his circumnavigation—and the first Englishman to sail the Pacific, the Indian Ocean, and the South Atlantic. Despite Spanish protests about his piratical conduct while in their imperial waters, Queen Elizabeth herself came aboard "The Golden Hind," which was lying at Deptford in the Thames Estuary, and personally bestowed knighthood on the farmer's son.

Mayor of Plymouth. In the same year, 1581, Drake was made mayor of Plymouth, an office he fulfilled with the same thoroughness that he had shown in all other matters. He organized a water supply for Plymouth that served the city for 300 years. In 1585 he married again, his first wife, a Cornish woman named Mary Newman, whom he had married in 1569, having died in 1583. His second wife, Elizabeth Sydenham, was an heiress and the daughter of a local Devonshire magnate, Sir George Sydenham. In keeping with his new station, Drake bought himself a fine country house—Buckland Abbey (now a national museum)—a few miles from Plymouth. Drake's only grief was that neither of his wives bore him any children.

During these years of fame when Drake was a popular hero, he could always obtain volunteers for any of his expeditions. But he was very differently regarded by many of his great contemporaries. Such well-born men as the naval commander Sir Richard Grenville and the navigator and explorer Sir Martin Frobisher disliked him intensely. He was the parvenu, the rich but common upstart, with West Country manners and accent and with none of the courtier's graces. Drake had even bought Buckland Abbey from the Grenvilles by a ruse, using an intermediary, for he knew that the Grenvilles would never have sold it to him directly. It is doubtful, in any case, whether he cared about their opinions, so long as he retained the goodwill of the Queen. This was soon enough demonstrated, for in 1585 Elizabeth placed him in command of a fleet of 25 ships. Hostilities with Spain had broken out once more, and he was ordered to cause as much damage as possible to the Spaniards' overseas empire. Drake fulfilled his commission, capturing Santiago in the Cape Verde Islands and taking and plundering the cities of Cartagena in Colombia, St. Augustine in Florida, and San Domingo (Santo Domingo, Hispaniola). The effect of his triumph in the West Indies was cataclysmic. Spanish credit, both moral and material, almost foundered under the losses. The Bank of Spain broke, the Bank of Venice (to which Philip II was principal debtor) nearly foundered, and the great German bank of Augsburg refused to extend the Spanish monarch any further credit. Even Lord Burghley, Elizabeth's principal minister, who had never approved of Drake or his methods, was forced to concede that "Sir Francis Drake is a fearful man to the King of Spain."

Defeat of the Spanish Armada. By 1586 it was known that Philip II was preparing a fleet for what was called "The Enterprise of England," and that he had the blessing of Pope Sixtus V to conquer the heretic island and return it to the fold of Rome. Drake was given carte blanche by the Queen to "impeach the provisions of Spain." In the following year, with a fleet of some 30 ships, he showed that her trust in him had not been misplaced. He stormed into the Spanish harbour of Cádiz and in 36 hours destroyed thousands of tons of shipping and supplies, all of which had been destined for the Armada. This action, which he laughingly referred to "as singeing the king of Spain's beard," was sufficient to delay the invasion fleet for a further year. But the resources of Spain were such that by July 1588 the Armada was in the English Channel. Lord Howard had been chosen as English admiral to oppose, with Drake as his vice admiral. It was, however, the latter's dash and fire that largely turned the scales, Drake himself managing to capture a rich prize during the long sea fight in the Channel. It was also Drake who prompted the use of fire ships to drive the Armada out of Calais, where it had taken refuge. Then, to delight his Protestant heart, "The Winds of God blew," so that the Spanish fleet was dispersed and largely wrecked. Drake was England's hero, achieving a popularity never to be equalled by any man until Horatio Nelson emerged more than 200 years later. Innumerable souvenirs were struck in his name, and he was immortalized in poems and broadsheets.

Last years. Drake's later years were not happy, however. An expedition that he led to Portugal proved abortive, and his last voyage, in 1596, against the Spanish possessions in the West Indies was a failure, largely because the fleet was decimated by fever. Drake himself succumbed and was buried at sea off the town of Puerto Bello (modern Portobelo, Panama). Few men have been more famous in their lifetimes. As the Elizabethan historian John Stow wrote:

> He was more skilful in all points of navigation than any . . . He was also of perfect memory, great observation, eloquent by nature . . . In brief he was as famous in Europe and America, as Timur Lenk (Tamerlane) in Asia and Africa.

At a later date, Dr. Samuel Johnson wrote eulogistically of his character and bravery. But to the Spaniards he was, as their ambassador to England remarked, "the master-thief of the unknown world." He was "low of stature, of strong limb, round-headed, brown hair, full-bearded, his eyes round, large and clear, well-favoured face and of a cheerful countenance." A devout churchman and an able businessman, Sir Francis Drake was one of the world's greatest seamen. He embodied many of the virtues of expansionist Elizabethan England. (E.Br.)

BIBLIOGRAPHY. There is no definitive biography of Drake. Of the comparatively short biographies available, the most useful is probably that by C.C. Lloyd (1957). J.A. Williamson, *Sir Francis Drake* (1951), is the work of an author expert in the naval and exploratory history of the period. E.D.S. Bradford, *Drake* (1965), is light and readable. Books placing Drake in his contemporary setting include J.A. Williamson, *The Age of Drake,* 5th ed. (1965); Julian Corbett's old but still valuable classic, *Drake and the Tudor Navy,* 2 vol. (1898); and K.R. Andrews, *Drake's Voyages: A Reassessment of Their Place in Elizabethan Maritime Expansion* (1967). Collections of documents, such as letters and narratives referring to the voyages, include *New Light on Drake: A Collection of Documents Relating to His Voyage of Circumnavigation, 1577–1580,* ed. by Zelia Nuttall (1914); *The Last Voyage of Drake and Hawkins,* ed. by K.R. Andrews (1972); and California Historical Society, *Drake's Plate of Brass: Evidence of His Visit to California in 1597* (1937).

Drake, Joseph Rodman (b. Aug. 7, 1795, New York City—d. Sept. 21, 1820, New York City), Romantic poet who contributed to the beginnings of a U.S. national literature by a few memorable lyrics before his early death.

Drake's father died while the boy was young, and his mother remarried and went to live in New Orleans, leaving her son with relatives in New York. He graduated from medical school there in 1816. While a student, he became friends with another poet, Fitz-Greene Halleck, with whom he began collaborating, in 1819, on topical satirical verses, the "Croaker Papers," published under a pseudonym in the New York *Evening Post.* These lampoons of public personages appeared in book form in 1860. Drake married an heiress, honeymooned in Europe, and returned to New York to open a pharmacy.

Although he had asked his wife to destroy his unpublished poems, she kept them, and a daughter saw to the publication of 19 of his verses in 1835 as *The Culprit Fay and Other Poems.* The title poem, considered his best, deals with the theme of the fairy lover in a Hudson River setting. The volume also contains two fine nature poems, "Niagara" and "Bronx." These and other poems appeared in his *Life and Works* (1935), edited by F.L. Pleadwell.

Drake Passage, deep waterway, 600 mi (1,000 km) wide, connecting the Atlantic and Pacific oceans south of Tierra del Fuego, off which, on Isla Hornos, stands Cape Horn, the southern tip of South America. To the south, the waterway is bounded by the South Shetland Islands, situated about 100 mi north of the Antarctic Peninsula. Across this stretch of ocean the climate changes from the cool, humid, subpolar type found at Tierra del Fuego to the frozen conditions of Antarctica.

The Drake Passage played an important part in the trade of the 19th and early 20th centuries before the opening of the Panama Canal in 1914. The stormy seas and icy conditions

made the rounding of Cape Horn through the Drake Passage a rigorous test for ships and crews alike, especially for the sailing vessels of the day.

Though bearing the name of the famous 16th-century English seaman and explorer, the Drake Passage was, in fact, first traversed in 1615 by a Flemish expedition led by Willem Schouten. Drake did not sail through the passage but passed instead through the Straits of Magellan to the north of Tierra del Fuego, although he was blown back into the northern latitudes of the passage by a Pacific storm.

The passage has an average depth of about 11,000 ft (3,400 m), with deeper regions of up to 15,600 ft near the northern and southern boundaries.

The sediments on the sea floor result from the interplay of glacial debris from Antarctica, material of biological origin, and eroded material from South America. Proceeding southward, the sediments are first mainly sandy and clayey silts and then, later, silts with ice-rafted material (*i.e.,* material dropped from floating glacial ice as it melts). Near 58° S is a zone of numerous manganese nodules.

The winds over the passage are predominantly from the west and are most intense in the northern half. The most commonly observed wind speeds are from 12 to 23 mph, but winds of more than 45 mph also occur.

The mean annual air temperature ranges from 41° F (5° C) in the north to 27° F (−3° C) in the south. The coldest temperatures, of −4° F (−20° C), occur in July. Cyclones (atmospheric low-pressure systems with winds that blow clockwise in the Southern Hemisphere) formed in the Pacific Ocean traverse the passage at the southern end. Cloud cover remains over the passage for about six-tenths of the year.

The sea ice cover extending northward from Antarctica varies from year to year as well as seasonally. In the late summer (February) the passage is ice free. In September the maximum ice cover occurs; 25 percent to full cover extends to 60° S, with occasional ice floes reaching Cape Horn.

The water within the passage flows from the Pacific into the Atlantic, except for a small amount of water in the south that comes from the Scotia Sea. The general movement, known as the Antarctic Circumpolar Current, is the most voluminous in the world, moving at a rate of nearly 5,300,000,000 cu ft (150,000,000 cu m) a second. Surface water temperature varies from near 43° F (6° C) in the north to 30° F (−1° C) in the south, with the temperature altering sharply near 60° S. This transitional zone is called the Antarctic Convergence, or Polar Front; it separates the sub-Antarctic surface water from the colder and fresher Antarctic surface water. At depths of between about 1,600 and 10,000 ft there occurs the relatively warm and salty Circumpolar Deep Water Current.

The Antarctic Circumpolar Current, which is slightly accelerated by the passage, is strongest in the vicinity of the convergence. Near Cape Horn is a fairly swift coastal flow that is derived from a current that hugs the Chilean coast. After traversing the passage, the Circumpolar Current turns sharply to the north.

Photographs of the sea floor show the presence of numerous animals—either directly or indirectly by their tracks and fecal remains. The most common of these are such organisms as sea urchins and starfish; sponges are also found. There is also a relatively high abundance of plankton. Krill (small shrimplike crustaceans) are very abundant in the south, as are the blue and fin whales that feed on them. Squid also feed on krill and, in turn, form a basic food for the sperm whales. Krill are also important to the diet of the emperor penguin and the crabeater seal. Antarctic cods are the most common fish. Some of these fish and all of the cold water Chaenichthyidae (icefish) are "bloodless"—*i.e.,* they have no detectable hemoglobin in their blood.

Drakensberg, mountain range of southern Africa, rising to more than 11,400 ft (3,475 m) and extending 700 mi (1,125 km) from northeastern Transvaal, through Lesotho, to southeastern Cape Province, South Africa. Part of the Great Escarpment, the Drakensberg divides Swaziland, Natal, and the not internationally recognized Republic of Transkei from most of Transvaal, the Orange Free State, and Lesotho.

Segment of the Drakensberg known as Cathedral Peak, South Africa
Gerald Cubitt

The most elevated stretch of the Drakensberg, at or near the eastern and southern boundaries of Lesotho, is comprised of severely eroded basalt capping a sandstone base. Its pinnacles and broken and fractured blocks present a steep eastern scarp (10,000 to over 11,000 ft in elevation) and steep southern scarp (8,000 to 10,000 ft in elevation) along the length of the Lesotho–Natal and Lesotho–Transkei borders, respectively.The local Zulu name for the eastern face, Quathlamba, meaning "barrier of pointed spears" or "piled up rocks," is an accurate physical description of this part of the Drakensberg. Immediately below the steep scarps to the south and east are sandstone terraces with basalt outcrops and deep valleys—an area of many game reserves, scenic national parks, and caves with ancient San (Bushman) paintings and engravings.

To the north and west the range descends gradually into the jumble of Lesotho's weathered basalt mountains where waterfalls and deep gorges are commonplace. North of the juncture of the Orange Free State–Natal–Lesotho borders the Drakensberg becomes progressively less elevated with the steep eastern escarpment giving way to gentle slopes; and north of the town of Belfast in eastern Transvaal the range once again becomes more rugged, attaining heights of more than 7,600 ft.

The Drakensberg of Lesotho–Natal is snow-capped in winter. Mountaineering is challenging, and some peaks remain unclimbed because of difficult access. The natural tussock steppe is not farmed or developed and this area is dotted with mountain resorts and camping grounds.

Consult the INDEX *first*

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dram, unit of weight in the avoirdupois system, equivalent to 1/16 ounce (27.34375 grains, or 1.772 grams), and in the apothecaries' system, equivalent to 1/8 ounce (60 grains, or 3.888 grams). The term also refers to the fluid dram, a measure of capacity equal to 1/8 fluid ounce. In England, "dram" came to mean a small draught of cordial, stimulant, or spirituous liquor; hence the term dram-house, or dram-shop, for the taverns where one could purchase a dram. "Dram" is a phonetic spelling of "drachm," a Greek word designating an ancient coin and weight that probably originated as the amount one could hold in one's hands.

Dráma, town and *nomós* (department), Macedonia, northern Greece, just north of the main tributary of the Angítis Potamós (river), at the northern edge of the plain of Dráma. The town, a tobacco and agricultural (cotton and rice) centre, is served by several limestone springs issuing from the base of the nearby Falakrón Óros (mountains). In the 18th century it replaced Philippi (modern Filippoi) to the southeast as the chief town of the plain. After the departure of the Turkish inhabitants in 1922, its population was almost doubled by the arrival of Greek refugees from Turkey. Dráma is the headquarters of an army corps and the seat of a metropolitan bishop. It has a tobacco research station, a rail link to Thessaloníki, and a direct road link to the port of Kavála. Pop. (1981) town, 36,109; *nomós,* 94,772.

dramatic literature, the texts of plays that can be read, as distinct from being seen and heard in performance.

A brief treatment of dramatic literature follows. For full treatment, *see* MACROPAEDIA: Literature, The Art of.

The relations between dramatic texts and the performances for which such writing was intended are neither simple nor regular. In the case of the Greek dramatists of the 5th century BC, the texts now available are a small selection made by later copying and preservation. There is no way of knowing how these relate, precisely, to the compositions made available for the original productions. The problem here as in many later periods is the relation between the words written to be spoken or sung by the performers and the many other elements of dramatic composition—in movement, in scene and costume, and occasionally in music—that the performance would include. Some of these can be inferred from the particular styles of writing, but most have to be studied from other kinds of surviving accounts.

In the drama of the English Renaissance it was at first unusual to publish plays as if they were literary works, but the importance of the dramatic writing of the period eventually established many of the plays as texts. It is again necessary to infer other elements of the full dramatic composition from other kinds of information about theatres, audiences, and acting. In later periods, and especially from the 19th century onward, it became habitual to include in the written text of a play, and especially in its independently published form, details not only of scene and stage movement but also of the appearance of the characters and of the states of mind intended to accompany or to punctuate the spoken words. Some of these later texts of plays resemble, in part, the printed modes of novels or short stories.

There is no doubt that the printed texts of plays, in any of these forms, can be read as literature. Many of them are now regarded as being among the great works of literature of the world: *The Oresteia, King Lear, Peer Gynt.* Yet it is then easy to forget that they are always a particular form of writing, for several voices and for action. It can be reasonably claimed that one gains the essential meanings of a play from the printed text alone, but there are cases when a plain silent reading from the text may miss some significant points. It is possible, for example, to read the Greek plays, especially in translation, without realizing that this or that "speech" was in fact sung, by a

single actor or by the two halves of the chorus. In what are called the "soliloquies" of Shakespeare it is possible, from the printed text, to suppose that these are forms of "private thought," when in fact, within the well understood dramatic conventions of the period, they were spoken aloud, directly or indirectly, to audiences. In many other cases the physical movements and relations that were part of the essential composition may be missed altogether, or only vaguely apprehended, from the apparently self-sufficient text of the words spoken and its minimal "stage directions."

Most drama is a form of writing for oral and actual performance, and it is in the period when imaginative writing has been taken to be coterminous with "literature," and especially with printed literature, that some of its elements have been most persistently misunderstood. The phrase dramatic literature has elements in common with the phrase oral literature, when the condition of silent reading of print has come to seem the normal or even universal condition of the reception and study of imaginative writing. The name for work within these conditions—"literature"—was transferred to these other forms of writing intended primarily for oral communication. The need for understanding the conditions of oral performance is now more widely recognized. At the same time, given this recognition, the texts of the great plays are still read as dramatic literature, with a proper emphasis on the distinguishing features of the dramatic.

dramatic monologue, a poem written in the form of a speech of an individual character; it compresses into a single vivid scene a narrative sense of the speaker's history and psychological insight into his character. Though the form is chiefly associated with Robert Browning, who raised it to a highly sophisticated level in such poems as "My Last Duchess," "The Bishop Orders His Tomb at St. Praxed's Church," "Fra Lippo Lippi," and "Andrea del Sarto," it is actually much older. Many Old English poems are dramatic monologues—for instance, "The Wanderer" and "The Seafarer." The form is also common in folk ballads, a tradition that Robert Burns imitated with broad satiric effect in "Holy Willie's Prayer." Browning's contribution to the form is one of subtlety of characterization and complexity of the dramatic situation, which the reader gradually pieces together from the casual remarks or digressions of the speaker. The subject discussed is usually far less interesting than what is inadvertently revealed about the speaker himself. In "My Last Duchess," in showing off a painting of his late wife, an Italian aristocrat reveals his cruelty to her. The form parallels the novelistic experiments with point of view in which the reader is left to assess the intelligence and reliability of the narrator. Later poets who successfully used the form were Ezra Pound ("The River Merchant's Wife: A Letter"), T.S. Eliot ("Love Song of J. Alfred Prufrock"), and Robert Frost ("The Pauper Witch of Grafton"). *See also* soliloquy.

drame bourgeois, type of play that enjoyed brief popularity in France in the late 18th century. Written for and about the middle class and based upon the theories of the French essayist and encyclopaedist Denis Diderot (1713–84), the *drame bourgeois* was conceived of as occupying a place between tragedy and comedy; it was designed as a serious depiction of middle-class problems, especially social abuses, but usually included a conventional happy ending. Diderot wrote two *drames* illustrating his theories, *Le Fils naturel* (published 1757; *Dorval; or, The Test of Virtue*) and *Le Père de famille* (published 1758; *The Father*), adapting them from the earlier *comédie larmoyante* ("tearful comedy") of Nivelle de La Chaussée. Diderot's plays and those of his successors, Michel-Jean Sedaine and Louis-Sébastien Mercier, are regarded by critics today as sentimental and humourless, full of inflated dialogue and pompous sermonizing. *Drame bourgeois,* however, was important to the development of French acting, leading to more natural styles of speech and gesture, as well as being an attempt at greater historical accuracy in costumes and scenery. Diderot and his followers are also seen as promoting an aura congenial to the romanticism of the next century and as distant precursors of the earliest writers of problem plays, such as Émile Augier and Alexandre Dumas *fils.*

Drammen, city, seat of Buskerud *fylke* (county), southeastern Norway. Located at the junction of the Dram River with Dram Fjord, southwest of Oslo, the site was first settled in the 13th century as two separate communities, Bragernes and Strømsøy. Each was granted common town privileges in 1715. In 1811 they merged with Tangen to form the present city. Drammen is a seaport and a railroad terminus; its manufactures include wood products, plastics, abrasives, textiles, leather goods, and beer. Granite is quarried nearby. Pop. (1987 est.) mun., 51,497.

Dramselva, also called DRAMMENSELVA, English DRAM RIVER, or DRAMMEN RIVER, river, Buskerud *fylke* (county), southeastern Norway. After rising on the southern slopes of the Halling Mountains as the Halling River and flowing east-northeast to the town of Gol, it flows south-southeast to Krøderen (lake) and thence southward to enter Dram Fjord at the city of Drammen after a course of 192 miles (309 km). The name Drammen refers strictly to the lowest 30 miles (48 km) of the river (below Krøderen) but is also used for the whole river drainage system of 6,600 square miles (17,100 square km). Its flow is highly regulated by a series of hydroelectric facilities, and several paper and lumber mills adjoin the river.

Drancy, northeastern industrial suburb of Paris, Seine-Saint-Denis *département,* Paris region, France. It lies 3 miles (5 km) from the city limits of the capital. During the German occupation of France in World War II, buildings in the southeast of the locality were turned into a concentration camp. From 1941 to 1944, about 120,000 French and non-French Jews passed through Drancy on their way to extermination camps in Poland, where most of them perished. The French artist and poet Max Jacob died in the Drancy camp in 1944. Pop. (1982) 60,122.

Drang nach Osten (German: "Drive to the East"), German policy or disposition to colonize the Slavic lands east of Germany. The term originally referred to the eastward movement of German settlers in the 12th and 13th centuries but was resurrected by Adolf Hitler in the 20th century to describe his plans for acquiring *Lebensraum* ("living space") for Germans.

The medieval *Drang nach Osten* was part of a general German expansion and was particularly directed toward the territory between the rivers Elbe and Oder. Here peasants could settle land on more favourable terms than farther west, while many knights needed fiefs and lordships to uphold their rank. The great German princes won extensive lands in the region: the Welf duchy of Saxony was supreme in the later 12th century; by 1250 the Ascanian dynasty had large holdings in Brandenburg, while the Wettin margraves of Meissen were powerful farther south. In the 13th century the religious order of the Teutonic Knights won large territories in Prussia and farther north around the shores of the Baltic Sea.

During the 20th century, the German Nazis invoked the *Drang nach Osten* to glorify their territorial greed directed against Czechoslovakia, Poland, and the Soviet Union. (The phrase occurred in Hitler's tirades against Czechoslovakia during the late 1930s.) After Germany's initial successes in World War II, the idea became submerged in more general schemes of world domination.

Draper, Charles Stark (b. Oct. 2, 1901, Windsor, Mo., U.S.—d. July 25, 1987, Cambridge, Mass.), American aeronautical engineer noted as a designer of navigational and guidance systems for ships, airplanes, and rockets.

Draper joined the faculty of the Massachusetts Institute of Technology (MIT), Cambridge, in 1935. Three years later he became a full professor and was placed in charge of the Instrumentation Laboratory. He immediately began the development of a gunsight for naval anti-aircraft guns, which was installed on most U.S. naval vessels during World War II.

Encouraged by the success of the gunsight, Draper started work on a gyroscopically controlled bombsight, and, with the advent of long-range rockets, he expanded his efforts to include inertial guidance systems.

In 1951 Draper became chairman of the aeronautical department at MIT. His inertial navigation system for aircraft, called spatial inertial reference equipment (SPIRE), was successfully tested in 1953. This system allows a plane to fly thousands of miles to its destination without reference to outside navigational aids, such as radio or the positions of celestial bodies. In 1954 Draper introduced an inertial navigation system that, in an improved and miniaturized form, was incorporated into many U.S. guided missiles, including the Polaris. His group at the Instrumentation Laboratory also developed the guidance systems for the spacecraft of the Apollo Project, which landed man on the Moon.

Draper, Henry (b. March 7, 1837, Prince Edward County, Va., U.S.—d. Nov. 20, 1882, New York City), American physician and amateur astronomer who made the first photograph of the spectrum of a star (Vega), in 1872. He was also the first to photograph a nebula, the Orion Nebula, in 1880. His father, John William Draper, in 1840 had made the first photograph of the Moon.

Henry Draper

By courtesy of the Lick Observatory Archives, Santa Cruz, Calif.

Henry Draper was appointed to the medical staff of Bellevue Hospital, New York City, in 1859 and in 1866 became dean of the medical faculty of the University of the City of New York. For his photography of the transit of Venus in 1874, Congress ordered a gold medal struck in his honour. His widow established the Henry Draper Memorial Fund at Harvard Observatory, financing the making of the great *Henry Draper Catalogue* of stellar spectra.

Draper, Ruth (b. Dec. 2, 1884, New York City—d. Dec. 30, 1956, New York City), American monologist and monodramatist whose art was acclaimed throughout the United States and Europe.

Draper began her career by writing sketches about people she knew or had observed and then performing them at parties. She appeared only once in a full-length play, in 1916. She made her New York debut as a monologist

Ruth Draper
EB Inc.

in 1917, in a bill of one-acters, one of which, *The Actress*, she herself wrote. Her critical reception was dismal; she received praise only for her own sketch, which confirmed her in the choice of her career. Her London debut in a program of her own sketches, in 1920, established her as a master of her craft. From then on she triumphed everywhere in the world, often playing at the behest of other artistic celebrities or political leaders, until her final performance at the Playhouse in New York City on Dec. 26, 1956. Her art was one of delicate suggestion; she played on a bare stage with few props, changed character with a single item of apparel, and created the illusion of crowds or intimate conversations by her subtle modulation of feature, gesture, and voice. *The Letters of Ruth Draper 1920–1956: A Self-Portrait of a Great Actress*, edited by Neilla Warren, was published in 1979.

drapery, depiction in drawing, painting, and sculpture of the folds of clothing. Techniques of rendering drapery clearly distinguish not only artistic periods and styles but the work of individual artists. The treatment of folds often has little to do with the nature of the

Early Renaissance drapery, detail of "The Primavera," painting on panel by Sandro Botticelli, 1477–78; in the Uffizi Gallery, Florence
Alinari—Art Resource/EB Inc.

actual material; its significance stems largely from the fact that it presents to the spectator the main mass of the clothed human figure. In Classical art, the treatment of drapery varied between the tightly meticulous, and free-flowing lines revealing the shape of the figure beneath. In the Hellenistic period the main emphasis was on volume rather than line.

Christian iconographers of the Middle Ages adopted the Classical tradition of drapery and clothed Christ, the Virgin, and the Apostles in vaguely toga-like garments, with little relation to historical accuracy. A gentle interplay of soft folds characterized the European Gothic style from the 13th century onward, and that tradition—modified by Classical influences such as the use of linear patterns—was taken over by artists of the Renaissance who painted diaphanous, figure-revealing garments. Mannerist and Baroque drapery emphasized the theatrical potentialities of drapery. At the same time, many painters began to employ in their studios specialists to draw and paint dress and drapery.

In the 19th century in France, the lavish dresses of the Second Empire made it inevitable that any painter concerned with contemporary life must pay considerable attention to drapery. With the advent of Art Nouveau this concern became even more emphatic. Also in the 19th century, the growth of popular fashion magazines and of the *haute couture* stimulated the development of fashion drawing as an art form evolved from drapery drawing.

draught (in banking): *see* exchange, bill of.

draughting: *see* drafting.

Draughts (board game): *see* Checkers.

Drava River, German DRAU, English DRAVE, a major right-bank tributary of the Danube, in south central Europe, rising in the Carnic Alps near Dobbiaco, Italy, and flowing eastward through Austria as the Drau. It is 447 mi (719 km) long and forms the Drau Tal, the longest longitudinal valley of the Alps. Near Legrad, Yugos., it is joined by the Mura (Mur) River. It forms part of the Yugoslavian–Hungarian border. Numerous hydroelectric power stations produce about one-third of Austria's electricity, and more for export. Its swift flow presents a dangerous challenge to canoeists; it is navigable only from Villach, Austria. The Drava Valley was the chief passage through which invaders from the east, such as the Huns and Slavs, penetrated the Alpine countries. The main towns of the Drava and its affluents are Klagenfurt and Graz, Austria, and Maribor and Osijek, Yugos.

Drāviḍa style (Indian architecture): *see* South Indian temple architecture.

Dravidian languages, family of 23 languages spoken in South Asia. The major languages are Telugu, Tamil, Kannada, Malayalam, Gondi, Kurukh, and Tulu.

A brief treatment of the Dravidian languages follows. For full treatment, *see* MACROPAEDIA: Languages of the World.

Speakers of Dravidian languages are found mainly in the Republic of India but also in parts of Sri Lanka, Southeast Asia, Africa, and Pakistan. The four major langauges—Telugu, Tamil, Kannada, and Malayalam—possess independent scripts and literary histories dating from the pre-Christian era; they form the basis of the linguistic states of Andhra Pradesh, Tamil Nadu, Karnataka, and Kerala, respectively. Tamil has the greatest geographical extent and the richest literature, paralleled in India only by that of Sanskrit. In phonology and grammar, Tamil corresponds in many points to the ancestral parent language, Proto-Dravidian. The Dravidian languages have remained an isolated family, without demonstrable connections with the Indo-European tongues or other languages. They were first recognized as an independent family in 1816.

Tamil, whose earliest literary monuments date from roughly the 3rd and 2nd centuries BC, is divided into a number of dialects, into Brahmin and non-Brahmin speech forms, and into formal and informal language. Malayalam possesses an independent script and a rich modern literature. In the Nīlgiris and adjacent regions, minor tribes speak Kota, Toda, Badaga, and Irula. Kodagu is spoken in Coorg. Kannada, spoken in the state of Karnataka, has social dialects and a number of regional dialects. In the southern region of Karnataka are found speakers of Tulu. Telugu has distinct written and spoken styles, as well as regional dialects and social dialects. Kolami is another language of Andhra Pradesh; Konda, Gadba, and Kui are spoken in Orissa; Gondi and Parji are spoken in Madhya Pradesh. Further to the north are found Kurukh speakers, and in the Bihār area there are Malto speakers. Brahui is spoken only in certain districts of Pakistan.

Although, in modern times, Dravidian has been found principally in the south of India, it is well established that Dravidian speakers must have once been more widespread. Features of the Dravidian languages appear in the Ṛgveda, the earliest known Indo-Aryan literary work. Scholars have shown that pre-Indo-Aryan and pre-Dravidian bilingualism can account for the influences of Dravidian on Indo-Aryan. The Aryan tongues in the northern parts of India entirely replaced the Dravidian languages before the Christian Era.

Virtually nothing is known about the immigration of Dravidian speakers into India. It is suggested that at one point they came into contact with the Ural-Altaic speakers, which explains affinities between the two language groups. Between 2000 and 1500 BC, Dravidian speakers moved to the southeast of India; in about 1500 BC, three distinct dialect groups probably existed—Proto-North Dravidian, Proto-Central Dravidian, and Proto-South Dravidian.

Progress in comparative Dravidian studies is still meagre, and the reconstruction of the Dravidian protolanguage must be tentative. Proto-Dravidian had five vowels, each having two quantities, short and long. A characteristic feature of the consonantal system was the six positions of articulation for obstruants (stops). Initial consonant clusters did not occur. All Proto-Dravidian roots were monosyllables; the language used only suffixes.

By the 5th century BC further divisions occurred within each of the three subfamilies. The Dravidian languages entered history in Sanskrit and Greco-Roman texts. The lands of Pāṇḍya, Cōḷa, and Kerala are mentioned by the great Buddhist leader Aśoka (3rd century BC). It is very probable that Western-language terms for rice and ginger are cultural loans from Old Tamil *arici* and *iñcivēr,* respectively. Sometime during the reign of Aśoka, Tamil and Kannada developed into distinct idioms; a third major Dravidian linguistic and cultural unit, Telugu, appeared. About 250 BC, the Aśokan Southern Brāhmī script was adapted for Tamil and was used in cave inscriptions by Jain monks for several centuries. The earliest inscriptions in Kannada date from AD 450; in Telugu, from AD 633; in Malayalam, from the close of the 9th century. Tamil, Malayalam, Kannada, and Telugu have been used continuously in administration and literature up to the present day. All of them developed features of diglossia, a dichotomy between formal language and informal speech; all of them have adapted quickly to economic, social, and political change; all of them are used for basic courses in science and the arts. Nothing is known of the history of the non-literary Dravidian languages before their "discovery" at the end of the 18th century. Structural and systemic balance is characteristic of the Dravidian group, as is a slow rate of change.

When compared to Proto-Dravidian, the var-

ious distinct languages show consonantal and vowel systems that have undergone a variety of sound changes. In grammar, the prevailing process is suffixation, the addition of suffixes; these suffixes attach to one another. The major word classes are nouns, adjectives, verbs, and indeclinables. One feature of the language is the "pronominalized" or "personal" nouns and adjectives; *e.g.,* Old Tamil *iḷai* "youth," *iḷai-y-am* "young-we," *iḷai-y-ar* "young-they." Gerunds and participles play an important role in the sentence. The different languages were receptive to loanwords in differing degrees. The most important sources of loanwords have been Sanskrit, Pāli, and Prākrit; in modern times they have been Urdu, Portuguese, and English.

Dravidian local race, a subgroup, roughly corresponding to a breeding isolate in genetics, of the Indic (Hindu) geographical race. It comprises primarily the speakers of the Dravidian languages of southern India. The chief physical characteristics of the Dravidians are medium stature, moderate to heavy skin pigmentation, stocky build, a tendency toward dolichocephaly (long-headedness, in which the head is relatively long from front to back), and flatter, broader-nosed faces than those of the Indic (Aryan) local race of northern India. *See also* local race; Indic geographical race; Indic local race.

dravite, a brown, magnesium-rich variety of tourmaline. *See* tourmaline.

dravya (Sanskrit: "substance"), a fundamental concept in the Jaina philosophy of India. The Jainas assume the existence of five so-called *astikāya*s, or eternal categories of being, which together make up the *dravya,* or "substance," of existence. These five are *dharma, adharma, ākāśa, pudgala,* and *jīva. Dharma,* in a meaning peculiar to Jainism, is the medium of movement, and *adharma* is that of rest, enabling beings to move and to stop moving. *Ākāśa* is the space in which everything exists and is of two kinds, world space (*lokākāśa*) and nonworld space (*a-lokākāśa*), infinitely larger than world space but empty. These three categories are unique and inactive. *Pudgala* ("matter") and *jīva* ("soul") are active, infinite, but stable in their number. Only *pudgala* is perceptible, and only *jīva* has soul. Jainism is the oldest Indian school of philosophy that separated matter and soul completely. A sixth category of *dravya* was added later and is *kāla,* "time," which is eternal but is not universal, for it does not occur in the outermost layers of the world.

drawbridge, major type of movable bridge (*q.v.*) originating in medieval Europe.

drawing, the art or technique of producing images on a surface, usually paper, by means of marks, usually of ink, graphite, chalk, charcoal, or crayon. Drawing is distinguished from painting by an emphasis on form, or shape, rather than mass and colour and from other graphic arts such as lithography and etching by the direct relationship between production and result.

A brief account of drawing follows. For full treatment, *see* MACROPAEDIA: Drawing. For a description of the place of drawing among the visual arts and for a list of MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Six, Division II.

Line has at times been considered the essential ingredient of drawing. While many drawings are indeed pure outline and most are based on line, it cannot be considered the specific quality of drawing, for some drawings have no lines at all but only areas of tone, such as Georges Seurat's studies in chalk or John Constable's in sepia. Most drawings are monochromatic, but various media such as coloured crayon or colour washes may be employed.

Drawing is often a stage preliminary to work in a more substantial medium, such as painting, sculpture, or architecture. Full-size drawings or plans are a usual part of making artifacts, from furniture to machinery. Drawings of this preparatory sort are practically all that survive from before the Renaissance, and there are few even of them. Partly because of the perishable nature of most drawing materials, but also because, during the Middle Ages, preparatory drawings were commonly done to standard designs and collected in pattern books, there was no call for every artist to provide his own. The best known pattern book is by Villard de Honnecourt and shows how to design people and animals around geometrical shapes. Even the drawings that he notes as done from life are highly conventionalized.

Under the influence of Giotto's naturalism, drawing techniques changed; the stylized outlines of the pattern books gave way to drawings done from nature, in which forms within the outline are given solidity by hatching (fine lines drawn close together, chiefly to give an effect of shading) and highlighting. Cennino Cennini, in *Il libro dell'arte* (1437; *The Craftsman's Handbook,* 1933), recommends drawing from nature as well as from the masters. Drawing, during the Italian Renaissance, started to become an independent technique and to acquire its importance in the theory of art. It is associated especially with Florentine art, in contrast to the more painterly style of Venice, and the dominance of fresco painting in Florence shaped Florentine ideas of drawing. Leon Battista Alberti, writing in 1435, identified drawing with circumscription, or outline, and although he allowed that "a good drawing is often very pleasing on its own account," he defined it in terms of painting, as the first of painting's "three parts": "Outline will be that which describes the going around of the edge in painting." Indeed, such outlines for fresco painting, sometimes pricked for tracing onto the wall, were a common type of drawing in the Renaissance. Alberti's "second part" of painting was composition, "that method by which the parts of the things seen are put together in the picture," and Piero della Francesca, writing about 50 years later, more or less encompassed both "parts" in his larger definition: "By drawing we mean profiles and outlines placed proportionately in their places." His younger contemporary, Leonardo da Vinci, writing in his notebooks, called for a fresh approach to drawings, likening them to rough drafts for a poem. His own are technically experimental and often independent of paintings—observations or flights of imagination that are an end in themselves. Raphael (who was influenced by Leonardo's drawings) and Michelangelo used drawing as a means of working out relations between figures and of modelling forms within them; Michelangelo developed a style of close hatching for this purpose that invites comparison with the chiselling methods of sculpture. His admirer Giorgio Vasari had the idea of collecting the drawings of the masters to demonstrate their different manners; it is in his writings that we find the meaning of drawing greatly elevated and extended. Vasari's word is *disegno,* which means design as well as drawing, and much else. It is, according to Vasari, the foundation of the three arts (painting, sculpture, and architecture), not only in the traditional sense of providing preparatory drawings for them but in a new Platonist sense of being the idea behind their creation, implanted in the artist's mind by God; it is the animating principle of all creative processes.

The adherents of this point of view naturally believed in using drawings at all stages of planning their compositions, and the gulf widened between them and the Venetians, who painted without reliance on outline or, apparently, on closely followed preliminary drawing. This divergence of opinion and practice regarding the role of drawing continued to surface between rival schools of painting during the following centuries. The insistence on drawing as the foundation of art came to be associated in the 16th century with the Academy of Annibale Carracci, where artists met to draw from life.

Meanwhile, drawing had achieved greater autonomy; it was recognized as a means of recording, for example, the features of the great, as in the portrait drawings by Albrecht Dürer, Hans Holbein, or the French court artists of the 16th century, some of which correspond to no known paintings. Rembrandt, a prolific draughtsman, seldom used his drawings for preparing paintings or etchings but treated them as an independent form. By the 17th century, drawings had definite market value; connoisseurs specialized in collecting them, and forgers began to exploit the demand. The great collections of drawings in the British and the Ashmolem museums are based on those of 17th- and 18th-century artists and connoisseurs.

In the 18th and 19th centuries, the old debate about drawing and painting revived in the rivalry between Classical and Romantic schools of painting. Jean-Auguste-Dominique Ingres, the master of pure line drawing, maintained that "drawing is the probity of art; line drawing is everything." In England, later in the 19th century, John Ruskin and the Pre-Raphaelites had similar views; but the Impressionists, a generation later, used drawing side by side with painting, rather than as the basis of it. In the 20th century, the drawing became fully autonomous as an art form, figuring significantly among the works of virtually every major artist, and the line itself was exploited both for its representational and its purely expressive qualities.

drawing, also called DRAFTING, in yarn manufacture, process of attenuating the loose assemblage of fibres called sliver (*q.v.*) by passing it through a series of rollers, thus straightening the individual fibres and making them more parallel. Each pair of rollers spins faster than the previous one.

Drawing reduces a soft mass of fibre to a firm uniform strand of usable size. In the production of man-made fibres, drawing is a stretching process applied to fibres in the plastic state, increasing orientation and reducing size.

drawing, engineering: *see* drafting.

drawing and quartering, part of the penalty anciently ordained in England for treason. Until 1870 the full punishment for the crime included the following: the condemned person was dragged to the place of execution, hanged by the neck (but not until he was dead), and disemboweled (or drawn) while still alive; his entrails were burned before his eyes; he was decapitated; and his body was divided into four parts (or quartered).

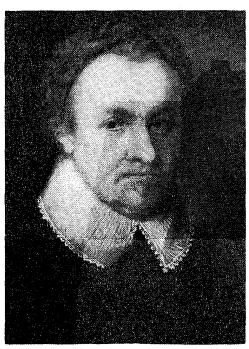
This punishment was first inflicted in 1283 on the Welsh prince David and in 1305 on the Scottish patriot Sir William Wallace. In 1803 Edward Marcus Despard and his six accomplices were hanged, drawn, and quartered for conspiring to assassinate George III. The sentence was last passed (though not carried out) upon two Irish Fenians in 1867.

drawn thread work, Italian PUNTO TIRATO, in fabric, a method of producing a design by drawing threads out of the body of a piece of material, usually linen, and working stitches on the mesh thus created. In Italy it preceded the development, in the 16th century, of needle lace, and it continued to be practiced internationally even after. It appears on embroidery samplers from the 17th century onward and is a technique common to embroidery and lace.

dray, the heaviest type of dead-axle wagon used in conjunction with a team of draft animals. Drays were either of the two- or four-wheeled type and were employed most often in and about cities for the transport of heavy loads or objects such as large machines. Features of the dray included smaller wheels than those used on other wagons, a flat, level floor, and, usually, no sides. Some drays, however, did have box bodies or stake sides. Machinery trucks, floats, and transfer wagons were specialized varieties of drays.

Drayton, Michael (b. 1563, Hartshill, Warwickshire, Eng.—d. 1631, London), poet, the first to write English odes in the manner of Horace.

Drayton spent his early years in the service of Sir Henry Goodere, to whom he owed his education, and whose daughter, Anne, he celebrated as Idea in his poems. His first published work, *The Harmonie of the Church* (1591), contains biblical paraphrases in an antiquated style. His next works conformed more nearly to contemporary fashion: in pastoral, with *Idea, The Shepheards Garland* (1593); in sonnet, with *Ideas Mirrour* (1594); in erotic idyll, with *Endimion and Phoebe* (1595); and in historical heroic poem, with *Robert, Duke of Normandy* (1596) and *Mortimeriados* (1596). The last, originally written in rhyme royal, was recast in Ludovico Ariosto's ottava rima verse as *The Barrons Wars* (1603).



Drayton, oil painting by an unknown artist, 1628; in the Dulwich College Picture Gallery, London

By courtesy of the College Governors of Alleyn's College of God's Gift, London

Drayton's most original poems of this period are *Englands Heroicall Epistles* (1597), a series of pairs of letters exchanged between famous lovers in English history.

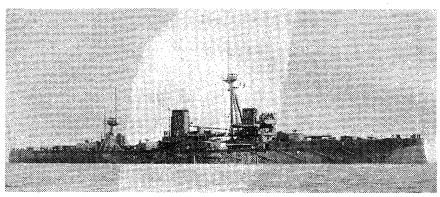
Upon the death of Queen Elizabeth I, Drayton, like most other poets, acclaimed in verse the accession of King James I, but unlike them omitted any reference to the late queen. For this tactlessness he failed to receive any appointment or reward. The disappointment adversely affected his poetry of the next few years. He recovered himself with his first collected *Poems* (1605), and in *Poems Lyric and Pastoral* (1606) he introduced a new mode with the "odes," modeled on Horace. "The Ballad of Agincourt" shows Drayton's gift for pure narrative.

Further collected editions culminated in his most important book, *Poems* (1619). Here Drayton reprinted most of what he chose to preserve, often much revised, with many new poems and sonnets. He had also published the first part of his most ambitious work, *Poly-Olbion* (1612–22), in which he intended to record the Elizabethan discovery of England: the beauty of the countryside, the romantic fascination of ruined abbeys, its history, legend, and present life, but he was too eager to cram everything in, so that the poem becomes a catalog in alexandrines. He produced a second part in 1622.

In his old age he wrote some of his most delightful poetry, especially the fairy poem *Nymphidia* (1627), with its mock-heroic undertones, and *The Muses Elizium* (1630). The *Elegies upon Sundry Occasions* (1627), addressed to his friends, often suggest, with their easy, polished couplets, the manner of the age of Alexander Pope.

Dreadnought, British battleship launched in 1906 that established the pattern of the turbine-powered, "all-big-gun" warship, a type that dominated the world's navies for the next 35 years.

The *Dreadnought* displaced 18,000 tons (more than 20,000 tons full load), was 526 feet (160 m) long, and carried a crew of about 800. Its four propeller shafts, powered by steam



HMS *Dreadnought*

By courtesy of the National Archives, Washington, D.C.

turbines instead of the traditional steam pistons, gave it an unprecedented top speed of 21 knots. Because recent improvements in naval gunnery had made it unnecessary to prepare for short-range battle, *Dreadnought* carried no guns of secondary calibre. Instead, it mounted a single-calibre main armament of 10 12-inch guns in five twin turrets. In addition, 24 3-inch quick-firing guns, 5 Maxim machine guns, and 4 torpedo tubes were added for fighting off destroyers and torpedo boats.

The *Dreadnought* immediately made all preceding battleships obsolete, but by World War I it was obsolescent itself, having been outclassed by faster "superdreadnoughts" carrying bigger guns. The *Dreadnought*'s only notable engagement of the war was the ramming and sinking of a German U-boat near the Pentland Firth, Scot., in March 1915. Placed in reserve in 1919, the ship was sold for scrap the following year and broken up in 1923.

dream, a hallucinatory experience that occurs during sleep.

A brief treatment of dreams follows. For full treatment, *see* MACROPAEDIA: Sleep and Dreams.

Although the visual aspect of dreams is usually most vivid, in some cases dreams are primarily auditory. Dream reports range from the very ordinary and the realistic to the fantastic and the surreal. Mankind has always attached great importance to dreams; however, conceptions of their source and significance have changed tremendously over the centuries.

In the ancient world, the belief was prevalent that dreams were sent by the gods, and they were considered as a means to predict the future and devise cures for the ill. Nearly four thousand years ago, the Egyptians catalogued interpretations of dreams, and prophetic dreams are mentioned in many Middle Eastern and Asian texts, including the Bible. While the ancient Greeks generally shared the belief in the predictive power of dreams, it is notable that Aristotle discussed dreams in a more scientific manner, stressing the roles of sense impressions and the emotions. However, it was not until the 19th century that widespread belief in the divine source of dreams began to ebb. At that time, Alfred Maury made an exhaustive study of dreams and concluded that they resulted from the misinterpretation of sense impressions during sleep (*e.g.*, a loud sound during the night stimulating a dream of a thunderstorm). Modern theories of dreams have stressed that they are extensions of the waking state.

In the late 20th century, the study of dreams has focused on two topics: the physiological process of dreaming and the content of dreams. Researchers have found physiological clues as to when a dream is actually taking place. The principal dream period, marked by a combination of rapid eye movement (REM), a brain-wave pattern similar to that produced during wakefulness, and increased physiological activity, is called REM sleep (or the D-[Dream-] state). Since its discovery in the mid-1950s, researchers have conducted experiments in which they awaken subjects who show signs of REM sleep—in most cases the subjects report intensely the experience of vivid visual dreams. Subjects awakened while not in REM sleep report dreams less frequently and have more difficulty remembering them. Thus, the evidence supports a close association between REM sleep and the experience of vivid, spontaneously recalled dreams. Extreme behavioral manifestations such as night terrors, nightmares, enuresis (bed-wetting), and sleepwalking have been found to be generally unrelated to ordinary dreaming.

REM sleep recurs about every 90 minutes throughout the time spent asleep, in periods that successively grow in duration from an initial length of 10 minutes. Between the ages of 10 and the mid-60s people spend about a quarter of their time asleep in REM sleep. If this amount is temporarily lowered owing to the ingestion of certain drugs or by waking a sleeper in REM sleep, as soon as permitted the person will recover by increasing his or her REM sleep percentage, accompanied by an increase in dreaming.

Although the presence of REM sleep indicates a high probability that a person is dreaming, the content of his or her dream is directly available only to the dreamer. Thus, to study the contents of dreams, researchers must rely on reports made by dreamers after they awaken. Unpleasant feelings in dreams are reported almost twice as often as pleasant ones. The contents of most dreams seem to consist of fairly direct representations of people and settings familiar to the dreamer. The sense of strangeness that accompanies dreams is thought to result from the sharp discontinuities in time and place occurring in dream events.

Dreams have provided creative solutions to intellectual and emotional problems and have offered ideas for artistic pursuits. A famous example is drawn from science: the German chemist August Kekule, while struggling to find the structure of the benzene molecule, dreamed of a snake biting its tail and, on waking, realized that benzene has the form of a ring. It seems that a type of cognitive synthesis occurs subconsciously during dreaming, which facilitates conscious insight.

Perhaps the most famous theory of the significance of dreams is the psychoanalytic model developed by Sigmund Freud in *The Interpretation of Dreams* (German: *Die Traumdeutung;* 1900). In Freud's view, the events of a dream (the manifest content) are produced by the so-called dreamwork, whose task is to give disguised expression to unconscious desires (the latent content). These desires are ordinarily kept out of consciousness (repressed), because they represent forbidden impulses, often of a sexual nature. During sleep, the force of repression is reduced, hence repressed desires can be safely expressed. But to prevent these unacceptable desires from emerging in an explicit form into the dreamer's consciousness, the dreamwork transforms them into acceptably disguised or symbolic images by drawing on sensory stimuli, waking experiences, and deep-seated memories. A central therapeutic technique employed in psychoanalysis is the interpretation of a patient's dreams, in the effort to understand the workings of his or her unconscious mind.

dream allegory, also called DREAM VISION, allegorical tale presented in the narrative framework of a dream. Especially popular in the Middle Ages, the device made more acceptable the fantastic and sometimes bizarre world of personifications and symbolic objects characteristic of medieval allegory. Well-known examples of the dream allegory include the first part of *Roman de la rose* (13th century); Chaucer's *Book of the Duchesse* (1369/70); *Pearl* (late 14th century); *Piers Plowman* (*c.* 1362–*c.* 1387), attributed to William Langland; William Dunbar's *The Thissil and the Rois* and *The Goldyn Targe* (early 16th century); and Bunyan's *Pilgrim's Progress* (1678).

Dream of the Red Chamber, Wade–Giles romanization HUNG LOU MENG, Pinyin HONG LOU MENG, novel written by Ts'ao Chan (1715?–63), generally considered to be the greatest of all Chinese novels. The work, published in English as *Dream of the Red Chamber* (1929), first appeared in manuscript form in Peking during Ts'ao Chan's lifetime. In 1791, almost 30 years after Ts'ao's death, the novel was published in a complete version of 120 chapters prepared by Ch'eng Wei-yuan and Kao E. Controversy still goes on as to whether the final 40 chapters were actually forged by Kao E, substantially written by Ts'ao Chan and simply discovered and put into final form by Ch'eng and Kao, or perhaps composed by an unknown author.

The novel is a blend of realism and romance, psychological motivation and fate, daily life and supernatural occurrences. A series of episodes rather than a strongly plotted work, it details the decline of the Chia family, composed of two main branches, with a proliferation of kinsmen and servants. There are 30 main characters and more than 400 minor ones. The major focus, however, is on young Pao-yü, the gifted but obstinate heir of the clan. Spoiled by his mother and grandmother, he is continually reprimanded by his strict Confucian father, who especially abhors Pao-yü's intimacy with his numerous female cousins and maidservants. Most notable among these relations are the melancholy Tai-yü (Black Jade), Pao-yü's ill-fated love, and the vivacious Pao-ch'ai (Precious Clasp), Pao-yü's eventual wife. The work and the character Pao-yü himself are generally thought to be semi-autobiographical creations of Ts'ao Chan. Its portrait of the extended family reflects a faithful image of upper-class life in the early Ch'ing dynasty (1644–1911/12), while the variety of individual character portraits reveals a psychological depth considered not previously approached in Chinese literature.

Dream of the Rood, The, Old English lyric, the earliest dream poem and one of the finest religious poems in the English language, once, but no longer, attributed to Caedmon or Cynewulf. In a dream the unknown poet beholds a beautiful tree—the rood, or cross, on which Christ died. The rood tells him its own story. Forced to be the instrument of the saviour's death, it describes how it suffered the nail wounds, spear shafts, and insults along with Christ to fulfill God's will. Once blood-stained and horrible, it is now the resplendent sign of mankind's redemption. The poem was originally known only in fragmentary form from some 8th-century runic inscriptions on the Ruthwell Cross, now standing in the parish church of Ruthwell, now Dumfries District, Dumfries and Galloway Region, Scot. The complete version became known with the discovery of the 10th-century Vercelli Book in northern Italy in 1822.

dream vision (allegorical tale): *see* dream allegory.

Dreaming, the, also called DREAM-TIME, or WORLD DAWN, Australian Aboriginal languages ALTJIRA, ALTJIRANGA, ALCHERINGA, WONGAR, or DJUGURBA, mythological period of time that had a beginning but no foreseeable end, during which the natural environment was shaped and humanized by the actions of mythic beings. Many of these beings took the form of human beings or of animals ("totemic"); some changed their forms. They were credited with having established the local social order and its "laws." Some, especially the great fertility mothers, but also male genitors, were responsible for creating human life—*i.e.*, the first people.

Mythic beings of the Dreaming are eternal. Though in the myths some were killed or disappeared beyond the boundaries of the people who sang about them, and others were metamorphosed as physiographic features (for example, a rocky outcrop or a waterhole) or manifested as or through ritual objects (*see* tjurunga), their essential quality remained undiminished. In Aboriginal belief, they are spiritually as much alive today as they ever were. The places where the mythic beings performed some action or were "turned into" something else became sacred, and it was around these that ritual was focussed.

The Dreaming, as a coordinated system of belief and action, includes totemism. Together, they express a close relationship: man is regarded as part of nature, not fundamentally dissimilar to the mythic beings or to the animal species, all of which share a common life force. The totem serves as an agent, placing man within the Dreaming and providing him with an indestructible identity that continues uninterruptedly from the beginning of time to the present and into the future.

Drebbel, Cornelis (Jacobszoon) (b. 1572, Alkmaar, Neth.—d. Nov. 7, 1633, London), Dutch inventor who built the first navigable submarine.

An engraver and glassworker in Holland, Drebbel turned to applied science and in 1604 went to England, where King James I became his patron. He devised an ingenious "perpetual motion clock," actuated by changes in atmospheric pressure and temperature, which greatly enhanced his reputation. In 1620 he completed his "diving boat." Propelled by oars and sealed against the water by a covering of greased leather, the wooden vessel travelled the River Thames at a depth of 12 to 15 feet (about 4 metres) from Westminster to Greenwich. Air was supplied by two tubes with floats to maintain one end above water.

Drebbel also discovered the use of tin compounds as mordants for cochineal, a scarlet dye, and suggested a method of making sulfuric acid by the oxidation of sulfur. Among many other inventions attributed to him are the compound microscope, an improved thermometer, and self-regulating ovens.

Dred Scott decision (March 6, 1857), ruling of the U.S. Supreme Court that made slavery legal in all the territories, thereby adding fuel to the sectional controversy and pushing the nation along the road to civil war.

The decision—only the second time in the nation's history that the Supreme Court declared an act of Congress unconstitutional—was a clear victory for the slaveholding South. Southerners had argued that both Congress and the territorial legislature were powerless to exclude slavery from a territory. Only a state could exclude slavery, they maintained.

Dred Scott was a slave whose master in 1834 had taken him from Missouri (a slave state) to Illinois (a free state), then into the Wisconsin Territory (a free territory under the provisions of the Missouri Compromise), and finally back to Missouri. In 1846, with the help of anti-slavery lawyers, Scott sued for his freedom in the Missouri state courts on the grounds that his residence in a free state and a free territory had made him a free man.

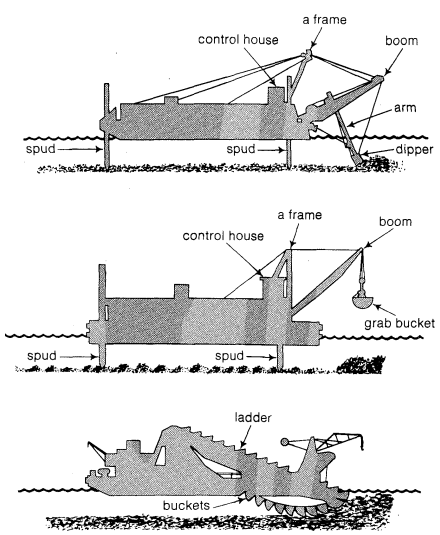
The Missouri Supreme Court overturned an initial ruling by a lower court which had declared Scott free, and the case, then, began a long sojourn up to the U.S. Supreme Court. The court announced its decision on March 6, 1857, just two days after the inauguration of Pres. James Buchanan. Though each justice wrote a separate opinion, Chief Justice Roger B. Taney's opinion is most often cited on account of its far-reaching implications for the sectional crisis.

Taney, one of the seven justices denying Scott his freedom (two dissented), declared that a Negro could not be entitled to rights as a U.S. citizen, such as the right to sue in federal courts. In fact, Taney wrote, Negroes had "no rights which any white man was bound to respect."

The decision might have ended there, with the dismissal of Scott's appeal. But Taney and the other justices in the majority went on to declare that the Missouri Compromise of 1820 (which had forbidden slavery in that part of the Louisiana Purchase north of the latitude 36°30′, except for Missouri) was unconstitutional because Congress had no power to prohibit slavery in the territories. Slaves were property, and masters were guaranteed their property rights under the Fifth Amendment. Neither Congress nor a territorial legislature could deprive a citizen of his property without due process of law. As for Scott's temporary residence in a free state, Illinois, the majority said that Scott had still been subject then to Missouri law.

The Dred Scott decision seemed a mortal blow to the newly created Republican Party, formed to halt the extension of slavery into the western territories. It also forced Stephen A. Douglas, advocate of popular sovereignty (*q.v.*), to come up with a method (the "Freeport Doctrine") whereby settlers could actually ban slavery from their midst. President Buchanan, the South, and the majority of the Supreme Court hoped that the Dred Scott decision would mark the end of antislavery agitation. Instead, the decision increased antislavery sentiment in the North, strengthened the Republican Party, and fed the sectional antagonism that burst into war in 1861.

dredge, large floating device for underwater excavation. Dredging has four principal objectives: (1) to develop and maintain greater depths than naturally exist for canals, rivers, and harbours; (2) to obtain fill to raise the level of lowlands and thus create new land areas and improve drainage and sanitation;



Several types of dredges
(Top) Dipper dredge; (centre) grab dredge; (bottom) ladder dredge

(3) to construct dams, dikes, and other control works for streams and seashore; and (4) to recover subaqueous deposits or marine life having commercial value.

Dredges are classed as mechanical and hydraulic. Many special types in both classes, and combinations of the two, have been devised. All types of dredges may have living quarters on board. Though dredges have been constructed to remove many kinds of deposits, the bulk of material removed has consisted of sand and mud.

A dipper dredge is essentially a power shovel mounted on a barge for marine use. Distinctive features are the bucket and its arm, the boom that supports and guides the arm and is mounted to work around a wide arc, and the mechanism that gives excavating movement to the bucket. A grab, or clamshell, dredge lowers, closes, and raises a single bucket by means of flexible cables. In operation the bucket is dropped to the bottom, where it bites because of its weight and the action of the bucket-closing mechanism. A grab dredge can work at virtually unlimited depths. A ladder dredge employs a continuous chain of buckets rotating around a rigid adjustable frame called a ladder. When the ladder is lowered to the bottom at a slant, the empty buckets descend along the underside to the bottom, where they dig into the mud; the loaded buckets return along the ladder's upper side and dump at the top. The scraper dredge, also called a dragline, handles material with a scoop suspended from a swinging boom. The scoop is drawn forward by a line attached to the front, while a second line attached to the rear holds the scoop at the proper angle to slice the earth away as the device is pulled along. A hydraulic dredge makes use of a centrifugal pump. In the pump casing, an impeller expels by centrifugal action a mixture of solids, water, and gases. As a partial vacuum is created within the pump, atmospheric pressure on the outside water surface and the weight of the water itself (hydrostatic pressure) both act to force water and suspended solids from the bottom through the suction pipe into the pump. The materials emerging from the pump are conveyed into barges or through another pipe to the shore. Long stakes, called spuds, are frequently used to pinion a dredge to the bottom.

Drees, Willem (b. July 5, 1886, Amsterdam, Neth.—d. May 14, 1988, The Hague), statesman and socialist leader who was the prime minister of The Netherlands from 1948 to 1958. His four successive governments augmented his country's comprehensive welfare state, continued the postwar abandonment of the traditional Dutch neutrality in favour of military and economic alliances, and unsuccessfully tried to retain the Republic of Indonesia as an autonomous state under the Dutch crown.

Educated at Commercial School, Amsterdam, Drees was appointed stenographer to the Netherlands States General (Parliament) in 1907. A member of the Labour (Social Democratic) Party, he was elected to the Hague city council in 1913 and to the Second (principal) Chamber of the States-General in 1933. From 1939 he was chairman of the Labour group in the Second Chamber. When the Germans occupied his country during World War II, Drees was imprisoned for trying to organize resistance. Released in 1941, he rejoined the resistance movement and presided over the Fatherland Committee, which prepared the first governmental measures after the liberation of The Netherlands in 1945.

Drees served (1945–48) as minister of social affairs in the governments of Willem Schermerhorn and Louis Beel. In 1946 Drees and Schermerhorn, a left-wing Liberal, had formed a new socialist party, the Partij van de Arbeid ("Party of Labour"). As prime minister from Aug. 6, 1948, Drees formed ministries that were coalitions of his own party and the Katholieke Volkspartij ("Catholic People's Party"). When the latter party dissolved the coalition in a dispute over new tax proposals, Drees resigned on Dec. 12, 1958, and retired from politics.

Under Drees's leadership The Netherlands joined the North Atlantic Treaty Organization (NATO), the Western European Union (WEU), the European Economic Community (EEC), and other international associations. In December 1948, war broke out in Indonesia between the Dutch and the Indonesians, but in 1949 Drees's government acknowledged the United States of Indonesia (later the Republic of Indonesia) as a partner in a federation. Drees was in office when, in 1954, Indonesia terminated this union.

Dreikaiserbund, English THREE EMPERORS' LEAGUE, an alliance in the latter part of the 19th century of Germany, Austria-Hungary, and Russia, devised by German chancellor Otto von Bismarck. It aimed at neutralizing the rivalry between Germany's two neighbours by an agreement over their respective spheres of influence in the Balkans and at isolating Germany's enemy, France.

The first Dreikaiserbund was in effect from 1873 to 1875. A second one, formal and secret, was established June 18, 1881, and lasted for three years. It was renewed in 1884 but lapsed in 1887. Both alliances ended because of continued strong conflicts of interest between Austria-Hungary and Russia in the Balkans. The second treaty provided that no territorial changes should take place in the Balkans without prior agreement and that Austria could annex Bosnia and Hercegovina when it wished; in the event of war between one party and a great power not party to the treaty, the other two parties were to maintain friendly neutrality.

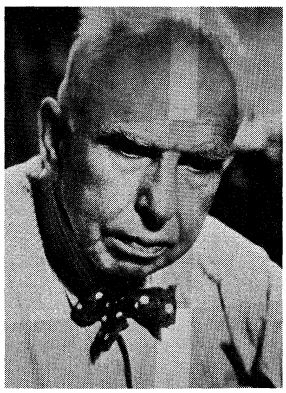
Bismarck was able temporarily to preserve the tie with Russia in the Reinsurance Treaty (*q.v.*) of 1887; but, after his dismissal, this treaty was not renewed, and a Franco-Russian alliance developed.

Dreikurs, Rudolf (b. Feb. 8, 1897, Vienna, Austria—d. May 25, 1972, Chicago, Ill., U.S.), American psychiatrist and educator who developed the Austrian psychologist Alfred Adler's system of individual psychology into a pragmatic method for understanding the purposes of reprehensible behaviour in children and for stimulating cooperative behaviour without punishment or reward.

After training at the University of Vienna (M.D., 1923), Dreikurs developed, in collaboration with Adler, clinics for child guidance, alcoholics, and psychopaths, as well as doing mental-hygiene and welfare work. Emigrating to the United States in 1937, he taught psychiatry and founded the Alfred Adler Institutes of individual psychology in Chicago and Tel Aviv, Israel.

Dreiser, Theodore (b. Aug. 27, 1871, Terre Haute, Ind., U.S.—d. Dec. 28, 1945, Hollywood, Calif.), novelist who was the outstanding American practitioner of naturalism. He was the leading figure in a national literary movement that replaced the observance of Victorian notions of propriety with the unflinching presentation of real-life subject matter. Among other themes, his novels explore the new social problems that had arisen in a rapidly industrializing America.

Life. Dreiser was the ninth of 10 surviving children in a family whose perennial poverty forced frequent moves between small Indiana towns and Chicago in search of a lower cost of living. His father, a German immigrant, was a mostly unemployed millworker who subscribed to a stern and narrow Roman Catholicism. His mother's gentle and compassionate outlook sprang from her Czech Mennonite background. In later life Dreiser would bitterly associate religion with his father's ineffectuality and the family's resulting material deprivation, but he always spoke and wrote of his mother with unswerving affection. Dreiser's



Theodore Dreiser
The Granger Collection, New York City

own harsh experience of poverty as a youth and his early yearnings for wealth and success would become dominant themes in his novels, and the misadventures of his brothers and sisters in early adult life gave him additional material on which to base his characters.

Dreiser's spotty education in parochial and public schools was capped by a year (1889–90) at Indiana University. He began a career as a newspaper reporter in Chicago in 1892 and worked his way to the East Coast. While writing for a Pittsburgh newspaper in 1894, he read works by the scientists T.H. Huxley and John Tyndall and adopted the speculations of the philosopher Herbert Spencer. Through these readings and his own experience, Dreiser came to believe that human beings are helpless in the grip of instincts and social forces beyond their control, and he judged human society as an unequal contest between the strong and the weak. In 1894 Dreiser arrived in New York City, where he worked for several newspapers and contributed to magazines. He married Sara White in 1898, but his roving affections (and resulting infidelities) doomed their relationship. The couple separated permanently in 1912.

Dreiser began writing his first novel, *Sister Carrie,* in 1899 at the suggestion of a newspaper colleague. Doubleday, Page and Company published it the following year, thanks in large measure to the enthusiasm of that firm's reader, the novelist Frank Norris. But Doubleday's qualms about the book, the story line of which involves a young kept woman whose "immorality" goes unpunished, led the publisher to limit the book's advertising, and consequently it sold fewer than 500 copies. This disappointment and an accumulation of family and marital troubles sent Dreiser into a suicidal depression from which he was rescued in 1901 by his brother, Paul Dresser, a well-known songwriter, who arranged for Theodore's treatment in a sanitarium. Dreiser recovered his spirits, and in the next nine years he achieved notable financial success as an editor in chief of several women's magazines. He was forced to resign in 1910, however, because of an office imbroglio involving his romantic fascination with an assistant's daughter.

Somewhat encouraged by the earlier response to *Sister Carrie* in England and the novel's republication in America, Dreiser returned to writing fiction. The reception accorded his second novel, *Jennie Gerhardt* (1911), the story of a woman who submits sexually to rich and powerful men to help her poverty-stricken family, lent him further encourage-

ment. The first two volumes of a projected trilogy of novels based on the life of the American transportation magnate Charles T. Yerkes, *The Financier* (1912) and *The Titan* (1914), followed. Dreiser recorded his experiences on a trip to Europe in *A Traveler at Forty* (1913). In his next major novel, *The 'Genius'* (1915), he transformed his own life and numerous love affairs into a sprawling semi-autobiographical chronicle that was censured by the New York Society for the Suppression of Vice. There ensued 10 years of sustained literary activity during which Dreiser produced a short-story collection, *Free and Other Stories* (1918); a book of sketches, *Twelve Men* (1919); philosophical essays, *Hey-Rub-a-Dub-Dub* (1920); a rhapsodic description of New York, *The Color of A Great City* (1923); works of drama, including *Plays of the Natural and Supernatural* (1916) and *The Hand of the Potter* (1918); and the autobiographical works *A Hoosier Holiday* (1916) and *A Book About Myself* (1922).

In 1925 Dreiser's first novel in a decade, *An American Tragedy,* based on a celebrated murder case, was published. This book brought Dreiser a degree of critical and commercial success he had never before attained and would not thereafter equal. The book's highly critical view of the American legal system also made him the adopted champion of social reformers. He became involved in a variety of causes and slackened his literary production. A visit to the Soviet Union in 1927 produced a skeptical critique of that communist society entitled *Dreiser Looks at Russia* (1928). His only other significant publications in the late 1920s were collections of stories and sketches written earlier, *Chains* (1927) and *A Gallery of Women* (1929), and an unsuccessful collection of poetry, *Moods, Cadenced and Declaimed* (1926).

The Great Depression of the 1930s ended Dreiser's prosperity and intensified his commitment to social causes. He came to reconsider his opposition to communism and wrote the anticapitalist *Tragic America* (1931). His only important literary achievement in this decade was the autobiography of his childhood and teens, *Dawn* (1931), one of the most candid self-revelations by any major writer. In the middle and late '30s his growing social consciousness and his interest in science converged to produce a vaguely mystical philosophy.

In 1938 Dreiser moved from New York to Los Angeles with Helen Richardson, who had been his mistress since 1920. There he set about marketing the film rights to his earlier works. In 1942 he began belatedly to rewrite *The Bulwark,* a novel begun in 1912. The task was completed in 1944, the same year he married Helen. (Sara White Dreiser had died in 1942.) One of his last acts was to join the American Communist Party. Helen helped him complete most of *The Stoic,* the long-postponed third volume of his Yerkes trilogy, in the weeks before his death. Both *The Bulwark* and *The Stoic* were published posthumously (1946 and 1947, respectively). A collection of Dreiser's philosophical speculations, *Notes on Life,* appeared in 1974.

Works. Dreiser's first novel, *Sister Carrie* (1900), is a work of pivotal importance in American literature despite its inauspicious launching. It became a beacon to subsequent American writers whose allegiance was to the realistic treatment of any and all subject matter. *Sister Carrie* tells the story of a rudderless but pretty small-town girl who comes to the big city filled with vague ambitions. She is used by men and uses them in turn to become a successful Broadway actress while George Hurstwood, the married man who has run away with her, loses his grip on life and descends into beggary and suicide. *Sister Carrie* was the first masterpiece of the American naturalistic movement in its grittily factual presentation of the vagaries of urban life and in its ingenuous heroine, who goes unpunished for her transgressions against conventional sexual morality. The book's strengths include a brooding but compassionate view of humanity, a memorable cast of characters, and a compelling narrative line. The emotional disintegration of Hurstwood is a much-praised triumph of psychological analysis.

Dreiser's second novel, *Jennie Gerhardt* (1911), is a lesser achievement than *Sister Carrie* owing to its heroine's comparative lack of credibility. Based on Dreiser's remembrance of his beloved mother, Jennie emerges as a plaster saint with whom most modern readers find it difficult to empathize. The novel's strengths include stinging characterizations of social snobs and narrow "religionists," as well as a deep sympathy for the poor.

The Financier (1912) and *The Titan* (1914) are the first two novels of a trilogy dealing with the career of the late-19th century American financier and traction tycoon Charles T. Yerkes, who is cast in fictionalized form as Frank Cowperwood. As Cowperwood successfully plots monopolistic business coups first in Philadelphia and then in Chicago, the focus of the novels alternates between his amoral business dealings and his marital and other erotic relations. *The Financier* and *The Titan* are important examples of the business novel and represent probably the most meticulously researched and documented studies of high finance in first-rate fiction. Cowperwood, like all of Dreiser's major characters, remains unfulfilled despite achieving most of his apparent wishes. The third novel in the trilogy, *The Stoic* (1947), is fatally weakened by Dreiser's diminished interest in his protagonist.

The 'Genius' (1915) is artistically one of Dreiser's least successful novels but is nonetheless indispensable to an understanding of his psychology. This book chronicles its autobiographical hero's career as an artist and his unpredictable pursuit of the perfect woman as a source of ultimate fulfillment.

Dreiser's longest novel, *An American Tragedy* (1925), is a complex and compassionate account of the life and death of a young anti-hero named Clyde Griffiths. The novel begins with Clyde's blighted background, recounts his path to success, and culminates in his apprehension, trial, and execution for murder. The book was called by one influential critic "the worst-written great novel in the world," but its questionable grammar and style are transcended by its narrative power. Dreiser's labyrinthine speculations on the extent of Clyde's guilt do not blunt his searing indictment of materialism and the American dream of success.

Dreiser's next-to-last novel, *The Bulwark* (1946), is the story of a Quaker father's unavailing struggle to shield his children from the materialism of modern American life. More intellectually consistent than Dreiser's earlier novels, this book also boasts some of his most polished prose.

Assessment. Dreiser's considerable stature, beyond his historic importance as a pioneer of unvarnished truth-telling in modern literature, is due almost entirely to his achievements as a novelist. His sprawling imagination and cumbersome style kept him from performing well in the smaller literary forms, and his nonfiction writing, especially his essays, are marred by intellectual inconsistency, a lack of objectivity, and even bitterness. But these latter traits are much less obtrusive in his novels, where his compassion and empathy for human striving make his best work moving and memorable. The long novel gave Dreiser the prime form through which to explore in depth the possibilities of 20th-century American life, with its material profusion and spiritual doubt. Dreiser's characters struggle for self-realization in the face of society's narrow and repressive moral conventions, and they often obtain material success and erotic gratification while a more enduring spiritual satisfaction eludes them. Despite Dreiser's alleged deficiencies as a stylist, his novels succeed in their accumulation of realistic detail and in the power and integrity with which they delineate the tragic aspects of the American pursuit of worldly success. *Sister Carrie* and *An American Tragedy* are certainly enduring works of literature that display a deep understanding of the American experience around the turn of the century, with its expansive desires and pervasive disillusionments. (L.E.Hu.)

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Drenewydd (Wales): *see* Newtown.

Drenthe, also spelled DRENTE, *provincie,* northeastern Netherlands. It extends westward from the German border, between the provinces of Groningen and Friesland (north and northwest) and Overijssel (south). Drained by many shallow streams and short canals, it has an area of 1,025 square miles (2,654 square km). Its capital is Assen. More than 50 megalithic funerary monuments (*hunebedden,* "huns' graves") attest to prehistoric settlement of the area. It was part of the bishopric of Utrecht from 1046 to 1522 but passed to the Holy Roman emperor Charles V in 1536 and was incorporated in the Habsburg dominions. It took part in the Dutch revolt against Spain but was not made a province until 1796.

The province's soils are mostly sandy with large areas of bogs; alluvium covers the valley floors. Some of the lowland regions are planted in market gardens and orchards. In the 19th century, settlements of paupers and criminals were established to reclaim the heathlands for agricultural use. Much of the heathland has been laid to grass, and reclamation continues. Rye and potatoes remain the chief crops, but dairying and cattle and pig raising have become important. Afforestation, begun privately before 1800 and under provincial control since 1905, has been considerable. Peat has been cut for fuel since medieval times. Beginning in the 17th century, there have been efforts to cut all the peat from a bog area and convert it to agricultural use.

Drenthe has a long tradition of cottage industries, such as spinning, weaving, and rope making. Agricultural processing is the chief economic activity, including the production of potato flour and strawboard. There are diversified industries at Meppel (the port of Drenthe), Hoogeveen, Assen, and Emmen. The oil industry near Schoonebeek has been developed since World War II. Pop. (1988 est.) 436,586.

Drepanius, Latinius Pacatus: *see* Pacatus Drepanius, Latinius.

Dresbachian stage, lowermost stage (or time interval of deposition) of the Upper Cambrian (Croixian) series of rocks in North America (the Cambrian period occurred from 570 to 505 million years ago). The type area of the Dresbachian is the region near the town of Dresbach, Minn. In this region, the Dresbachian consists of sandstones and shales, whereas, to the west of Dresbach, limestones predominate. The trilobite genus *Crepicephalus* is the characteristic fossil of the Dresbachian stage.

Dresch, Jean-Emmanuel (b. Nov. 30, 1905, Paris), French geographer and geologist, known for his studies of arid North Africa.

Dresch was a professor at the Muslim college in Rabat, Mor., from 1931 until 1941; he became a professor in the Faculty of Letters at Caen, Fr. (1943), at Strasbourg (1945), and at the University of Paris (1948), where he was appointed the director of the Institut de Géographie in 1960. His work includes desert landscape development and studies of the Atlas Mountains. He wrote *La Méditerranée et le Moyen Orient* (1953; "The Mediterranean and the Middle East"); *Les Paysages tropicaux humides et le zone aride* (1966; "Humid Tropical Landscapes and the Arid Zone"); and *Un géographe au déclin des empires* (1979; "A Geographer at the Decline of the Empires").

Dresden, until 1990 a *Bezirk* (district) of southeastern East Germany, formed in 1952 from parts of Saxony and Silesia. With an area of 2,602 square miles (6,738 square km) and drained by the Elbe and Spree rivers, it consisted of the Lausitzer (Lusatia) Bergland granite plateau in the north and east, the Elbe basin in the west, and part of Erzgebirge (Ore Mountains) in the south. The basin focussing on the city of Dresden was the agricultural, industrial, and population centre of the *Bezirk*. The towns and villages of the Lausitzer plateau are mainly engaged in the textile industry. The chief towns after Dresden (the capital) were Görlitz, Bautzen, Meissen, Zittau, and Riesa (*qq.v.*). Pop. (1989 est.) 1,757,363.

Dresden, city, traditional capital of Saxony, from 1919 to 1952 and from 1990 capital of Saxony *Land* (state); it lies in the Elbe River Basin between Meissen and Pirna, southeast of Leipzig. It originated as the Slav village of Drežd'ane, meaning Forest Dwellers on the Plain, on the Elbe's north bank. The town on the south bank was founded at a ford by Margrave Dietrich of Meissen as a German colony, first recorded in 1216. The Slav settlement, although older, was known as Neustadt (New Town) and the later German town as Altstadt (Old Town).

Glockenspiel Pavilion of the Zwinger complex, Dresden, Ger.

W. Krammisch—Bruce Coleman Inc./EB Inc.

In 1270 Dresden was the capital of Margrave Henry the Illustrious, and after his death it belonged to the King of Bohemia and the Margrave of Brandenburg until it was restored *c.* 1319 to the margraves of Meissen, who chartered it in 1403. On the division of Saxony in 1489 it became the residence and capital of the Albertine line of Wettin rulers, later electors and kings of Saxony. Dresden accepted the Reformation in 1539. After a disastrous fire in 1491, it was rebuilt and fortified. The electors Augustus I and Augustus II modernized it in the Baroque and Rococo styles in the late 17th and 18th centuries, rebuilding Neustadt (burned in 1685) and founding Friedrichstadt, northwest of Altstadt. The Treaty of Dresden (1745), between Prussia, Saxony, and Austria, ended the second Silesian War and confirmed Silesia as Prussian. Two-thirds destroyed in the Seven Years' War (1756–63), Dresden's fortifications were later dismantled. In 1813 Napoleon I made the town a centre of military operations and there won his last great battle on August 26 and 27. Dresden was almost completely destroyed by massive bombing raids that took place on the night of Feb. 13–14, 1945, by 800 aircraft of an Anglo-American force. The city continued to be bombarded in raids lasting until April 17. The raids succeeded in obliterating the greater part of one of Europe's most beautiful cities, killing between 35,000 and 135,000 people, but achieved little militarily. Dresden was so badly damaged that it was suggested that the best approach might be to level the site. A compromise was reached by rebuilding the famous Baroque buildings around the castle and creating a new city in the area outside.

Many buildings were completed or founded by King Anthony (1755–1836), for whom Antonstadt on the north bank is named. Before World War II, Dresden was called Florence on the Elbe and was numbered among the world's most beautiful cities, noted for its architecture and art treasures. The Frauenkirche (1726–43; Church of Our Lady) was destroyed, but its ruins have been kept as a memorial; the Hofkirche (1738–55) and the Kreuzkirche (restored 1491, 1764–92, and 1900; Church of the Holy Cross) have been restored. The former royal palace (1530–35, restored 1889–1901 in German Renaissance style) was heavily damaged. Most of Dresden's fabulous art treasures were taken for safekeeping outside of the city, and, although many were seized by the Russians in 1945, some were returned in 1955. Among many museums and galleries, the famous Zwinger (1711–32) has been restored, and its numerous collections (including pewter and porcelain) and museums (zoology, mineralogy, mathematical and scientific instruments) have been reopened. The Semper (picture) Gallery (1846) was reopened in 1960; the gem of its priceless art collections is Raphael's "Sistine Madonna." The Japanese Palace, formerly housing a manuscript and map library, has been rebuilt and now displays collections of coins and porcelain.

Dresden is a city of music with a great operatic tradition, where Carl Maria von Weber and Richard Wagner conducted and where operas by Richard Strauss and others had their first performances. The Opera House (1878), destroyed in the war, was reconstructed. The city is the home of the Dresden State Theatre and the Dresden Philharmonic Orchestra (founded 1870). There is a music college and colleges of medicine, plastic arts, transport, and teachers' training and a celebrated Academy of Art. A major centre for scientific education and research, particularly in the atomic field, Dresden is the site of a Technical University, with a library containing more than one million volumes, the Central Institute for Nuclear Physics, and the German Museum of Hygiene, internationally known for its manufacture of transparent plastic anatomical models. There are several historic parks, notably, the Grosse Garten (1676), with botanical and zoological gardens, and the open-air theatre (1956).

Stimulated by railway connections with Berlin and Leipzig, Dresden's industry developed in the 19th century, and suburbs grew up on the Elbe's south bank. Manufacturing expanded greatly after World War II. There is little heavy industry, but precision and optical instruments, radio and electrical equipment, electrical transformers and hydroelectric generators, X-ray and photographic apparatus, and machinery are manufactured. Market gardening is extensive, and flowers and shrubs are grown for export. The Dresden china industry originated in Dresden but was moved to Meissen, 15 miles northwest, in 1710. At the centre of an extensive railway system, Dresden has an airport and is connected by the Elbe with the inland waterway system as far as Hamburg and into Czechoslovakia. Pop. (1989 est.) 518,057.

Dresden, Battle of (Aug. 26–27, 1813), Napoleon's last major victory in Germany; it was fought on the outskirts of the Saxon capital of Dresden, between Napoleon's 120,000 troops and 170,000 Austrians, Prussians, and Russians under Prince Karl Philipp Schwarzenberg.

The allies had hoped to capture Dresden, Napoleon's major base of operations and supply depot. On August 23 Napoleon learned that the Dresden garrison of fewer than 20,000 men—commanded by Laurent Gouvion-Saint-Cyr—was threatened by the allied advance, and he rushed reinforcements there. In one of history's great marches, the Imperial Guard covered 90 miles (145 kilometres) in three days, and two corps of conscripts covered 120 miles (190 kilometres) in four days, giving Napoleon 70,000 troops on the first day of the battle and 120,000 on the second. Meanwhile, Gouvion-Saint-Cyr constructed many fortifications.

On August 26 Schwarzenberg attacked in a great semicircle around the city, his flanking troops resting on the Elbe River. Gouvion-Saint-Cyr's defenders yielded ground slowly, at great cost to the attackers. Napoleon arrived and in the late afternoon drove the allies back to their original positions. On the morning of the 27th he took the offensive. The superior mobility of his artillery decided the issue, when rain and mud made it almost impossible for infantry or cavalry to function effectively. The allies were forced to retire, with losses of 38,000 to French losses of 10,000. Napoleon became ill, and the pursuit of the allies was left to the corps commanders. They were seriously beaten, on August 30 and September 6, negating the value of the victory at Dresden.

Dresden Codex, Latin CODEX DRESDENSIS, along with the Madrid and Paris codices, one of the three pre-Columbian Mayan hieroglyphic writings to survive the book burnings by the Spanish clergy. It contains astronomical calculations—eclipse-prediction tables, the synodical period of Venus—of exceptional accuracy. The Mayas' reputation as astronomers is based largely on these figures. The codex was acquired by the Sächsische Landesbibliothek (Saxon State Library), Dresden, Saxony, and was published by Edward King, Viscount Kingsborough, in *Antiquities of Mexico* (1830–48). King erroneously attributed the codex to the Aztecs. The first scientific edition of the codex was made by E. Förstemann (Leipzig, 1880). *See also* Madrid Codex; Paris Codex.

Dresdner Bank AG, major German commercial bank, one of the largest banks in the western world. Headquarters are in Frankfurt am Main.

It was established in 1872 as Dresdner Bank in Dresden, and in 1884 the main office was

relocated to Berlin. In 1952 the bank was split into three: Rhein-Main Bank AG, Hamburger Kreditbank AG, and Rhein-Ruhr Bank AG. The three were reunited into the present Dresdner Bank in 1957.

In addition to providing commercial banking and financial services, the bank is dominant in the financing of export and import transactions. The bank and its associated companies also offer services in money markets, foreign exchange, and issuing of securities.

In 1974 the bank combined with several European and South American banks to establish the Euro-Latinamerican Bank in London, which finances development projects in Latin America. The bank is also a member of the Associated Banks of Europe Corporation (ABECOR), which provides financial services to clients throughout the world.

dress, covering, or clothing and accessories, for the human body. The variety of dress is enormous, varying with different sexes, cultures, geographical areas, and historic eras. Broadly, the more sophisticated and highly developed the culture, the more elaborate, hierarchical, and varied have been its traditional forms of dress.

A brief treatment of dress follows. For full treatment, *see* MACROPAEDIA: Dress and Adornment; Industries, Manufacturing.

Dress design. Dress is influenced by economies and utility and also by fashion and taste. The fashion plate, a mass-produced illustration of clothing styles, was invented early in the 19th century. It enabled the swift communication of new ideas in clothing, which has continued to the present day. Throughout the history of dress, certain styles have gone in and out of fashion over and over again. The full or hoop skirt, for example, exemplified by the farthingale in the 16th century, returned in the early 18th century and was revived again in the 1850s and, briefly, with the crinoline, in the 1950s. The short skirts and low waists of the 1920s were again fashionable in the 1960s.

The term dress encompasses not only such familiar garments as shirts, skirts, trousers, jackets, and coats but also footwear, caps and hats, sleepwear, sports clothes, corsets, and gloves. Hairstyles and the wearing of beards, mustaches, and wigs at different times and in various forms are all linked to the history of fashion and dress. The same is true of the use of cosmetics and jewelry.

Western styles of dress are worn virtually worldwide, though many non-Western styles continue to be important in such countries as Japan and India. The traditional dress of China, later adopted by the Japanese, where it evolved into the kimono, was the long silk robe, called a *p'ao.* This was a sort of wide-sleeved kimono and was introduced into Japan in the 8th century AD. Silk had been discovered in China by at least 2000 BC, and the long tradition of making and wearing luxurious garments is shown by reliefs and paintings from the Han Dynasty (206 BC–AD 220). New styles were introduced by the Manchus in 1644 in which emblematic colours and patterns were significant. Chinese and Japanese dress had symbolic importance related to the wearer's status. The kimono is still worn in Japan, belted by the elegant wide sash, or obi.

Dress and personal ornamentation with jewelry has traditionally been important in the Indian subcontinent, where two ancient garments, the woman's sari and the man's dhoti, are still used. These are long pieces of cloth wrapped around the body. Traditionally, the top of the body was left bare, but after Muslim conquest in the 12th century, new styles were adopted that included baggy trousers and jackets for both men and women.

Among the earliest examples of dress were the simple linen garments worn by some Egyptians, usually as a form of kilt. Those of lower social status wore nothing at all. In ancient Greece, garments were simple pieces of wool or cotton, draped in various ways. The chiton, a type of shirt usually of linen, was worn by both men and women. The peplos, worn only by women, was a vertically folded length of wool draped in several different ways, usually belted. Sandals were the usual footwear worn by both sexes.

In Roman times the Greek forms of dress were adapted, but sharp class distinction began to be associated with various forms of dress. The tunic, like the chiton, was made in different forms and fabrics. The toga eventually became the state dress, worn by the emperor and high officials, and its draping became increasingly elaborate.

Clothing changed little in the Middle Ages, though trousers and, later, close-fitting hose began to be worn by men. By the 14th century, women wore long gowns that became quite elaborate. In 16th-century England the ruff, a frilled collar of folded linen, came into fashion and is familiar from portraits of Queen Elizabeth and her courtiers.

By 1670 a revolution in dress had occurred, and men were wearing long coats, waistcoats, and trousers. Wigs, too, became fashionable and remained so into the 18th century. In the 18th century, women's dress became richer and more varied with each generation. Another change took place in about 1790 toward greater simplicity and informality, part of the overall taste for neoclassicism.

American fashion followed that of Europe, though the plain gray cloth and large white collars of the Puritans were widely worn in the northern Colonies. As wealth increased, dress became richer, more refined and stylish.

By the early 19th century, French design dictated women's fashion, while English styles became the ideal for men. During the reign of Queen Victoria, clothing was less romantic, more modest, and drabber in colour, with full skirts and heavy shawls. Men wore shiny black top hats. Crinolines, bustles, and trains all had their moments of popularity. By the end of the century, sports clothes had come into vogue, and the trend toward informality had begun and was to continue to the present day. By the 1920s, skirts for women were short, and men wore wide, baggy trousers. Soft-collared shirts replaced stiff white collars. As women's roles in society changed, so did their forms of dress, with tailored suits and slacks becoming increasingly important from the 1930s.

Christian Dior's "New Look" of 1947, with its narrow shoulders and long billowing skirt, began the postwar fashion revolution that was characterized by a wide choice of styles and the breaking down of class barriers in dress. London's "Mod" look from Carnaby Street in the 1960s led to an erratic era of fluctuating hemlines and unisex fashions, but by the 1980s fashion revivals of earlier eras had resulted in a rather traditional elegance and classical styling.

Clothing technology. Over the centuries, advances in technology took place very slowly. The iron needle did not come into use until the Middle Ages. Until the 18th century all tailoring operations were performed by hand. Finally in the 1700s the invention of foot- and water-powered machinery for spinning and weaving made factory production of cloth possible. This breakthrough stimulated the development of the sewing machine. Barthélemy Thimonnier of Paris patented the first practical machine in 1830. Improved versions soon followed, including one by Isaac M. Singer of Pittstown, N.Y., in 1851.

The next major mechanical achievement in the industry came in 1860 with the introduction of the band-knife machine that could cut several thicknesses of cloth at one time. Twentieth-century advances in the manufacturing process have included the computerized grader machine (1967), which grades and cuts patterns directly from an original set automatically; a computer-controlled laser beam that burns or vaporizes fabric rather than cutting it; and high-speed sewing machines capable of sewing up to 8,000 stiches per minute.

The raw materials used by the apparel and allied industries are classified according to construction: strand, matted, molecular mass, and cellular. With strand construction, yarns are converted into woven, knitted, and braided fabrics. Matted construction converts fibres into felts, paper, and padding yardage; molecular-mass construction produces plastic film, metal foil, and rubber sheetings. Cellular construction is the building block for skins, furs, hides, and synthetic foam.

Textile fabrics are created by weaving, braiding, or knitting. In weaving, two or more yarns are interfaced perpendicularly to each other. In braiding, two or more yarns are interlaced diagonally to each other. In knitting, yarns are interlooped. Yarns are strands spun either from natural fibres such as cotton, linen, or wool, or from synthetic fibres such as rayon and nylon.

Most leathers are made from skins of sheep, goats, kids, calves, pigs, horses, and cattle, and to a lesser degree from the skins of lizards, snakes, alligators, elk, buffalo, ostriches, kangaroos, chamois, walruses, elephants, and seals.

There are three basic steps in the modern manufacturing process: cutting, sewing, and pressing. In addition, there are five other processes used in assembling, decorating, and finishing the components. These are baking or curing, cementing, fusing, molding, and riveting. The last-mentioned process includes nailing and the insertion of grommets.

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dressage (French "training"), systematic and progressive training of riding horses to execute precisely any of a wide range of maneuvers, from the simplest riding gaits to the most intricate and difficult airs and figures of *haute école* ("high school"). Dressage achieves balance, suppleness, and obedience with the purpose of improving and facilitating the horse's performance of normal tasks. If the advanced training stage is reached, dressage may become an objective in itself. Competitions in dressage have been regularly included in the Olympic Games since 1912. For winners of this event, *see* Olympic Games.

Of great importance to dressage is collection, in which the horse's gaits are shortened and raised by bringing the balance rearward to lighten the forehand, thus giving special agility in a limited space. This change is made without sacrificing ability to move freely. The desired result is that the horse will be keen but submissive and support the weight of the rider without undue strain on any set of joints or muscles. The overall objectives are to enable the horse to comply easily and willingly with the demands of the rider and at the same time to improve the horse's pace and bearing.

Dressage is generally divided into elementary training (*campagne*) and the much more advanced *haute école.* Elementary training consists of teaching the young horse obedience, balance, and relaxation. Starting with the horse on a longe line, or training rope, and then under the saddle, the horse is taught basic and natural movements, especially on a straight line, with some collection and extension of gaits, half and full halts, backing, and turns. The more capable horses may learn movements on two tracks (moving diagonally to the side and forward), basic figures, and variations of the canter. In *haute école,* prac-

ticed most eminently at the Spanish Riding School of Vienna, the horse's natural movements are developed to the greatest perfection. It moves in almost perfect balance and precision; it walks, trots, and canters in highest collection and extension, all in response to barely perceptible movements of its rider's hands, legs, and weight. Typical *haute école* movements include the pirouette, a turn on the haunches in four or five strides at a collected canter; the piaffe, a trot in place; the passage, a very collected, cadenced, high-stepping trot; the levade, in which the horse raises and draws in its forelegs, standing balanced on its bent hind legs; the courbette (curvet), a jump forward at the levade; and the capriole, in which the horse jumps straight upward, with its forelegs drawn in, kicking back with its hind legs horizontal, and lands again in the same spot from which it took off.

dresser, side table, developed from the court cupboard, for the display of fine tableware, such as silver, pewter, or earthenware. Dressers were widely used in England beginning in Tudor times, when they were no more than a table occasionally fitted with a row of drawers. The front stood on three or five turned (shaped on a lathe) legs linked by stretchers and by corner posts. The front of the top and the drawer fronts were decorated with matching molding. A low backboard, often with small drawers in front, was introduced about 1690, and soon afterward, a decorative apron beneath the main drawers was added. Shelves without backs were added later to display English delftware. Dressers of this type became essential features of every middle-class kitchen up to the 19th century.

In France the dresser was in use from the early years of the 16th century. Decorated

Colonial American dresser, 1775–1800, with Pennsylvania German sgraffito ware displayed on the shelves; in The Henry Francis du Pont Winterthur Museum, Delaware

Courtesy, The Henry Francis du Pont Winterthur Museum

with more elaborate carving than the English, it adopted architectural forms such as Gothic crockets (ornaments in the form of curved and bent foliage) and panels, reeded strapwork (design of narrow fillets or bands folded, crossed, or interlaced), cornices, and entablatures. Unlike the English dresser, it was basically a cupboard with two doors and a pot board below. A similar form was made in Germany, the lower portion enclosed by doors, the upper portion by recessed cupboards with a heavy cornice. Decoration in both France and Germany was sometimes enriched further by inlays of marble, mother-of-pearl, ivory, or rare woods.

Dresser, Christopher (b. July 4, 1834, Glasgow—d. Nov. 24, 1904, Mulhouse, Fr.), British designer, one of the first professional industrial designers and a leader in the 19th-century vogue for Japanese-influenced design.

Dresser studied for two years at the School of Design at Somerset House, London, and then taught botany. After publication of his *Unity in Variety* (1859), he became a fellow of the Linnean Society. His *Art of Decorative Design* (1862) appeared just before he began work as a designer. He visited Japan as a representative of the British government in 1876 and thereafter adapted Japanese motifs and design principles for his own uses.

Dresser's work was strongly influenced by his scientific outlook, which some authorities claim led to overtheorization and elaboration of the principles of design, reducing the aesthetic interest of his designs. His work, however, showed a genuine understanding of materials, especially metal and glass.

Other works by Dresser include *The Development of Ornamental Art in the International Exhibition* (1862) and *Japan, Its Architecture, Art and Art Manufactures* (1882).

dressing table, also called TOILET TABLE, a table used for the toilet. The term originally was applied in the 17th century to small tables

French 18th-century dressing and writing table by Jean-François Oeben or Jean-François Leleu; in the Wallace Collection, London

Reproduced by permission of the Trustees of the Wallace Collection, London; photograph, John R. Freeman & Co. Ltd.

with two or three drawers. It soon became common practice to conceal the fittings of the dressing table when they were not in use, and great ingenuity was exercised by 18th-century cabinetmakers to combine the most convenient fittings with a handsome piece of furniture. In the *Cabinet-Makers' London Book of Prices* (1788), Thomas Shearer included a design for a dressing stand "with folding tops.... The top and bottom fronts are shams, in the back part of the stand is a cistern which receives water from the bason drawer ...." The inside included "A glass hung to a sliding piece, 3 powder boxes, a lift-out to hold 4 razors, hone and oil bottle, a ditto for combs, and partion'd off for tooth brushes, a shallow ditto for tweezers, knives etc. 2 places for essence bottles, and 2 ivory boxes, at the back part are partitions for 2 water bottles which go down in a place for a tumbler, and a place at each side for rolls of pomatum ...."

Some dressing tables were combined with writing tables, a hybrid at which the French excelled. In the 19th century the dressing table, like other cabinet furniture, assumed heavier proportions and eventually became a matching part of the bedroom suite.

Dressler, Marie, original name LEILA MARIE KOERBER (b. Nov. 9, 1869, Coburg, Ont., Can.—d. July 28, 1934, Santa Barbara, Calif., U.S.), U.S. actress whose heartwarming portrayals of strongly self-sufficient, humorous old women established her as one of Hollywood's most popular screen personalities during the early 1930s.

After appearing with a roving light-opera troupe at the age of 14, Dressler eventually became a featured vaudeville comedienne, known throughout the United States and Great Britain. She made her film debut at Mack Sennett's Keystone Studio in *Tillie's Punctured Romance* (1914) in which Charlie Chaplin and Mabel Normand also appeared. Following World War I Dressler was almost lost sight of as an actress.

In 1927 she was reestablished in motion pictures and regained public notice in slapstick comedies with Polly Moran. She met with great success as Marthy in *Anna Christie* (1930), in which she played a worldly wise, waterfront drunk, and was typed in such roles in many pictures, such as *Politics* (1931), *Prosperity* (1932), *Dinner at Eight* (1933), and *Tugboat Annie* (1933). She won the Academy Award for best actress for her performance in *Min and Bill* (1931) in which she costarred with Wallace Beery.

Dreux, town, Eure-et-Loir *département*, Centre region, north central France, on the Blaise River, northwest of Chartres. Known to the Romans as Drocae, it was held by the Durocasses, a Gallic tribe. It gave its name to a medieval family of counts. François, duc de Guise, defeated the Huguenots there in 1562, marking the beginning of the Wars of Religion. Monuments include Le Beffroi, or old town hall (1512–37); a Gothic church of Saint-Pierre (13th–17th century); and the 19th-century chapel of Saint-Louis (a mausoleum for the princes of the Orléans family). Manufactures include chemicals and railroad and agricultural equipment. Pop. (1982) 31,764.

Drew, Charles Richard (b. June 3, 1904, Washington, D.C.—d. April 1, 1950, near Burlington, N.C., U.S.), black American physician and surgeon, internationally recognized as a leading authority on the preservation of human blood for transfusion.

Educated at Amherst College (graduated 1926), McGill University, Montreal (1933), and Columbia University (1940), Drew became a surgeon and professor of medicine at Freedmen's Hospital, Washington, D.C., and Howard University (1942–50). His special interest in the structure of human blood and its preservation for later use in transfusions led him to positions as director of the medical division of the British Blood Transfusion Association and of the American Red Cross Blood Bank during World War II.

On April 1, 1950, Drew was injured in an automobile accident. In desperate need of a blood transfusion, he was rushed to the nearest hospital, which turned him away because of his race. He died en route to a hospital for blacks.

Drew, Daniel (b. July 29, 1797, Carmel, N.Y., U.S.—d. Sept. 18, 1879, New York City), U.S. railway financier of the 19th-century "robber baron" era.

Daniel Drew, engraving by J.C. Buttre after a photograph by M. Brady

By courtesy of the Library of Congress, Washington, D.C.

After a successful career as a cattle trader, Drew bought an interest in 1834 in a New York-to-Peekskill steamboat and six years later established the People's Line. He also bought control of the Stonington Line on Long Island Sound and operated a steamship service on Lake Champlain. His growing capital enabled him in 1844 to open the Wall Street brokerage firm of Drew, Robinson, and Company, which became one of the principal traders in railroad stocks in the U.S. Drew's association with the Erie Railroad began in 1853. The "Erie War" of 1866–68, in which Drew joined Jay Gould and James Fisk in opposing Cornelius Vanderbilt, who sought to buy control of the Erie Railroad, eventually led to his ruin.

In the panic of 1873 his losses were considerable, and in March 1876 he filed for bankruptcy. An avowed Methodist, Drew had contributed some of his earlier wealth to the founding of Drew Theological Seminary at Madison, N.J., and a smaller women's seminary at his birthplace.

Drew, Georgiana Emma: *see* Barrymore, Georgiana.

Drew, Jane: *see* Fry, E. Maxwell and Jane Drew.

Drew, John, Jr. (b. Nov. 13, 1853, Philadelphia—d. July 9, 1927, San Francisco), U.S. actor noted for his roles in Shakespearean comedy, society drama, and light comedies.

Drew was the eldest son of John and Louisa Lane Drew, who were actors and managers. He first appeared on the stage in 1873 under his mother's management. In 1875 Drew made his New York debut as Bob Ruggles in Augustin Daly's comedy *The Big Bonanza.* He continued his association with Daly, making his first popular success as Alexander Sprinkle in Daly's *Arabian Night; or Haroun al Raschid and His Mother-in-law* in November 1879. He left Daly in 1892 to join Charles Frohman's company and for the next 20 years appeared, under Frohman's direction, in such plays as *A Marriage of Convenience, One Summer's Day, Richard Carvel, Much Ado About Nothing, The Will, The Circle, The School for Scandal,* and *Trelawny of the "Wells."* When Frohman died in the "Lusitania" disaster of 1915, Drew's career began to ebb. So esteemed was he by his fellow actors, however, that he was chosen lifetime president of the Players' club, an honour previously accorded only to Edwin Booth, founder of the club, and Joseph Jefferson. His memoirs, *My Years on the Stage,* appeared in 1922.

Drew, John, Sr. (b. Sept. 3, 1827, Dublin—d. May 21, 1862, Philadelphia), theatrical manager and leading U.S. actor of Irish romantic comedy. One of his best roles was as Gerald Pepper in Samuel Lover's *White House of the Peppers.*

After a brief career as a seaman, Drew turned to the stage, making his New York debut sometime between 1842 and 1846. With the juvenile actor William Wheatley, he assumed management of the Arch Street Theatre in Philadelphia, probably in 1853, though some accounts place this event 10 years earlier. In 1850 he married the actress and theatrical manager Louisa Lane, who assumed management of the theatre in 1861. He toured widely, visiting England and Ireland in 1855, California and Australia in 1857, Australia and England again in 1858, and returned home early in 1862, a few months before his death.

Drew, Louisa Lane (b. Jan. 10, 1820, London—d. Aug. 31, 1897, Larchmont, N.Y., U.S.), noted U.S. actress and manager of Mrs. John Drew's Arch Street Theatre company in Philadelphia, which was one of the most brilliant in U.S. theatre history. As was the custom during the 19th century, she often played "breeches" roles, *e.g.*, Romeo, Mark Antony, and other Shakespearean roles.

Drew was the daughter of a British acting couple. She began her stage career at the age of eight, achieving success almost immediately. In 1850 she married the Irish comic actor and manager John Drew, Sr., and 11 years later took over the lease that Drew and the juvenile actor William Wheatley had been managing. She directed the company until 1892, toured for 11 seasons, and continued her stage appearances up until the time of her death, winning acclaim in such roles as Lady Teazle, Peg Woffington, Lydia Languish, and, most memorably, Mrs. Malaprop.

Drexel, Anthony Joseph (b. Sept. 13, 1826, Philadelphia—d. June 30, 1893, Carlsbad, Bohemia), U.S. banker and philanthropist who founded Drexel Institute of Technology in Philadelphia.

Upon inheriting their father's banking house of Drexel and Company in Philadelphia, Anthony and his brothers transformed it into an investment-banking concern. In 1871 they organized Drexel, Morgan and Company of New York City and Drexel, Harjes and Company in Paris. Anthony specialized in flotation of government bonds, railroad organization, mining development, and urban real estate. From 1864 he was co-owner with George W. Childs of the *Philadelphia Public Ledger.* Various churches, hospitals, and charities, as well as Drexel Institute of Technology, benefitted from his philanthropy.

Drexel, Katharine (b. Nov. 26, 1858, Philadelphia—d. March 3, 1955, Cornwells Heights, Pa., U.S.), U.S. founder of the Blessed Sacrament Sisters for Indians and Colored People, a congregation of missionary nuns dedicated to the welfare of American Indians and blacks.

Katharine was the daughter of the U.S. financier and philanthropist Francis Anthony Drexel, from whom she inherited a vast fortune. When the vicar apostolic of Dakota Territory appealed for the Christian education of Indians, she responded by financing mission schools in South Dakota, Minnesota, New Mexico, and Wyoming. She later visited these establishments, touring by burro and stagecoach. While in Rome (January 1887), she had a private audience with Pope Leo XIII, who asked that she become a missionary herself.

In 1889 Katharine entered the novitiate of the Sisters of Mercy, Pittsburgh, where, eventually, companions joined her. In 1891 she founded her congregation at the Drexel homestead. The following year they moved to the motherhouse, St. Elizabeth's Convent, Cornwells Heights, Pa., with Katharine as the first superior general; the community received papal approbation from Pope St. Pius X in 1913.

Katharine began a vast building campaign with the founding of St. Catherine's Boarding School for Pueblo Indians, Santa Fe, N.M., in 1894, followed by another school at Rock Castle, Va., in 1899, for black girls. She opened more schools in Arizona and Tennessee (1903) and in 1915 founded Xavier University in New Orleans for black girls. By 1927 she had established convents for her congregation at Columbus (Ohio), Chicago, Boston, and New York City. Katharine received high commendation from Pope Pius XII on her golden jubilee in 1941. At the time of her death, she had used more than $12,000,000 of her inheritance for her charitable and apostolic missions, working in conjunction with the U.S. Indian Office, through which she helped found the Society for the Preservation of the Faith Among Indian Children (or Preservation Society). M.D. Letterhouse's *The Francis A. Drexel Family* appeared in 1939, followed by K. Burton's *The Golden Door: The Life of Katharine Drexel* in 1957.

Dreyer, Carl Theodor (b. Feb. 3, 1889, Copenhagen—d. March 20, 1968, Copenhagen), internationally acclaimed motion-picture director whose most famous films were serious explorations of religious experience, executed in the Danish "static" style that emphasized prolonged, exploratory close-ups at the expense of rapid action.

Dreyer was a pianist, a clerk, a journalist, and a theatre critic before entering the cinema in 1913 as a writer of subtitles. He eventually became a well-known scriptwriter and editor. His first film as a director was *Praesidenten* (1919; "The President"), followed by *Blade af satans bog* (1920; *Leaves from Satan's Book*); *Prästänkan* (1920; *The Parson's Widow*); *Die Gezeichneten* (1922; *Love One Another*); *Der var engang* (1922; *Once upon a Time*); *Mikaël* (1924), filmed in Germany; *Du skal aere din hustru* (1925; *Master of the House*); and *Glomsdalsbruden* (1925; "The Bride of Glomsdal").

Carl Dreyer
By courtesy of the Museum of Modern Art Film Stills Archive, New York

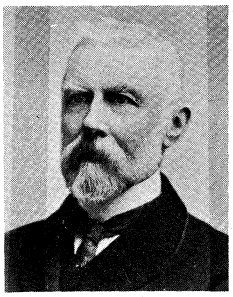
La Passion de Jeanne d'Arc (1928; "The Passion of Joan of Arc"), Dreyer's most famous silent film, was based on the official records of her trial and execution for witchcraft. Filmed in France, it starred Maria Falconetti as the mystically inspired heroine. Dreyer created a new kind of historical drama by using sustained close-ups to establish an intimate relationship between the audience and the characters. The picture earned worldwide critical recognition and came to be considered one of the finest of all silent films.

Dreyer's distinctive directorial style was based on his use of authentically detailed settings and extensive close-ups. The action of his films, centring on an individual who separates himself from the group and thus becomes an object of persecution, usually takes place within a limited geographical area and a short span of time. Slow in tempo with an aura of sombre grimness, his pictures often deal with witchcraft and the supernatural, with the tension between good and evil in even the most ordinary human situations, with the tragedy of puritanical cruelty and repression, and with the power of physical and spiritual love.

Dreyer also directed outstanding sound pictures. *Vampyr* (1932), filmed in France, is based on a story of vampirism by Sheridan Le Fanu; *Vredens dag* (1943; *Day of Wrath*) is a drama of witch-hunting and religious persecution, set in 17th-century Denmark, that won international recognition and substantially contributed to the revival of the Danish cinema; *Två människor* (1945; *Two People*); and *Ordet* (1955; *The Word*), winner of the Grand Prize at the Venice Film Festival, dramatizes the complex relationship between social good and spiritual good in an ambiguous story of a hardworking, down-to-earth farm family who are burdened by the younger son's

insane delusion that he is Christ. Dreyer's last film *Gertrud* (1964), is a subtle character study of a woman to whom love is all important.

Dreyer, Johan Ludvig Emil (b. Feb. 13, 1852, Copenhagen—d. Sept. 14, 1926, Oxford), Danish astronomer who compiled the *New General Catalogue of Nebulae and Clusters of Stars*, published in 1888, and its supplements, published in 1895 and 1908. This



Johan Dreyer, *c.* 1910
Archiv fur Kunst und Geschichte, West Berlin

work, together with the supplements, was republished in 1953; it still remains one of the standard reference catalogs.

In 1874 Dreyer was appointed assistant at the Earl of Rosse's observatory in Parsonstown, County Offaly. Four years later he moved to Dunsink Observatory in Dublin. In 1882 he became director of the observatory at Armagh, Ire.; he retired from this post in 1916. That same year he was awarded the Gold Medal of the Royal Astronomical Society. He later served as the society's president (1923–24).

In addition to his catalogue of nebulae and star clusters, Dreyer published a number of other astronomical works. He wrote a biography of his illustrious countryman, *Tycho Brahe* (1890), and collected and edited all of Tycho's works and correspondence in 15 volumes (published between 1913 and 1929).

Dreyfus, Alfred (b. Oct. 19, 1859, Mulhouse, Fr.—d. July 12, 1935, Paris), French army officer whose trial for treason began a 12-year controversy, known as the Dreyfus Affair, that deeply marked the political and social history of the French Third Republic.

Dreyfus, before 1894
H. Roger-Viollet

Dreyfus was the son of a wealthy Jewish textile manufacturer. In 1882 he entered the École Poytechnique and decided on a military career. By 1889 he had risen to the rank of captain.

Dreyfus was assigned to the War Ministry when, in 1894, he was accused of selling military secrets to the German military attaché. He was arrested on October 15, and on December 22 he was convicted and sentenced to life imprisonment on the infamous penal colony of Devil's Island, off the coast of French Guiana.

The legal proceedings, which were based on insufficient evidence, were highly irregular. Although he denied his guilt and although his family consistently supported his plea of innocence, public opinion and the French press as a whole, led by its virulently anti-Semitic section, welcomed the verdict and the sentence. In particular, the newspaper *La Libre Parole*, edited by Édouard Drumont, used Dreyfus to symbolize the supposed disloyalty of French Jews.

But doubts began to grow. Lieut. Col. Georges Picquart found evidence that Maj. C.F. (Walsin-)Esterhazy was engaged in espionage and that it was Esterhazy's handwriting found on the letter that had incriminated Dreyfus. When Picquart was removed from his post, it was believed that his discovery was too inconvenient for his superiors. The pro-Dreyfus side slowly gained adherents (among them, journalists Joseph Reinach and Georges Clemenceau—the future World War I premier—and a senator, Auguste Scheurer-Kestner).

The affair was made absurdly complicated by the activities of Esterhazy in inventing evidence and spreading rumours, and of Maj. Hubert Joseph Henry, discoverer of the original letter attributed to Dreyfus, in forging new documents and suppressing others. When Esterhazy was brought before a court martial, he was acquitted, and Picquart was arrested. This precipitated an event that was to crystallize the whole movement for revision of Dreyfus' trial. On Jan. 13, 1898, the novelist Émile Zola (*q.v.*) wrote an open letter published on the front page of *Aurore*, Clemenceau's paper, under the headline "J'Accuse." By the evening of that day, 200,000 copies had been sold. Zola accused the army of covering up its mistaken conviction of Dreyfus and of acquitting Esterhazy on the orders of the Ministry of War.

By the time of the Zola letter, the Dreyfus case had attracted widespread public attention and had split France into two opposing camps. The issues were regarded as far exceeding the personal matter of the guilt or innocence of Dreyfus. The anti-Dreyfusards (those against reopening the case), nationalist and authoritarian, viewed the controversy as an attempt by the nation's enemies to discredit the army and saw it as a case of national security against international socialism and Jewry, of France against Germany. The Dreyfusards (those seeking exoneration of Captain Dreyfus) saw the issue as the principle of the freedom of the individual subordinated to that of national security and as republican civilian authority pitted against a military authority that acted independently of the state.

Amid uproar in Parliament, the government was pressed by the nationalists to bring Zola to justice, while anti-Semitic riots broke out in the provinces. A petition demanding revision of the Dreyfus trial was signed by some 3,000 persons, including Anatole France, Marcel Proust, and a host of intellectuals. The trial of Zola began on February 7; he was found guilty of libel and sentenced to a year's imprisonment and a fine of 3,000 francs.

From 1898 to 1899 the Dreyfusard cause gained in strength. Major Henry committed suicide at the end of August 1898, after confessing his forgeries. Esterhazy, in panic, fled to Belgium and London. The confession of Henry opened a new phase in the affair, for it ensured that the appeal of the Dreyfus family for a retrial would now be irresistible.

A new ministry, led by René Waldeck-Rousseau (*q.v.*), took office in June 1899 and resolved to bring the affair to an end at last. Dreyfus, brought back from Devil's Island for retrial, appeared before a new court martial in Rennes (Aug 7–Sept. 9, 1899). It found him guilty, but the president of the republic, in order to resolve the issue, pardoned him. Dreyfus accepted the act of clemency but reserved the right to do all in his power to establish his innocence.

In 1904 a retrial was granted and in July 1906 a civilian court of appeals (the Cour d'Appel) cleared Dreyfus and reversed all previous convictions. Parliament passed a bill reinstating Dreyfus. On July 22 he was formally reinstated and decorated with the Legion of Honour. After further short service in the army, in which he attained the rank of major, he retired to the reserves. He was recalled to active service during World War I and, as a lieutenant colonel, commanded an ammunition column. After the war he retired into obscurity.

The Dreyfus case—or *l'Affaire*, as it came to be called—was an important landmark in the history of the Third Republic and of modern France. From the turmoil of which it was the centre emerged a sharper alignment of political and social forces, leading to such drastic anticlerical measures as the separation of church and state in 1905 and to a cleavage between right-wing nationalists and left-wing antimilitarists that haunted French life until 1914 and even later. On each side were mobilized France's most eminent literary men, and the violent controversy destroyed the cohesion of French life for more than a generation after. A conjunction of mistaken loyalties, repeated stupidities, base forgeries, and excited extremisms inflamed the situation into a national crisis. At best, it evoked a passionate repudiation of anti-Semitism, which did France honour; at worst, it revealed and intensified a chronic internal division that was to be a major source of national weakness.

Dreyfuss, Henry (b. March 2, 1904, New York City—d. Oct. 5, 1972, South Pasadena, Calif., U.S.), U.S. industrial designer noted for the number and variety of his pioneering designs for modern products.

At the age of 17 Dreyfuss was designing sets for stage presentations at a Broadway motion-picture theatre. In 1927 a store commissioned him to study its merchandise from the standpoint of attractiveness and to make drawings indicating improvements that the manufacturers could make. He made the study but refused to undertake the design because he felt that the proper way to approach design was to work directly with the manufacturer from the start rather than to try to improve a design after the product had been made.

He opened his first industrial design office in 1929. At the same time, he was an active and successful designer of sets for the Broadway theatre. In 1930 he began designing for Bell Telephone Laboratories, an association that resulted in the design of a series of telephones. Other notable designs include the interior of Super G Constellation aircraft for the Lockheed Aircraft Corporation and the interior of the ocean liner "Independence."

Dreyfuss designs stress the user of the product. He said that "when the point of contact between the product and people becomes a point of friction, then the industrial designer has failed." His book *The Measure of Man* (1960, rev. ed. 1967) contained extensive data on the human body and its movements. His approach to industrial design is described in his book *Designing for People* (1955, 2nd ed. 1967). From 1963 to 1970 he was associated with the University of California at Los Angeles. On Oct. 5, 1972, Dreyfuss, along with his wife, Doris, died of carbon monoxide poisoning in a car in the garage of their home.

Dreyschock, Alexander (b. Oct. 15, 1818, Zack, Bohemia—d. April 1, 1869, Venice), Bohemian pianist and composer, often compared to Liszt for technical prowess.

Dreyschock, who gave his public debut at the age of eight, went to Prague in 1833 to study with Václav Tomašek. In 1838 he began extensive tours throughout Europe. He became professor of piano at the St. Petersburg Conservatory in 1862, but, unable to bear the climate, he left Russia for Italy in 1868. He died there the following spring.

Dreyschock was particularly known for his brilliant octaves, double sixths and thirds, and solos played by his left hand alone. J.B. Cramer, an English composer and virtuoso, is reported to have exclaimed, "The man has no left hand! Here are two right hands!" Dreyschock primarily performed his own works but did include many classical pieces in his repertoire.

Dreyse rifle, also called NEEDLE GUN, rifle named for its inventor, Nikolaus von Dreyse. It had a long, sharp firing pin designed to pierce the charge of propelling powder and strike the detonating material (usually mercury fulminate) located at the base of the bullet. The Dreyse rifle, invented between 1827 and 1829, was adopted by the Russian Army in 1848. It was replaced by the Mauser in 1871. *See also* rifle.

Driesch, Hans Adolf Eduard (b. Oct. 28, 1867, Bad Kreuznach, Rhine Province, Prussia—d. April 16, 1941, Leipzig), German experimental embryologist and philosopher who was the last great spokesman for vitalism, the theory that life cannot be explained as physical or chemical phenomena.

Driesch

By courtesy of the Ruprecht-Karl-Universitat, Heidelberg, W.Ger.

Driesch was the son of a well-to-do Hamburg gold merchant. For his early education, his father sent him to a prominent humanistic gymnasium that had been founded by a friend of Martin Luther. Driesch's interest in zoology was aroused while he was still a child by the unusual live animals his mother kept in their home.

Following the prevailing custom in Germany, Driesch attended several universities (at Hamburg, Freiburg, and Jena); he studied zoology and also chemistry and physics, which were not usual topics of study at that time for zoologists. He did his doctoral work at Jena under Ernst Heinrich Haeckel, whose main interest was in phylogeny, a special branch of evolutionary theory. But Driesch's own work took a different direction. His doctoral dissertation in 1887 dealt with factors controlling the growth of colonial hydroids.

For the next 10 years Driesch traveled extensively; he also experimented during this period with marine eggs, frequently at the international Zoological Station in Naples. In 1891 he separated the first two cells formed by a dividing sea urchin egg and discovered that each would form a whole larva. A similar experiment had been performed on the frog's egg by Wilhelm Roux in 1888, but with quite different results; each of the first two cells formed only half an embryo, and Roux concluded that the parts of an organism are determined at the two-cell stage. Driesch, however, concluded that the fate of a cell is not determined at the two-cell stage, but by its position in the whole organism. He published his first wholly theoretical monograph that year and, in 1892, speculated that vitalistic interpretations of biological data might be reasonable. His experimental results gave strong impetus to the then new science of experimental embryology.

Driesch made many other less well-known but equally important contributions to embryology. He produced a giant larva by fusing two embryos. By compressing dividing eggs he caused an abnormal distribution of nuclei, thereby proving that the nuclei are all equivalent; this experiment was an important forerunner of modern genetics. He recognized that nuclei and cytoplasm interact and postulated that the nucleus exerts its influence on the cytoplasm by means of ferments, or enzymes. In 1896 he shook sea urchin larvae to displace their skeleton-forming cells and observed the displaced cells return to their original positions. This experiment was the first demonstration of embryonic induction—that is, the interaction between two embryonic parts resulting in differentiation that would not have occurred otherwise—the theoretical aspects of which he had speculated upon in a monograph published in 1894.

By 1895 Driesch was a convinced vitalist. He felt himself driven to this position by his inability to interpret the results of his cell-separation experiments in mechanistic terms; he could not envisage a machine that could divide into two identical machines. Driesch applied the Aristotelian term entelechy to denote a vital agent that could regulate organic development. Although such an agent could not be explained by physical science, he believed that its actions were related to the activity of enzymes, which he recognized as important in development.

In 1899 Driesch married Margarete Reifferscheidt, by whom he had two children, Kurt and Ingeborg, both of whom became musicians. Settling in Heidelberg, he continued to perform embryological experiments until 1909, when he was at last habilitated—the procedure then required to enter the German university hierarchy—in natural philosophy. As a member of the faculty of natural sciences, he held successive professorships of philosophy at Heidelberg beginning in 1912 and transferred to Cologne in 1919 and to Leipzig in 1921. As a philosopher he was strongly influenced by Immanuel Kant, and metaphysics was one of his specialties; logic was another. Perhaps because of his leanings toward vitalism, he also became interested in parapsychology.

Driesch's work was of immediate importance in stimulating the progress of experimental embryology. His experimental and theoretical studies—widely disseminated in his own time though now forgotten—on embryonic induction, enzyme action, and nuclear and cytoplasmic interaction led to work that continues today, but in a less vitalistic framework. In 1935 Driesch was forced into early retirement by the Nazis, but he continued to write until his death. (J.M.O.)

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Drieu La Rochelle, Pierre (b. Jan. 3, 1893, Paris—d. March 16, 1945, Paris), French writer of novels, short stories, and political essays whose life and works illustrate the malaise common among European youth after World War I.

Drieu, the brilliant son of a middle-class family, attended the École des Sciences Politique with the intention of entering diplomatic

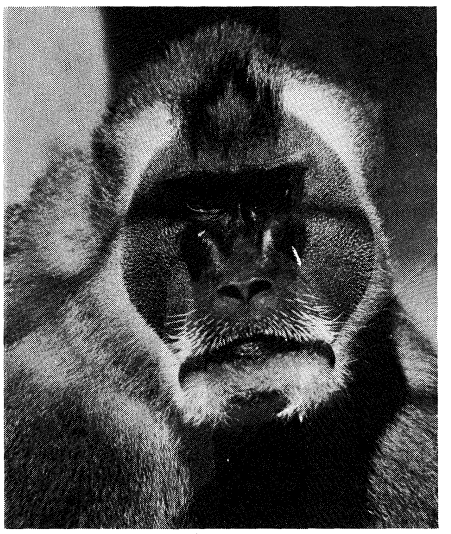
Drieu La Rochelle, 1934

H. Roger-Viollet

service. His plans, however, were interrupted by World War I, in which he fought and was wounded. He—like many others of his generation—emerged from the war disillusioned, and he began a lifelong search for a sound moral and philosophical approach to life. He briefly became involved in the Surrealist movement. Characteristic novels of this period include his first novel, *L'Homme couvert de femmes* (1925; "The Man Covered With Women"), and *Le Feu follet* (1931; *The Fire Within,* or *Will o' the Wisp;* filmed by Louis Malle in 1963). *Le Feu follet* is the story of the last hours in the life of a young bourgeois Parisian addict who kills himself. In one fashion or another, the subject of decadence and the general loss of moral fibre in postwar French society was to remain a subject of major concern throughout his life.

His later works include *La Comédie de Charleroi* (1934; *The Comedy of Charleroi and Other Stories*), a memoir of the war; *Rêveuse bourgeoisie* (1937; "Dreamworld Bourgeoisie"); and, perhaps his best known novel, *Gilles* (1939). Having worked through several political ideologies, Drieu eventually settled on Fascism. He collaborated with the Vichy government during World War II, and, shortly after the liberation of France, he committed suicide. His *Récit secret* (1961; *Secret Journal and Other Writings*) and *Mémoires de Dirk Raspe* (1966) were among a number of his works that were published posthumously.

drill (*Mandrillus leucophaeus*), large, short-tailed monkey, family Cercopithecidae, formerly found from Nigeria to Cameroon. As a result of hunting and deforestation, the drill is an endangered species restricted to remote forest regions of Cameroon. The drill, like the related mandrill (*q.v.*), is sometimes placed in the baboon genus, *Papio.* Like the man-



Drill (*Mandrillus leucophaeus*)

J. Kohler—Bavaria-Verlag

drill, the drill is a stout-bodied, quadrupedal monkey with vividly coloured buttocks. It is, however, smaller (the male is about 82 centimetres [32 inches] long) and has a black face. The lower lip is crimson; the hairs around the face and a tuft behind the ears are yellowish white; and the rest of the fur is olive-brown. The drill is also like the mandrill in being diurnal, omnivorous, mainly terrestrial, and, apparently, gregarious. A powerful animal, it can fight ferociously if molested.

drill, preparation of soldiers for performance of their duties in peace and war through the practice and rehearsal of prescribed movements. In a practical sense, drill consolidates soldiers into battle formations and familiarizes them with their weapons. Psychologically, it develops a sense of teamwork, discipline, and self-control; it promotes automatic performance of duties under disturbing circumstances and instinctive response to the control and stimulus of leaders.

Modern drill is essentially of two types: close-order and extended-order, or combat drill. Close-order drill comprises the formal movements and formations used in marching, parades, and ceremonies. Combat drill trains a small unit in the looser, extended formations and movements of battle.

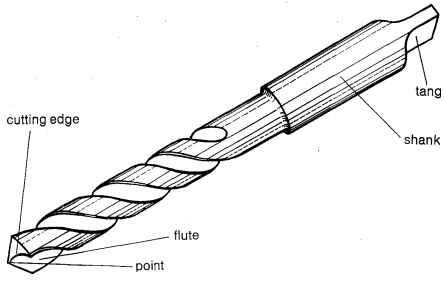
Rudimentary drill appeared in ancient Egypt with the dawn of formal warfare because of the need to assemble and move large numbers of men for battle. Drill in the modern sense was introduced by the Greeks, who periodically practiced the maneuvers of the phalanx; the Spartans carried disciplined drill to an extreme unequalled by their contemporaries. Philip II of Macedonia and Alexander III the Great further improved the phalanx and its drill. The careful training of the legions contributed largely to Roman domination of the Mediterranean world for almost a thousand years. After Rome's decline, military drill almost disappeared as warfare degenerated into undisciplined melees and individual dueling. Two notable exceptions were the well-trained professional armies of Byzantium and the disciplined cavalry formations of Genghis Khan and his successors.

Gustavus II Adolphus of Sweden accelerated a gradual revival of skill in European warfare early in the 17th century. His introduction of simplified drill techniques for the use of improved weapons was copied by all Europe. By the end of the 17th century, France led in the development of modern standing armies, largely because of a drill system devised by Louis XIV's inspector general of infantry, Jean Martinet, whose name became a synonym for drillmaster. To make effective use of inaccurate muskets, concentrated volleys had to be delivered at short range. Troops advanced in rigidly maintained battle lines, all firing simultaneously on command. Through ceaseless drill, the Prussian Army of Frederick II the Great achieved a mechanical perfection in these tactics. At Valley Forge during the American Revolution, Baron von Steuben, a German officer who helped train American troops, adapted Prussian techniques into a less rigid drill system fitted to the American character and to conditions of warfare in the New World.

Exact parade ground maneuvers on the battlefield disappeared in the 19th century because of improvements in the range and accuracy of weapons. This trend began during the American Civil War, when soldiers had to be trained to spread out, take cover, and dig entrenchments. It was hastened later by the introduction of the machine gun and quick-firing artillery. Close-order drill, however, was retained not only because it had value for ceremonies and for moving large bodies of men on foot but also because it provided a psychological foundation of teamwork and discipline without which combat drill is impossible.

drill, cylindrical end-cutting tool used to originate or enlarge circular holes in solid material.

Usually, drills are rotated by a drilling machine and fed into stationary work, but on other types of machines a stationary drill may be fed into rotating work or drill and work may rotate in opposite directions. To form the two cutting edges and to permit the admission of a coolant and the ejection of chips, two longitudinal or helical grooves or flutes



Parts of a twist drill

are provided. The point, or tip, of a drill is usually conical in shape, and it has cutting edges where the flutes end. The angle formed by the tapering sides of the point determines how large a chip is taken off with each rotation of the drill. The degree of twist of the helical flutes also affects the drill's cutting and chip-removal properties. For general-purpose twist drills the helix angle is about 32°. The angle formed by the two sides of the tapering point is 118° for standard drills, while for drilling tough metals, a flatter point with a 135° angle is recommended. The peripheral portion of the drill body not cut away by the flutes is called the land, and to reduce friction and prevent the land from rubbing against the sides of the hole, most of the land is cut away, leaving a narrow ridge called the margin that follows the edge of the side of the flute that forms the cutting edge. The fluted part, or body, of a drill is either hardened high-carbon steel or high-speed steel; other drills have inserts of cemented carbide to form cutting edges or are made from sintered-carbide rods. The shanks of twist drills are either straight or tapered and when not integral with the body are made from low-carbon steel and welded to the body. Straight-shank drills must be gripped in a chuck; tapered shanks fit with a sticking taper in matching holes in the machine and are driven partly by the taper and partly by a tang that fits in a slot in the machine. For enlarging cored, punched, or drilled holes, core drills are particularly suited. These have three or four flutes, and because the cutting edges do not extend to the centre of the drill, they cannot originate holes in solid materials. Cutting is accomplished by a chamfered edge at the end of each flute. *See also* auger.

drill press, also called DRILLING MACHINE, device for producing holes in hard substances. The drill is held in a rotating spindle and is fed into the workpiece, which is usually clamped in a vise resting on a table. The drill may be gripped in a chuck with three jaws that move radially in unison, or it may have a tapered shank that fits into a tapered hole in the spindle. Means are always provided for varying the spindle speed and on some machines for automatically feeding the drill into the workpiece.

Drill presses for occasional use in general-purpose machine shops usually have only one spindle. For drilling several holes successively or simultaneously in a workpiece, machines with multiple spindles are available. When large quantities of identical mechanical components are required, special-purpose drilling machines, with spindles arranged in a variety of positions relative to the workpiece, can be constructed. Although drill presses are used mainly for drilling holes, they can also be used for enlarging holes with a boring tool or finishing holes with a reamer. With the aid of a special tapping attachment and a tap, they can produce threads in a hole. *See also* boring machine.

drilling machinery, equipment used to drill holes in the ground for such activities as prospecting, well sinking (petroleum, natural gas, water, and salt), and scientific explorations. Drilling holes in rock to receive blasting charges is an operation in tunneling, mining, and other excavating.

Most modern drilling machines are either percussive (chipping rock or ground intermittently by impact) or rotary (involving a cutting or grinding action). A combined rotary-percussive drill uses both types of action when the hardness of the stratum warrants it.

The simplest rotary drill is the earth auger, which is hand-operated and resembles the wood auger used in carpentry. The earth auger, used principally for drilling holes in relatively soft earth, is armed with either a spiral drill or a pod-type drill and is attached to a shaft by a socket joint. Successive sections are added to the shaft as the hole deepens.

Rotary drilling may be adapted for use at any angle and is suitable for underground mining. In most rotary drilling, hollow rods of steel provide circulation of cooling water or other fluid. There are three kinds of rotary drill bits: (1) drag bits, which cut the rock with two, three, or four wings, sometimes tipped with tungsten carbide, and are used mostly in soft rock; (2) roller bits, which operate with a crushing action by means of wedge-shaped teeth and are used for harder rock; (3) diamond bits, which grind away the rock. The coring-type diamond bit makes an annular hole, the core of which provides a sample cross section of the strata penetrated, and is used for prospecting.

Percussive drilling is slower than rotary drilling but has a number of special applications, such as for shallow holes. In percussive drilling, blows are applied successively to a tool attached to rods or a cable, and the tool is rotated so that a new portion of the face is attacked at each blow.

Another simple percussive drill consists of one or more lengths of wrought-iron pipe open at both ends, driven by a heavy hammer or, for larger holes, a light pile driver. A second cylinder is sunk inside the first, and water is pumped down the inner pipe to loosen soil and raise debris. For deep boring, rotary drilling has replaced these methods.

Long after the rock drill was invented, manual drilling by two men was still usual in mining operations. One man turned the drill, while the second swung the hammer. Most advances in drilling machinery have been developed by tunnelers. The driving of two particular tunnels, the Mont Cenis (Fréjus) tunnel, between France and Italy, and the Hoosac tunnel, in Massachusetts, U.S.—both driven during the 1850s and '60s—produced a great number of innovations in rock-drilling equipment, most notably the compressed-air drill.

The first patented rock drill was invented in 1849 by J.J. Couch of Philadelphia. Its drill rod passed through a hollow piston and was thrown like a lance against the rock; caught on the rebound by a gripper, it was again hurled forward by the stroke of the piston. A notable development was a hammering-type rock drill for overhead drilling devised by C.H. Shaw, a Denver machinist, before 1890. Cuttings dropped out by gravity. This machine was called a stoper when it was used in Colorado and California mines. A pneumatic feed held the machine in place and fed the steel into

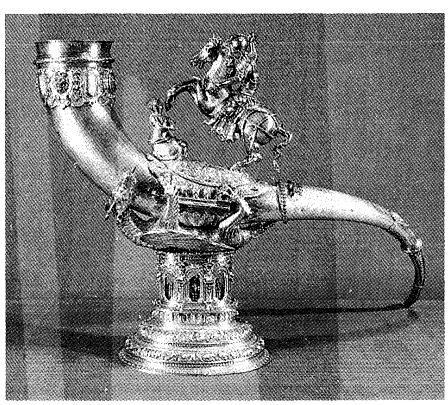
the rock. These two developments, hammering action and air-leg feed, became important in modern machines. The problem of removing the cuttings from horizontal drill holes was eventually solved by the invention of the hollow drill with an air channel for blowing compressed air into the bottom of the hole.

Modern rock drills are commonly mounted on large rigs to bore many holes at one time; the Mont Blanc Tunnel between France and Italy (1960s) was the first tunnel the entire diameter of which was drilled and blasted in a single operation. At the opposite end of the scale, lightweight pneumatic rock drills have also found wide favour in mining and certain tunnelling operations. The chief prototype is that designed by Eric Ryd of Sweden, employing a tungsten carbide bit.

drilling mud, mixture of clay, usually bentonite, and water used primarily in oil, gas, and water-drilling operations to carry rock cuttings to the surface and also to lubricate and cool the drilling bit. Special chemicals are added to the mud to compensate for the varying composition of the water and the formation being drilled and to increase the weight of the column. The drilling mud, by hydrostatic pressure, also helps prevent the collapse of unstable strata into the hole and the intrusion of water from water-bearing strata that may be encountered.

Drina River, river in Yugoslavia, originating with the confluence of the Tara and Piva rivers and following a 215-mi (346-km) course, mainly northward, to enter the Sava. Its upper course is through canyons and gorges, while its lower course is wider. The Drina is entirely within Bosnia and Hercegovina, though it forms the boundary with Serbia for part of its length. Two large man-made lakes, at Bajina Bašta and Zvornik, supply the power for hydroelectric stations. The Drina Basin, taking in 7,556 sq mi (19,570 sq km), has the highest hydroelectric potential of all the river systems within Yugoslavia. The upper Drina and tributaries are noted for freshwater fishing. Major cities are Višegrad and Zvornik, site of a hydroelectric plant; the former is the locale of the historical novel *Na Drini ćuprija* (1945; *The Bridge on the Drina,* 1959) by Yugoslav writer Ivo Andrić, winner of the Nobel Prize for Literature in 1961.

drinking horn, ceremonial vessel usually made from the horn of an ox or a buffalo or



Silver drinking horn of the Guild of St. George, 1566; in the Rijksmuseum, Amsterdam

By courtesy of the Rijksmuseum, Amsterdam

the tusk of an elephant, with mounts of metal. The earliest drinking horns date from around the early 7th century. The drinking horn was largely replaced by other, more suitable vessels in the 16th century, but isolated examples were made later.

drinking song, song on a convivial theme composed usually for singing in accompaniment to drinking. The form became a standard element in certain types of 19th-century opera and operetta, frequently involving not only a soloist but also a chorus joining in with choral repeats or refrains. In Italy the drinking song is known as *brindisi* (Italian: "toast"). In Giuseppe Verdi's operas drinking songs range from the cheerful "Libiamo" ("Let Us Drink") in *La traviata* (1853), to Iago's foreboding toast in *Otello* (1887).

As a result of the European example of Johann Strauss, Jr., and other composers of light opera and operetta, the drinking song became a staple item in American musical plays to the point where in the 1920s John Philip Sousa testified before the United States Congress against prohibition on the grounds that it adversely affected the American musical theatre because it deprived the drinking song of its traditional social motivation.

Articles are alphabetized word by word, not letter by letter

Drinkwater, John (b. June 1, 1882, Leytonstone, Essex, Eng.—d. March 25, 1937, London), English poet, playwright, and critic, remembered as a typical man of letters of the

Drinkwater, portrait by J.W. Thompson, 1935; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Georgian age of the 1910s and 1920s. He was a successful promoter of repertory theatre in England and the author of popular chronicle dramas. In 1907 he became manager and producer for the Pilgrim Players, which developed into the Birmingham Repertory Theatre Company. He published several volumes of verse (including *The Collected Poems,* 2 vol., 1923); critical studies (*William Morris,* 1912; *Swinburne,* 1913; and others); and several historical plays, of which *Abraham Lincoln* (1918) was produced with great success both in London and in the U.S. His autobiography appeared in *Inheritance,* 2 vol. (1931) and *Discovery* (1932).

dripstone (architecture): *see* hoodmold.

drive, in psychology, an urgent basic need pressing for satisfaction, usually rooted in some physiological tension, deficiency, or imbalance (*e.g.,* hunger and thirst) and impelling the organism to action. Some researchers have used the term need synonymously, although others distinguish between need as the deprived state and drive as its psychological manifestations (*e.g.,* tension and restless or goal-directed activity). Psychologists also distinguish between drives that are innate and directly related to basic physiological needs (*e.g.,* food, air, and water) and drives that are learned (*e.g.,* drug addiction). Among the other drives or needs that have been proposed are achievement, activity, affection, affiliation, curiosity, elimination, exploration, manipulation, maternity, pain avoidance, sex, and sleep.

In the 1940s U.S. psychologist Clark Hull proposed a drive-reduction theory of learning. In its simplest form, the theory claimed that no learning occurred unless a drive produced tension and impelled the organism into activity to procure a reward that would reduce the drive and satisfy its related physiological need. Later research suggests, however, that learning may also occur in the absence of any drive. *See also* motivation.

driver ant, African member of the insect subfamily Dorylinae (family Formicidae; order Hymenoptera) characterized by a nomadic existence alternating with quiet, egg-laying periods. These ferocious ant colonies, when in the nomadic stage, move to a new spot each day.

Using their powerful cutting jaws, driver ants attack everything in their path, including snakes, birds, mammals, and even human beings. Their systematic search for prey involves climbing into trees and shrubs. The African driver ant is similar to the New World army ant (*Eciton*). *See* ant.

driving and coaching, art or sport of controlling and directing draft animals from a coach or other conveyance to which they are harnessed. The animal most commonly employed is the horse, but the mule, ass, ox, reindeer, and dog have been, and still are, used in some areas of the world.

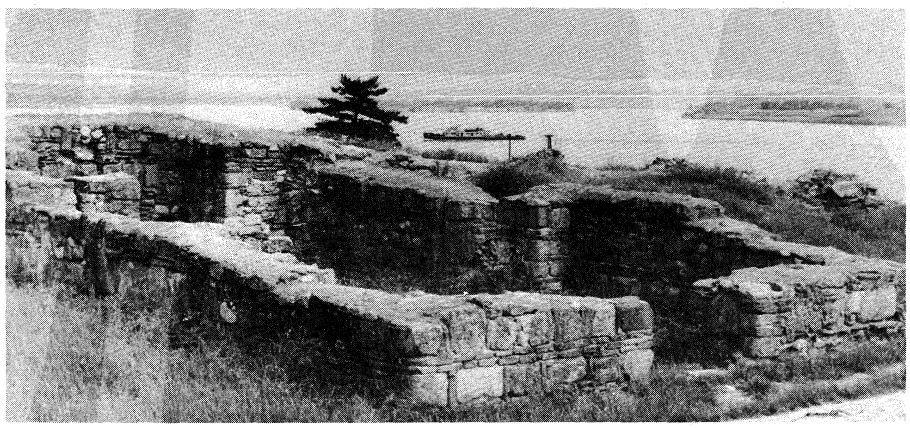
Only at the end of the 18th century did the construction of better roads and the invention of springs for carriages make driving at all pleasurable. By the beginning of the 19th century the art of coachbuilding had reached a high degree of perfection, and driving as a pastime became fashionable. Even up to World War I there were stagecoaches running in and out of London. On July 13, 1888, J. Selby performed the celebrated feat of driving the "Old Times" coach from London to Brighton and back in 7 hours 50 minutes, averaging 13.79 miles per hour (with 8 teams and 14 changes). A number of driving clubs existed in England in the 19th century: the Benson Driving club from 1807 to 1854; the Richmond club from 1838 to 1845; and the Four-in-Hand Driving Club from 1850 to 1926. The Coaching Club was founded in 1870 and survives; in 1958 the British Driving Society was formed to encourage people who wish to drive horses for pleasure. In the United States, the Coaching Club, founded in 1875, held its last extended drive in 1916 but continued in existence, establishing the Coaching Club American Oaks, an annual stake race for three-year-old fillies, at Belmont Park, first held in 1917. Driving and coaching exhibitions are included in many horse shows such as the Richmond Royal and Royal International horse shows in England, and in some of the larger U.S. shows.

The number of horses driven is usually one, two, or four. When two horses are used they may either be placed side by side in double harness, or, less commonly, one following the other in a tandem. Four horses, or a four-in-hand, are harnessed in two pairs, one following the other, and called, respectively, the leaders and the wheelers. Three horses, two wheelers and a single leader, are known as a unicorn team. In Russia and Hungary three horses are driven abreast, the centre horse trotting and the outside horses galloping; such a team is known as a troika.

driving wagon: *see* bike wagon.

drizzle, very small, numerous water drops that may appear to float while being carried by air currents; drizzle drops generally have diameters between about 0.2 and 0.5 millimetre (0.008 and 0.02 inch). Smaller ones are usually cloud or fog droplets, while larger drops are called raindrops. Drizzle often is accompanied by fog but differs from it because drizzle drops fall to the ground. Drizzle commonly falls from stratus clouds. *See also* rain.

Drobeta-Turnu Severin, city, capital of Mehedinţi *judeţ* (district), southwestern Romania, an important inland port on the Danube near the point where the river leaves the Iron Gate. The original settlement was mentioned by the 2nd-century Greek geographer Ptolemy of Alexandria as Drobeta, a Dacian town made into a castrum by the Romans. The name Turnu Severin, meaning Tower of Severus, came from a tower built to commemorate a victory by the 2nd- and 3rd-century emperor Septimius Severus. The vestigial piers of the Roman bridge—built across the Danube for Emperor Trajan by Apollodorus of Damascus in the 2nd century—can be seen at low water. The Iron Gates Museum contains a model of the bridge. Other architectural ruins are those of the castrum built to guard the bridge, the baths and palaestra, and the remains of a 13th-century church and citadel. The town lapsed until 1833, when the inhabitants of nearby Cerneţi were permitted to evacuate their village, which had been set on fire by the Turks in 1828, and move to Turnu Severin. The city was joined with Drobeta in the 1970s.



Ruins of the Roman *castrum,* Drobeta-Turnu Severin, Romania

By courtesy of Editura stiintifica si enciclopedica, Bucharest

After World War II the city grew rapidly. A small prewar shipyard was expanded and merged with the railway shops to form the Mechanical Works for Naval Engineering and Railway Wagons. Meat- and food-processing factories and timber mills were constructed. The city is also the centre for tourist excursions to the Iron Gate and the Cazane Gorges. Pop. (1982 est.) 82,558.

Droeshout, Martin (b. *c.* April 1601, London—d. *c.* 1650), engraver, primarily remembered for his engraved portrait of William Shakespeare, which appeared in the First Folio edition of Shakespeare's plays (1623).

The son of Michael Droeshout, he was probably the pupil of his father and of his elder brother John, both engravers. The Shakespeare engraving was eulogized by Ben Jonson and called true to life. Since the engraver was only 15 years old at the time of Shakespeare's death, the portrait was probably not done from life. Among Droeshout's more successful mature works are several other portraits, book decorations, and allegorical, mythological, and satirical subjects.

Drogheda, Irish DROICHEAD ÁTHA (Bridge of the Ford), urban district and seaport on the southern border of County Louth, Ireland, on the River Boyne about 4 mi (6.5 km) from its mouth. Drogheda was a stronghold and trading post of the Norsemen (8th–11th centuries) and of the Anglo-Normans (12th century). Two towns grew up, one on either side of the river; they received separate incorporation in 1228 but were combined by charter in 1412. In the reign of Edward III it was a staple town (by royal fiat a trade and export centre), and several medieval parliaments met there. In 1649 it fell to Oliver Cromwell, and its inhabitants were massacred. It ceased to be a parliamentary borough in 1885 and a county of itself in 1898.

The remains of the ancient fortifications comprise the St. Lawrence Gate and the West Gate. Other remains are the tower of a Dominican friary (founded 1224) and the arch of an Augustinian abbey (founded 1206). In St. Peter's Church, a shrine contains the embalmed head of the archbishop of Armagh, St. Oliver Plunket, who was martyred in London in 1681. Industry includes linen and cotton mills, coach-building works, flour mills and sawmills, a brewery, a large cement works, and the manufacture of asbestos, pipes, fats, soaps, medical equipment, and agricultural machinery.

Drogheda is the centre for the Boyne salmon fishing, and agricultural produce and coal are traded by sea. Pop. (1981) 23,247.

Drogo DE HAUTEVILLE, Italian DROGO, or DROGONE, D'ALTAVILLA, French DREU DE HAUTEVILLE (b. Hauteville-la-Guichard, Normandy—d. Aug. 10, 1051, Monte Ilario, Salerno), count of Apulia (1046–51), half brother of Robert Guiscard. He led the Norman conquest of southern Italy after the death of his older brother William Iron Arm, whom he succeeded as count of Apulia.

Arriving in Italy (*c.* 1035) with William and his younger brother Humphrey, Drogo fought first for the Byzantines against the Muslims in Sicily, then in alliance with the Lombards in Apulia in Italy against the Byzantines. In 1042 the Lombard prince Gaimar V of Salerno made William count of Apulia and distributed the territories of Apulia among the Normans, giving Venosa, 80 miles (nearly 130 kilometres) east of Naples, to Drogo. When William died in 1046, Drogo succeeded him as count of Apulia, marrying Gaimar's daughter. Drogo's title was confirmed four years later by the Holy Roman emperor Henry III. Drogo was assassinated, along with several of his followers, in an anti-Norman conspiracy as he entered the chapel of his castle at Monte Ilario to attend a mass on St. Lawrence's Day, 1051.

Drogobych, also spelled DROGOBYČ, city, Lvov *oblast* (administrative region), Ukrainian Soviet Socialist Republic, and until 1959 the administrative centre of its own *oblast.* It was known in the 11th and 12th centuries for its salt. It is now a mining centre for petroleum, natural gas, potassium, and magnesium, and there are oil-refining, machine-building, and diverse light industries. Drogobych has a teacher-training institute. Pop. (1982 est.) 70,000.

Droichead Átha (Ireland): *see* Drogheda.

Droichead na Bandan (Ireland): *see* Bandon.

Droichead na Banna (Northern Ireland): *see* Banbridge.

Droim Mór (Northern Ireland): *see* Dromore.

droit du seigneur (feudal practice): *see* seigneur, droit du.

Droitwich, parish (town), Wychavon district, county of Hereford and Worcester, England. The older portion of the town lies on the River Salwarpe, a tributary of the River Severn; the modern town lies on higher ground.

Droitwich is famous for the salt obtained from its brine springs, or wyches, to which it probably owes its name and pre-Norman origin. In medieval times the springs belonged to the kings; the town's first royal charter (1215) was granted in return for a yearly rental of £100 for the springs. The health resort became more important than salt manufacturing in 1830, when the brine was used to treat rheumatic diseases. The salt industry finally left in 1922. Besides the St. Andrew's Brine Baths with their clinics, there are hospitals and convalescent homes.

In the old town are many half-timbered houses. Droitwich's light industries produce heating appliances, metal and plastic goods, and food products. Pop. (1981 prelim.) 18,073.

droll, in full DROLL-HUMOUR, or DROLLERY, short comic scene or farce adapted from an existing play or created by actors, performed in England during the Commonwealth period (1642–60) while the London theatres were closed down by the Puritans. Because stage plays were prohibited at this time, actors developed other, shorter means of entertainment to circumvent the restrictions, performing drolls in inns and at fairs on improvised stages.

Robert Cox was the leading performer of drolls, and his repetoire included "The Merry Conceits of Bottom the Weaver" from *A Midsummer Night's Dream* and "The Bouncing Knight, or The Robbers Rob'd" from *Henry IV, Part I.* Other subjects of drolls were Falstaff, the grave-diggers' scene in *Hamlet,* and, occasionally, biblical adaptations. Francis Kirkman published a collection of 26 drolls in 1662 titled *The Wits; or, Sport upon Sport.*

Drôme, *département,* Rhône-Alpes region, southeastern France, formerly part of the historic provinces of Dauphiné and Provence (*qq.v.*). Bordered for more than 70 mi (111 km) by the Rhône River, on which Valence (*q.v.*), its capital, is situated, Drôme has an area of 2,519 sq mi (6,525 sq km). The Drôme and Isère rivers and other tributaries of the Rhône flow through the *département.* The eastern part of the *département* is mountainous and well wooded, the farthest outlying of the Pre-Alps of Vercors (bordered by an abrupt ridge of limestone), Diois, and Barronies. In the west the river valleys are well sheltered. France's main motorway, the Autoroute du Sud, passes through Drôme along the east bank of the Rhône.

In the basins of the Valence and Montélimar, despite the winds of the mistral (a cold seasonal wind blowing from the north), there is cultivation of grains and of fruits. The raising of silkworms and the spinning of silk, once major industries, ceased about the beginning of the 20th century because of competition with Chinese and Italian suppliers. Nevertheless, natural silk is still imported for weaving, both alone and with synthetic fibres, in some of the small cities of the *département.* Good wines (Côtes-du-Rhône, Hermitage) are produced, and Montélimar is famous for its nougat. France's most important nuclear generating station is situated in Pierrelatte in the Rhône Valley south of Montélimar. Drôme is noted for its picturesque towns and villages including Grignan, Dieulefit, and La Garde-

Adhémar. In Nyons a 14th-century bridge crosses the Aigues. The *département* has three *arrondissements*—Valence, Die, and Nyons—and is in the educational division of Grenoble. Pop. (1982) 389,781.

Dromore, Irish DROIM MÓR, town, Banbridge district (established 1973), formerly in County Down, Northern Ireland, on the River Lagan, just southwest of Belfast. A bishopric developed from an abbey reputedly founded there by a St. Colman *c.* 600. The town and cathedral were destroyed in an insurrection (1641). The present structure was built by the Anglican bishop Jeremy Taylor in 1661. Chief industries in the market town are bleaching, cloth dyeing, and hemstitching. The 8th- or 9th-century Cross of Dromore, formerly in the marketplace, was restored and reerected beside the Lagan Bridge in 1887. Pop. (1971) 2,316.

drone, French BOURDON, in music, a sustained tone, usually rather low in pitch, providing a sonorous foundation for a melody or melodies performed at a higher pitch level; also an instrumental string or pipe producing such a sustained sonority—*e.g.*, the drone strings of a hurdy-gurdy or the three drone pipes of a bagpipe. A drone may be continuous or intermittent, and an interval, as a rule the fifth, often replaces the single-pitch drone.

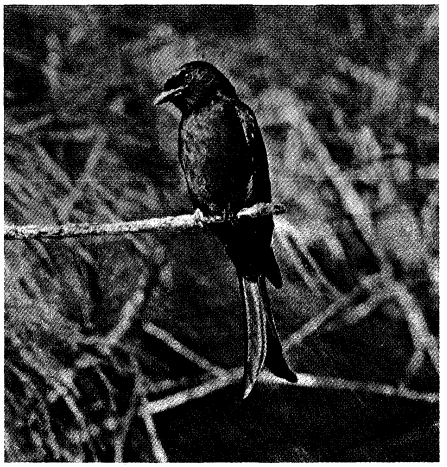
Use of drone instruments was popular in antiquity, as evidenced by their appearance on ancient bas-reliefs. Drones occur widely both in vocal and in instrumental folk music, particularly European. Balkan singers frequently sustain a drone against a sung melody. Various instruments have drones built into them, contributing to the characteristic sound of the instrument—*e.g.*, the launeddas, a Sardinian triple clarinet; the Appalachian dulcimer; the five-string banjo; and the vielle, the medieval troubadours' fiddle. Twentieth-century folk fiddlers often bow open strings to drone beneath the melody played on a neighbouring string. In the art music of India, the drone played on the tamboura sounds the two predominant notes of the raga (the melodic pattern developed by the soloist), producing a framework in which the raga is heard.

A pedal point (*q.v.*) is a drone used in the context of European harmony of the 17th to the 19th century. French music savoured the particular flavour of the bourdon as early as the Notre-Dame organa of the 12th and early 13th centuries. In the France of Louis XIV and his immediate successors, a nobility alienated from manual labour and the soil fancied itself closer to nature as it practiced the quasi-rural musette, a bagpipe made of velvet and ivory; the composers François Couperin (1668–1733) and Jean-Philippe Rameau (1683–1764), among others, wrote a number of drone pieces for the harpsichord.

As for the organ, bourdon stops sounding an octave below the notated pitch soon became standard for the pedal board. Thus, the term bourdon is sometimes used to denote the kind of pedal point that, in the context of 18th- and 19th-century functional harmony, seemed particulary suited to harnessing polyphonic energies, especially as generated in the fugues of J.S. Bach.

drongo, family name DICRURIDAE, any of 20 species of Old World woodland birds (order Passeriformes), often with forked tails. Drongos frequently attack much bigger birds (*e.g.*, hawks and crows) that might hurt their eggs or young; innocuous birds (such as doves and orioles) nest near drongos and thereby gain protection.

Most drongos are 18 to 63.5 centimetres (7 to 25 inches) long and glossy black, sometimes with white on the head or underparts (sexes alike); the eyes, in most, are fiery red. Some are crested or have head plumes, and the tail is usually long and forked, with out-turned corners. The tail of the Southeast Asian racket-tailed drongo (*Dicrurus paradiseus*) bears 30-cm (12-in.) "wires"—outer feathers that are unbranched for most of their length and carry rather large vanes at the ends.



African drongo (*Dicrurus adsimilis*)
A.J. Deane

Drongos range from Africa to central Asia, Australia, and western Pacific islands, inhabiting forest, open country, and gardens. They feed like flycatchers or shrikes, taking large insects and termites. Their voices are loud mixtures of harsh and sweet sounds; some species, like the racket-tail, are good mimics. The nest is a flimsy basket that seems too small for the brooding bird.

One of the commonest birds of southern Asia is the 33-cm (13-in.) black drongo (*D. macrocercus*), also called king crow because it can intimidate the true crow. The 24-cm (9 1/2-in.) African drongo (*D. adsimilis*; perhaps the same as *D. macrocercus*) is common throughout sub-Saharan Africa.

drop cut, method of faceting gemstones into a pear shape suitable for pendants, earrings, and other jewelry. A pendeloque is a pear-shaped modification of the round brilliant cut used for diamonds. A briolette is an elongated, pear-shaped stone covered with bands of triangular or rectangular facets, usually with a pointed end and without a girdle.

drop-leaf table, table with one or two hinged leaves supported by hinged legs, arms, or brackets. An early 17th-century form is the gateleg table, which was followed by two later English forms—the Pembroke table and its more elongated version, the sofa table, which dates from about the 1790s. The sofa table could be drawn up to a sofa and was long enough for two people to sit at, side by side. It had a flap at either end, each supported on a hinged bracket. The top rested on a pair of decorative trestles, or braced frames, composed, for example, of two uprights on a horizontal support, terminating in a pair of outward-curving feet.

Mahogany drop-leaf dining table, New York, third quarter of the 18th century; in the Albany Institute of History and Art, Albany, N.Y.
By courtesy of the Albany Institute of History and Art, Albany, N.Y.

Regency sofa tables were often supported on a single centre pedestal resting on a platform that had four outward-curving feet terminating in brass lions' paws. The butterfly table is a late 17th-century American type whose name derives from its shape when fully extended. The simplest form of drop-leaf table is the bracket table, a small side table fixed to the wall and supported by a bracket.

Droseraceae, family of perennial and sometimes annual flowering plants commonly known as sundews (*see* sundew), within the order Nepenthales. The leaves are usually in a basal rosette, and both leaf surfaces are generally covered with sticky gland-tipped hairs and sensitive tentacles that entrap insects. About 100 species, worldwide in distribution, are known.

Drost, Aernout (b. March 15, 1810, Amsterdam—d. Nov. 5, 1834, Amsterdam), Dutch writer whose historical novels were the first important works of the 19th-century Romantic movement in The Netherlands. His passion for history had considerable effect on many of his contemporaries and successors.

Drost's first novel, *Hermingard van de Eikenterpen* (1832), portraying the conversion of a Germanic woman to Christianity in 4th-century Holland, gave him scope for the development of his Romantic ideals and religious concepts. Drost's career was short; he died at the age of 24. Of his other main works, published posthumously under the title *Schetsen en verhalen* (1835–36; "Sketches and Stories"), the most important is *De pestilentie te Katwijk* ("The Plague at Katwijk"), in which the influence of the Baroque masters Joost van den Vondel and Pieter Corneliszoon Hooft is evident. The dialogue is full of 17th-century expressions, and the story as a whole shows Drost's intense admiration of his country's "great forefathers." Drost's founding of the journal *De muzen* (1832; "The Muses"), precursor of *De nieuwe gids* ("The New Guide"), was a significant step toward the later Dutch literary revival.

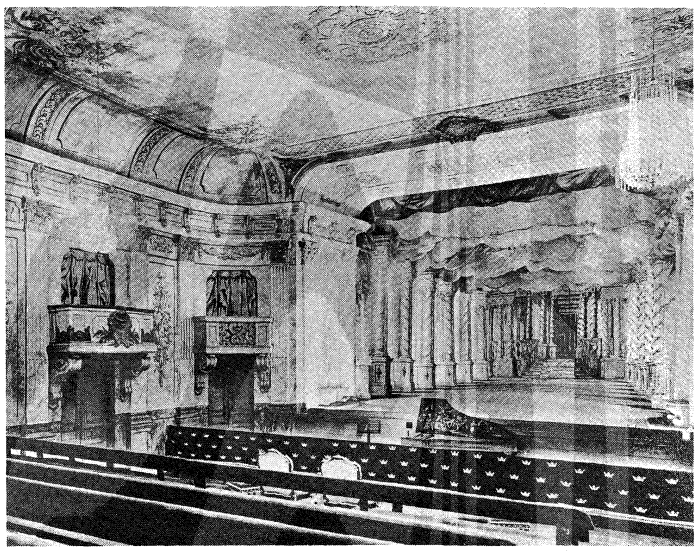
Droste-Hülshoff, Annette, Freiin von (baroness of), original name ANNA ELISABETH FRANZISKA ADOLPHINE WILHELMINE LOUISE MARIA, FREIIN VON DROSTE ZU HÜLSHOFF (b. Jan. 10, 1797, Schloss Hülshoff, near Münster, Westphalia—d. May 25, 1848, Meersburg, Baden), one of the great women poets of Germany, author of prose tales that are considered the forerunner of the 19th-century realistic short story.

Born into a family of Catholic aristocracy, she was educated by tutors and lived most of her life in isolation. She owed her introduction to literature to a young novelist, Levin Schücking (1814–83), for whom, despite their difference in age, she developed a deep, suppressed, and unreciprocated passion. Her first collection of poetry, *Gedichte* (1838; "Poems"), included poems of a deeply religious nature. Between 1829 and 1839 she wrote a cycle of religious poems, *Das geistliche Jahr* (1851; "The Spiritual Year"), which contains some of the most earnest religious poetry of the 19th century and reflects the inner turbulence and doubt of her spiritual life.

Her fame rests chiefly on her poetry dealing with her native Westphalian landscape. An extremely sensitive and acute observer, she created detailed and evocative descriptions of extraordinary poetic beauty, capturing the atmosphere of her homeland, particularly its gloomy heaths and moorlands. Her only complete prose work, a novella, *Die Judenbuche* (1842; *The Jew's Beech*), is a psychological study of a Westphalian villager who murders a Jew. For the first time in German literature,

the fate of the hero is portrayed as arising from his social environment; the crime becomes understandable within the context of the life in the village.

Drottningholm Theatre, 18th-century court theatre of the Royal Palace of Drottningholm near Stockholm. It is preserved with its original sets and stage machinery as a theatrical museum. Built in the 1760s by the architect Carl Fredrik Adelcrantz, it was the home of



Interior view of the Drottningholm Theatre, built by Carl Fredrik Adelcrantz, 1766, depicted after its restoration in 1921

By courtesy of the Drottningholms Teatermuseum, Sweden

several French and Swedish acting companies and prospered especially during the enlightened reign of the playwright-king Gustav III (ruled 1771–92). After the King's death it was used as a storeroom. This fortunate neglect resulted in its preservation. In 1921 it was cleaned and restored. Among the items preserved are Baroque scenery designed by Carlo Bibiena and Louis-Jean Desprez and some stage machinery in working condition, such as a device for simulating waves designed according to Nicola Sabbatini's theatre manual of 1638. The theatre is now used for operas in the summertime.

Drouais, Jean-Germain (b. Nov. 25, 1763, Paris—d. Feb. 13, 1788, Rome), historical painter who was one of the leading early Neoclassicists in France.

Drouais's father, François-Hubert Drouais (1727–75), and his grandfather, Hubert Drouais (1699–1767), were well-known portrait painters. Jean studied first under his father, then under N.-G. Brenet, and finally under Jacques-Louis David, whom he accompanied to Rome. There he was influenced by ancient art and by Raphael. Goethe, who was at Rome when Drouais's "Marius at Minturno" was finished, has recorded the deep impression made by the picture. The last picture he completed was "Philoctetes on the Island of Lemnos."

Drouet, Jean-Baptiste (b. 1763, Sainte-Menchould, Fr.—d. April 11, 1824, Mâcon), French revolutionary, chiefly remembered for his part in the arrest of Louis XVI at Varennes.

He grew up and lived in the town of Sainte-Menchould in Champagne, where his father had been postmaster. There, the carriages conveying Louis XVI and his family on their flight to the frontier stopped at his door on the evening of June 21, 1791; and the passengers were recognized by Drouet, who took steps which led to their arrest on reaching Varennes. For this service he declined a reward. In September 1792 he was elected deputy of the Convention. He voted the death of the king without appeal, showed implacable hostility to the Girondins and proposed the slaughter of all English residents in France. He was captured by the Austrians at the siege of Maubeuge in Hainault (1793) and imprisoned at Spielberg in Austria until the close of 1795. He then became a member of the Council of Five Hundred and was named secretary. Drouet was implicated in the conspiracy of Babeuf (1796) and was imprisoned, but he escaped to Switzerland and then to Teneriffe. There he took part in the resistance to Horatio Nelson's attempt on the island in 1797. He later visited India.

The first empire found in him a docile subprefect of Sainte-Menehould. After the second Restoration he had to leave France (1816). Returning secretly, he settled at Mâcon under the name of Merger.

Drouet, Jean-Baptiste, COMTE (count) D'ERLON (b. July 29, 1765, Reims, Fr.—d. Jan. 25, 1844, Paris), French soldier whose long career raised him from the ranks of both Louis XVI's and Napoleon's armies to be the first governor general of Algeria and a marshal of France under Louis-Philippe.

A volunteer in the regiment of Beaujolais from 1782, he had reached the rank of corporal in 1792, before the fall of the monarchy. Elected captain in 1793, he became aide-de-camp to Gen. P. Lefebvre in 1794 and thenceforward enjoyed rapid promotion. General of division in 1803, he was created comte d'Erlon by Napoleon in January 1809. He served in Bavaria and Spain and was promoted lieutenant general in 1813. Under the first Restoration he was made commander of the 16th military division but conspired against the regime. Joining Napoleon during the Hundred Days in 1815, he was made a peer of France and given command of an army corps, but in the Waterloo campaign he spent June 16 between Ney at Quatre-Bras and Napoleon at Ligny, failing to support either as required.

On the second Restoration, Drouet fled to Bavaria, where, as Baron Schmidt, under King Maximilian I's protection, he set up a brewery near Munich. The death sentence passed on him in France in 1816, was, however, cancelled in 1825. Returning to France in 1830, he was reinstated on the active list by the regime of Louis-Philippe.

In July 1834 Drouet was appointed governor general of Algeria. Ignorant of the country, he at first let himself be guided by his chief-of-staff, Gen. C.A. Trézel, but on Trézel's being posted to Oran he fell under the influence of a scheming emissary of Abdelkadar ('Abd al-Qādir). He disavowed Trézel after the latter's defeat by Abdelkadar at La Macta. Drouet was recalled to France in July 1835. After some years at Nantes, he was made marshal of France in April 1843.

drought, also spelled DROUTH, lack or insufficiency of rain for an extended period that causes a considerable hydrologic (water) imbalance and, consequently, water shortages, crop damage, streamflow reduction, and depletion of groundwater and soil moisture. It occurs when evaporation and transpiration (the movement of water in the soil through plants into the air) exceed precipitation for a considerable period. Drought is the most serious physical hazard to agriculture in nearly every part of the world. Efforts have been made to control it by seeding clouds to induce rainfall, but these experiments have had only limited success.

There are four basic kinds of drought:

1. Permanent drought characterizes the driest climates; the sparse vegetation is adapted to aridity, and agriculture is impossible without continuous irrigation.
2. Seasonal drought (*q.v.*) occurs in climates that have well-defined annual rainy and dry seasons; for successful agriculture, planting must be adjusted so that the crops develop during the rainy season.
3. Unpredictable drought involves an abnormal rainfall failure; it may occur almost anywhere but is most characteristic of humid and subhumid climates. Usually brief and irregular, it often affects only a relatively small area.
4. Invisible drought can also be recognized: in summer, when high temperatures induce high rates of evaporation and transpiration, even frequent showers may not supply enough water to restore the amount lost; the result is a borderline water deficiency that diminishes crop yields.

Drouyn de Lhuys, Edmond (b. Nov. 19, 1805, Paris—d. March 1, 1881, Paris), French statesman and foreign minister under Napoleon III.

Drouyn was a brilliant student and entered the diplomatic service early. From 1833 to 1836 he distinguished himself as chargé d'affaires at The Hague. He went next to Madrid as first secretary in the embassy, where he became an indispensable agent of French diplomacy.

He ran for office in 1842 and was elected deputy, as he was in 1846 and 1849. When Louis-Napoléon Bonaparte became president, he made Drouyn de Lhuys foreign minister (1848) and then ambassador to London (1849). As ambassador, he averted a rupture with the British over the Don Pacifico affair. In 1851 he was again made foreign minister, but stepped down to become a senator (1852). Later that year Napoleon III once more appointed Drouyn de Lhuys foreign minister, and although he played a part in the conferences of Vienna (1854–55), his term as foreign minister was frustrating. Napoleon III would not accept his advice to form an alliance with Austria; he resigned in 1855. In 1862 Drouyn de Lhuys accepted for the fourth time the ministry of foreign affairs—a term filled with disappointments, owing more to external factors than to any bungling on his part. He tried in vain to reconcile the opposing demands for papal and secular states in Italy and tried without success to limit the growing power of Prussia. Napoleon III did not feel that Prussia was any menace, however, and in disagreement over the problem, Drouyn de Lhuys resigned in 1866. With the outbreak of the Franco-German War (1870), Drouyn de

Lhuys left for Jersey. He returned to France but from then on lived a strictly private life.

drowning, suffocation by immersion in a liquid, usually water. Water closing over the victim's mouth and nose cuts off the body's supply of oxygen. Deprived of oxygen the victim stops struggling, loses consciousness, and gives up the remaining tidal air in his lungs. There the heart may continue to beat feebly for a brief interval, but eventually it ceases. Until recently, the oxygen deprivation that occurs with immersion in water was believed to lead to irreversible brain damage if it lasted beyond three to seven minutes. It is now known that victims immersed for an hour or longer may be totally salvageable, physically and intellectually, although they lack evidence of life, having no measurable vital signs—heartbeat, pulse, or breathing—at the time of rescue. A fuller appreciation of the body's physiological defenses against drowning has prompted modification of traditional therapies and intensification of resuscitative efforts, so that many people who once would have been given up for dead are being saved.

Although asphyxiation (lack of oxygen that causes unconsciousness) is common to all immersion incidents, actual aspiration of water into the lungs may or may not occur. Up to 15 percent of fatal drownings are "dry," presumably because the breath is held or because a reflex spasm of the larynx seals off the airway inlet at the throat. When aspiration does occur, the volume of fluid entering the lungs rarely exceeds a glassful; the lungs "fill with water" chiefly because of an abnormal accumulation of body fluids (pulmonary edema) that is a secondary complication of oxygen deprivation. Commonly, also, quantities of water are swallowed and later vomited spontaneously or during resuscitative procedures; vomiting after the protective laryngeal spasm has subsided can lead to aspiration of stomach contents.

A natural biological mechanism that is triggered by contact with extremely cold water, known as the mammalian diving reflex, enhances survival during submersion, thus permitting seagoing mammals to hunt for long periods underwater. Scientists have recently determined that vestiges of the reflex persist in humans. The mechanism is powerful in children. It diverts blood from the limbs, abdomen, and surface areas of the body to the heart and the brain. It also causes an interruption of respiratory efforts and reduces the rate of the heartbeat. Even though the heart functions at a slower rate, in other respects it performs normally; actual arrest of circulatory processes is a relatively late development in the drowning sequence. In this suspended state, intracranial blood retains sufficient oxygen to meet the brain's reduced metabolic needs, despite a total absence of respiratory gas exchange.

In warm water the body's need for oxygen is increased; therefore, the oxygen deprivation caused by immersion is rapidly lethal or permanently damaging to the brain. Such warm-water drownings occur commonly in domestic bathtubs.

Immersion in icy water causes body temperature and metabolism to fall rapidly (the thermal conductivity of water is 32 times greater than that of air). Immersion hypothermia—below normal body temperature—reduces cellular activity of tissues, slows the heart rate, and promotes unconsciousness. None of these effects is imminently life-threatening; survival following hypothermic coma is almost 75 percent.

Rescue teams now continue the benefits of cold-water protection with "therapeutic hypothermia." "Lifeless" immersion victims with core temperatures as low as 62.6° F (17° C) have survived. *See also* lifesaving.

Droysen, Johann Gustav (b. July 6, 1808, Treptow, Pomerania [Germany]—d. June 19, 1884, Berlin), historian and politician whose belief in Prussia's destiny to lead Germany influenced German unification, which he lived to see. Ironically, his ardent Prussian patriotism did not save him from falling into disfavour after the revolutionary events of 1848, because his other views were generally liberal and individualistic.

Droysen, engraving, 1884
By courtesy of the Staatsbibliothek, Berlin

Droysen's devotion to Prussia began in his boyhood, during the War of Liberation against Napoleonic rule. While professor of classical philology at Berlin (1835–40), he wrote on Alexander the Great and used the term Hellenism to describe the diffusion of Greek culture over the eastern Mediterranean and Middle East in the 4th–1st centuries BC.

After the revolution of 1848 Droysen became a member of the Frankfurt Parliament and secretary of its constitutional committee. After the Prussian king Frederick William IV refused the German imperial crown in 1849, Droysen, disappointed, retired from politics.

As professor of history at Kiel (1840–51), however, he collaborated in 1850 with Carl Samwer in writing a history of relations between Denmark and the duchies of Schleswig and Holstein from 1806, a work that affected the opinions of many Germans on the then-acute dispute with Denmark. He supported the rights of the duchies so prominently that in 1851, after Holstein passed to Denmark, he prudently left Kiel to teach at Jena, where he finished a biography (1851–52) of Graf Yorck von Wartenburg, Prussian general in the War of Liberation. He spent his remaining years on his great work, *Geschichte der preussischen Politik,* 14 vol. (1855–86; "History of Prussian Politics"). This history, unfinished at Droysen's death, ends at the year 1756.

Droz, Numa (b. Jan. 27, 1844, La Chaux-de-Fonds, Switz.—d. Dec. 15, 1899, Bern), prominent Swiss politician and twice federal president, who is best-remembered for his stand against the German chancellor Otto von Bismarck in the Wohlgemut affair (1889).

As director of the department of public instruction and religious affairs in the canton of Neuchâtel (1871–75), Droz composed a controversial ecclesiastical law (1873) that led to local religious schism. Elected in 1872 to the federal Ständerat (council of cantons), he entered the federal executive (Bundesrat) three years later and served twice as president of the confederation (1881, 1887). As head of the federal department of commerce and industry (1886), he authorized new factory and patent legislation; and from 1887 until 1892 he headed the federal political department, a position hitherto reserved for the confederation president. In the affair of August Wohlgemut, a German spy expelled by Switzerland, he firmly opposed Bismarck's threatened infringements of Swiss sovereignty and neutrality. He was named director of the International Bureau of Railways (1893).

Drozdov, Vasily Mikhaylovich (Russian Orthodox patriarch): *see* Philaret.

Drucker, Peter F(erdinand) (b. Nov. 19, 1909, Vienna), Austrian-born American management consultant, educator, and author whose conservative writings provided much of the philosophical and practical underpinning for the modern business corporation.

Drucker received a doctoral degree in law at the University of Frankfurt and worked as a journalist in Germany before fleeing to England in 1933 after the rise to power of Adolf Hitler. He worked in England until 1937, when he moved to the United States as an adviser to British banks doing business there and as a foreign correspondent for several British newspapers. A naturalized American citizen, Drucker was a professor of management at New York University from 1950 to 1972 and is credited with playing a leading role in the development of management education.

Some observers divide Drucker's numerous books and articles into four categories. His early works—such as *The End of Economic Man* (1939) and *The New Society* (1950)—discuss the nature of industrial society. A second line of books—including *The Concept of the Corporation* (1946) and *The Practice of Management* (1954)—explain general ideas about modern business management. A third, later body of work—including *America's Next Twenty Years* (1957) and *Technology, Management and Society* (1970)—offers speculation on the future impact of such developments as technological change. Finally, there are writings that address questions of practical corporate management, notably *Managing in Turbulent Times* (1980) and *The Changing World of the Executive* (1982; a collection of essays). Drucker also wrote two novels.

Drug (India): *see* Durg.

drug, any chemical agent that affects the functions of living things. Drugs are used in treating, diagnosing, and preventing disease.

A brief treatment of drugs follows. For full treatment, *see* MACROPAEDIA: Drugs and Drug Action.

Commonly used types of drugs include antibiotics, stimulants, tranquilizers, sedatives and hypnotics, antidepressants, analgesics, narcotics, anesthetics, hormones, and a wide variety of preparations for specific purposes, such as laxatives, heart stimulants, anti-blood-clotting agents, diuretics, and antihistamines. Vaccines, which are preparations of killed or weakened bacteria or viruses used to stimulate resistance to subsequent infections, are sometimes also considered drugs. Vaccination has proved particularly effective in preventing viral diseases. While bacterial infections have largely succumbed to antibiotics and other drugs, viral diseases still remain largely impossible to treat with drugs because it is difficult to find chemical agents that can selectively destroy viral nucleic acids or enzymes without harming those of the infected cells.

Drugs employed in cancer therapy are among the more recent advances in drug research. Every drug that has been developed to kill cancer cells, however, also affects rapidly dividing normal cells. Because each drug exerts its effects at different phases of the cell cycle, complex regimens of anticancer drugs may be used to reduce the incidence of cellular resistance and side effects.

Drugs can be given by enteral or parenteral administration. Enteral administration involves the alimentary tract and includes such methods as oral and rectal administration. Parenteral methods encompass all other routes, including injection, inhalation, and percutaneous administration (absorption through the skin).

Drugs are able to affect the functioning of living things by interrupting the extensive chemical system of communications that reg-

ulates the integrated functioning of the cells of the organism. The effects of drugs mimic those of endogenous substances of the body, and thus they do not impart new activities to the cells. In order for a drug molecule of a certain molecular configuration to be effective, it must bind with a specific, complementary site that is often located on the membrane of the cell and that is called a receptor. The drug–receptor complex thus formed triggers certain biochemical changes within the cell to bring about specific biochemical effects.

Drugs that bind to receptors and actively bring about biochemical changes are called agonists. Drugs that compete with agonists (which can be other drugs or endogenous molecules) but do not in themselves bring about an effect are called antagonists. Regardless of whether a drug is an agonist or an antagonist, it will not exert its influence on target molecules or cells if the receptor configuration is not complementary.

The oldest existing catalogue of drugs (called pharmacopoeia) is a stone tablet from ancient Babylonia (*c.* 1700 BC). The development of modern pharmacology began in the 19th century, when chemicals with drug action were first isolated from plants containing them.

Drug research made another leap forward with the discovery of antibiotics in 1928. Most drugs today are products of chemical synthesis, but numerous drugs of plant, animal, mineral, and microbial origin are still important. Recently, genetic engineering has provided a new source of compounds that are too complex to synthesize economically.

drug abuse, the excessive, maladaptive, or addictive use of drugs for nonmedical purposes despite social, psychological, and physical problems that may arise from such use. Abused substances include such agents as anabolic steroids, which are used by some athletes to accelerate muscular development and increase strength and which can cause heart disease, liver damage, and other physical problems; and psychotropic agents, substances that affect the user's mental state and are used to produce changes in mood, feeling, and perception. The latter category, which has a much longer history of abuse, includes opium (and such derivatives as heroin), hallucinogens, barbiturates, cocaine, amphetamines, tranquilizers, the several forms of cannabis, and alcohol. *See also* steroid.

A brief treatment of drug abuse follows. For full treatment, *see* MACROPAEDIA: Alcohol and Drug Consumption.

The history of nonmedical drug consumption is ancient. The discovery of the mood-altering qualities of fermented fruits and substances such as opium has led to their use and, often, acceptance into society. Just as alcohol has a recognized social place in the West, so many other psychotropics have been accepted in different societies.

The major problem that arises from the consumption of psychotropic drugs is dependence, the compulsion to use the drug despite any deterioration in health, work, or social activities. Dependence varies from drug to drug in its extent and effect; it can be physical or psychological or both. Physical dependence becomes apparent only when the drug intake is decreased or stopped and an involuntary illness called the withdrawal (or abstinence) syndrome occurs. Drugs known to produce physical dependence are the opiates (*i.e.,* opium and its derivatives) and central-nervous-system depressants such as barbiturates and alcohol. Psychological dependence is indicated when the user relies on a drug to produce a feeling of well-being. This type of dependence varies widely with both substance and user. In its most intense form the user becomes obsessed with the drug and focuses virtually all his interest and activity on obtaining and using it.

Another related phenomenon is tolerance, a gradual decrease in the effect of a certain dose as the drug is repeatedly taken; increasingly larger doses are needed to produce the desired effect. Tolerance does not always develop. It is most marked with habitual opiate users. The term addiction is often used synonymously with dependence but should probably be reserved for drugs known to cause physical dependence.

Other hazards of drug abuse include general risks, such as the danger of infection by the AIDS virus and other diseases that can be communicated by use of nonsterile needles or syringes when drugs are taken by injection. Some hazards are associated with the specific effects of the particular drug—paranoia with high doses of stimulants, for example. In addition, adverse social effects stemming from drug abuse are numerous.

Heroin, an opiate that is not used medically in the United States, is one of the drugs most associated with abuse and addiction in the eyes of the public. In general, opiates are called narcotics because they are used medically to relieve pain and produce sleep. Other opiates that have been abused are opium, morphine, pethidine, codeine, dipipanone, and methadone. Methadone is often used in substitution therapy as a less-addictive opiate that, theoretically at least, can be used to wean the user off heroin and eventually off opiates altogether.

Drugs that either depress or stimulate the central nervous system have long been used for nonmedical reasons. Depressants include all sedatives and hypnotics such as barbiturates and benzodiazepines (minor tranquilizers). These are usually taken by mouth but can be injected. The main stimulants are amphetamines or their derivatives and cocaine, a natural component of the leaves of the coca plant. Amphetamines can be taken by mouth or injected; cocaine is either injected or inhaled through the nose. One form of cocaine (freebase, or crack) is generally smoked.

Other drugs that are frequently abused include cannabis (marijuana, hashish, etc., from the hemp plant *Cannabis sativa*), PCP, and such hallucinogens, or psychedelics, as LSD and mescaline.

The purchase, sale, and nonmedical consumption of all the aforementioned drugs are illegal, and these psychotropic drugs can be obtained only on the black market. However, this is not the only route to drug abuse. Alcohol, for instance, can be legally purchased throughout much of the world, despite its high potential for abuse. Also, dependence on prescribed drugs is not uncommon, especially with tranquilizers and hypnotics. What was once a serious social problem of dependence on prescribed barbiturates has been overtaken largely by the widespread use of benzodiazepine tranquilizers such as diazepam (Valium) and chlordiazepoxide (Librium). Millions of legal prescriptions for these drugs are issued every year.

Problems relating to drug abuse can also occur with substances not normally thought of as drugs. Solvent abuse, commonly known as "glue-sniffing," is a growing problem, especially among teenagers and even younger children. The inhalation of volatile solvents produces temporary euphoria but can lead to death by respiratory depression, asphyxiation, or other causes.

drug allergy, hypersensitivity reaction to therapeutic agents that occasionally occurs on second exposure to a drug against which an individual has already produced antibodies. Some drugs rarely cause allergic reactions (*e.g.,* tetracyclines, digitalis), while others frequently provoke allergy (*e.g.,* penicillin). Symptoms vary with the drug and the sensitivity of the affected person but include, as separate reactions, hives (urticaria), serum sickness, and, rarely, anaphylaxis (collapse of the circulatory system with accompanying respiratory symptoms). Several drugs can successfully counteract these allergic symptoms; after drug allergy has been established, lifelong avoidance of the offending drug, and often of its derivatives, must be observed.

drug poisoning: *see* medicinal poisoning.

Druid (Celtic: "Knowing [or Finding] the Oak Tree"), member of the learned class among the ancient Celts. They seem to have frequented oak forests and acted as priests, teachers, and judges. The earliest known records of the Druids come from the 3rd century BC.

According to Julius Caesar, who is the principal source of information about the Druids, there were two groups of men in Gaul that were held in honour, the Druids and the noblemen (equites). Caesar related that the Druids took charge of public and private sacrifices, and many young men went to them for instruction. They judged all public and private quarrels and decreed penalties. If anyone disobeyed their decree, he was barred from sacrifice, which was considered the gravest of punishments. One Druid was made the chief; upon his death, another was appointed. If, however, several were equal in merit, the Druids voted, although they sometimes resorted to armed violence. Once a year the Druids assembled at a sacred place in the territory of the Carnutes, which was believed to be the centre of all Gaul, and all legal disputes were there submitted to the judgment of the Druids.

Caesar also recorded that the Druids abstained from warfare and paid no tribute. Attracted by those privileges, many joined the order voluntarily or were sent by their families. They studied ancient verse, natural philosophy, astronomy, and the lore of the gods, some spending as much as 20 years in training. The Druids' principal doctrine was that the soul was immortal and passed at death from one person into another.

The Druids offered human sacrifices for those who were gravely sick or in danger of death in battle. Huge wickerwork images were filled with living men and then burned; although the Druids preferred to sacrifice criminals, they would choose innocent victims if necessary.

Caesar is the chief authority, but he may have received some of his facts from the Stoic philosopher Poseidonius, whose account is often confirmed by early medieval Irish sagas. Caesar's description of the annual assembly of the Druids and their election of an arch-Druid is also confirmed by an Irish saga.

In the early period, Druidic rites were held in clearings in the forest. Sacred buildings were used only later under Roman influence. The Druids were suppressed in Gaul by the Romans under Tiberius (reigned AD 14–37) and probably in Britain a little later. In Ireland they lost their priestly functions after the coming of Christianity and survived as poets, historians, and judges (*filid, senchaidi,* and *brithemain*). Many scholars believe that the Hindu Brahman in the East and the Celtic Druid in the West were lateral survivals of an ancient Indo-European priesthood.

drum, also called CROAKER, in biology, any of about 160 species of fishes of the family Sciaenidae (order Perciformes); drums are carnivorous, generally bottom-dwelling fishes. Most are marine, found along warm and tropical seashores. Comparatively few inhabit temperate or fresh waters. Most are noisemakers and can "vocalize" by moving strong muscles attached to the air bladder, which acts as a resonating chamber, amplifying the sounds.

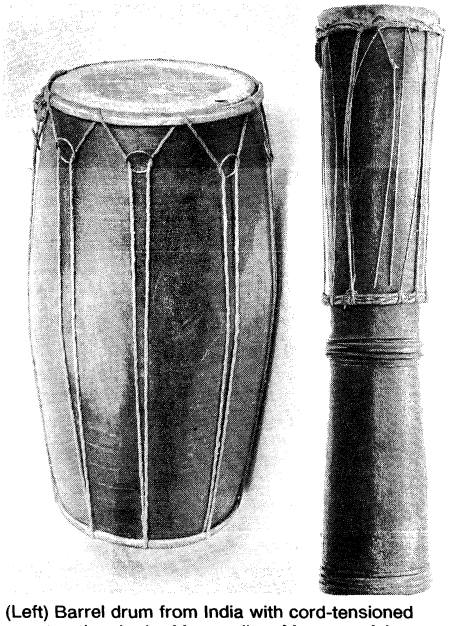
Drums have two dorsal fins and are usually silvery in colour. The weakfishes, sea-

trouts, and squeteagues (*Cynoscion*) have large mouths, jutting lower jaws, and canine teeth, but most drums have underslung lower jaws and small teeth. Some also have whisker-like barbels on the chin. Size varies. The largest member of the family, weighing up to 100 kilograms (225 pounds), is the totuava (*C. macdonaldi*) of the Gulf of California; other species are much smaller.

Although the name croaker or drum is applied to the family as a whole and to certain species, some of the sciaenids are known by such names as corbina, whiting, weakfish, and channel bass. Many members of the family are food or game fishes.

Among the better known species are the channel bass, or red drum (*Sciaenops ocellatus*), a large, reddish, western Atlantic species; the freshwater drum, or sheepshead (*Aplodinotus grunniens*), a silvery, lake and river fish of the Americas; the kingfish, or whiting (*Menticirrhus saxatilis*), of the Atlantic, notable among drums in lacking an air bladder; and the sea drum, or black drum (*Pogonias cromis*), a gray or coppery red, western Atlantic fish.

drum, musical instrument, the sound of which is produced by the vibration of a stretched membrane (and thus classified as a membranophone). Basically, a drum is either a tube or a bowl of wood, metal, or pottery (the "shell") covered at one or both ends by a membrane



(Left) Barrel drum from India with cord-tensioned construction, in the Metropolitan Museum of Art, New York City; (right) tubular drum from Borneo

By courtesy of (left) the Metropolitan Museum of Art, New York City, gift of Alice E. Getty, 1946, (right) M. Morrow

(the "head"), which is usually struck by hand or stick. Friction drums, a class apart, are sounded by rubbing.

Tubular drums assume many shapes (goblet, hourglass, barrel, etc.) and are considered shallow if the height is less than the diameter. If the drum is so shallow that the shell cannot act as a resonator for the sound (as in a tambourine), it is considered a frame drum.

Drums appear with wide geographical distribution in archaeological excavations from Neolithic times onward; one excavated in Moravia is dated at 6000 BC. Early drums consisted of a section of hollowed tree trunk covered at one end with reptile or fish skin and were struck with the hands. Later, the skin was taken from hunted game or cattle, and sticks were used. The double-headed drum came later, as did pottery drums in various shapes. The heads were fastened by several methods, some still in use. The skin might be secured to single-headed drums by pegs, nails, glue, buttoning (through holes in the membrane), or neck lacing (wrapping a cord around the membrane overlap). Double-headed drums were often directly cord-tensioned (*i.e.,* through holes in the skin). Modern European drums often combine two hoops pressing against each head (one rolled in the skin, the other outside) with indirect lacing (*i.e.,* to the hoops).

Drums typically have conspicuous extramusical functions—civil, message transmitting, and, particularly, religious. Credited with magical powers, they are often held sacred. In many societies their manufacture involves ritual. In East Africa, offerings such as cattle are made to the royal kettledrums, which not only symbolize the king's power and status but also offer him supernatural protection.

Giant frame drums were used in the temples of ancient Sumer, and Mesopotamian objects from *c.* 3000 BC depict frame drums and small cylindrical drums played horizontally and vertically. Early Egyptian artifacts (*c.* 4000 BC) show a drum with skins stretched by a network of thongs. A waisted, or hourglass, drum is seen on one of the Bhārhut reliefs, the oldest Indian temple reliefs (2nd century BC). The modern Indian *ḍamaru* is an hourglass-shaped clapper drum—when it is twisted its heads are struck by the ends of one or two cords attached to the shell. Barrel and shallow-nailed drums are particularly associated with India and the Far East; and giant drums were used in war in ancient China.

Frame drums were played in the ancient Near East (chiefly by women), Greece, and Rome and reached medieval Europe through Islāmic culture. Their shape varies (round, octagonal, square, etc.), they may have one or two heads, and they may have attached jingles or snares. Possibly of different origin are the frame drums used in the magico-religious ceremonies of shamans (medicine men) in Central Asia, the Arctic regions, and North America. Double-headed frame drums with enclosed pellets (found in India and Tibet) are known as rattle drums.

Shallow kettledrums are first depicted in *c.* 600 in Persia. Larger ones, mentioned with the smaller type in the 10th century, are not pictured alone until the 12th. Though originally of clay and cord braced, kettledrums were later made of metal (or sometimes wood). They spread with Islāmic culture through Europe, Africa, and Asia.

Little is known about medieval European drums and drumming, the only evidence being pictures and written references; no medieval drums survive. Written percussion parts (in instruction books only) date from the 16th century, drummers having been expected to extemporize their parts. By the 13th century, three types of drum appear to have been established: the nakers, small paired kettledrums; the tab, a small cylindrical drum, often with snares; and the tambourine. They apparently served only as time beaters and, except for the tambourine, were beaten with sticks. Only from about the 14th century were drums built to produce loud, carrying sounds, a result of the introduction of mercenary infantry troops, in whose regiments fifes were soon paired with drums. Large kettledrums were associated with royalty and nobility. They entered the orchestra as a purely musical instrument in the mid-17th century, the bass drum (originally emulating the long drums of Turkish Janissary troops) during the 18th century, and the military-derived side, or snare, drum during the 19th.

Drums figure prominently in the 20th century in orchestral, military, popular dance, jazz, and rock groups. The word drum is sometimes used for nonmembrane struck instruments, such as steel drums, bronze drums, and slit drums (made of hollowed wood).

drum, in packaging, cylindrical container commonly made of metal or fibreboard. Steel drums with capacities ranging up to 100 gallons (416 litres) have been produced since about 1903 (the sizes less than 12 gallons are called pails). The most common drums are made of 18-gage (0.048 inch, or 1.2 millimetres, thick) steel and contain 55 gallons; they become the property of the buyer of the contents. Heavier drums or those made of more expensive metals (aluminum, Monel, stainless steel, or nickel) commonly remain the property of the vendor. Provided with a protective interior coating, in most cases a synthetic resin, steel drums or pails can be used for packaging most liquid and solid substances, and they have largely replaced wooden barrels and kegs.

Fibreboard drums have been produced since early in the 20th century. They are made with ends of steel or paperboard in sizes up to 75 gallons and are cheap and lightweight. They are commonly resin-coated or lined with loose plastic bags for packaging solid materials.

drum, in architecture, any of the cylindrical stone blocks composing a column that is not a monolith. The term also denotes a circular or polygonal wall supporting a dome, cupola, or lantern (*qq.v.*).

drum table, heavy circular table with a central support, which was introduced in the late 18th century. The deep top, commonly covered with tooled leather, was fitted with bookshelves or drawers, some of which were imitation. The support was sometimes in the form of a pillar resting on four elegantly tapering legs terminating in claw feet. In other

Drum table, English, early 19th century; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

examples, the supports rested on a platform with four concave sides, the platform in turn resting on claw feet.

An alternative name for the drum table was a loo table. A variant of the drum table, called a rent table, had a circular or polygonal top, the drawers in the frieze (horizontal band beneath the top) being labelled with the days of the week and constituting a filing system for the rent collector.

Drumheller, city, southern Alberta, Canada, on the Red Deer River, 86 mi (138 km) northeast of Calgary. A grain-shipping point, it is surrounded by extensive coal, gas, and oil fields and by wheat fields. It was founded in 1910 by Samuel Drumheller, a coal-mining pioneer who helped launch Alberta's great coal industry. The circular 28-mi Dinosaur Trail into the Red Deer Valley badlands begins at the Dinosaur Fossil Museum in Drumheller; it advances past the Homestead Antique Museum (with pioneer and Indian relics) and the picturesque Little Church and through oil and wheat fields before entering ancient seabeds of fossilized oysters, the Dinosaur Burial Grounds, and petrified forests. Inc. village, 1913; town, 1916; city, 1930. Pop. (1981) 6,508.

drumlin, elliptical, streamlined hill composed of till deposited beneath moving glacial ice.

Peterborough Drumlin on the Trent Canal, near Campbellford, Ontario
By courtesy of the Geological Survey of Canada, Ottawa

Drumlins commonly are found in clusters, with their long axes roughly parallel to the direction of ice movement. They slope steeply in the direction from which the glacier came and gently in the direction in which it moved. They vary in height from 6 to 60 m (20 to 200 feet) and in length up to several miles. Most are formed of clayey till, although some have bedrock cores. Drumlin fields may contain as many as 10,000 drumlins; one of the largest fields is in the northwestern plains of Canada. Often arranged in echelon or in a belt, they disrupt drainage so that small lakes and swamps may form between them. A long slender hill or series of ridges composed of till, but without the typical drumlin shape, is called a drumlinoid.

Drummond, Henry (b. Dec. 5, 1786, the Grange, near Alresford, Hampshire, Eng.—d. Feb. 20, 1860, Albury, Surrey), British banker, writer, and member of Parliament who helped found the Catholic Apostolic Church.

Drummond studied at the University of Oxford for two years but did not take a degree. He became a partner in Drummond's Bank, London, and served in Parliament for Plympton Erle, Devonshire (1810–13), and for West Surrey (1847–60).

While traveling in 1817 he met the Scottish theologian Robert Haldane in Geneva and became a polemical and monetary supporter of the evangelical clergy who were opposed to the Socinian, or rationalist, tendencies then prevalent in Geneva. In 1826 he and several clergymen and laymen held the first of five annual conferences on the prophetic Scriptures at his Albury home. From these meetings the Catholic Apostolic Church evolved.

Drummond was ordained an angel (bishop) for Scotland in 1834. He built a chapel and chapter house at Albury, which became a centre of the movement, and continued his financial and spiritual activities for the Catholic Apostolic Church. He published voluminously on such questions as the interpretation of prophecy, the circulation of the Apocrypha, and the principles of Christianity.

Henry Drummond
BBC Hulton Picture Library

Drummond (of Hawthornden), William (b. Dec. 13, 1585, Hawthornden, near Edinburgh—d. Dec. 4, 1649, Hawthornden), first notable poet in Scotland to write deliberately in English. He also was the first to use the canzone, an Italian metrical form, in English verse.

Drummond studied at Edinburgh and spent a few years in France, ostensibly studying law at Bourges and Paris. On the death of his father, first laird of Hawthornden, in 1610, he settled down on his Hawthornden estate, leaving law for literature and devoting himself to the life of a cultured and rather detached man of means. There was a certain natural reticence in Drummond's character, but he had many friends, including the poets Michael Drayton and Sir William Alexander and the playwright Ben Jonson.

Jonson visited Drummond in 1618, and Jonson's record of their conversations throws light on both personalities. Jonson said that Drummond's poems, though good, "smelled too much of the Schooles, and were not after the fancie of the tyme." Drummond adapted and translated poems from French, Italian, and Spanish, in addition to borrowing from such English poets as Sir Philip Sidney.

William Drummond, oil painting by an unknown artist; in the Scottish National Portrait Gallery, Edinburgh
By courtesy of the Scottish National Portrait Gallery, Edinburgh

Apart from his *Poems* (1614, 1616) and *Flowres of Sion* (1623), Drummond wrote *Forth Feasting* (1617), a poem celebrating James I's visit to Scotland in that year, and he was apparently the author of *Polemo-Medinia inter Vitarvam et Nebernam* (1645?), a macaronic piece intermingling Scots and Latin. His prose writings include a group of Royalist political pamphlets; *The History of Scotland, from the year 1423 until the year 1542* (1655); and *A Cypresse Grove* (1623; earlier version, *A Midnight's Trance*, 1619), a meditation on death and mutability.

Drummond, William Henry (b. April 13, 1854, Mohill, County Leitrim, Ire.—d. April 6, 1907, Cobalt, Ont., Can.), Irish-born Canadian writer of humorous dialect poems conveying a sympathetic but sentimentalized picture of the habitants, or French-Canadian farmers.

Drummond emigrated to Canada in about 1864, left school at the age of 15 to help support his family, but at 30 took a degree in medicine at Bishop's College in Quebec. After four years in country practice he moved to Montreal, where he gave public readings of his poems with great success. His verses, mingling humour and pathos, are written in a synthetic patois and from the viewpoint of a British imperialist but are redeemed by his evident goodwill and genuine fondness for his subject. His first collection, *The Habitant* (1897), was followed by several others, all of which were published together as *The Poetical Works of William Henry Drummond* (1912).

William Henry Drummond
By courtesy of the Public Archives of Canada

Drummond de Andrade, Carlos (b. Oct. 31, 1902, Itabira, Braz.—d. Aug. 17, 1987, Rio de Janeiro), poet, journalist, author of *crônicas* (a short fiction-essay genre widely cultivated in Brazil), and literary critic, considered one of the most accomplished poets of modern Brazil and a major influence on mid-20th-century Brazilian poetry. His experiments with poetic form (including laying the foundation of what later developed into concrete poetry) and his often ironic treatment of realistic themes reflect his concern with the plight of modern man, especially Brazilian urban man, in his struggle for freedom and dignity.

After receiving his degree in pharmacy (1925), Drummond de Andrade turned to poetry and joined the new group of Brazilian Modernists who were introducing colloquial language and unconventional syntax in their free-verse forms. He helped to found the literary magazine *A Revista* ("Review") in 1925. The first of his many collections of poetry, *Alguma poesia* (1930; "Some Poetry"), shows both his affinity with the Modernist movement and his own strong poetic personality.

Drummond de Andrade voiced the frustrations of rural immigrants to anonymous and crushing urban centres and of bored middle-class city residents trapped in meaningless routines. His *crônicas* reveal a special concern for children and the urban poor.

At the time of his retirement from a career of government service, in 1962, Drummond de Andrade was director of the historical section of the National Historical and Artistic Heritage Service of Brazil. He was the author of approximately 15 volumes of poetry and a half dozen collections of *crônicas*. His best-known single poem is perhaps "José" (published in 1942 in *Poesias*), which depicts the boredom of an urban apartment dweller.

Drummondville, city, seat of Drummond regional county (*municipalité régionale de comté*), Trois-Rivières (Three Rivers) region, southern Quebec province, Canada, on the Saint-François River. Founded in 1815 by Major General Frederick George Heriot and named after Sir Gordon Drummond, then commander in chief of Canada, it became an important textile-milling town after the 1920s, when nearby hydroelectric plants were completed. Drummondville, about 60 mi (100 km) northeast of Montreal, is now a commercial and industrial centre on major railroad

lines and the Trans-Canada Highway. In addition to textiles, manufactures include lumber, heavy machinery, paper products, pencils, clothing, light bulbs, and rubber goods. The towns of Saint-Joseph, Drummondville West, and Drummondville South were annexed to Drummondville in 1955, 1966, and 1981, respectively. Inc. village, 1874; town, 1888; city, 1936. Pop. (1981) 36,567.

Drummossie, Battle of (1746): *see* Culloden, Battle of.

drumstick tree, also called HORSERADISH TREE (*Moringa pterygosperma*), small, deciduous tree, of the family Moringaceae, native to tropical Asia but also naturalized in Africa and tropical America. Reaching about 9 metres (30 feet), a drumstick tree has corky gray bark, branching, fernlike leaves, and scented clusters of white flowers. The dagger-like fruits sometimes are 45 centimetres (18 inches) long. Flowers, pods, leaves, and even twigs are cooked and eaten. A horseradish-flavoured condiment is prepared from the crushed roots. Ben oil, extracted from the seeds, is used by watchmakers. Perfume makers value it for its retention of scents.

Druon Antigonus, legendary giant of Antwerp, who cut off the right hands of mariners refusing him tribute. His own right hand was cut off by another legendary giant, called Salvius Brabo, a cousin of Julius Caesar. The two severed hands included in the coat of arms of Antwerp have been connected with this legend, as has the etymology of the city's name. The Brabo Fountain (1887), in

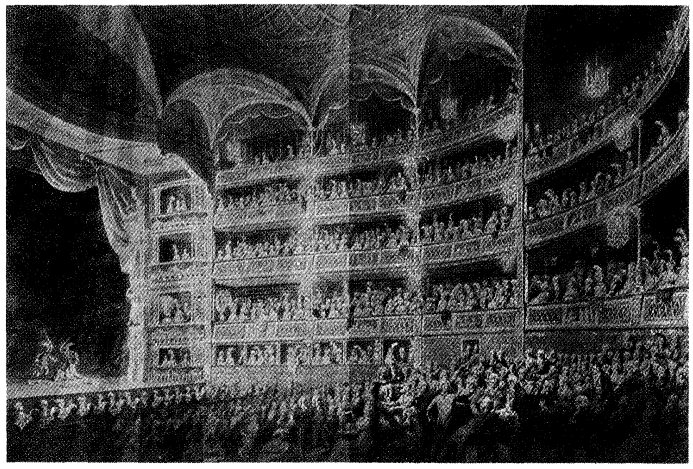
Druon Antigonus, illustration from *Gog and Magog,* by Frederick William Fairholt, 1859

By courtesy of the Folklore Society Library, University College, London; photograph, R.B. Fleming

front of the Hôtel de Ville, is surmounted by a statue of Brabo brandishing the severed hand of Druon.

drupe, fruit in which the outer layer of the ovary wall is a thin skin, the middle layer is thick and usually fleshy (though sometimes tough, as in the almond, or fibrous, as in the coconut), and the inner layer, known as the pit, or putamen, is hard and stony. Within the pit is usually one seed, or, rarely, two or three, in which case only one develops fully. In aggregate fruits such as the raspberry and blackberry—which are not true berries—many small drupes are clumped together. Other representative drupes are the cherry, peach, mango, olive, walnut, and dogwood.

Drury Lane Theatre, London, oldest English theatre still in use, built by the dramatist Thomas Killigrew for his company of actors as the Theatre Royal under a charter from Charles II. It opened May 7, 1663, in the propitious era of Restoration drama and prospered until destroyed by fire (1672). Rebuilt on its present site in Drury Lane in 1674 with



"The Drury Lane Theatre, London," watercolour by Edward Dayes, 1795; in the Henry E. Huntington Library and Art Gallery, San Marino, Calif.

By courtesy of the Henry E. Huntington Library and Art Gallery, San Marino, Calif.

Sir Christopher Wren as architect, the second Theatre Royal featured the plays of John Dryden and works of William Congreve.

Drury Lane enjoyed one of its finest periods (1710–34) under the control of the famous triumvirate made up of the actor-playwright Colley Cibber, the comedian Robert Wilks, and the character actor Thomas Doggett. It then fell into the hands of a spendthrift, Charles Fleetwood, whose mismanagement almost brought the theatre to ruin, despite such triumphs as David Garrick's brilliant performances as Lear and Richard III, and Charles Macklin's revolutionary portrayal of Shylock as a tragic rather than comic character. It was rescued in 1747 when Garrick took over and opened with a brilliant new troupe, a more natural style of acting and production, and superior Shakespearean texts. Garrick upheld these high standards for the next 30 years. He was succeeded by Richard Brinsley Sheridan. Under his management (1776–88), *The School for Scandal* held the stage, and Sarah Siddons' memorable performance of Lady Macbeth and John Philip Kemble's Hamlet were given. When a new "fireproof" theatre, built in 1794, burned down in 1809, another was designed by Benjamin Wyatt and opened in 1812. In this era the actor Edmund Kean attracted large audiences. After his decline, Drury Lane went into a long period of progressive deterioration until taken over by Augustus Harris in the 1880s, when it prospered as the home of spectacles and pantomimes featuring the music-hall artist Dan Leno. In the 1900s it was the scene of the acting triumphs of Henry Irving, Ellen Terry, and Sir Johnston Forbes-Robertson. The conductor Sir Thomas Beecham's great opera seasons were held there. During World War II, it was headquarters of ENSA (Entertainments National Service Association).

On May 7, 1963, the Drury Lane celebrated its tercentenary.

Druse (Islāmic sect): *see* Druze.

Druse revolt (1925): *see* Druze revolt.

Drusilla, Livia: *see* Livia Drusilla.

Drusus, Marcus Livius (d. 109 BC), Roman politician, tribune with Gaius Gracchus in 122 who undermined Gracchus' program of economic and political reform by proposing reforms even more appealing to the populace but evidently without seriously intending that they be implemented. On the issue of colonization Drusus went further than Gracchus by proposing the immediate foundation in Italy and Sicily of 12 colonies to be settled by citizens without property qualifications. He also proposed that all land that had been distributed since the passage of Tiberius Gracchus' agrarian reform bill should be rent free.

By pressing for immunity from corporal punishment (even during military service), Drusus was promising the Latins more protection from abuses by Roman magistrates than even Roman citizens enjoyed. This was a skillful measure since many Latins preferred protection from the magistrates to all the privileges that Roman citizenship would confer. Although a commission was set up to carry out these Leges Livianae, the laws were probably not implemented.

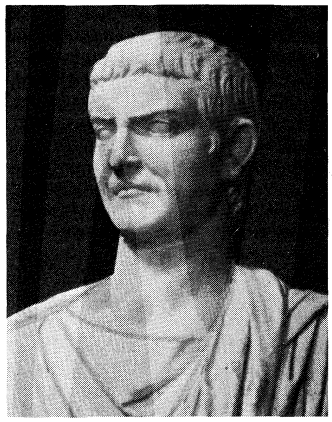
Drusus was consul in 112 and became governor of Macedonia, where he campaigned successfully against the Scordisci tribe. On his return he celebrated a triumph in 110 and, as censor in 109, died in office.

Drusus, Marcus Livius (d. 91 BC), son of the tribune of 122 by the same name; as tribune in 91, Drusus made the last nonviolent civilian attempt to reform the government of republican Rome. Drusus began by proposing colonial and agrarian reform bills. He then introduced a judiciary law that probably specified that the law courts, then controlled by the equites, or cavalry, should be impanelled jointly from senators and equites and that all jurors should be liable to prosecution for corruption.

By this compromise Drusus sought to reconcile the equestrian and senatorial orders, which had come into conflict after the trial by equites of an honest governor who had refused to allow extortion of his province by *publicani* ("tax collectors"). Neither order was satisfied with Drusus' proposal, however, and opposition from all sides increased when he pushed for the enfranchisement of the Italian allies. The Senate declared his legislation invalid on technical grounds. Disturbances involving Drusus' supporters among the allies increased, and the reformer was murdered. His assassin was never discovered.

Drusus Caesar (b. *c.* 13 BC—d. AD 23), only son of the Roman emperor Tiberius. After the death of Tiberius' nephew and adoptive son Germanicus (AD 19), Drusus became heir to the imperial succession.

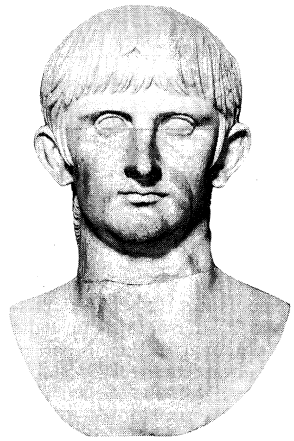
Though reputedly violent and dissolute, Drusus showed ability in public business. In AD 14 he suppressed a dangerous mutiny in



Drusus Caesar, detail of a marble statue; in the Lateran Museum, Rome
BBC Hulton Picture Library

Pannonia. He became consul in 15. As governor of Illyricum (17–20), he engineered the fall of Maroboduus, king of the German Marcomanni. Consul again in 21, he received the administrative privileges of tribunician power in 22. He died before Tiberius, allegedly poisoned by his wife Livilla and by Tiberius' adviser Sejanus.

Drusus Germanicus, Nero Claudius (b. 38 BC—d. 9 BC), younger brother of Tiberius (later emperor) and commander of the Roman forces that occupied the German territory between the Rhine and Elbe rivers from 12 to 9 BC.



Nero Claudius Drusus Germanicus, marble bust by an unknown artist; in the Capitoline Museum, Rome
Anderson—Alinari from Art Resource/EB Inc.

Drusus was born shortly after his mother, Livia Drusilla, was divorced by Tiberius Claudius Nero; she immediately married Octavian (later Augustus), who was suspected of being Drusus' real father. Like his brother, Drusus was allowed to seek office five years before the legally specified age. He became praetor (magistrate) in 11 and consul in 9. With Tiberius he fought against two Alpine tribes (the Raeti and Vindelici), and in 13 he was made governor of the three Gauls. In this office he carried out an important census and erected the altar of Augustus at Lugdunum (now Lyon).

In 12–9 he led expeditions into Germany, establishing bases, first at Vetera (at the junction of the Lippe and Rhine rivers) and then at Mogontiacum (now Mainz). The Frisii, Chauci, Cherusci, and Chatti tribes were subdued, and a canal, the Fossa Drusiana, was dug from the Rhine to the North Sea. In the year 9, Drusus reached the Elbe River, but he was thrown from his horse and died of the injuries 30 days later. He was posthumously given the cognomen Germanicus.

Drusus had married, about 16 BC, the younger Antonia, daughter of Mark Antony and Octavia. Their surviving children were Germanicus, Livilla, and Claudius, later emperor.

Druz, ed-, Jebel: *see* Durūz, ad-, Jabal.

Druze, also spelled DRUSE, Arabic plural DURŪZ, singular DARAZI, relatively small Middle Eastern religious sect characterized by an eclectic system of doctrines and by a cohesion and loyalty among its members (at times politically significant) that have enabled them to maintain through almost a thousand years of turbulent history their close-knit identity and distinctive faith. They call themselves *muwaḥḥidūn* ("monotheists").

The Druze permit no conversion, either away from or to their religion, and no intermarriage. In these circumstances the survival of their religion and community across almost a millennium is the more remarkable in that their religious system is kept secret not only from the outside world but in part even from their own number; only an elite of initiates, known as *ʿuqqāl* ("knowers"), participate fully in their religious services and have access to the secret teachings of the *ḥikmah,* the Druze religious doctrine. In times of persecution, a Druze is allowed to deny his faith outwardly if his life is in danger. This concession, or *taqīyah,* is allowed according to *at-Taʿlīm* ("Instruction"), the anonymously written "catechism" of Druze faith.

It is not known to what extent this people was self-conscious and distinct before adopting their present religion. Druze religious beliefs developed out of Ismaʿīlī teachings. Various Jewish, Christian, Gnostic, Neoplatonic, and Iranian elements, however, are combined under a doctrine of strict monotheism. Propagation of the tenets of the new religion began in Cairo in AD 1017, led by Ḥamzah ibn ʿAlī; it is from the name of Ḥamzah's subordinate, Muḥammad ad-Darazī, that the group derives its name. The eclectic belief-system was organized into a doctrine of the soteriological divinity of al-Ḥākim bī-Amr Allāh ("Ruler by the Command of Allāh"), the sixth caliph (996–1021) of the Fāṭimid dynasty of Egypt, whom they call al-Ḥākim bī Amrih ("Ruler by His Own Command"). It is believed by the Druze that al-Ḥākim did not die but vanished and will one day return in triumph to inaugurate a golden age. There is some suggestion that a number of people in widely scattered areas accepted this system, but only the Druze have survived. It is known certainly that a great many groups in the Middle East at that time, most of whom came under the various headings of the heretical Shīʿite Muslim sects and movements, accepted similar notions and joined similar causes.

Although the Druze cloak their religion in secrecy, the source materials for outsiders' knowledge of Druze history and religion are not as scarce as might be expected. There is, of course, information from non-Druze sources, though these sources are not always accurate. Muslim and Christian accounts of historical events, as well as comments on and assessments of the Druze religion and customs, should be treated with reserve and caution because of their polemical character. Jewish sources contemporary with the first half of the reign of al-Ḥākim present him in a favourable light.

The Druze people have figured prominently at various periods in the local history: in the Arab stand against the Crusades; in the century following the Ottoman conquest (from 1516), prospering as powerful vassals (until their leader and early westernizer Fakhr ad-Dīn of the house of Maʿn was driven out, to take asylum at the courts of Tuscany and Naples); in the 19th century, with imperialist involvements, under the prominent Shihāb family, which has also Sunnite Muslim and Christian branches; and in the 20th century, in many of the vicissitudes of Arab and Lebanese development.

Druze revolt (1925), Druze also spelled DRUSE, uprising of Druze tribes throughout Syria and in part of Lebanon directed against French mandatory officials who attempted to upset the traditions and the tribal hierarchy of Jabal ad-Durūz.

In 1923 Captain Carbillet, the French, but Druze-elected, governor of Jabal ad-Durūz, introduced modern administrative and social reforms that antagonized the population. The high-handed treatment accorded Druze complaints by the high commissioner, General Sarrail, and his arrest and detainment of several Druze leaders in July 1925 resulted in a full-fledged rebellion. Led by Sulṭān al-Aṭrash, the Druze defeated the French in August and by September were joined by Syrian nationalists from the People's Party, who entreated their countrymen to join the revolt. When the rebellion reached Damascus, the French bombed the city, but Druze discontent continued to expand into southern Lebanon. The French fought the insurgents throughout 1926, bombing Damascus once again, this time meeting with greater success, and by mid-1927 most of the trouble had died out.

Jabal ad-Durūz was henceforth kept under tighter French control; high officials, such as the governor, were no longer elected but appointed and most often were French. The natural tendency of the Druze to isolationism was encouraged in order to keep them free of the nationalist sentiments sweeping the Arabs but dependent on the French for their security.

druzhina, in early Rus, a prince's retinue, which helped him to administer his principality and constituted the area's military force. The first *druzhinniki* (members of a *druzhina*) in Rus were the Norse Varangians, whose princes established control there in the 9th century. Soon members of the local Slavic aristocracy as well as adventurers of a variety of other nationalities became *druzhinniki.*

The *druzhina* was composed of two groups: the senior members (who became known as boyars) and the junior members. The boyars were the prince's closest advisers; they also performed higher state functions. The junior members constituted the prince's personal bodyguard and were common soldiers. All the members were dependent upon their prince for financial support, but each member served the prince freely and had the right to leave him and join the *druzhina* of another prince. As a result, a prince was inclined to seek the goodwill of his *druzhina;* he paid the *druzhinniki* wages, shared his war booty and taxes with them, and eventually rewarded the boyars with landed estates, complete with rights to tax and administer justice to the local population.

By the middle of the 12th century, the characteristics of the two groups had begun to change. The boyars, having acquired their own patrimonial estates and retinues, became less dependent on the princes and began to form a new landed aristocratic class. The junior members became a prince's immediate servitors and collectively assumed the name *dvoriane* (courtiers). During the period of Mongol rule (after 1240), the term *druzhina* fell out of use. *See also* boyar.

Druzhkovka, also spelled DRUŽKOVKA, city, Donetsk *oblast* (province), Ukrainian Soviet Socialist Republic, at the confluence of the Krivoy Torets and Kazyonny Torets rivers. Druzhkovka, which before the Russian Revolution of 1917 was a small metallurgical centre, now has an important machine-works

as well as a metalworking industry. There are technical colleges offering instruction in machine building and mining. The area is important for the working of fireclays. Pop. (1982 est.) 68,000.

dry dock, type of dock (*q.v.*) consisting of a rectangular basin dug into the shore of a body of water and provided with a removable enclosure wall or gate on the side toward the water, used for major repairs and overhaul of vessels.

When a ship is to be docked, the dry dock is flooded, and the gate removed. After the vessel is brought in, and properly positioned and guyed, the watertight gate is placed in its seat and the dock is pumped dry, bringing the craft gradually to rest on supporting blocks anchored to the floor.

In older installations, in which the basins were relatively small, the dock structure was built mainly of massive stonework, or in a few instances, heavy timber framing. Later, these materials were supplanted by concrete, first in the ordinary mass form and later reinforced with steel. Modern dry docks are considerably larger in size and correspondingly more complex than their prototypes.

A dry dock gate, with its removable watertight barrier, has many forms and arrangements. In some, two leaves form a mitre gate hinged to the side walls of the dock. In others, the leaves roll on a track into recesses in the dock walls. In still others, a one-piece gate is hinged at the bottom sill so it may be lowered to allow a ship to enter. The type most commonly used, however, is the floating gate, which is held in its seat by its weight when the dock is empty and can be removed simply by floating it out of the way when the dock is filled with water.

While most ship repair work is carried out in stationary dry docks, there are some services that can be performed by mobile or floating structures. The principal such facility, the floating dry dock, is a trough-shaped cellular structure, used to lift ships out of the water for inspection and repairs. The ship is brought into the channel of the partly submerged dock, which is then floated by removing ballast from its hollow floor and walls and draining the dock so that it supports the craft on blocks attached to the dock floor. A typical floating dry dock is built of steel, with a framing system similar to that of a ship, although both timber and reinforced concrete have been used. Floating dry docks ordinarily are operated in sheltered harbours where wave action presents no problem.

dry farming, also called DRYLAND FARMING, the cultivation of crops without irrigation in regions of limited moisture, typically less than 20 inches (50 centimetres) of precipitation annually. Dry farming depends upon efficient storage of the limited moisture in the soil and the selection of crops and growing methods that make the best use of this moisture. Tilling the land shortly after harvest and keeping it free from weeds are typical methods, but in certain latitudes stubble is left in the fields after harvest to trap snow. Moisture control during crop growing consists largely of destruction of weeds and prevention of runoff. The ideal soil surface is free of weeds but has enough clods or dead vegetable matter to hinder runoff and prevent erosion.

Crops adapted to dry farming may be either drought resistant or drought evasive. Drought-resistant crops, such as sorghum, are able to reduce transpiration (emission of moisture) and may nearly cease growing during periods of moisture shortage, resuming growth when conditions again become favourable. Drought-evasive crops achieve their main growth during times of year when heat and drought conditions are not severe. Crops adapted to dry farming are usually smaller and quicker to mature than those grown under more humid conditions and are usually allotted more space.

dry forest: *see* monsoon forest.

dry gas, natural gas that is always in the gaseous state in the reservoir and produces little condensable hydrocarbons (compounds composed mainly of hydrogen and carbon) when brought to the surface. Thus, these gases contain very small proportions (less than 0.1 gallon condensables per 1,000 cubic feet) of hydrocarbons heavier than ethane—butane or propane, for example. *See also* wet gas.

Dry Ice, trademark for carbon dioxide (*q.v.*) in its solid form, a dense, snowlike substance that sublimes (passes directly into the vapour without melting) at −78.5° C (−109.3° F), used as a refrigerant, especially during shipping of perishable products such as meats or ice cream. In the production of Dry Ice, advantage is taken of the spontaneous cooling that occurs when compressed, liquefied carbon dioxide at −57° C (−71° F) or lower is allowed suddenly to expand to atmospheric pressure: the liquid freezes to a finely divided solid that is compacted into cakes, weighing about 20 kilograms (45 pounds).

dry offset, also called LETTERSET, or INDIRECT RELIEF PRINTING, offset printing process combining the characteristics of letterpress and offset. A special plate prints directly onto the blanket of an offset press, and the blanket then offsets the image onto the paper. The process is called dry offset because the plate is not dampened as it would be in the offset lithography process.

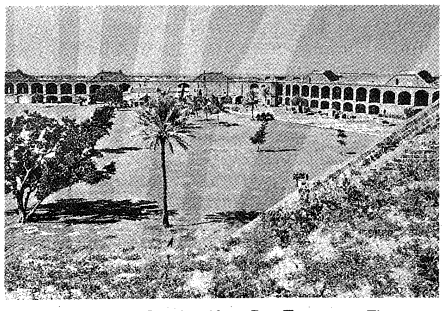
The process was developed by the U.S. Bureau of Engraving and Printing to produce long runs of tax stamps and savings bonds. *See also* offset printing.

dry painting: *see* sand painting.

dry plate, in photography, glass plate coated with a gelatin emulsion of silver bromide. It can be stored until exposure, and after exposure it can be brought back to a darkroom for development at leisure. These qualities were great advantages over the wet collodion process, in which the plate had to be prepared just before exposure and developed immediately after. The dry plate, which could be factory produced, was introduced in 1871 by R.L. Maddox. It was superseded by celluloid film early in the 20th century.

dry rot, symptom of fungal disease in plants, characterized by firm spongy to leathery or hard decay of stem (branch), trunk, root, rhizome, corm, bulb, or fruit. *See* bulb rot; crown gall; fruit spot; heart rot; rot.

Dry Tortugas, the last eight in a long string of coral islands (keys) and sandbars that extend westward from Key West (in Monroe County), at the tip of southern Florida, U.S., into the Gulf of Mexico. Ponce de León discovered them in 1513 and named them for the tortoises that abounded there. Later, mariners added the accurate adjective dry. A lighthouse was constructed on Garden Key in 1825 and another, on the largest key, Loggerhead, in 1856. The unfinished Ft. Jefferson (1846–76) on Garden Key remained in Federal hands during the Civil War and served as a prison until 1873. Among the prisoners was Samuel A. Mudd, sentenced for complicity in the assassination of Abraham Lincoln because he had set John Wilkes Booth's broken leg. Possessing abundant bird and marine life, the fort and islands were proclaimed a national monument in 1935.

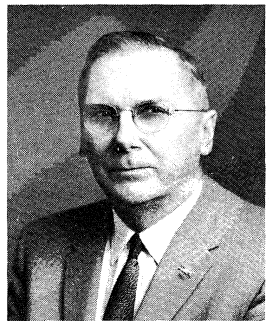


Ft. Jefferson on Garden Key, Dry Tortugas, Fla.
By courtesy of the National Park Service

dry wash: *see* arroyo.

Dryden, Hugh L(atimer) (b. July 2, 1898, Pocomoke City, Md., U.S.—d. Dec. 2, 1965, Washington, D.C.), U.S. physicist and deputy administrator of the National Aeronautics and Space Administration (NASA) for seven years.

Educated at Johns Hopkins University (Baltimore) in 1920, Dryden was named chief of the aerodynamics section of the National Bureau of Standards, Washington. He made



Hugh L. Dryden, 1962
By courtesy of the National Aeronautics and Space Administration

pioneering studies in the aerodynamics of high speed and some of the earliest studies of air flow around wing surfaces at the speed of sound. In 1934 he became chief of the mechanics and sound division. During World War II he headed the Washington Project of the National Defense Research Committee, which developed the Bat radar-homing missile, the first successful U.S. guided missile, which was used by the navy against the Japanese during World War II. For his part in the project, he was awarded the Presidential Certificate of Merit in 1948.

Dryden resigned from the National Bureau of Standards in 1947 and became director of aeronautical research of the National Advisory Committee for Aeronautics (NACA). Two years later he became director of NACA, and under his leadership the organization gained widespread recognition for its advanced aeronautical research and development. In 1958 he became deputy administrator of NASA and in 1962 led negotiations for joint U.S.–Soviet space projects. He was instrumental in achieving the exchange of weather-satellite data and operation of cooperative communications satellite tests.

Dryden, John (b. Aug. 19, 1631, Aldwinkle, Northamptonshire, Eng.—d. May 1, 1700, London), English poet, dramatist, and literary critic who so dominated the literary scene of his day that it came to be known as the Age of Dryden.

Youth and education. The son of a country gentleman, Dryden grew up in the country. When he was 11 years old the Civil War broke out. Both his father's and mother's families sided with Parliament against the King, but Dryden's own sympathies then are unknown.

About 1644 he was admitted to Westminster School, where Dryden received a predominantly classical education under the celebrated Richard Busby. His easy and lifelong familiarity with classical literature begun at West-

John Dryden, oil painting by Sir Godfrey Kneller; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

minster later resulted in idiomatic English translations.

In 1650 he entered Trinity College, Cambridge, where he took his B.A. degree in 1654. What Dryden did between leaving the university in 1654 and the Restoration of Charles II in 1660 is not known with certainty. In 1649 his contribution to a memorial volume for Oliver Cromwell that same year which marked him as a poet worth watching. His "heroic stanzas" were mature, considered, sonorous, and sprinkled with those classical and scientific allusions that characterized his later verse. This kind of public poetry was always one of the things Dryden did best.

When in May 1660 Charles II was restored to the throne, Dryden joined the poets of the day in welcoming him, publishing in June *Astraea Redux,* a poem of more than 300 lines in rhymed couplets. For the coronation in 1661, he wrote *To His Sacred Majesty.* These two poems were designed to dignify and strengthen the monarchy and to invest the young monarch with an aura of majesty, permanence, and even divinity. Thereafter Dryden's literary productivity was remarkable and his touch almost invariably confident and sure. On Dec. 1, 1663, Dryden married Elizabeth Howard, the youngest daughter of Thomas Howard, 1st earl of Berkshire. In due course she bore him three sons.

Dryden's longest poem to date, *Annus Mirabilis* (1667), was a celebration of two victories by the English fleet over the Dutch and the Londoners' survival of the Great Fire of 1666. In this work Dryden was once again gilding the royal image and reinforcing the concept of a loyal nation united under the best of kings. It was hardly surprising that when the poet laureate, Sir William Davenant, died in 1668, Dryden was appointed poet laureate in his place and two years later was appointed royal historiographer.

Writing for the stage. Soon after his restoration to the throne in 1660, Charles II granted two patents for theatres, which had been closed since 1642. Dryden soon joined the little band of dramatists who were writing new plays for the revived English theatre. His first play, *The Wild Gallant,* a farcical comedy with some strokes of humour and a good deal of licentious dialogue, was produced in 1663. It was a comparative failure, but in January 1664 he had some share in the success of *The Indian Queen,* a heroic tragedy in rhymed couplets in which he had collaborated with Sir Robert Howard. Dryden was soon to successfully exploit this new and popular genre, with its conflicts between love and honour and its lovely heroines before whose charms the blustering heroes sank down in awed submission. In the spring of 1665 Dryden had his own first outstanding success with *The Indian Emperour,* a play that was a sequel to *The Indian Queen.*

In 1667 Dryden had another remarkable hit with a tragicomedy, *Secret Love, or the Maiden Queen,* which appealed particularly to the king. In Dryden's new play the part of Florimel, a gay and witty maid of honour, was played to perfection by the king's latest mistress, Nell Gwynn. In Florimel's rattling exchanges with Celadon, the Restoration aptitude for witty repartee reached a new level of accomplishment. In 1667 Dryden also reworked for the stage Molière's comedy *L'Étourdi* (translated by William Cavendish, duke of Newcastle) under the title *Sir Martin Mar-all.*

In 1668 Dryden published *Of Dramatick Poesie, an Essay,* a leisurely discussion between four contemporary writers of whom Dryden (as Neander) is one. This work is a defense of English drama against the champions of both ancient Classical drama and the Neoclassical French theatre; it is also an attempt to discover general principles of dramatic criticism. By deploying his disputants so as to break down the conventional oppositions of ancient and modern, French and English, Elizabethan and Restoration, Dryden deepens and complicates the discussion. This is the first substantial piece of modern dramatic criticism; it is sensible, judicious, and exploratory and combines general principles and analysis in a gracefully informal style. Dryden's approach in this and all his best criticism is characteristically speculative and shows the influence of detached scientific inquiry.

In 1668 Dryden agreed to write exclusively for Thomas Killigrew's company at the rate of three plays a year and became a shareholder entitled to one-tenth of the profits. Although Dryden averaged only a play a year, the contract apparently was mutually profitable. In June 1669 he gave the company *Tyrannick Love,* with its blustering and blaspheming hero Maximin. In December of the next year came the first part of *The Conquest of Granada by the Spaniards,* followed by the second part about a month later. All three plays were highly successful; and in the character Almanzor, the intrepid hero of *The Conquest of Granada,* the theme of love and honour reached its climax. But the vein had now been almost worked out, as seen in the 1671 production of that witty burlesque of heroic drama *The Rehearsal,* by George Villiers, 2nd duke of Buckingham, in which Dryden (Mr. Bayes) was the main satirical victim. *The Rehearsal* did not kill the heroic play, however; as late as November 1675, Dryden staged his last and most intelligent example of the genre, *Aureng-Zebe.* In this play he abandoned the use of rhymed couplets for that of blank verse.

In writing those heroic plays, Dryden had been catering to an audience that was prepared to be stunned into admiration by drums and trumpets, rant and extravagance, stage battles, rich costumes, and exotic scenes. His abandonment of crowd-pleasing rant and bombast was symbolized in 1672 with his brilliant comedy *Marriage A-la-Mode,* in which the Restoration battle of the sexes was given a sophisticated and civilized expression that only Sir George Etherege and William Congreve at their best would equal. Equally fine in a different mode was his tragedy *All for Love* (1677), based on Shakespeare's *Antony and Cleopatra* and written in a flowing but controlled blank verse. Dryden had now entered what may be called his Neoclassical period, and if his new tragedy was not without some echoes of the old extravagance, it was admirably constructed, with the action developing naturally from situation and character.

By 1678 Dryden was at loggerheads with his fellow shareholders in the Killigrew company, which was in grave difficulties owing to mismanagement. Dryden offered his tragedy *Oedipus,* a collaboration with Nathaniel Lee, to a rival theatre company and ceased to be a Killigrew shareholder.

Verse satires. Since the publication of *Annus Mirabilis* 12 years earlier, Dryden had given almost all his time to playwriting. If he had died in 1680, it is as a dramatist that he would be chiefly remembered. Now, in the short space of two years, he was to make his name as the greatest verse satirist that England had so far produced. In 1681 the king's difficulties—arising from political misgivings that his brother, James, the Catholic duke of York, might succeed him—had come to a head. Led by the Earl of Shaftesbury, the Whig Party leaders had used the Popish Plot to try to exclude James in favour of Charles's illegitimate Protestant son, the Duke of Monmouth. But the king's shrewd maneuvers eventually turned public opinion against the Whigs, and Shaftesbury was imprisoned on a charge of high treason.

As poet laureate in those critical months Dryden could not stand aside, and in November 1681 he came to the support of the king with his *Absalom and Achitophel,* so drawing upon himself the wrath of the Whigs. Adopting as his framework the Old Testament story of King David (Charles II), his favourite son Absalom (Monmouth), and the false Achitophel (Shaftesbury), who persuaded Absalom to revolt against his father, Dryden gave a satirical version of the events of the past few years as seen from the point of view of the king and his Tory ministers and yet succeeded in maintaining the heroic tone suitable to the king and to the seriousness of the political situation. As anti-Whig propaganda, ridiculing their leaders in a succession of ludicrous satirical portraits, Dryden's poem is a masterpiece of confident denunciation; as pro-Tory propaganda it is equally remarkable for its serene and persuasive affirmation. When a London grand jury refused to indict Shaftesbury for treason, his fellow Whigs voted him a medal. In response Dryden published early in 1682 *The Medall,* a work full of unsparing invective against the Whigs, prefaced by a vigorous and plainspoken prose "Epistle to the Whigs." In the same year, anonymously and apparently without Dryden's authority, there also appeared in print his famous extended lampoon, *Mac Flecknoe,* written about four years earlier. What triggered this devastating attack on the Whig playwright Thomas Shadwell has never been satisfactorily explained; all that can be said is that in *Mac Flecknoe* Shadwell's abilities as a literary artist and critic are ridiculed so ludicrously and with such good-humoured contempt that his reputation has suffered ever since. The basis of the satire, which represents Shadwell as a literary dunce, is the disagreement between him and Dryden over the quality of Ben Jonson's wit. Dryden thinks Jonson deficient in this quality, while Shadwell regards the Elizabethan playwright with uncritical reverence. This hilarious comic lampoon was both the first English mock-heroic poem and the immediate ancestor of Alexander Pope's *The Dunciad.*

Late works. In 1685, after the newly acceded king James II seemed to be moving to Catholic toleration, Dryden was received into the Catholic Church. In his longest poem, the beast fable *The Hind and the Panther* (1687), he argued the case for his adopted church against the Church of England and the sects.

The abdication of James II in 1688 destroyed Dryden's political prospects, and he lost his laureateship to Shadwell. He turned to the theatre again. The tragedy *Don Sebastian* (1689) failed, but *Amphitryon* (1690) succeeded, helped by the music of Henry Purcell. Dryden collaborated with Purcell in

a dramatic opera, *King Arthur* (1691), which succeeded. His tragedy *Cleomenes* was long refused a license because of what was thought to be the politically dangerous material in it, and with the failure of the tragicomedy *Love Triumphant* in 1694, Dryden stopped writing for the stage.

In the 1680s and '90s Dryden supervised poetical miscellanies and translated the works of Juvenal and Persius for the publisher Jacob Tonson with success. In 1692 he published *Eleonora,* a long memorial poem commissioned for a handsome fee by the husband of the Countess of Abingdon. But his great late work was his translation of Virgil, contracted by Tonson in 1694 and published in 1697. Dryden was now the grand old man of English letters and was often seen at Will's Coffee-House chatting with younger writers. His last work for Tonson was *Fables Ancient and Modern* (1700), which were mainly verse adaptations from the works of Ovid, Chaucer, and Boccaccio, introduced with a critical preface. He died in 1700 and was buried in Westminster Abbey between Geoffrey Chaucer and Abraham Cowley in the Poets' Corner.

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Dryden, John Fairfield (b. Aug. 7, 1839, Temple Mills, Maine, U.S.—d. Nov. 24, 1911), American senator and businessman, the founder of the Prudential Insurance Company of America, the first company to issue industrial life insurance in the United States.

Dryden made a study, while attending Yale College (1861–65), of industrial, or "workingman's," insurance (small policies usually based on weekly premiums) as developed by the Prudential Assurance Company of London and by private benevolent societies. In 1873 Dryden and a few backers founded the Widows and Orphans Friendly Society in Newark, N.J. It was succeeded in 1875 by the Prudential Friendly Society, which took the name Prudential Insurance Company of America in 1877. Dryden was secretary of the company from 1875 to 1881 and president from 1881 until his death. He was U.S. senator from New Jersey in 1902–07. His son Forrest Fairfield Dryden (1864–1932) succeeded him as Prudential's president in 1912.

Consult the INDEX *first*

Drygalski, Erich Dagobert von (b. Feb. 9, 1865, Königsberg, Prussia [now Kaliningrad, Russian S.F.S.R.]—d. Jan. 10, 1949, Munich), German geographer and glaciologist who led an expedition to the Antarctic (1901–03) as part of an international program of exploration. Sailing in the *Gauss* under the sponsorship of the German government, his party landed on Antarctica at about 90° E, in the area now known as Wilhelm II Coast. Trapped in the pack ice, they were forced to winter about 50 miles (80 km) east of Gaussberg, an ice-free volcanic peak that Drygalski named and that was a notable discovery. The results of the venture were published in 20 volumes of scientific reports, *Deutsche Südpolar-Expedition 1901–1903* (1905–31; "German South Polar Expedition"). His general account of the trip, *Zum Kontinent des eisigens Südens* ("Concerning the Continent of the Icy South"), appeared in 1904.

Drygalski
Bavaria-Verlag

From 1906 to 1934 he was professor of geography at the University of Munich. In 1910 he took part in the expedition of Ferdinand, Graf von Zeppelin, to the Arctic island of Spitsbergen (now Svalbard), north of Norway, where he studied the influence of glaciers on land features. With Fritz Machatschek he published a comprehensive textbook on glaciology, *Gletscherkunde* (1942; "Science of Glaciers").

drying oil, unsaturated fatty oil, either natural (such as linseed oil) or synthetic, that when spread into a thin film becomes hard, tough, and elastic upon exposure to the air. Drying oils are used as vehicles in paints, varnishes, and printing inks.

In the 2nd century AD, the Greek physician Galen wrote of the use of nut oils—*e.g.,* hempseed and linseed oils—as drying oils. In the 6th century AD, another Greek physician, Aëtius, mentioned that certain nut oils could be used as a protective coating. The art of using drying oils for this purpose grew rapidly thereafter.

Chemical drying oils began to be used much later. The Flemish masters Hubert and Jan van Eyck were the first to use drying oils as a vehicle in oil painting in the early 15th century. The films deposited by drying oils may lose some of their elasticity upon aging.

dryland farming: *see* dry farming.

Dryopithecus, genus of extinct apelike animals that is representative of a group of small, generalized apes that contains the ancestors of both the modern apes and humans. Although *Dryopithecus* has been known by a variety of names based upon fragmentary material found over a widespread area including Europe, Africa, and Asia, it appears probable that only a single genus is represented. *Dryopithecus* is found as fossils in Miocene and Pliocene deposits (between 2,500,000 and 26,000,000 years old) and apparently originated in Africa.

Several distinct forms of *Dryopithecus* are known, including small, medium, and large, gorilla-sized animals. In many respects, as might be expected, *Dryopithecus* is rather generalized in structure and lacks most of the specializations that distinguish the modern apes from modern man. The canine teeth are larger than those in man but not as strongly developed as those in modern apes. The limbs were not excessively long—an adaptation in the apes for swinging through the trees. The skull lacked the well-developed crests and massive brow ridges found in modern apes.

It is likely that *Dryopithecus* proper gave rise to the modern gorillas and chimpanzees. At some time during the Miocene Epoch, the dryopithecines gave rise to a derivative that eventually led to the earliest manlike forms and finally to man. A form close to this branching of the dryopithecine stock is represented by the genus *Ramapithecus,* distinguished by its more advanced dentition. The dryopithecines probably inhabited forested areas.

drypoint, an engraving method in which the design to be printed is scratched directly into a copperplate with a sharply pointed instrument. Lines in a drypoint print are characterized by a soft fuzziness caused by ink printed from a burr, a rough ridge of metal thrown up on each side of the furrow of the drypoint line. The course of the line, however, is often abruptly angular when changing directions, because the metal of the plate continually resists the engraving point. Drypoint is most often used with other printmaking techniques. It can be used to give dark accents to a nearly completed etching, for example, or it can be used first to sketch in lightly on a copperplate the proposed design for a line engraving.

Drypoint was in use by the late 15th century

"Weary," drypoint on thin Japanese paper by James McNeill Whistler, 1863
By courtesy of the National Gallery of Art, Washington, D.C., gift of Myron A. Hofer in memory of his mother, Jane Arms Hofer, 1947

and, in the early 16th century, the German artist Albrecht Dürer already had a thorough command of the technique. Its greatest master was Rembrandt (1606–69), in whose etchings drypoint became increasingly prominent. After suffering a period of neglect in the late 18th and early 19th centuries, drypoint was revived and has been used by most modern etchers. *See also* engraving; etching.

drywall construction, a type of construction in which the interior wall is applied in a dry condition without the use of mortar. It contrasts with the use of plaster, which dries after application.

The materials used in drywall construction are gypsum board, plywood, fibre-and-pulp boards, and asbestos-cement boards. The large, rigid sheets are fastened directly to the frame of the building with nails, screws, or adhesives or are mounted on furring (strips of wood nailed over the studs, joists, rafters, or masonry, which allow free circulation of air behind the interior wall).

Specialized tools for hanging drywall include the drywall hammer and the joint tool, which is similar to a plastering trowel but made of flexible steel with a concave bow. It is used to apply and smooth a plasterlike compound in joints between wallboards, feathering it out so that the outer edges virtually disappear and the joint, when painted, effectively becomes invisible. Nailheads, slightly depressed or "dimpled" by the hammer, disappear when similarly treated.

Drywall construction is used to avoid delays, because the interior walls do not have to dry before other work can be started, and to obtain specific finishes. Wallboard is manufactured in both finished and unfinished forms. Finished wallboards are faced with vinyl or other materials in a variety of permanent colours and textures, so that they need not be painted when installed. Backing materials and composition of the panel base determine the degree of insulation, fire resistance, and vapour barrier afforded. Wallboards are fire-rated from 1 hour to 4 hours according to the time that a fire's progress would be retarded by the wallboard.

Because drywall is mounted on the frame of a building, the framing lumber must be straight for the interior wall to align perfectly; and the lumber must have low moisture content to avoid loosening of the drywall nails. These problems are not encountered in the use of plaster for interior finishes. However, because of the time that it saves, drywall construction has become relatively common in residential buildings.

Dschang, town, northwestern Cameroon, west central Africa, on a forested plateau northwest of Yaoundé. Its high elevation of 4,525 feet (1,379 m) makes the town a health and tourist resort, despite communications difficulties caused by rugged terrain and high rainfall. It is also a local trade centre for agricultural products and livestock. In the vicinity there are experimental plantations growing cinchona (plants whose bark yields quinine), an experimental station for processing green tea, and a hydroelectric power plant. Bauxite deposits are located nearby at Fongo-Tongo, and there is a small brick-making industry. Dschang is served by a hospital, an agricultural college, and an airfield. Pop. (1981 est.) 21,705.

DSM, in full NAAMLOZE VENNOOTSCHAP DSM (Dutch: DSM Limited Company), state-owned Dutch chemical company. Until 1975 the company was known as DSM NV Nederlandse Staatsmijnen (the Dutch State Mine Company). The major shareholder is The Netherlands government. Headquarters are in Heerlen, Neth.

Following World War II, the chemical industry was one of the fastest growing sectors of the Dutch economy. Its output increased 10-fold between the late 1940s and the early '70s. In the late 20th century, however, the company was beset with problems caused by worldwide recession, and it cut back sharply on investment in chemical production. High wage levels, necessary antipollution improvements, and soaring energy costs also contributed to the company's financial difficulties.

In addition to chemicals, the company produces fertilizers, plastics, building materials, oil and petroleum products, and household products. It also participates in North Sea oil exploration.

D.S.O., recipient of the Distinguished Service Order, a British military decoration. *See* Distinguished Service Order.

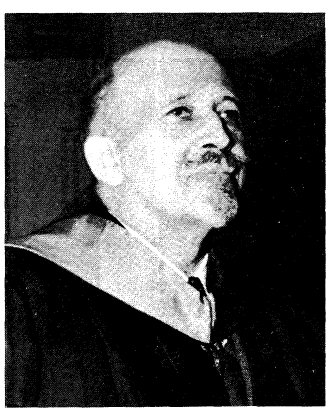
DTA (chemistry technique): *see* differential thermal analysis.

du (in proper names): *see* below and *see also* names spelled with no space after "du" (*e.g.*, Dubois, Pierre).

Du Bois, Franz: *see* Sylvius, Franciscus.

Du Bois, W(illiam) E(dward) B(urghardt) (b. Feb. 23, 1868, Great Barrington, Mass., U.S.—d. Aug. 27, 1963, Accra, Ghana), American sociologist, the most important black protest leader in the United States during the first half of the 20th century. He shared in the creation of the National Association for the Advancement of Colored People (NAACP) in 1909 and edited *Crisis,* its magazine, from 1910 to 1934. Late in life he became identified with Communist causes.

Early career. Du Bois was graduated from Fisk University, a black institution at Nashville, Tenn., in 1888. He received a Ph.D. from Harvard University in 1895. His



W.E.B. Du Bois
By courtesy of Atlanta University

doctoral dissertation, *The Suppression of the African Slave-Trade to the United States of America, 1638–1870,* was published in 1896. Although Du Bois took an advanced degree in history, he was broadly trained in the social sciences; and at a time when sociologists were theorizing about race relations, he was conducting empirical inquiries into the condition of blacks. For more than a decade he devoted himself to sociological investigations of blacks in America, producing 16 research monographs published between 1897 and 1914 at Atlanta University, where he was a professor, as well as *The Philadelphia Negro; A Social Study* (1899), the first case study of a black community in the United States.

Although originally Du Bois had believed that social science could provide the knowledge to solve the race problem, he gradually came to the conclusion that in a climate of virulent racism, expressed in such evils as lynching, peonage, disfranchisement, Jim Crow segregation laws, and race riots, social change could be accomplished only through agitation and protest. In this view, he clashed with the most influential black leader of the period, Booker T. Washington, who, preaching a philosophy of accommodation, urged blacks to accept discrimination for the time being and elevate themselves through hard work and economic gain, thus winning the respect of the whites. In 1903, in his famous book *The Souls of Black Folk,* Du Bois charged that Washington's strategy, rather than freeing the black man from oppression, would serve only to perpetuate it. This attack crystallized the opposition to Booker T. Washington among many black intellectuals, polarizing the leaders of the black community into two wings—the "conservative" supporters of Washington and his "radical" critics.

Two years later, in 1905, Du Bois took the lead in founding the Niagara Movement, which was dedicated chiefly to attacking the platform of Booker T. Washington. The small organization, which met annually until 1909, was seriously weakened by internal squabbles and Washington's opposition. But it was significant as an ideological forerunner and direct inspiration for the interracial NAACP, founded in 1909. Du Bois played a prominent part in the creation of the NAACP and became the association's director of research and editor of its magazine, *Crisis.* In this role he wielded an unequaled influence among middle-class blacks and progressive whites as the propagandist for the black protest from 1910 until 1934.

Both in the Niagara Movement and in the NAACP, Du Bois acted mainly as an integrationist, but his thinking always exhibited, to varying degrees, separatist-nationalist tendencies. In *The Souls of Black Folk* he had expressed the characteristic dualism of black Americans:

> One ever feels his twoness—an American, a Negro; two souls, two thoughts, two unreconciled strivings; two warring ideals in one dark body, whose dogged strength alone keeps it from being torn asunder. . . . He simply wishes to make it possible for a man to be both a Negro and an American, without being cursed and spit upon by his fellows, without having the doors of Opportunity closed roughly in his face.

Black nationalism and socialism. Du Bois's black nationalism took several forms—the most influential being his pioneering advocacy of Pan-Africanism, the belief that all people of African descent had common interests and should work together in the struggle for their freedom. Du Bois was a leader of the first Pan-African Conference in London in 1900 and the architect of four Pan-African congresses held between 1919 and 1927. Second, he articulated a cultural nationalism. As the editor of *Crisis* he encouraged the development of black literature and art and urged his readers to see "Beauty in Black." Third, Du Bois's black nationalism is seen in his belief that blacks should develop a separate "group economy" of producers' and consumers' cooperatives as a weapon for fighting economic discrimination and black poverty. This doctrine became especially important during the economic catastrophe of the 1930s and precipitated an ideological struggle within the NAACP.

He resigned from the editorship of *Crisis* and the NAACP in 1934, yielding his influence as a race leader and charging that the organization was dedicated to the interests of the black bourgeoisie and ignored the problems of the masses. Du Bois's interest in cooperatives was a part of his nationalism that developed out of his Marxist leanings. At the turn of the century, he had been an advocate of black capitalism and black support of black business, but by about 1905 he had been drawn toward Socialist doctrines. Although he joined the Socialist Party only briefly in 1912,

he remained sympathetic with Marxist ideas throughout the rest of his life.

Upon leaving the NAACP he returned to Atlanta University, where he devoted the next 10 years to teaching and scholarship. In 1940 he founded the magazine *Phylon,* Atlanta University's "Review of Race and Culture." In 1945 he published the "Preparatory Volume" of a projected encyclopaedia of the black, for which he had been appointed editor in chief. He also produced two major books during this period. *Black Reconstruction: An Essay Toward a History of the Part Which Black Folk Played in the Attempt to Reconstruct Democracy in America, 1860–1880* (1935) was an important Marxist interpretation of the Reconstruction era (the period following the American Civil War during which the seceded Southern states were reorganized according to the wishes of Congress); and more, significantly, it provided the first synthesis of existing knowledge on the role of blacks in that critical period of American history. In 1940 appeared *Dusk of Dawn,* subtitled *An Essay Toward an Autobiography of a Race Concept.* In this brilliant book, Du Bois explained his role in both the African and Afro-American struggles for freedom, viewing his career as an ideological case study illuminating the varied, complex facets of the black–white conflict.

Following this fruitful decade at Atlanta University, he returned once more to a research position at the NAACP (1944–48). This brief connection ended in a second bitter quarrel, and thereafter Du Bois moved steadily leftward politically. Identified with pro-Russian causes, he was indicted in 1951 as an unregistered agent for a foreign power. Although a federal judge directed his acquittal, Du Bois had become completely disillusioned with the United States. In 1961 he joined the Communist Party and, moving to Ghana, renounced his American citizenship more than a year later. (El.R.)

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Du Bois-Reymond, Emil Heinrich (b. Nov. 7, 1818, Berlin—d. Dec. 26, 1896, Berlin), German founder of modern electrophysiology, known for his research on electrical activity in nerve and muscle fibres.

Working at the University of Berlin (1836–96) under Johannes Müller, whom he later succeeded as professor of physiology (1858), he studied fishes that are capable of generating electrical currents. Turning to the study of electrical conduction along nerve and muscle fibres, he found (1843) that a stimulus applied to the electropositive surface of the nerve membrane causes a decrease in electrical potential at that point and that this "point of reduced potential"—the impulse—travels along the nerve as a "wave of relative negativity." He immediately was able to demonstrate that this phenomenon of "negative variation" also occurs in striated muscle and is the primary cause of muscular contraction. Although later research showed the process of nerve and muscle stimulation to be much more complex than Du Bois-Reymond's model, the summation of his studies in *Untersuchungen über thierische Elektricität,* 2 vol. (1848–1884; "Researches on Animal Electricity"), created the field of scientific electrophysiology.

Du Bois-Reymond, engraving, about 1900

Archiv fur Kunst und Geschichte, Berlin

Du Bois-Reymond's intellectual collaboration with Hermann von Helmholtz, Carl Ludwig, and Ernst von Brücke proved to be of great importance to the course of German physiology and to biological thought in general. At the university, their biophysics program, designed to reduce physiology to applied physics and chemistry, influenced the psychological theories of Sigmund Freud and did much to purge physiology of vitalistic theories that depicted all organic matter as arising from a "life force" peculiar to living things and quite different from all known physical phenomena.

Du Bos, Charles (b. Oct. 27, 1882, Paris—d. Aug. 5, 1939, La Celle-Saint-Cloud, Fr.), French critic of French and English literature whose writings on William Shakespeare, Percy Bysshe Shelley, and Lord Byron helped turn French attention toward English literature.

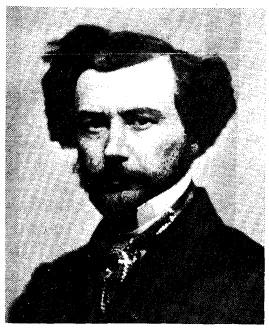
Because his mother was English, Du Bos was exposed to English literature at an early age. He studied at the University of Oxford for a year (1900–01) and also in Germany. Among his works are studies of Goethe and of the French authors Gustave Flaubert, Prosper Mérimée, and François Mauriac and correspondence with his friend André Gide. The correspondence was published as *Le Dialogue avec André Gide* (1929; 2nd ed., *Lettres de Charles Du Bos et réponses d'André Gide,* 1950). His chief interest was in what he called the "soul" of a work and its effects in the "soul" of a reader. As he became older, this concern became increasingly religious, and his *Journal intime,* 6 vol. (1946–55), written partly in English, is an account of the spiritual evolution that brought him into the Roman Catholic church in 1927.

Du Buat, Pierre-Louis-Georges (b. April 23, 1734, Tortisambert, Fr.—d. Oct. 17, 1809, Vieux-Condé), French hydraulic engineer who derived empirical formulas for computing the discharge of fluids from pipes and open channels. His emphasis on achieving results that would be of practical use in the design of hydraulic works strongly influenced the development of experimental hydraulics in the 18th and 19th centuries.

Educated in Paris, Du Buat served as a military engineer from 1761 to 1791. In his writings, he compiled a wealth of experimental data from which he determined his basic algebraic expression for discharge from pipes and channels. Although valid only within the range of his experimental data, this equation provided the best available means at the time of predicting the performance of water-supply systems and similar works.

Du Camp, Maxime (b. Feb. 8, 1822, Paris—d. Feb. 9, 1894, Baden-Baden, Ger.), French writer and photographer who is chiefly known for his vivid accounts of 19th-century French life. He was a close friend of the novelist Gustave Flaubert.

An outgoing, adventurous man, Du Camp also pioneered in photography and published works in virtually every literary genre. He traveled widely with Flaubert (1844–45 and 1849–51), and his *Égypte, Nubie, Palestine et Syrie* (1852), written after one of their journeys, is among the first books illustrated with photographs. During the revolutionary year 1848 he was wounded and then decorated for counter-revolutionary activity in France. His *Expédition des deux-Siciles* (1861; "Expedition to the Two Sicilies") recounted his experiences as a volunteer with the Italian revolutionary Garibaldi.



Du Camp

H. Roger-Viollet

In 1851 Du Camp founded the *Revue de Paris* and in it published Flaubert's great novel, *Madame Bovary;* disputes arising from the publication of the novel ended their friendship. To *La Revue des Deux Mondes,* Du Camp contributed his *Paris, ses organes, ses fonctions et sa vie,* 6 vol. (1869–75; "Paris, Its Mechanisms, Its Workings, and Its Life"), an extensive document of the city. He also wrote poems (*Les Chants modernes,* 1855; "Modern Songs"), art criticism, novels, a monograph on his friend, the writer Théophile Gautier, and *Souvenirs littéraires,* 2 vol. (1882–83; "Literary Recollections"), which included previously unrevealed information about Flaubert and his struggles with epilepsy.

du Cange, Charles du Fresne, seigneur: *see* Cange, Charles du Fresne, seigneur du.

Du Casse, Pierre-Emmanuel-Albert, Baron (b. Nov. 16, 1813, Bourges, Fr.—d. March 15, 1893, Paris), French soldier and military historian who was the first editor of the correspondence of Napoleon.

In 1849 Du Casse was commissioned by Prince Jérôme Bonaparte, formerly king of Westphalia, to write a history of one of his commands. On completion of that work, the prince named him aide-de-camp and asked him to edit the papers of Napoleon. Because Du Casse worked with little care, the editions, beginning with *Mémoires pour servir à l'histoire de la campagne de 1812 en Russie* (1852; "Historical Memoirs of the Russian Campaign of 1812"), were not entirely trustworthy, but they did throw some light on Napoleon and his entourage. Du Casse wrote and edited numerous other works, including *La Guerre au jour le jour, 1870–71* (1875; "The War: A Day to Day Account, 1870–71"), *Les Rois frères de Napoléon* (1883; "The Brothers Napoleon, Kings"), and *La Crimée et Sébastopol, de 1853 à 1856* (1892), an account of his experiences in the Crimean War.

Du Fu (Chinese poet): *see* Tu Fu.

du Maurier, Dame Daphne, married name LADY DAPHNE BROWNING, (b. May 13, 1907, London—d. April 19, 1989, Par, Cornwall, Eng.), English novelist and playwright, daughter of actor-manager Sir Gerald du Maurier, best-known for her novel *Rebecca* (1938).

Her first novel, *The Loving Spirit* (1931), was followed by many successful, usually romantic tales set on the wild coast of Cornwall, where she came to live. She also wrote historical

fiction, several plays, and *Vanishing Cornwall* (1967), a travel guide. Her popular *Rebecca* was made into a motion picture in 1940. Du Maurier was made a Dame Commander in the Order of the British Empire in 1969. She published an autobiography, *Growing Pains*, in 1977; the collection *The Rendezvous and Other Stories* in 1980; and a literary reminiscence, *The Rebecca Notebook and Other Memories*, in 1981.

du Maurier, George (Louis Palmella Busson) (b. March 6, 1834, Paris—d. Oct. 6, 1896, London), British caricaturist whose illustrations for *Punch* were acute commentaries on the Victorian scene. He also wrote three successful novels.

His happy childhood at Passy, Fr., is recalled in *Peter Ibbetson* (1891); his full-blooded enjoyment of student life in the Latin Quarter of Paris is reflected in *Trilby* (1894); in *The Martian* (1897) there is a poignant episode based on his own tragic experience of losing the sight of his left eye. This misfortune obliged him to abandon painting in favour of drawing. In 1860 he moved to London, where his skilled draftsmanship and engaging personality quickly established his success. His gently satiric caricatures were mainly aimed at the growing nouveau riche class and the aesthetes led by Oscar Wilde. His book illustrations and drawings for such periodicals as *Once a Week* and *The Leisure Hour*, however, are sometimes considered his best work. His granddaughter, Daphne Du Maurier, edited *The Young George Du Maurier: A Selection of His Letters, 1860–1867* in 1951.

Du Maurier, Sir Gerald (Hubert Edward Busson) (b. March 26, 1873, London—d. April 11, 1934, London), actor-manager, the chief British exponent of a delicately realistic style of acting that sought to suggest rather than to state the deeper emotions.

A son of the artist and novelist George Du Maurier, he won immense popularity, but the

Sir Gerald Du Maurier, 1929
By courtesy of the National Film Archive, London

fact that he presented characters in terms of his own personality, in contemporary plays, led many to underrate him. Educated at Harrow, Du Maurier made his debut in 1894. Among the plays in which he appeared were Sir James Barrie's *Admirable Crichton*, *Peter Pan*, and *Dear Brutus*. He joined in the management of Wyndham's Theatre in 1910 and then of the St. James's in 1925. He was knighted in 1922. He also acted in and produced films. His daughter, Daphne Du Maurier, published a life of her father, *Gerald: A Portrait* (1934).

Du Mont, Allen B(alcom) (b. Jan. 29, 1901, Brooklyn, N.Y., U.S.—d. Nov. 15, 1965, New York City), U.S. engineer who perfected the first commercially practical cathode-ray tube, which was not only vitally important for much scientific and technical equipment but was the essential component of the modern television receiver.

Du Mont joined the Westinghouse Lamp Company, Bloomfield, N.J., in 1924 as an engineer in the development laboratory. He developed high-speed manufacturing and testing

Du Mont, 1953
AP/Wide World Photos

equipment that allowed Westinghouse to increase its production to 50,000 vacuum tubes a day.

In 1928 Du Mont became chief engineer of the De Forest Radio Company, Passaic, N.J., where he became interested in the patents and equipment of Charles F. Jenkins, who had established an experimental television station in the early 1920s. Working from Jenkins' patents, Du Mont set up a simultaneous picture and sound broadcast in 1930 and concluded that electromechanical systems were inadequate for practical television and that a purely electronic system was needed.

Du Mont set up a company in 1931 that later was known as Allen B. Du Mont Laboratories, Inc. He improved cathode-ray tubes and developed the modern oscilloscope, widely used in the laboratory for the measurement and study of wave forms.

In 1937 Du Mont began manufacturing the first commercial television receivers, which were based upon his improved cathode-ray tube. His company also established experimental television transmission facilities and marketed the first postwar television receivers.

Du Mont served with the National Television System Committee, which formulated the broadcast standards for both black-and-white and colour television. He also worked with the Federal Communications Commission concerning the allocation of frequencies for television channels.

du Pont FAMILY, French-descended U.S. family whose fortune was founded on explosive powders and textiles and who diversified later into various other areas of manufacturing. Pierre-Samuel du Pont de Nemours (*q.v.*) was born in Paris and was one of the main writers of the Physiocratic school of economics. His sons founded the two branches of the du Pont family.

The first son, Victor-Marie du Pont (1767–1827), was attaché to the first French legation to the U.S. (1787), aide-de-camp to Lafayette (1789–91), second secretary of the French legation (1791–92), and first secretary (1795–96). In 1800 he returned to settle in the U.S. and became naturalized. When his attempts in New York at a mercantile importing business (1802–05) and then a land development project (1806–09) both failed, he went south to manage his brother Irénée's woollen mills in Wilmington, Del., but was largely ineffectual in this too. He was later a director of the Bank of the United States, Philadelphia. His son, Samuel Francis du Pont (1803–65), was a U.S. naval officer. He served in the Mexican War, was on the board that designed the curriculum for the Naval Academy at Annapolis, Md., and commanded squadrons and fleets in the blockade of the South during the U.S. Civil War, rising to the rank of rear admiral. A naval attack that he led on the defenses of Charleston, S.C., in 1863, however, met a crushing defeat, and he was relieved of command; he retired from active duty.

The other son of Pierre-Samuel, Eleuthère-Irénée du Pont (1771–1834), had worked at the French royal powder works before arriving in America in 1800. Impressed by the poor quality and high price of American powder, he made further studies and eventually in 1802 established a gunpowder plant near Wilmington, Del., that became highly profitable, especially during the War of 1812, and that marked the successful beginning of the E.I. du Pont de Nemours and Co. (the name that he chose in 1833). He also established a woollen mill and pursued farming as an avocation. His immediate successors were two sons, Alfred Victor du Pont (1798–1856), who headed the company from 1834 to 1850 in a traditional manner, and Henry du Pont (1812–89), who proved more vigorously enterprising. Though a graduate of West Point (1833), he left the army a year later and joined the family business, heading the company during the great period from 1850 to 1889 and expanding its activities especially after the Civil War; he acquired powder works as far away as California and gained control of various associated enterprises. In the course of this time he was in partnership with other members of the family, including another brother and a nephew. One of his sons, Henry Algernon du Pont (1838–1926), was a graduate of West Point and a Medal of Honor winner in the Civil War; he entered the family business in 1878 and pushed for its incorporation in 1899. Retiring in 1902, he was U.S. senator from Delaware from 1906 to 1917. In 1902, three cousins—Thomas Coleman du Pont (1863–1930), Alfred Irénée du Pont (1864–1935), and Pierre Samuel du Pont (1870–1954)—became chief directors, assuring that direction of the corporation would remain in the family.

"De," "la," and similar components of a name, when followed by a space, are alphabetized as separate words (e.g., *De Forest, Lee*). *When they are joined to the following part of a name, the combination is treated as a single word* (e.g., *DeForest, John William*).

du Pont (de Nemours), Pierre-Samuel (b. Dec. 14, 1739, Paris—d. Aug. 6, 1817, Eleutherian Mills, near Wilmington, Del.), French economist whose numerous writings were mainly devoted to spreading the tenets of the physiocratic school and whose adherence to these doctrines largely explains his conduct during his long political career.

An early work on free trade, *De l' Exportation et de l'importation des grains* (1764; "On

du Pont (de Nemours), engraving by L.-J. Cathelin, after a portrait by J. Ducreux
By courtesy of the Bibliotheque Nationale, Paris

the Export and Import of Grains"), brought him the friendship of A.-R.-H. Turgot, whose biography he wrote (1782) and whose papers he edited (9 vol., 1809–11). When Turgot became minister of finance in 1774, du Pont served as inspector general of commerce (1774–76). He was largely responsible for the clause in the Treaty of Versailles of 1783 calling for a trade treaty between France and Great Britain, and he greatly influenced the free-trade treaty between France and Britain that was signed in 1786. For these services he was ennobled. In 1787 he became secretary to the Assembly of Notables. An adherent of a constitutional monarchy, he was a member of the Estates-General convened for 1789, in which he represented the third estate of Nemours.

One of the chief promoters of the Tennis Court oath, he played an important part in the beginnings of the French Revolution. He was opposed to the policies of the radical republicans, and he defended Louis XVI in August 1792. Though forced into hiding during the Terror and later imprisoned, he was eventually released through the help of friends. A member of the Chamber of Ancients under the Directory, he was suspected of activities on behalf of the royalists and was again arrested but quickly released.

He now planned to go to the United States. After much delay, he arrived in the United States with his sons, Éleuthère Irénée and Victor, in January 1800. For Thomas Jefferson he drew up a scheme of national education and established companies to promote Franco-American trade. These ventures were not successful, but Éleuthère, a pupil of the French chemist Antoine Lavoisier, founded a powder-manufacturing company in the United States that eventually became one of the largest chemical-manufacturing firms in the world.

In 1802 Pierre-Samuel returned to France to promote the sale of Louisiana to the United States, hoping thereby to improve Franco-American relations. He became vice president of the Paris Chamber of Commerce. He eventually became critical of Napoleon's economic and foreign policy. In 1814 he assisted Talleyrand in restoring the Bourbons, became secretary-general of the provisional government, and was made councillor of state by Louis XVIII. During the Hundred Days he left France and went to the United States, where he remained.

du Pont, Pierre Samuel (b. Jan. 15, 1870, Wilmington, Del., U.S.—d. April 5, 1954, Wilmington), manufacturer and the largest American munitions producer during World War I.

Pierre Samuel du Pont was the great-great-grandson and namesake of the French economist, whose son, Éleuthère Iréné du Pont, began the family's fortunes in America in 1802. Graduating from the Massachusetts Institute of Technology in 1890, the young du Pont joined his family's firm, E.I. du Pont de Nemours Powder Co. He was made assistant superintendent at the Carney's Point, N.J., plant, where he helped produce a smokeless shotgun powder. The family enterprise went through a consolidation in 1902, creating one company, E.I. du Pont de Nemours & Co., out of almost 100 firms. Du Pont became its treasurer and then its president from 1915 to 1919, when he became chairman of the board, a post he held until 1940. He saw the firm's production expand from 12,000,000 pounds of munitions yearly before the war to more than 1,000,000 pounds each day at the height of production during World War I. The company constructed a facility near Nashville, Tenn., for smokeless powder production that became the largest such factory in the world. Moreover, production began in part of the facility only 67 days after groundbreaking ceremonies. Before the war ended, the du Pont company had sold nearly 1,500,000,000 pounds of explosives to the government and its allies.

After the war, Pierre Samuel du Pont purchased enough stock in the General Motors Corporation to place himself as president (1920–23) and as chairman of the board (1923–29). Besides serving on the boards of numerous banks and corporations, du Pont donated generously to educational activities in Delaware. In 1940 he retired to his 1,000-acre estate, Longwood, though he continued his philanthropies.

Du Pont Company, byname of E.I. DU PONT DE NEMOURS & COMPANY, American corporation engaged primarily in the manufacture of chemicals, plastics, and synthetic fibres. The company was founded by Éleuthère Irénée du Pont (1771–1834) in Delaware in 1802 to produce black powder and later other explosives, which were the company's main products until the 20th century, when it began a diversification of products. Today Du Pont has plants, subsidiaries, and affiliates worldwide. Headquarters are in Wilmington, Del.

As a young French émigré, du Pont discovered that a good prospect for business in America would be the milling of gunpowder. Returning to Paris, he found investors, and on April 21, 1801, the articles of partnership were signed for E.I. du Pont de Nemours & Company. On July 19, 1802, he settled along the Brandywine Creek near Wilmington, Del., and hired workmen to build his powder mills. The first black powder was marketed two years later; sales rose yearly, especially during the War of 1812, and by the time of his death his mills were a major American enterprise.

Blasting powders for industries, mines, and quarries were becoming more important, and in 1857 the company produced a "soda powder" that was the first strictly industrial explosive. In 1880 it began manufacturing nitroglycerin and dynamite. In 1904, as a by-product of its manufacture of explosives, it began producing a special nitrocellulose for lacquers, leather finishes, etc. Nitrocellulose plastics came in 1915; and the purchase of a number of firms in 1917 brought in dyestuffs, paints, acids, heavy chemicals, and other products. Du Pont first introduced neoprene synthetic rubber in 1931 and nylon in 1938 and expanded into such diverse products as plastics, electrochemicals, photographic film, and agricultural chemicals. A few of the famous Du Pont synthetics were Orlon, Mylar, and Dacron.

The company first incorporated in 1899, after nearly a century as a partnership. In 1907 it became the target of a U.S. antitrust suit and in 1912 was forced to divest itself of a major proportion of its powder business. In 1917 the company began buying an interest in General Motors Corporation and owned 25 percent of the stock at the end of 1925. In 1962, after 13 years of antitrust litigation, Du Pont was ordered to divest itself of GM stock.

Corporate management was also changing. From 1802 to 1940 all heads of the company had been members of the du Pont family, and all but one (a son-in-law, presiding 1834–37) had borne the du Pont name. This control had been reinforced in 1915 by creation of the Christiana Securities Company, whose major stockholders were du Ponts and which had effective control (28 percent) of the shares of E.I. du Pont de Nemours & Company (newly incorporated that year). By the 1970s, under the tax laws, however, the du Ponts found the setup disadvantageous and in 1977 succeeded (after lengthy litigation) in having Christiana merged into the Du Pont Company. Direction of the company was passing to persons unrelated to the du Ponts, and the company's structure was changing: after 1940 only one chief executive was a du Pont (1962–67), and the company underwent extensive departmental reorganizations in 1967 and 1973–76, largely to streamline operations in the face of stiffening foreign competition. In 1981 Du Pont acquired Conoco, Inc. (Continental Oil Company), which it continued to operate as a subsidiary.

Du Sable, Jean-Baptist-Point (b. 1750?, St. Marc, Sainte-Domingue [now Haiti]—d. Aug. 28, 1818, St. Charles, Mo., U.S.), black pioneer trader and founder of the settlement that later became the city of Chicago.

Du Sable, whose French father had moved to Haiti and married a black woman there, is believed to have been a freeborn. At some time in the 1770s he went to the Great Lakes area of North America, settling on the shore of Lake Michigan at the mouth of the Chicago River, with his Potawatomi wife, Kittihawa (Catherine). His loyalty to the French and the Americans led to his arrest in 1779 by the British, who took him to Fort Mackinac. From 1780 to 1783 or 1784 he managed for his captors a trading post called the Pinery on the St. Clair River in present-day Michigan, after which he returned to the site of Chicago. By 1790 Du Sable's establishment there had become an important link in the region's fur and grain trade.

In 1800 he sold out and moved to Missouri, where he continued as a farmer and trader until his death. But his 20-year residence on the shores of Lake Michigan had established his title as Father of Chicago.

Du Toit, Jakob Daniel, pseudonym TOTIUS (b. Feb. 21, 1877, Paarl, Cape Colony, S.Af.—d. July 1, 1953, Pretoria, Transvaal), Afrikaans poet, pastor, biblical scholar, and the compiler of an Afrikaans Psalter (1936), regarded as one of the finest poetic achievements of its kind in Dutch, Flemish, or Afrikaans.

Du Toit was educated in Pretoria, Rustenburg, and Daljosafat, studied at the theological seminary at Burgesdorp, and passed his final examination for the ministry of the Dutch Reformed Church in 1899.

On the outbreak of the South African War he joined the Boer forces as chaplain. In 1900 he went to the Free University, Amsterdam, where he received a doctor's degree in theology in 1903 and then entered the ministry. From 1911 he was professor of theology at the University of Potchefstroom, Transvaal; on retirement in 1949 he was elected chancellor.

Du Toit was responsible for the greater part of the translation of the Bible into Afrikaans, completed in 1932. The Calvinism and patriotism confirmed in him by the circumstances of his childhood and training are revealed at a high artistic level in his finest poetry, the patriotic poems in *Trekkerswee* (1915) and the personal lyrics in *Passieblomme* (1934) and *Skemering* (1948). These and other volumes—including *By die Monument* (1908), *Verse van Potgieter's Trek* (1909), *Wilgerboombogies* (1912), *Rachel* (1913), and *Uit donker Afrika* (1936)—also show the influence of the Flemish poet Guido Gezelle.

Du Toit, Stephanus Jacobus (b. 1847, Paarl, Cape Colony—d. May 29, 1911, Cape Province, Union of South Africa), South African pastor and political leader who, as the founder of the Afrikaner Bond (a bitterly anti-British political party of Dutch South Africans), was influential in generating Boer (Dutch) political opposition to British rule in South Africa. He was also instrumental in the establishment of Afrikaans (a dialect of Dutch) as an official language in South Africa.

Du Toit's political career began in 1875, when he founded an organization, the Society of True South Africans. He began publishing books in Afrikaans and translated the Bible into that language. His movement had the si-

multaneous effects of establishing Afrikaans as a literary language and of rallying Boer political consciousness around a common Afrikaner culture. He created the Afrikaner Bond in 1879, and by 1884 it was the most important Boer party in Cape Colony. In 1882 Du Toit migrated to the Boer republic of the Transvaal to become its superintendent of education.

du Vigneaud, Vincent (b. May 18, 1901, Chicago, Ill., U.S.—d. Dec. 11, 1978, White Plains, N.Y.), American biochemist and winner of the Nobel Prize for Chemistry in 1955 for the isolation and synthesis of two pituitary hormones: vasopressin, which acts on the muscles of the blood vessels to cause elevation of blood pressure; and oxytocin, the principal

Du Vigneaud, 1968

By courtesy of Cornell University, Ithaca, N.Y.

agent causing contraction of the uterus and secretion of milk.

Du Vigneaud studied at the University of Illinois, Urbana, took his Ph.D. from the University of Rochester, N.Y. (1927), then studied at Johns Hopkins University, Baltimore, the Kaiser Wilhelm Institute, Berlin, and the University of Edinburgh. He headed the biochemistry department of the George Washington University Medical School, Washington, D.C. (1932–38), and was professor and head of the department of biochemistry at the Cornell University Medical College, New York City (1938–67), and professor of chemistry at Cornell University, Ithaca, N.Y. (1967–75).

Under du Vigneaud's direction, the Cornell laboratories contributed to such major achievements as the synthesis of penicillin, the isolation and determination of the structure of the sulfur-bearing vitamin biotin, and the examination of many other sulfur-containing organic compounds.

Dual Alliance, also called FRANCO-RUSSIAN ALLIANCE, a political and military pact that developed between France and Russia from friendly contacts in 1891 to a secret treaty in 1894; it became one of the basic European alignments of the pre-World War I era. Germany, assuming that ideological differences and lack of common interest would keep republican France and tsarist Russia apart, allowed its Reinsurance Treaty (*q.v.*) with Russia to lapse in 1890. In the event of war, France wanted support against Germany; and Russia, against Austria-Hungary. The two powers slowly came closer together, upsetting the system of alliances that had been established by Otto Von Bismarck to protect Germany against such a potential "two-front" threat. In August 1891 they made a preliminary agreement to consult in case of aggression against either of them. This agreement was strengthened by a military convention in August 1892. To preserve secrecy, it was necessary to bypass discussion and ratification by the French Parliament, the alliance being formalized through an exchange of letters (Dec. 27, 1893–Jan. 4, 1894) that accepted the previously agreed upon terms. The new alliance was to be in force as long as the Triple Alliance (*q.v.*) of Germany, Austria-Hungary, and Italy, and its terms were to be secret. It provided that in the event of an attack on France by Germany or by Italy supported by Germany, Russia would field 700,000 to 800,000 men to fight Germany; in the event of an attack on Russia by Germany or by Austria-Hungary supported by Germany, France would field 1,300,000 men to fight Germany. Provisions for specific military plans and organizations were also made. The alliance was renewed and strengthened in 1899 and 1912.

Dual Monarchy: *see* Austria-Hungary.

dual organization, a social structure characterized by the division of society into two complementary parts called moieties. According to a strict definition, moieties are groups that are exogamous (*i.e.,* marriage between members of the same moiety is forbidden), of unilineal descent, and in some sense opposed. Sometimes the term moiety is used more loosely to refer simply to one of two divisions of a society, regardless of descent or marriage regulation. Dual organization, then, occurs in two basic forms: as a feature related to but not necessarily determining the regulation of marriage (kinship moieties) and as a ceremonial organization. Usually the two forms are combined, but sometimes only one form occurs, or the two appear concurrently as separate systems. Thus, the Canela of South America have four dual schemes, one of which regulates marriage whereas the other three are independent ceremonial groupings; all of these bisect the tribe exhaustively and determine membership by the name given a person by his maternal uncle, by the generation of his peer group, or by affiliation to one of the Canela social groups.

Although moieties are often referred to interchangeably with phratries and clans, they are distinct from these two groupings. Phratries comprise two or more related clans, and there must be more than two phratries in the society. Clan members emphasize descent from a common ancestor, whereas members of a moiety, while regarding themselves as related, do not stress common descent. Clans function frequently as landholding units and in cooperative economic enterprises; moieties do so rarely. More frequently moieties align themselves according to divisions in myth and folklore, such as the Tagaro and Supwe moieties of north Pentecost Island (Vanuatu), named for two culture heroes and bearing the respective traits of each.

On a worldwide basis, matrilineal moieties (matrimoieties) are far more common than patrilineal moieties (patrimoieties) and are generally found in association with smaller kin groups, such as lineages and clans. In all cases—whether the moieties are exogamous or nonexogamous, unilineal or not, or whether they are aligned on the basis of season, geographic position, name bestowal or other criteria—they serve to divide society into two opposed parts that channel reciprocal duties and rights, competition, and cooperation.

Duala, also spelled DOUALA, Bantu-speaking people of the forest region of southern Cameroon living on the estuary of the Wouri River. By 1800 the Duala controlled Cameroon's trade with Europeans, and their concentrated settlement pattern developed under this influence. Their system of chieftaincy was partly founded on trading wealth. For much of the 19th century there were two political–commercial kingdoms, Bell and Akwa; these were weakened by the 1880s.

The Wouri estuary now supports a fishing and agricultural economy in which oil palms, cassava, cocoyam (taro), plantain, and corn (maize) are the principal crops. The Duala trace descent patrilineally, and associations, or secret societies, serve as instruments of social control. By the 1970s most Duala were nominal Christians. Their older religious system recognized a high god, or creator, but no further pantheon and no true shrines or priests. Other beliefs concerned the power of ancestors, witchcraft, and magical objects.

Many Duala are now found in various urban occupations. In the late 20th century the chiefly lines remained an elite, but their influence was waning.

dualism, in religion, belief in two supreme opposed powers or gods, or sets of divine or demonic beings, that control the world. Dualism is a phenomenon of major importance in the religions of the ancient world.

A brief treatment of religious dualism follows. For full treatment, *see* MACROPAEDIA: Religious and Spiritual Belief, Systems of.

A certain kind of dualism is implied in every religion by the simple fact that the *sacred* is considered to be radically different from and opposed to the *profane.* Hindu philosophy posits an eternal dialectical tension between ultimate reality and the illusory world of phenomena. Greek philosophers from Parmenides to Plato exhibit a marked preoccupation with either refuting or asserting dualistic conceptions of reality. In Chinese Taoism, the entire inventory of opposing principles in the world is embraced in the dualistic doctrine of Yin-Yang.

In terms of mythology, most polytheistic religions recognize a class of supernatural beings (such as demons, Titans, monsters) that are different from and antagonistic to the gods. Even within a single pantheon of divinities there may be noted a tension and a conflict between the celestial and the terrestrial or chthonic gods (*e.g.,* the Asen and the Vanen in Germanic mythology), or between destructive and constructive deities (*e.g.,* Seth and Osiris in Egyptian religion). Another very characteristic type of religious dualism, exemplified in numerous cosmogonies worldwide, stresses the introduction of evil into a previously perfect universe.

The extreme or absolute form of religious dualism is to be found in ancient Persia, where the Iranian religious reformer Zoroaster proclaimed an irreducible opposition between Ahura Mazdā, the Wise Lord (or Ormazd, as he later came to be called), and Angra Mainyu, the Evil Spirit (or Ahriman). According to Zoroaster, Ahriman freely chose to do evil, thus bringing misery, illness, and death into the world. Later Zoroastrianism presented Ormazd and Ahriman as two coeternal principles of good and evil—the Creator and the Destroyer. Manichaeism took over this pessimistic valuation and blended it with the Gnostic myth of the corrupted creation.

Under the influence of Iranian eschatology, some dualistic elements found their way into Jewish apocalyptic literature, but only in subordination to absolute monotheism. The New Testament utilizes some old dualistic formulas, but in a different sense, denoting antithetical phases in the history of salvation. Though Christianity accepts a radical difference between good and evil, it rejects a metaphysical dualism. In Roman Catholic theology, God and creature, Spirit and matter, etc., are only different modalities in the absolute unity of being.

dualism, in philosophy, the use of two irreducible, heterogeneous principles (sometimes in conflict, sometimes complementary) to analyze the knowing process (epistemological dualism) or to explain all of reality or some broad aspect of it (metaphysical dualism). Examples of epistemological dualism are being and thought, subject and object, and sense datum and thing; examples of metaphysical

dualism are God and the world, matter and spirit, body and mind, and good and evil. Dualism is distinguished from monism, which acknowledges only one principle, and from pluralism, which invokes more than two basic principles. Philosophers sometimes employ more than one dualism at the same time; *e.g.,* Aristotle simultaneously invoked those of matter and form, body and soul, and immaterial and material substance.

dualism, mind-body (philosophy): *see* mind-body dualism.

duality, in mathematics, principle whereby one true statement can be obtained from another by merely interchanging two words. It is a property belonging to the branch of algebra known as lattice theory, which is involved with the concepts of order and structure common to different mathematical systems. A mathematical structure is called a lattice if it can be ordered in a specified way (*see* order). Projective geometry, set theory, and symbolic logic are examples of systems with underlying lattice structures, and therefore also have principles of duality.

Projective geometry has a lattice structure that can be seen by ordering the points, lines, and planes by the inclusion relation. In the projective geometry of the plane, the words "point" and "line" can be interchanged, giving for example the dual statements: "Two points determine a line" and "Two lines determine a point." This last statement, sometimes false in Euclidean geometry, is always true in projective geometry because the axioms do not allow for parallel lines. Sometimes the language of a statement must be modified in order that the corresponding dual statement be clear; the dual of the statement "Two lines intersect in a point" is vague, while the dual of "Two lines determine a point" is clear. Even the statement "Two points intersect in a line," however, can be understood if a point is considered as a set (or "pencil") containing all the lines on which it lies, a concept itself dual to the idea of a line being considered as the set of all points that lie on it.

There is a corresponding duality in three-dimensional projective geometry between points and planes. Here, the line is its own dual, because it is determined by either two points or two planes.

In set theory, the relations "contained in" and "contains" can be interchanged, with the union becoming the intersection and vice-versa. In this case, the original structure remains unchanged, so it is called self-dual.

In symbolic logic there is a similar self-duality if "implied" and "is implied by" are interchanged, along with the logical connectives "and" and "or."

Duality, a pervasive property of algebraic structures, holds that two operations or concepts are interchangeable, all results holding in one formulation also holding in the other, the dual formulation.

Duan Qirui: *see* Tuan Ch'i-jui.

Duane-Hunt law, in atomic physics, the relationship between the voltage (V) applied to an X-ray tube and the maximum frequency ν of the X rays emitted from the target. It is named after the American physicists William Duane and Franklin Hunt. The relationship is expressed as $\nu = Ve/h$, in which e is the charge of the electron and h is Planck's constant. This law is sometimes called the inverse photoelectric equation.

Duang (king of Cambodia): *see* Duong.

Duārs, also spelled DWĀRS, or DOOĀRS, region of northeastern India, at the foot of the west Assam Himalayas. Its 3,400-square-mile (8,800-square-kilometre) area is divided by the Sankosh River into the Western and Eastern Duārs. Both were ceded by Bhutan to the British at the end of the Bhutan War (1864–65). The Eastern Duārs, in western Assam state, comprises a level plain intersected by numerous rivers and only slightly populated. The Western Duārs lies in northern West Bengal state and is a portion of the Tarai (*q.v.*), a lowland belt linking the Himalayas and the plains region. The Western Duārs is an important centre of the tea industry. The name Duārs (literally "doors") is derived from the several passes that lead from the region into the Lesser Himalayas.

Duarte (Portuguese personal name): *see under* Edward.

Duarte, Fausto (Castilho) (b. 1903, Praia, Saõ Tiago, Cape Verde Islands—d. 1953, Portugal), government official and writer whose early work in Portuguese established him as one of the earliest African novelists.

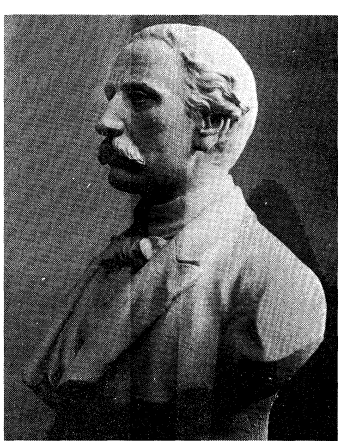
Duarte was educated under the official program of *assimilaçao* ("assimilation"), which after 1921 had social and political equality for Africans in the Portuguese sphere of influence as a goal. He was then sent to Portuguese Guinea (now Guinea-Bissau) as a government administrator.

Duarte's first novel, *Auá: Novela Negra* (1934; "Auá: Black Novel"), is set among the Fulani peoples of Guinea. He wrote three other novels—*O Negro sem Alma* (1935; "The Black Without Soul"), *Rumo ao Degrêdo* (1939; "Adrift as an Exile"), and *A Revolta* (1945; "The Revolution")—and a book of short stories—*Foram Estes os Vencidos* (1945; "To Move is to Conquer"). His works are important primarily because of the interest he took in African indigenous culture.

Duarte, Juan Pablo (b. 1813, Santo Domingo, Hispaniola [now in Dominican Republic]—d. 1876, Caracas, Venez.), father of Dominican independence, who lost power after the struggle succeeded and spent the end of his life in exile.

Duarte, who was sent to Europe for his education (1828–33), became determined to free the eastern part of Hispaniola from Haitian domination. On his return to the island he and several other patriots organized a secret society, La Trinitaria, to work toward independence and to stimulate liberalism. His first attempt to oust the Haitians in 1843 collapsed, and he fled the country; but his followers succeeded in overthrowing the Haitians the next year.

In February 1844 Duarte returned, and the Dominican Republic proclaimed its independence. It was not Duarte's followers, however, who ultimately triumphed, but a local caudillo (military dictator), Pedro Santana. The defeated Duarte was exiled and took up residence in Caracas, Venez. He left Caracas for his homeland only once, during the War of Restoration (1864) against Spain, after which he was sent on a diplomatic mission for one year.



Duarte, portrait bust by Abelard
By courtesy of the Organization of American States

Consult the INDEX *first*

Dubayy, also spelled DUBAI, constituent emirate of the United Arab Emirates (formerly Trucial States, or Trucial Oman). The second most populous and second largest state of the federation (area 1,510 square miles [3,900 square km]), it is roughly rectangular, with a frontage of about 45 miles (72 km) on the Persian Gulf. The capital, Dubayy town, the largest town of the federation, is on a small creek at the northeast of the state. Well over 90 percent of the emirate's population lives in the capital and nearby built-up sections. Dubayy is surrounded by Abu Dhabi emirate on the south and west and by Ash-Shāriqah emirate on the east and northeast. In addition, the small exclave (detached section) of Al-Ḥajarayn in the Wadi Ḥattá, more than 25 miles (40 km) from the nearest territory of Dubayy proper, belongs to the state.

The settlement of Dubayy town is known from 1799. The sheikh of Dubayy (then a minor) signed the British-sponsored General Treaty of Peace (1820), but the area was seemingly dependent on Abu Dhabi until 1833. In that year, a group of Āl bū Falāsāh clansmen of the Banī Yās, chiefly pearl fishers, left Abu Dhabi in a rivalry dispute and took over Dubayy town without resistance. From then on, Dubayy became, by local standards, a powerful state and was frequently at odds with its former rulers. The Qawāsim pirates tried to take control of Dubayy, but its rulers retained their independence by playing off the neighbouring sheikhdoms against each other. Together with the rest of the original Trucial States, Dubayy signed with Britain a maritime truce in 1835 and the Perpetual Maritime Truce in 1853. Its foreign relations were placed under British control by the Exclusive Agreement of 1892. When Britain finally left the Persian Gulf (1971), Dubayy was a prominent founding member of the United Arab Emirates.

The sheikhs of Dubayy, unlike most of their neighbours, long fostered trade and commerce; Dubayy town was an important port by the beginning of the 20th century. Many foreign merchants (chiefly Indians) settled there; until the 1930s, it was known for pearl exports. More recently, Dubayy town (including its twin city and commercial centre, Dayrah, on the opposite side of the creek) has become the region's chief port for the import of Western manufactures. Most of the United Arab Emirates' banks and insurance companies are headquartered there. After the devaluation of the Gulf rupee (1966), Dubayy joined the now independent state of Qatar in setting up a new monetary unit, the Qatar/Dubayy riyal. In 1973 Dubayy joined the other emirates in adoption of a national currency, the dirham. Dubayy has free trade in gold, and there is a brisk smuggling trade in gold ingots to India, where gold imports are restricted.

In 1966 the offshore oil field of Fath (Fateh, or Fatta) was discovered in the Persian Gulf about 75 miles (120 km) due east of Dubayy town, in waters where the state had granted an oil concession. By the 1970s, three 20-story submarine tanks, each holding 500,000 barrels, were installed on the seabed at the site. Shaped like inverted champagne glasses, they are popularly called The Three Pyramids of Dubayy. Dubayy's estimated oil reserves are less than one-twentieth those of neighbouring Abu Dhabi, but oil income combined with trading wealth have made Dubayy a very prosperous state. An aluminum smelter and an associated natural gas fractionator were built in the late 1970s near Dubayy town. The town

has been thoroughly modernized, with electricity, modern hotels, telecommunications stations, hospitals, and an international airport. A new deepwater harbour, Port Rāshid (named for the emir), was opened there in 1972 and a supertanker dry dock was completed in 1979. Dubayy town is connected by paved road with Ra's al-Khaymah town and Abu Dhabi town. Pop. (1980 prelim.) town, 265,702; (1985 prelim.) emirate, 419,104.

dubbing, in filmmaking, the process of adding new dialogue or other sounds to the sound track of a motion picture that has already been shot. Dubbing is most familiar to audiences as a means of translating foreign-language films into the audience's language. When a foreign language is dubbed, the translation of the original dialogue is carefully matched to the lip movements of the actors in the film. Dubbed sound tracks rarely equal the artistic quality of original foreign-language sound tracks, however, and hence subtitles may be preferred by viewers as a means of understanding the dialogue in foreign films.

Dubbing is often employed in the original-language version of a sound track for technical reasons. Filmmakers routinely use it to remedy defects that arise from synchronized filming (in which the actors' voices are recorded simultaneously with the photography). Synchronously recorded dialogue may be unclear or inaudible in a long-distance shot or because of accidental air traffic overhead, or it may simply be impossible to conceal a microphone close enough to pick up the actors' voices intelligibly. Dubbing allows the filmmaker to obtain high-quality dialogue regardless of the actual conditions that existed during shooting. Dubbing is also used to add sound effects to the original sound track. It may also be used in musicals to substitute a more pleasing voice for that of an actor who performs a song on camera.

The filmmakers of some countries rely on dubbing to supply the sound track of an entire film, because the technique can be less expensive and troublesome than synchronized filming.

Dubbo, city, east-central New South Wales, Australia, on the Macquarie River. Visited in 1818 by the explorer John Oxley, the district received its first settlers in 1824. Founded in 1841, Dubbo was an established village by 1849. It became a municipality in 1872 and a city in 1966. It is the trade centre of an area producing wheat, livestock, timber, and fruits and vegetables. Dubbo has slaughterhouses, flour mills, sawmills, brickworks, and joinery works. It is a major rail and road (Newell and Mitchell highways) junction lying 160 miles (260 km) northwest of Sydney. The Western Plains Zoo is nearby. Pop. (1986) 25,796.

Dubček, Alexander (b. Nov. 27, 1921, Uhrovec, Slovakia, Czech.), first secretary of the Communist Party of Czechoslovakia (Jan. 5, 1968, to April 17, 1969) whose liberal reforms led to the Soviet occupation of Czechoslovakia in August 1968.

Dubček received his early education in Kirghizia in Soviet Central Asia, where his father, Stefan Dubček, a member of the Czechoslovak Communist Party, had settled. The family returned to Czechoslovakia in 1938. During World War II, Dubček took part in the underground resistance to Nazi occupation and after the war rose steadily in Communist Party ranks, becoming in 1958 chief secretary of the regional committee in Bratislava and a member of the central committees of both the Slovak and the Czechoslovak Communist Parties. In 1962 he became a full member of the Central Committee's Presidium.

In October 1967, at a Central Committee meeting in Prague, Dubček rallied the support of party and economic reformers, as well as Slovak nationalists, against the leadership of Antonín Novotný. Novotný was forced to resign as first secretary on Jan. 5, 1968, and Dubček replaced him. During the early months of 1968 the Czechoslovak press was granted greater freedom of expression, and victims of political purges during the Stalin era were rehabilitated. On April 9 a reform program called "Czechoslovakia's Road to Socialism" was promulgated. The trend of developments aroused concern in the Soviet Union. From July 29 to August 2, the top leaders of the two countries conferred at the Slovak town of Cierna; their deliberations, which concluded with minor compromises by Dubček, were ratified by other east European communist leaders at Bratislava on Aug. 3, 1968. Still dissatisfied with developments in Czechoslovakia and fearful of the implications of liberalization, the Soviet Union and its Warsaw Pact allies invaded the country the night of August 20–21. Dubček and five other Presidium members were seized and taken to Moscow, where the Russians wrested major concessions from them. On his return to Prague Dubček gave an emotional address to his countrymen, requesting their cooperation.

Dubček was in a weak position. Gradually, his more progressive aides were removed, and in April 1969 he was demoted from first secretary of the party to president of the Federal Assembly (the national parliament). In January 1970 he was appointed ambassador to Turkey, but after being expelled from the party, he was recalled to Prague in June; later in 1970 he was made an inspector of the forestry administration, based in Bratislava.

Dubček returned to prominence in Czechoslovakia's national affairs in December 1989 after the country's Communist Party had given up its monopoly on power and agreed to participate in a coalition government. In an agreement between the Communists and the opposition front, the Civic Forum, Dubček on December 28 was elected chairman of the Federal Assembly.

Dube, John Langalibalele (b. Feb. 22, 1871, near Inanda Mission Station, Natal [now in South Africa]—d. Feb. 11, 1946, Umhlanga, Natal, S.Af.), South African minister, educator, journalist, and author of *Insila ka Shaka* (1930; *Jeqe, the Bodyservant of King Shaka*), the first novel published by a Zulu in his native language.

After studying at Oberlin College, Oberlin, Ohio, U.S., and being ordained a minister, Dube returned to Natal with the goal of establishing a school for his fellow Africans similar to Alabama's Tuskegee Institute. In the early 1900s he founded Ohlange Institute, 15 miles (25 km) from Durban, S.Af., and several years later he founded a girls' school nearby. His work with the institute and on *Ilanga lase Natal* ("The Natal Sun"), the first Zulu newspaper (which he helped to found in 1904), made him widely known. In 1912 he was elected the first president general of the South African Native National Congress (later the African National Congress).

Political involvement occupied much of the rest of his life, but he also found time to write a biography of the prophet Isaiah Shembe (*U-Shembe*) and *Insila ka Shaka,* his historical novel about Shaka, the great 19th-century chief who brought the Zulus to power. Dube received a Ph.D. degree from the University of South Africa in 1936, and from 1937 until his death, he represented Natal at the biannual meetings of the Native Representative Council in Pretoria.

Dubinsky, David (b. Feb. 22, 1892, Brest-Litovsk, Russia [now Brest, Belorussia, U.S.S.R.]—d. Sept. 17, 1982, New York, N.Y., U.S.), American labour leader who served as president of the International Ladies' Garment Workers Union (ILGWU) from 1932 to 1966.

The son of a baker in Russian Poland, Dubinsky was sent to Siberia in 1908 for his union activities. He escaped and emigrated to the United States in 1911. While working as a garment cutter in New York City, he renewed his union activities and became manager-secretary of Local 10 of the ILGWU in 1921, a post that he left in 1929 to assume the position of secretary treasurer of the entire ILGWU. He was elected president of the union in 1932.

Dubinsky transformed the ILGWU from a faction-ridden, insolvent regional union with 45,000 members into a model international union representing 450,000 workers. Under Dubinsky, the ILGWU pioneered initiatives in housing, pension plans, and health centres. An independent in both national union affairs and in politics, Dubinsky maintained his allegiance to the American Federation of Labor (AFL) but also supported the emergence of the CIO unions in the 1930s. He played a significant role in the merger of the AFL and CIO in 1955. His autobiography, *David Dubinsky: A Life with Labor,* was published in 1977.

Dublin, Irish BAILE ÁTHA CLIATH, county in the province of Leinster, Ireland, bounded by County Meath (north), by the Irish Sea (east), by County Wicklow (south), and by Counties Kildare and Meath (west). Its area is 356 square miles (922 square km), including the city of Dublin and the town of Dún Laoghaire. County Dublin is one of the smallest counties in Ireland and one of the most populous. Its central and northern parts are low-lying, while mountains occupy the southern border of the county. The principal summits are Glendoo (1,919 feet [585 m]) and Two Rock (1,699 feet), within the county, and Kippure (2,473 feet) in the border group; they are chiefly covered with heath and bog. The northern coast from Balbriggan to Howth has sandy shores but assumes a bolder aspect in the promontory of Howth. The chief river is the Liffey, which rises in the Wicklow Mountains a few miles southwest of Dublin city and flows through the city and into Dublin Bay. Among early remains are raths (prehistoric hill forts), dolmens, and round towers. Malahide Castle was founded in the 12th century.

The county was probably formed in the late 12th century; and it comprised the chief portion of country within the English Pale (the English enclave in Ireland), though the limits of the county itself underwent many changes before reaching their present configuration. Because of its proximity to the capital city, the county was the scene of sporadic fighting in the troubled years between 1914 and 1922, and gunrunning by Nationalists took place at Howth in June 1914.

Wheat, barley, and potatoes are the principal crops; cattle breeding is receiving greater attention. Cotton hosiery is manufactured at Balbriggan, and chocolate and cement goods are made in the west of the county. Administration is by a county council and a county manager. Dún Laoghaire has its own corporation. Several important railways converge on Dublin city. Pop. (1986) excluding Dublin city ("county borough"), 518,700.

Dublin, Irish DUBH LINN ("Black Pool"), also called BAILE ÁTHA CLIATH ("Town of the Ford of the Hurdle"), city, formally a county borough, and capital of Dublin county and of Ireland. Located in east-central Ireland at the head of Dublin Bay on the Irish Sea, Dublin is the country's chief port, centre of financial and commercial power, and seat of culture.

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

Dublin stands on a hill-ringed plain and straddles the River Liffey, which flows east-

ward into Dublin Bay. The city extends little more than 4 miles (6.5 km) in any direction from central Dublin Castle. The suburbs, however, stretch toward the nearby hills and the sea as far as 16 miles (26 km) from the city centre. The surrounding region has a temperate climate and is devoted mainly to agriculture.

Dublin was at one time famous for its textiles, particularly woolens, cotton, silk, and poplin. The Guinness Brewery, producer of beer and stout, is the nation's largest private employer and its largest industrial exporter. Other industries include food processing, the manufacture of glass and cigarettes, and shipbuilding. Government and trade are major activities; the principal exports include agricultural products and alcoholic beverages.

The city is low-built, with a municipal ordinance limiting most buildings to 10 stories. Few buildings date from before the 17th century; the city's architectural heritage, however, derives primarily from Norse, Norman, and Georgian influences, and the three elements meet in the historic Dublin Castle. Christ Church and St. Patrick's, both Protestant cathedrals, were rebuilt by the Normans in the 12th century and restored in the 19th. The Roman Catholic churches are 19th- and 20th-century structures.

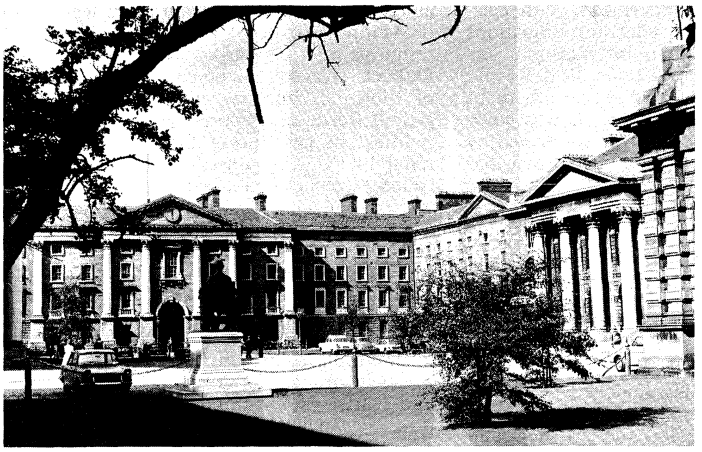
The area between St. Patrick's and the Guinness Brewery, known as the Liberties for having formerly been outside the city's jurisdiction, has been largely cleared for low-cost housing. Several of Dublin's most impressive government buildings were originally built by leading citizens as residences. Among these are the lord mayor's residence, built by Joshua Dawson in 1705, which was the site in 1919 of the ratification of the Irish declaration of independence from Great Britain, and Leinster House (1745), now the seat of the Irish parliament. Other monumental buildings include the Neoclassical Custom House (1781–91) and the Four Courts (1786–1802), both heavily damaged in the midst of rebellion and civil war (1921–22) and since rebuilt.

Educational and cultural institutions include the University of Dublin, or Trinity College (1591), and the Royal Dublin Society (1731). The National Library and National Museum are housed in Victorian buildings on the grounds of Leinster House. The influential writers William Butler Yeats, James Joyce, and Sean O'Casey were born in Dublin.

Dublin is the centre of the Irish railway network, and its port is the largest in the republic. Ferries from Great Britain land at the suburb of Dún Laoghaire. The international airport at Collinstown is located 6 miles (10 km) to the north of Dublin. Area city, 44 square miles (114 square km). Pop. (1986 est.) city, 502,337; (1981) Greater Dublin metropolitan area, 915,115.

"De," "la," and similar components of a name, when followed by a space, are alphabetized as separate words (e.g., *De Forest, Lee*). *When they are joined to the following part of a name, the combination is treated as a single word* (e.g., *DeForest, John William*).

Dublin, University of, also called TRINITY COLLEGE, oldest university in Ireland, founded in 1591 by Queen Elizabeth I of England and Ireland and endowed by the city of Dublin. When founded, it was intended that Trinity College would be the first of many constituent colleges of the University of Dublin. No other colleges were established, however, and the two names became interchangeable. The university was limited to Anglicans for many years, but in 1873 all religious requirements were eliminated. The library contains many beautiful illuminated manuscripts, including the famous *Book of Kells*.



The University of Dublin (Trinity College)
By courtesy of Irish Tourist Photo

Dublin Bay prawn: *see* scampi.

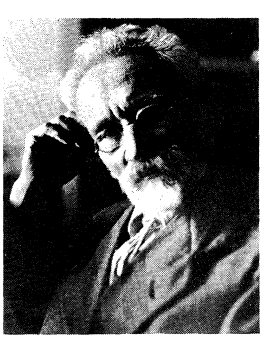
Dubna, city, Moscow *oblast* (administrative region), western Russian Soviet Federated Socialist Republic, on the Volga River where it is joined by the Moscow Canal, completed in 1937. Dubna is a new city, incorporated in 1956; in 1960 it absorbed the town of Ivankovo on the opposite bank. It is one of the Soviet Union's planned "science cities," its existence depending on the United Institute of Nuclear Research, which employs scientists from many countries. The city includes much open green area, characteristic of Soviet town planning. Pop. (1985 est.) 61,000.

Dubnow, Simon M(arkovich), also spelled SEMON, OR SEMYON, MARKOVICH DUBNOV (b. Sept. 10, 1860, Mstislavl, Russia [now in Belorussian S.S.R.]—d. Dec. 1941, Riga, Latvian S.S.R.), Jewish historian who introduced a sociological emphasis into the study of Jewish history, particularly that of eastern Europe.

Dubnow early ceased to practice Jewish rituals. He later came to believe that his vocation as a historian of Judaism was as true to the faith of his ancestors as were the Talmudic studies of his piously Orthodox grandfather.

Dubnow was largely a self-educated man. Throughout his life he supported himself as a teacher and professional writer. In 1882 he began his long association with the Russian-Jewish periodical *Voskhod* ("Rising"), to which he contributed, in serial form, many of his most famous scholarly and literary works. He left Russia in 1922 because of his hatred for Bolshevism and settled in Berlin. In 1933 he fled Germany because of the anti-Jewish policies of Nazi Germany and sought refuge in Riga. He was annihilated by the Nazis during the deportation of most of Riga's Jewish population to concentration and extermination camps.

Dubnow was one of the first scholars to subject Ḥasidism to systematic and unbiased study based upon laboriously collected source materials from both the Ḥasidim and their various opponents. This work appeared in *Geschichte des Chassidismus* (1931; "History of Ḥasidism"). The mature fruit of Dubnow's historical studies is his monumental *Die Weltgeschichte des jüdischen Volkes,* 10 vol. (1925–30; "The World History of the Jewish People"; Eng. trans. *History of the Jews*), which has been translated into several languages. The work is notable for its scholarship, impartiality, and cognizance of social and economic currents in Jewish history. According to Dubnow, the Jews not only are a religious community but also possess the distinctive characteristics of a cultural nationality and as such create their own forms of autonomous social and cultural life. The history of the Jews is, therefore, a history of the succession of large autonomous centres.



Dubnow, 1921
By courtesy of YIVO Institute for Jewish Research, New York

Related to Dubnow's philosophy of Jewish history was his theory of autonomism, or Diaspora nationalism, first expressed in his famous "Letters on Old and New Judaism" (Russian ed. 1907; *Nationalism and History: Essays on Old and New Judaism*). As a cultural nationalist he rejected Jewish assimilation but at the same time believed that political Zionism was messianic and unrealistic. Other notable works by Dubnow include his history of the Jews in Russia and Poland (Russian ed., 3 vol., 1916–20; *History of the Jews in Russia and Poland from the Earliest Times Until the Present Day*) and an autobiography entitled *Kniga zhizni,* 3 vol. (1930, 1934, 1940; "Book of Life").

Dubois, (Marie) Eugène (François Thomas) (b. Jan. 28, 1858, Eisden, Neth.—d. Dec. 16, 1940, de Bedlaer), Dutch anatomist and geologist who discovered remains of Java man, the first known fossil of *Homo erectus.*

Appointed lecturer in anatomy at the University of Amsterdam (1886), Dubois investigated the comparative anatomy of the larynx in vertebrates but became increasingly interested in human evolution. In 1887 he went to the East Indies as a military surgeon and on the island of Sumatra began to excavate caves in search of early hominid remains.

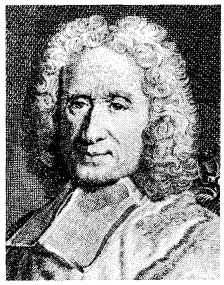
Continuing his quest on the island of Java, at Trinil, Dubois found a jaw fragment (1891) and later a skullcap and thighbone. The skull gave evidence of a small brain, massive brow ridges, a flat, retreating forehead, and other apelike features. Dubois named the fossils *Pithecanthropus erectus* to indicate an intermediate phase in the evolution then believed to proceed from simian ancestors having the upright posture characteristic of modern man. After publishing his findings (1894), he returned to Europe (1895) and became a professor of geology at the University of Amsterdam. Because of controversy surrounding his

discovery, he withdrew his materials from all examination until 1923.

Dubois, Guillaume (b. Sept. 6, 1656, Brive-la-Gallarde, Fr.—d. Aug. 10, 1723, Versailles), French cardinal, leading minister in the administration of Philippe II, duc d'Orléans (regent for King Louis XV from 1715 to 1723), and architect of the Anglo-French alliance that helped maintain peace in Europe from 1716 to 1733.

The son of a country doctor, Dubois studied for the priesthood before serving as tutor to the children of nobles who lived at the court of King Louis XIV. Among his pupils was Philippe, duc de Chartres, who succeeded to the title duc d'Orléans in 1701. When Orléans became regent for the five-year-old King Louis XV on the death of Louis XIV (Sept. 1, 1715), he made Dubois his secret adviser and envoy for foreign affairs.

Capable and unscrupulous, Dubois devoted himself to promoting the dynastic interests of Orléans, whose claim to the succession to the crown of the sickly Louis XV was disputed by a rival claimant, King Philip V of Spain, a grandson of Louis XIV. In order to gain support against Philip, Dubois concluded in 1716 an alliance with France's traditional enemy, Great Britain. He pledged to back the British king George I against the Jacobites (supporters of Stuart claims to the British throne), and in return he obtained a guarantee of British support for the dynastic rights of Orléans. In 1717–18 Dubois made similar agreements with the Dutch and Austrians, thereby forming the Quadruple Alliance (Aug. 2, 1718). He was officially designated secretary of state for foreign affairs in September 1718.



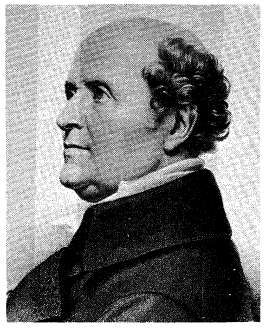
Guillaume Dubois, detail of an engraving by C. Roy, after a painting by H. Rigaud

By courtesy of the Musee Conde, Chantilly, Fr.; photograph, Giraudon

When the chief minister of Spain, Giulio Alberoni, tried to further Spain's territorial ambitions by unilaterally invading Sardinia and Sicily in 1717–18, Dubois joined the British in attacking Spain (1719). In June 1720, Philip V was forced to renounce his claims to the French throne and to dismiss Alberoni. Four months later, however, a severe financial crisis in France discredited Orléans's regime and jeopardized Dubois' position. The foreign minister saved himself by pursuing a pro-Spanish policy that was popular in France because both countries were under Bourbon rule. The result was the Franco-Spanish treaty of March 1721 and the betrothal of Louis XV to the infanta Mariana, daughter of Philip V. At the same time, Dubois remained faithful to the British alliance.

In spite of his disreputable personal life, Dubois acquired the support of the French Roman Catholic Church by opposing the Jansenists, a dissident church faction. Owing to this stance, as well as to his lavish bribery at the papal curia, he was made a cardinal in July 1721. He became *premier ministre* ("first minister") in August 1722, a year before his death.

Dubois, Jean-Antoine (b. 1765, Saint-Remèze, Fr.—d. Feb. 17, 1848, Paris), French educator, abbot, and priest who attempted



Jean-Antoine Dubois, detail of a lithograph by F.-S. Delpech

J.P. Ziolo

to convert the Hindus of India to Roman Catholicism.

Ordained in 1792, he sailed to India under the Missions Étrangères. Despite his efforts in many parts of South India, his mission failed, and he returned to Paris (1823), convinced that the conversion of the Hindus was impossible. In Paris he became director of the Missions Étrangères and later superior (1836–39). He translated the *Pañca-tantra* into French (1826), including *Aventures de Paramarta,* or *The Exploits of the Guru Paramarta.* His best-known book is considered to be *Moeurs, institutions et cérémonies des peuples de l'Inde* (1825; published first in English as *Description of the Character, Manners and Customs of the People of India,* 1817).

Dubois, Pierre (b. *c.* 1250, probably at Coutances, in Normandy, Fr.—d. *c.* 1320), French lawyer and political pamphleteer during the reign of Philip IV the Fair; his most important treatise, *De recuperatione Terrae Sanctae* (1306, "On the Recovery of the Holy Land"), dealt with a wide range of political issues and gave a good picture of contemporary intellectual trends while ostensibly outlining the conditions for a successful crusade.

Dubois studied at the University of Paris and became a successful lawyer at Coutances, in Normandy. By 1300 he had become an advocate in royal legal cases, and he represented Coutances in the Estates-General of 1302 and again in that of 1308. In 1300 he published a pamphlet articulating his ideas for monarchical reform and later another that dealt with the struggle between Philip IV and Pope Boniface VIII.

Chauvinistic, anticlerical, and considerably influenced by Aristotelianism, Dubois believed that internal peace in France could be won only by extending royal authority, expecially over the clergy, and by radically reforming French education, law, and administration. He believed that peace between the sovereign princes in Europe was possible only by the creation of a sort of permanent board of arbitration and by the French king's assumption of the position of leadership traditionally reserved for the Holy Roman emperors but left vacant by recent imperial weakness.

Dubois, (François-Clément-) Théodore (b. Aug. 24, 1837, Rosnay, Fr.—d. June 11, 1924, Paris), French composer, organist, and teacher known for his technical treatises on harmony, counterpoint, and sight-reading.

He studied under the cathedral organist at Rheims and at the Paris Conservatoire. In 1871 he succeeded César Franck as organist at the church of Sainte-Clotilde. In 1868 he was choirmaster at the Church of the Madeleine and later succeeded Camille Saint-Saëns as organist there. He taught harmony at the Paris Conservatoire (1871–90) and was director there (1896–1905). He wrote music of all types, including operas and choral and orchestral works; his outstanding composition is his oratorio, *Les sept parole du Christ* (1867; "The Seven Words of Christ").

Dubos, René (Jules) (b. Feb. 20, 1901, Saint-Brice, Fr.—d. Feb. 20, 1982, New York City), French-born American microbiologist, environmentalist, and author whose pioneering research in isolating antibacterial substances from certain soil microorganisms led to the discovery of major antibiotics. Dubos is also known for his research and writings on a number of subjects, including antibiotics, acquired immunity, tuberculosis, and bacteria indigenous to the gastrointestinal tract. In his later years his interest shifted to man's relationship to the natural environment.

Dubos was graduated in 1921 from the Institut National Agronomique in Paris. In 1924 he emigrated to the United States and continued his studies at Rutgers University (Ph.D., 1927). He then joined the Rockefeller Institute for Medical Research in New York City, where he spent most of his career, becoming a professor in 1957 and professor emeritus in 1971.

In 1930 Dubos isolated from a soil microorganism an enzyme that could decompose part of the bacillum that causes lobar pneumonia in humans. The enzyme subsequently proved to have a therapeutic effect on laboratory animals with that disease. In 1939 Dubos isolated another antibacterial substance and named it tyrothricin. This substance, which he was able to chemically analyze, became the first antibiotic to be commercially manufactured, though it soon proved too toxic for large-scale use. Dubos' researches and techniques stimulated interest in penicillin and led Selman Waksman to isolate streptomycin.

Dubos's works include *Bacterial and Mycotic Infections in Man* (1948), *Pasteur and Modern Medicine* (1960), *Man, Medicine, and Environment* (1968), and *So Human an Animal* (1968; Pulitzer Prize, 1969). He was for many years an editor of the *Journal of Experimental Medicine.*

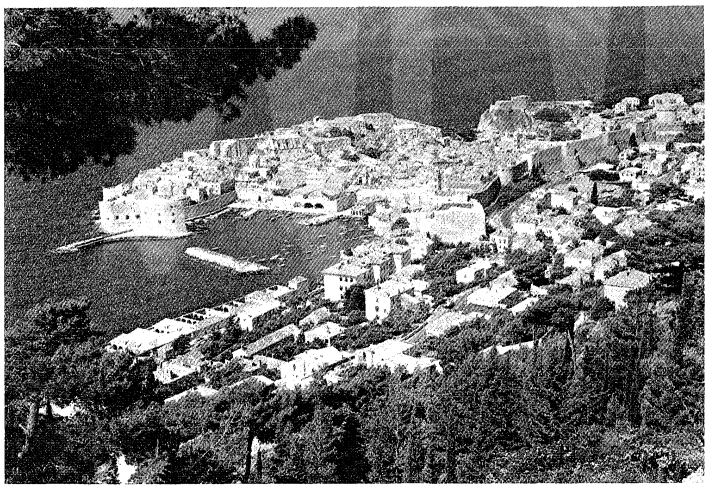
Dubrovnik, Italian RAGUSA, port of Dalmatia in Croatia, Yugos. Situated on the southern Adriatic coast, it is usually regarded as the most picturesque city on the Yugoslav coast. It occupies a promontory jutting into the sea under the bare limestone mass of Mount Srdj. The port's sea fortifications rise directly from the water's edge, and a massive round tower dominates the city on the landward side.

The city walls, mostly a double line, have long been the pride of Dubrovnik. Beyond them are many villas surrounded by gardens. The basic city plan dates from 1292, when the port was rebuilt following a fire. The Stradun, or main street, with beautiful late-Renaissance houses on each side, runs along a valley that, until 1272, was a marshy channel dividing the Latin island of Ragusa from the forest settlement of Dubrovnik (*dubrava* in Serbo-Croatian means "grove"). No motor vehicles are allowed inside the walls, and, except for the Stradun, the old city is a maze of picturesque narrow streets, many of them steep and twisting. Two 14th-century convents stand at the ends of the city; the Franciscans guarded the western gate, while the Dominicans kept the eastern. The Rector's Palace is one of the masterpieces of Dalmatian architecture. Lokrum, an offshore island, is famous for its gardens and orange groves. Annual festivals of the arts attract many tourists to the scenic city.

Dubrovnik is connected to Sarajevo and Belgrade by rail. From its new harbour at nearby Gruž, ships ply to other Dalmatian ports and to Italy. The main industries produce liqueurs, cheeses, silk, and leatherwork.

The city was founded as Rausa, or Ragusium, in the 7th century by Roman refugees fleeing the Slav and Avar sack of Epidaurus, just to the southeast. A colony of Slavs soon joined the Romans there, and from an early date

the city formed a link between two great civilizations. After the fall of Rome, Dubrovnik was ruled by Byzantium. From the 9th to the 12th century it defended itself against foreign powers, but in 1205–1358 it acknowledged Venetian suzerainty, though keeping much of its independence. The city-republic afforded asylum to refugees of all nations—one of them was King Richard I of England—and by means of treaty and tribute it enlarged its territory along the Dalmatian coast. It became a great mercantile power, being situated at the seaward end of overland trade routes to Byzantium and the Danube region. Ragusan land trade flourished throughout the Balkans.



Dubrovnik, Yugos.
Ray Manley—Shostal Assoc./EB Inc.

In 1420, when Dalmatia was sold to Venice, Dubrovnik remained a free city in all but name. For centuries the people of Dubrovnik were able to preserve their city-republic by skillful manoeuvring between East and West. A strategic treaty with Turkey protracted Dubrovnik's liberty and maintained the opportunity for a major trading role between the Ottoman Empire and Europe. In the 16th century it traded with India and the Americas, and the city sent men-of-war to Spain in 1588 for the abortive invasion of England.

A great development of art and literature, beginning in the 15th century and continuing to the 17th, earned Dubrovnik the title of "the South Slav Athens." For the first time in the history of the South Slavs, the language of the people was introduced into literature. The city's literary history, however, never compared to its maritime and mercantile achievements.

In 1667 an earthquake destroyed a considerable portion of the city, and about one-fifth of the inhabitants perished. Only during the Napoleonic Wars did the republic regain its prosperity. From 1800 to 1805, as the only neutral Mediterranean state, it secured a large share of the carrying trade. Napoleon I subjugated Dubrovnik in 1808, and the Congress of Vienna (1815) gave Dubrovnik to Austria; in 1918 it was incorporated into Yugoslavia. Pop. (1981 prelim.) mun., 66,131.

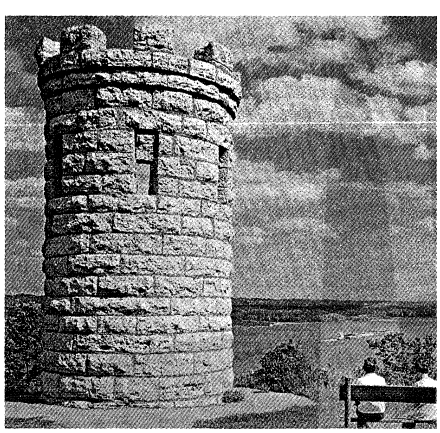
Dubuffet, Jean(-Philippe-Arthur) (b. July 31, 1901, Le Havre, Fr.—d. May 12, 1985, Paris), French painter, sculptor, and printmaker, best known for his development of art brut (*q.v.*; "raw art").

As an art student in Paris, Dubuffet demonstrated a facility for academic painting. In 1924, however, he gave up his painting, and by 1930 was making a living as a wine merchant. He did not return to a full-time art career until the early 1940s.

After World War II, as one of the leading artists of the School of Paris, he developed the techniques and philosophy of art brut. Derived from Dubuffet's studies of the art of children and of the mentally ill, art brut is intended to achieve immediacy and vitality of expression not found in self-conscious, academic art. To reflect these qualities, Dubuffet often used crude ideographic images incised into a rough impasto surface made up of such materials as tar, gravel, cinders, ashes, and sand bound with varnish and glue. His drawings and paintings are by turns childlike and obsessive, and their unfinished appearance excited much controversy.

During the 1960s Dubuffet experimented with musical composition and the creation of architectural environments. In various graphic and sculptural mediums he continued to explore the potentials of art brut. In his later years he also created several large sculptures of black-and-white painted fiberglass for various public spaces.

Dubuque, city, seat (1834) of Dubuque County, northeastern Iowa, U.S., on the Mississippi River (bridged to East Dubuque, Ill.), opposite the junction of the Wisconsin and Illinois boundary lines. It was named for Julien Dubuque (1762–1810), a French trader, who in 1788 concluded a treaty with the Fox Indians giving him lead-mining rights. He was the first white man to permanently settle in the region later to become Iowa; a monument marks the site of his mine and burial plot. Further concessions were rejected by the Indians until the Black Hawk Treaty of 1832. Mining and sawmilling were pioneering enterprises, but with the development of river and rail transportation the city became industrialized, emerging by the 1980s as the focal point of an expanding manufacturing area. Meat-packing, agriculture, and the manufacture of wood products and machinery are among the main economic activities.



Julien Dubuque Monument, Dubuque, Iowa
By courtesy of the Iowa Development Commission

In 1893 Dubuque was made an archdiocese of the Roman Catholic Church, which maintains Loras (1839) and Clarke (1843) colleges there. The University of Dubuque was founded in 1852 as the German Theological School of the Northwest. Our Lady of New Melleray Abbey, 12 mi (19 km) southwest, was founded in 1849 by Trappist monks. The city's Old Shot Tower (1856) was in full production during the Civil War, utilizing locally mined lead for bullets. Inc. town, 1837; city, 1841. Pop. (1980) 62,331; metropolitan area (SMSA), 93,745.

Ducale, Palazzo (Venice, Italy): *see* Doges' Palace.

Ducas FAMILY, also spelled DUKAS, or DOUKAS, Byzantine family that supplied several rulers to the empire. First prominent in the 9th century, the family suffered a setback when Constantine Ducas, son of Gen. Andronicus Ducas, lost his life attempting to become emperor in 913. Another Ducas family, perhaps connected with the earlier one through the female line, appeared toward the end of the 10th century. A member of this family became Emperor Constantine X in 1059, and his son, Michael VII (*see* Michael VII Ducas), ruled from 1071 to 1078. With Alexius I Comnenus, Michael's son Constantine was nominally co-emperor from 1081 to about 1090. Betrothed to Alexius' daughter, Anna, Constantine did not live to marry her. In 1204 Alexius V Ducas Murtzuphlus deposed the emperor Isaac II Angelus and his son Alexius IV, after which he tried in vain to defend Constantinople against crusaders from the West. A Michael Ducas played a leading role in the mid-14th-century civil war between emperors John V Palaeologus and John VI Cantacuzenus. His grandson was the 15th-century historian Ducas, known for his vernacular history of the period 1341–1462. So much prestige was attached to the Ducas name that many later rulers tried to add it to their own.

Ducas, Irene (Byzantine empress): *see* Irene (1066–1120).

Duccio DI BUONINSEGNA (b. mid-13th century, Siena, Republic of Siena—d. *c.* 1318, Siena?), one of the greatest Italian painters of the Middle Ages and the founder of the Sienese school. In Duccio's art the formality of the Italo-Byzantine tradition, strengthened by a clearer understanding of its evolution from classical roots, is fused with the new spirituality of the Gothic style. Greatest of all his works is "Maestà" (1311), the altarpiece of Siena cathedral.

Beginnings. There is little documented information about Duccio's life and career. In large part his life must be reconstructed from the evidence of those works that can be attributed to him with certainty, from the evidence contained in his stylistic development, and from the learning his paintings reveal. Duccio's father was from the town of Buoninsegna, near Siena, but at the time of Duccio's birth he lived in the town of Camporegio. He is first mentioned in 1278, when the treasurer of the commune of Siena commissioned him to decorate 12 strongboxes for documents. The following year he was given the task of decorating one of the wooden covers of the account books of the treasury. That Duccio was doing work more appropriate for an artisan than an artist must not lead one to assume that even at this time he was only a beginner. It is known that services of this type were requested, both in Siena and in Florence, of already established painters. Further, the fact that he was designated as "painter" and

was working for himself demonstrate that he was a mature and independent artist by 1278. In 1280 Duccio was fined the large sum of 100 lire by the commune of Siena for some

"Madonna Rucellai," tempera on wood by Duccio di Buoninsegna, 1285; in the Uffizi, Florence
Alinari—Art Resource/EB Inc.

unrecorded misconduct. This was the first of a considerable number of fines that the artist incurred at various times and for various reasons, and they suggest that he was of a restless and rebellious temperament. He was fined more than once for nonpayment of debts; in 1295 he was penalized for refusing to pledge allegiance to the head of the *popolo* party; in 1302 for not appearing for military duty; and in the same year for what appears to have been practicing sorcery.

The "Madonna Rucellai." On April 15, 1285, the Compagnia dei Laudesi, or singers of praise, of the Virgin Mary at the church of Sta. Maria Novella in Florence, commissioned "Duccio di Buoninsegna, painter of Siena" to paint a great altarpiece that was to represent the Madonna and Child together with other figures. For the work he was to be paid 150 florins, but if the painting, which had to be "a most beautiful picture" and had to have a gold border, was not satisfactory, the artist would receive no reimbursement. Despite the fact that this employment contract, preserved in the State Archives of Florence, came to light in 1790 and was published in 1854, it was only in 1930 that it was indisputably determined that the document referred to the Madonna of Sta. Maria Novella, now called the "Madonna Rucellai." From the time of Giorgio Vasari, a minor Florentine Renaissance painter who was the earliest, and probably the most influential, biographer of early Italian artists, this altarpiece, which was the largest yet painted, was considered to be a masterpiece of the Florentine painter Cimabue. Vasari's attribution, whereas it was probably due in part to a desire not to deprive the Florentine school and its founder of credit for so brilliant a work, was accepted almost unanimously until the present century because of strong similarities to the work of Cimabue in the "Madonna Rucellai." Some recent critics, no longer able to deny that the work is by Duccio, have concluded that he was a pupil, and in all essentials of his art even an imitator, of Cimabue.

The problem of the relative influence of Cimabue upon Duccio is critically very complex. The "Madonna Rucellai" shows affinities with the work of Cimabue in the type of the Virgin, in the serious and robust Child, and in the faces of the six adoring angels; nevertheless, it reveals strikingly new stylistic innovations in the softness of the angels set in midair, in the elegant and subtle lines, in the first feeling of French Gothic animated sweetness and spirituality, and in the light and shade modulation of the free-flowing, clear brush strokes.

There is no doubt that his knowledge of Cimabue's work was one of the components of Duccio's style at this time, but it was not the predominant, nor even the earliest influence; very probably Cimabue's influence was a late insertion into a personal style that had already evolved within the framework of the well-developed Sienese tradition. In the years between 1260 and 1280, largely due to the inspiration of its magnificent cathedral, Siena had emerged as one of the most vital centres of art in Italy. A remarkable succession of altarpieces by Sienese painters testifies to the simultaneous work of a number of artists, some of whom possessed quite distinct personalities. The variety of orientations of these painters shows that they did not work in provincial isolation but were sensitive to the diverse influences of the age, including Cimabue.

Duccio certainly studied these painters and was influenced by them. Notably evident in his style are the influence of the older painter Guido da Siena with the serene dignity of his figures, permeated by lyrical tenderness and grace, in the now-fading stylized postures of the Byzantine tradition, and of the master of the "St. John the Baptist Altarpiece" in the Pinacoteca Nazionale of Siena, with his complex Byzantine iconography and his vivid, dense colouring. Duccio was able to draw from sources outside Siena as well: from the combination of linear stylization and Hellenistic types that characterized the illustrations of books imported from Constantinople and also from contemporary French Gothic miniatures, with their lively tone and lyrical, animated stylizations of clothing and gesture. Duccio may also have travelled to Florence in his early years, coming into contact with Cimabue, but such an explanation is not entirely necessary to account for the formation of his style. In fact, in Duccio's only certain work prior to the "Madonna Rucellai," echoes of Cimabue are even less apparent than in the Rucellai altarpiece. The conclusion that Duccio was nothing more than a follower of Cimabue at the time he painted the "Madonna Rucellai" is implausible and overlooks the originality, as well as the excellence, of the work. If, in fact, he was in 1285 entrusted with a work of such significance at Florence, his reputation must have already been established and have spread beyond the confines of his native Siena.

Later commissions. Traces of Duccio's association with Cimabue remain in the large round stained-glass window of the choir of the Siena cathedral, for which Duccio made the designs. This work was commissioned between 1287 and 1288 and is the earliest known example of stained glass produced by an Italian.

Numerous documents attest to Duccio's action in Siena during the 20 years following the creation of the "Madonna Rucellai." He was by now the leading painter of the city and as such executed in 1302 an altarpiece, now lost, for the altar of the chapel of the Palazzo Pubblico, the city hall. During this period, some unsigned and undocumented altarpieces appeared, and some of these are certainly Duccio's work; the most significant of these is a small altarpiece representing the Virgin enthroned with angels and called "The Madonna of the Franciscans" because of the three monks kneeling at the foot of the throne. In this work a developed Gothic style appears in the curving outlines, which give an exquisite decorative effect.

The work in which the genius of Duccio unfolds in all its brilliant fullness and the one to which the painter owes his greatest fame, however, is the "Maestà," the altarpiece for the main altar of the cathedral of Siena. He was commissioned to do this work on Oct. 9, 1308, for a payment of 3,000 gold florins, the highest figure paid to an artist up to that time. On June 9, 1311, the whole populace of Siena, headed by the clergy and civil administration of the city, gathered at the artist's workshop to receive the finished masterpiece. They carried it in solemn procession to the accompaniment of drums and trumpets to the cathedral. For three days alms were distributed to the poor, and great feasts were held. Never before had the birth of a work of art been greeted with such public jubilation and never before had there been such immediate awareness that a work was truly a masterpiece and not just a reflection of the religious fervour of the people. Duccio himself was aware of the work's significance; he signed the throne of the Virgin with an invocation that was devout yet proud for the time: "Holy Mother of God, grant peace to Siena, and life to Duccio because he has painted you thus."

The "Maestà" is in the form of a large horizontal rectangle, surmounted by pinnacles, and with a narrow horizontal panel, or predella, as its base. It is painted on both sides. The entire central rectangle of the front side is a single scene showing the Madonna and Child enthroned in the middle of a heavenly court of saints and angels with the four patron saints of Siena kneeling at their feet. The back is subdivided into 26 compartments that illustrate the Passion of Christ. The front and back of the predella contain scenes of the infancy and the ministry of Jesus, and the pinnacles, crowning the entire work, represent events after the Resurrection. In all, there are 59 narrative scenes.

The rigorous symmetry with which the groups of adoring figures at the sides of the Virgin are arranged in the imposing scene of the central panel is inspired by compositions of the Byzantine tradition and gives evidence of Duccio's keen architectural sensibility by its power to draw attention to the "Maestà" as the true focal point of the cathedral's spatial and structural organization. Like elements of a living architecture, the 30 figures, through the slightest of gestures and turnings of the head, are intimately related, their positions repeated to give a feeling of intense lyrical contemplation. The consonance of feeling that arises from this contemplation gives the facial features of each a distinct, spiritual beauty, reminiscent, especially the faces of the angels, of the more idealistic creations of Hellenistic art. The Madonna, slightly larger than the other figures, seated on a magnificent and massive throne of polychrome marbles, inclines her head gently as if trying to hear the prayer of the faithful. Duccio thus succeeds in reconciling perfectly the Byzantine ideal of power and dignity with the underlying tenderness and mysticism of the Sienese spirit. The scenes in the predella, pinnacles, and back are filled with the Byzantine iconographic schemes from which Duccio finds it difficult to detach himself, and they are developed with a deeper concern for their narrative significance. The scenes are not, however, merely descriptions or chronicles. They include many touches from daily life, which provide a lyrical synthesis that harmonizes the character and gestures of the figures with their landscape and architectural surroundings.

Last years. Only scanty bits of information are available about the few years that Duccio lived after the completion of the "Maestà." He had a prosperous workshop from which other works emerged, but they seem to have been executed in great part by students. His finan-

cial condition must have been quite sound because by 1304 he bought a vineyard in the neighbourhood of Siena. Nevertheless, in 1313 he was once again deep in debt. At death he was survived by his wife, Taviana, and seven children. At least two of his children, Galgano and Giorgio, were painters, but nothing is known about their work or their merits. The identity of one of his direct followers is known, his nephew Segna di Buonaventura.

(E.Ca.)

MAJOR WORKS. "Madonna Rucellai" (1285; Uffizi, Florence; "Triptych: The Virgin and Child with Saints" (*c.* 1300; National Gallery, London); "Madonna with Child and Angels" (*c.* 1300; Galleria Nazionale dell'Umbria, Perugia, Italy); "Maestâ," altarpiece (1302; Palazzo Pubblico, Siena; now lost); "Maestâ," altarpiece (1308–11; Museo dell'Opera del Duomo, Siena; panels from this altarpiece can be seen in the National Gallery, London; the Frick Collection, New York City; and the National Gallery of Art, Washington, D.C.); "Madonna and Child of St. Cecilia a Crevole" (undated; Museo dell'Opera del Duomo, Siena); "Madonna Enthroned with Angels" (undated; Kunstmuseum, Bern); "The Madonna of the Franciscans" (undated; Pinacoteca Nazionale, Siena); "Madonna and Child" (undated; Stoclet Collection, Brussels); "St. Paul" (undated; Christian Museum [Keresztény Múzeum], Esztergom, Hung.); "The Annunciation" (undated; National Gallery, London); "Nativity with the Prophets Isaiah and Ezekiel" (undated; National Gallery of Art, Washington, D.C.); "The Presentation in the Temple" (undated; Museo dell'Opera del Duomo, Siena); "The Marriage at Cana" (undated; Museo dell'Opera del Duomo, Siena).

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Duccio, Agostino di: *see* Agostino di Duccio.

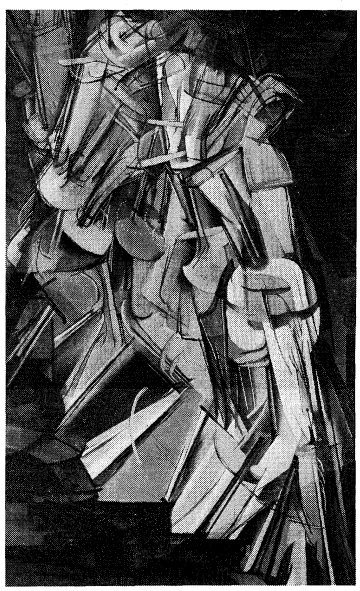
Ducetius (d. *c.* 440 BC), a Hellenized leader of the Siculi, an ancient people of Sicily, who for a short time welded the native communities of east Sicily into a powerful federation. He seized his opportunity during the confusion that followed the collapse of tyranny in Syracuse and other Sicilian states in 460. Enjoying the goodwill of the Syracusan democracy, he enlisted its help in driving out the colonists of the former tyrant Hieron from Catana and restoring it to its original Chalcidian inhabitants.

Ducetius then extended his influence over other communities and founded a new centre at Palice, but his independent policy led to an alliance of Syracuse and Acragas against him. After minor preliminary successes (including the capture of Inessa from its Greek colonists) he was decisively defeated by their combined forces in 450 and lost the confidence of the Siculi. On the strength of earlier connections, he took refuge in Syracuse and then went to Corinth.

In 446 Ducetius returned to Sicily and colonized Cale Acte on the north coast with Greeks and Siculi. From this centre he attempted to rebuild Siculi power, but his efforts were only partly successful before he died.

Duchamp, Gaston: *see* Villon, Jacques.

Duchamp, Marcel (b. July 28, 1887, Blainville, Fr.—d. Oct. 2, 1968, Neuilly), French artist who broke down the boundaries between works of art and everyday objects. After the sensation caused by "Nude Descending a Staircase, No. 2" (1912), he painted few other pictures. His irreverence for conventional aesthetic standards led him to devise his



"Nude Descending a Staircase, No. 2," oil on canvas by Marcel Duchamp, 1912; in the Philadelphia Museum of Art

By courtesy of the Philadelphia Museum of Art, the Louise and Walter Arensberg Collection

famous ready-mades and heralded an artistic revolution. Duchamp was friendly with the Dadaists, and in the 1930s he helped to organize Surrealist exhibitions. He became a U.S. citizen in 1955.

Early years. Although Duchamp's father was a notary the family had an artistic tradition stemming from his grandfather, a shipping agent who practiced engraving seriously. Four of the six Duchamp children became artists. Gaston, born in 1875, was later known as Jacques Villon, and Raymond, born in 1876, called himself Duchamp-Villon. Marcel, the youngest of the boys, and his sister Suzanne, born in 1889, both kept the name Duchamp as artists.

When Marcel arrived in Paris in October 1904, his two elder brothers were already in a position to help him. He had done some painting at home, and his "Portrait of Marcel Lefrançois" shows him already in possession of a style and of a technique. During the next few years, while drawing cartoons for comic magazines, Duchamp passed rapidly through the main contemporary trends in painting—Postimpressionism, the influence of Paul Cézanne, Fauvism, and finally Cubism. He was merely experimenting, seeing no virtue in making a habit of any one style. He was outside artistic tradition not only in shunning repetition but also in not attempting a prolific output or frequent exhibition of his work. In the Fauvist style Marcel painted some of his best early work three or four years after the Fauvist movement itself had died away. The "Portrait of the Artist's Father" is a notable example. Only in 1911 did he begin to paint in a manner that showed a trace of Cubism. He had then become a friend of the poet Guillaume Apollinaire, a strong supporter of Cubism and of everything avant-garde in the arts. Another of his close friends was Francis Picabia, himself a painter in the most orthodox style of Impressionism until 1909, when he felt the need of complete change. Duchamp shared with him the feeling that Cubism was too systematic, too static and "boring." They both passed directly from "semirealism" to a "nonobjective" expression of movement. There they met "Futurism" and "Abstractionism," which they had known before only by name.

The "Nude." To an exhibition in 1911 Duchamp sent a "Portrait" that was composed of a series of five almost monochromatic, superimposed silhouettes. In this juxtaposition of successive phases of the movement of a single body appears the idea for the "Nude Descending a Staircase, No. 2." The main difference between the two works is that in the earlier one the kangaroo-like silhouettes can be distinguished. In the "Nude," on the other hand, there is no nude at all but only a descending machine, a nonobjective and virtually cinematic effect that was entirely new in painting.

When the "Nude" was brought to the 28th Salon des Indépendants in February 1912, the committee, composed of friends of the Duchamp family, refused to hang the painting. These men were not reactionaries and were well accustomed to Cubism, yet they were unable to accept the novel vision. A year later at the Armory Show in New York City, the painting again was singled out from among hundreds that were equally shocking to the public. Whatever it was that made the work so scandalous in Paris, and in New York so tremendous a success, prompted Duchamp to stop painting at the age of 25. A widely held belief is that Duchamp introduced in his work a dimension of irony, almost a mockery of painting itself, that was more than anyone could bear and that undermined his own belief in painting. The title alone was a joke that was resented. Even the Cubists did their best to flatter the eye, but Duchamp's only motive seemed to be provocation.

Farewell to art. In 1912, after the "Nude," Duchamp did a few more paintings. Some of these, notably "Le Passage de la Vierge à la Mariée" and "Mariée" (Philadelphia Museum of Art), both done in Munich, are among the finest works of the period. Again they were neither Cubist, nor Futurist, nor Abstract, but they expressed Duchamp's typical vision of the body perceived in its inmost impulses.

There was no question that as a painter Duchamp was on a footing with the most gifted. What he lacked was faith in art itself, and he sought to replace aesthetic values in his new world with an aggressive intellectualism opposed to the so-called common-sense world. As early as 1913 he began studies for an utterly awkward piece: "The Large Glass, or The Bride Stripped Bare by Her Bachelors, Even." For it, he repudiated entirely what he called retinal art and adopted the geometrical methods of industrial design. It became like the blueprint of a machine, albeit a symbolic one, that embodied his ideas of man, woman, and love.

Like the "Nude," "The Large Glass" was to be unique among works of modern painting. Between 1913 and 1923, Duchamp worked almost exclusively on the preliminary studies and the actual painting of the picture itself.

His farewell to painting was by no means a farewell to work.

During this period a stroke of genius led him to a discovery of great importance in contemporary art, the so-called ready-made. In 1913 he produced the "Bicycle Wheel," which was simply an ordinary bicycle wheel. In 1914, "Pharmacy" consisted of a commercial print of a winter landscape, to which he added two small figures reminiscent of pharmacists' bottles. It was nearly 40 years before the ready-mades were seen as more than a derisive gesture against the excessive importance attached to works of art, before their positive values were understood. With the ready-mades, contemporary art became in itself a mixture of creation and criticism.

When World War I broke out, Duchamp, who was exempt from military service, was living and working in almost complete isolation. He left France for the United States, where he had made friends through the Armory Show. When he landed in New York in June 1915, he was welcomed by reporters as a famous man. His warm reception in intellectual circles as well raised his spirits. The wealthy poet and collector Walter Arensberg arranged a studio for him in his own home, where the painter immediately set to work on "The Large Glass." He became the centre of the Arensberg group, enjoying a reputation that led to many offers from art galleries eager to handle the works of the painter of the "Nude." He refused them all, however, not wanting to start a full-time career as a painter. To support himself, he gave French lessons. He was then, and remained, an artist whose works would have been sought after but who was content to distribute them free among his friends or to sell them for intentionally small amounts. He helped Arensberg buy back as many of his works as could be found, including the "Nude." They became a feature of the Arensberg Collection, which was left to the Philadelphia Museum of Art.

Besides "The Large Glass," on which he worked for eight more years until abandoning it in 1923, Duchamp did only a few more ready-mades. One, a urinal entitled "Fountain," he sent to the first exhibition of the Society of Independent Artists, in 1917. Although he was a founder-member of this society, he had signed the work "R. Mutt," and therefore it was refused. His ready-mades had anticipated by a few years the Dada movement, which Picabia introduced to New York City in the magazine *291* (1917). As an echo of the movement, Duchamp helped Arensberg and H.P. Roché to publish *The Blind Man,* which had only two issues, and *Rongwrong,* which had only one. Later, with the painter Man Ray, he published a single issue of *New York Dada* in 1921.

In 1918 he sold "The Large Glass," which was still unfinished, to Walter Arensberg. With the money from this and another painting, his last, he spent nine months in Buenos Aires, where he heard of the armistice and of the deaths of his brother Raymond Duchamp-Villon and of Guillaume Apollinaire. In Paris in 1919 he stayed with Picabia and established contact with the first Dada group. This was the occasion of his most famous ready-made, a photograph of the "Mona Lisa" with a moustache and a goatee added. The act expressed the Dadaists' scorn for the art of the past, which in their eyes was part of the infamy of a civilization that had produced the horrors of the war just ended.

In February 1923 Duchamp stopped working on "The Large Glass," considering it definitely and permanently unfinished. As the years passed, art activity of any kind interested him less and less, but the cinema came to fulfill his pleasure in movement. His works to this point had been only potential machines, and it was time for him to create machines that were real, that worked and moved. The first ones were devoted to optics and led to a short film, *Anemic Cinema* (1926). With these and other products, including "optical phonograph records," he acted as a kind of amateur engineer. The modesty of his results, however, was a way by which he could ridicule the ambitions of industry. The rest of the time he was absorbed in chess playing, even taking part in international tournaments and publishing a treatise on the subject in 1932.

Although Duchamp carefully avoided art circles, he remained in contact with the Surrealist group in Paris, composed of many of his former Dadaist friends. When in 1934 he published the *Green Box,* containing a series of documents related to "The Large Glass," the Surrealist poet André Breton perceived the importance of the painting and wrote the first comprehensive study of Duchamp, which appeared in the Paris magazine *Minotaure* in 1935. From that time on there was a closer association between the Surrealists and Duchamp, who helped Breton to organize all the Surrealist exhibitions from 1938 to 1959. Just before World War II he assembled his *Boîte-en-valise,* a suitcase containing 68 small-scale reproductions of his works. When the Nazis occupied France, he smuggled his material across the border in the course of several trips. Eventually he carried it to New York City, where he joined a number of the Surrealists in exile, including Breton, Max Ernst, and Yves Tanguy. He was instrumental in organizing the Surrealist exhibition in New York City in October and November of 1942.

Unlike his co-exiles, he felt at home in America, where he had many friends. During the war, the exhibition of "The Large Glass" at the Museum of Modern Art, New York City, helped to revive his reputation, and a special issue of the art magazine *View* was devoted to him in 1945. Two years later he was back in Paris assisting Breton with a Surrealist exhibition, but he returned to New York City promptly and spent most of the remainder of his life there. After his marriage to Teeny Sattler in 1954, he lived more than ever in semiretirement, content with chess and with producing, as the spirit moved him, some strange and unexpected object.

This contemplative life was interrupted in about 1960, when the rising generation of American artists realized that Duchamp had found answers for many of their problems. Suddenly tributes came to him from all over the world. Retrospective shows of his works were organized in America and Europe. Even more astonishing were the replicas of his ready-mades produced in limited editions with his permission, but the greatest surprise was still to come. After his death in Neuilly his friends heard that he had worked secretly for his last 20 years on a major piece called "Étant donnés: 1. la chute d'eau, 2. le gaz d'éclairage" (Given: 1. the waterfall, 2. the illuminating gas"). It is now at the Philadelphia Museum of Art and offers through two small holes in a heavy wooden door a glimpse of Duchamp's enigma.

Assessment. As artist and anti-artist, Marcel Duchamp is considered one of the leading spirits of 20th-century painting. With the exception of the "Nude Descending a Staircase, No. 2," however, his works were ignored by the public for the greater part of his life. Until 1960 only such avant-garde groups as the Surrealists claimed that he was important, while to "official" art circles and sophisticated critics he appeared to be merely an eccentric and something of a failure.

He was more than 70 years old when he emerged in the United States as the secret master whose entirely new attitude toward art and society, far from being negative or nihilistic, had led the way to Pop art, Op art, and many of the other movements embraced by younger artists everywhere. Not only did he change the visual arts but he also changed the mind of the artist. (R.Le.)

MAJOR WORKS. "Church at Blainville" (1902; Philadelphia Museum of Art); "Portrait of Marcel Lefrançois" (1904; Philadelphia Museum of Art); "Nude on Nude" (1909?; Arnold D. Fawcus Collection, Paris); "Portrait of the Artist's Father" (1910; Philadelphia Museum of Art); "Red Nude" (1910; Mary Sisler Collection, New York); "The Chess Players" (1910; Philadelphia Museum of Art); "Landscape" (1911; Museum of Modern Art, New York City); "Sad Young Man in a Train" (1911; Peggy Guggenheim Collection, Venice); "Nude Descending a Staircase, No. 1" (1911; Philadelphia Museum of Art); "Portrait" (1911; Philadelphia Museum of Art); "Apropos of Little Sister" (1911; Solomon R. Guggenheim Museum, New York City); "Nude Descending a Staircase, No. 2" (1912; Philadelphia Museum of Art); "Le Passage de la Vierge à la Mariée" (1912; Museum of Modern Art); "The King and Queen Surrounded by Swift Nudes" (1912; Philadelphia Museum of Art); "Bride" (1912; Philadelphia Museum of Art); "Bicycle Wheel" (1913; replica, Museum of Modern Art); "3 Standard Stoppages" (1913–14; Museum of Modern Art); "Glider Containing a Water Mill in Neighbouring Metals" (1913–15; Philadelphia Museum of Art); "Bottle Dryer" (1914; replica, Moderna Museet, Stockholm); "Network of Stoppages" (1914; Museum of Modern Art); "Nine Malic Moulds" (1914–15; Mrs. Marcel Duchamp Collection, New York); "In Advance of the Broken Arm" (1915; replica, Yale University Art Gallery); "With Hidden Noise" (1916; Philadelphia Museum of Art); "Nude Descending a Staircase, No. 3" (1916; Philadelphia Museum of Art); "Fountain" (1917; replica, Sidney Janis Collection, New York); "Tu m' " (1918; Yale University Art Gallery); "Nude Descending a Staircase, No. 4" (1918; Museum of the City of New York); "To be Looked at (from the Other Side of the Glass) with One Eye, Close to, for Almost an Hour" (1918; Museum of Modern Art); "L.H.O.O.Q." (1919; Mary Sisler Collection); "Why Not Sneeze Rose Sélavy?" (1921; Philadelphia Museum of Art); "The Large Glass" (1915–23; Philadelphia Museum of Art); "The Brawl at Austerlitz" (1921; W.N. Copley Collection, New York); "Rotary Demi-Sphere" (1925; Museum of Modern Art); "Discs Inscribed with Puns" (1926; W.N. Copley Collection); *The Green Box* (1934); *Rotoreliefs* (1935); "Door for Gradiva" (1937; replica, Dieter Keller Collection, Stuttgart, Ger.); *Boîte-en-valise* (1938–42; Mary Sisler Collection); "In the Manner of Delvaux" (1942; V. and A. Schwarz Collection, Milan); "Pocket Chess Set" (1943; New York); "George Washington" (1943; André Breton Estate, Paris); "Given the Illuminating Gas and the Waterfall" (1948–49; Maria Martins Collection, Rio de Janeiro); "Female Fig Leaf" (1950; Mary Sisler Collection); "Object-Dard" ("Dart-Object"; 1951; Mrs. Marcel Duchamp Collection); "Wedge of Chastity" (1954; Mrs. Marcel Duchamp Collection); "Self-Portrait in Profile" (1958; New York); "Cols alités" (1959; R. Lebel Collection, Paris); "With My Tongue in My Cheek" (1959; R. Lebel Collection); "Torture-morte" (1959; R. Lebel Collection); "Sculpture-morte" (1959; R. Lebel Collection); *Nine Etchings for the Large Glass and Related Works* by A. Schwarz (1967; A. Schwarz Collection); *Nine Etchings for the Large Glass and Related Works* by A. Schwarz (1968; A. Schwarz Collection); "Étant donnés: 1. la chute d'eau, 2. le gaz d'éclairage" (1946–66, assembled 1969; Philadelphia Museum of Art).

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Studies. Guillaume Apollinaire, *Les Peintres*

cubistes (1913; *The Cubist Painters,* 2nd ed., 1949); Calvin Tomkins, *The World of Marcel Duchamp* (1966); Pierre Cabanne, *Entretiens avec Marcel Duchamp* (1967; *Dialogues with Marcel Duchamp,* 1971), and *Les 3 Duchamp* (*The Brothers Duchamp,* 1976); Arturo Schwarz, *The Large Glass, and Related Works,* 2 vol. (1967–68) and *Marcel Duchamp* (1970; Eng. ed. 1975); Octavio Paz, *Marcel Duchamp* (1968), in Spanish; and Sarane Alexandrian, *Marcel Duchamp* (1976; Eng. trans. 1977).

Major exhibition catalogs. Marcel Duchamp, Pasadena Art Museum: A Retrospective Exhibition, October 8 Through November 3, 1963 (1963), the first major exhibition of Duchamp's works; *The Almost Complete Works of Marcel Duchamp: Catalogue of an Exhibition at the Tate Gallery 18 June–31 July 1966* (1966); Paris, Musée National D'art Moderne, *Marcel Duchamp* (1967), the first comprehensive exhibition of Duchamp's works in France; Anne d'Harnoncourt and Kynaston McShine, *Marcel Duchamp* (1973), published by the Museum of Modern Art, New York City, the most complete collection assembled to date.

Duchamp-Villon, Raymond, original name RAYMOND DUCHAMP (b. Nov. 5, 1876, Paris—d. Oct. 7, 1918, Cannes, Fr.), French sculptor, who was one of the first major modern sculptors to apply the principles of Cubism in his work.

In 1900 he gave up medicine for sculpture, often working closely with his brothers, the artists Marcel and Gaston Duchamp (the last-named being better known by his pseudonym, Jacques Villon). Duchamp-Villon was first influenced by the work of Auguste Rodin. His progression to more simplified forms can be seen in such portrait heads as "Baudelaire" (1911; Alexander M. Bing, New York City) and "Maggy" (1911; Solomon R. Guggenheim Museum, New York City), which was virtually reduced to simple geometric shapes. "The Seated Woman" (1914; Yale University Art Gallery) shows the growing influence on Duchamp-Villon of the Cubist painters' characteristic method of abstracting form out of the analytically dissected parts of the object depicted. His move toward abstraction was fully achieved in his masterpiece, "Horse" (1914),

"Horse," bronze sculpture by Raymond Duchamp-Villon, 1914

Collection Walker Art Center, Minneapolis, Minn., gift of the T.B. Walker Foundation; permission A.D.A.G.P. 1971, by French Reproduction Rights, Inc.

which reduces forms to their geometric essentials and integrates space into the mass of the work. He also began to apply Cubist principles to architecture but was killed in World War I before his experiments could be realized.

Duchenne, Guillaume-Benjamin-Amand (b. Sept. 17, 1806, Boulogne, Fr.—d. Sept. 15, 1875, Paris), French neurologist, who was first to describe several nervous and muscular disorders and, in developing medical treatment for them, created electrodiagnosis and electrotherapy.

During his lifelong private practice in Boulogne (1831–42) and Paris (1842–75), he explored the effects of electrical stimulation on diseased nerves and muscles. He rendered the first accounts of several types of muscular atrophy and paralysis caused by nerve disorders, including (1858) tabes dorsalis, or locomotor ataxia, a muscular atrophy caused by a degeneration of the dorsal columns of the spinal cord and sensory nerve trunks. His invention of an instrument (now known as Duchenne's trocar) to remove small portions of tissue located deep in the body founded the diagnostic practice of biopsy. His best-known writings are *De l'électrisation localisée* (1855) and *Physiologie des mouvements* (1867).

Duchesne, André, Latin ANDREAS CHESNEUS, ANDREAS QUERCETANUS, or ANDREAS QUERNEUS (b. May 1584, Île-Bouchard, Fr.—d. May 30, 1640, Paris), historian and geographer, sometimes called the father of French history, who was the first to make critical collections of sources for national histories.

Duchesne was educated at Loudun and Paris and devoted his early years to studies in history and geography. His first work, *Egregiarum seu Selectarum Lectionum et Antiquitatum Liber*

André Duchesne, detail from an engraving

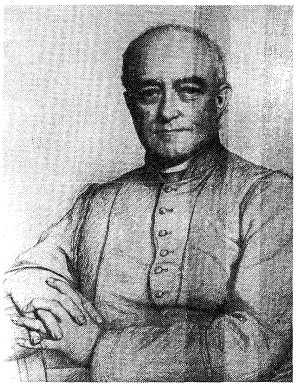
J.E. Bulloz

(1602; "Andreas Querneus' Book of Extraordinary or Select Readings and Antiquities"), drew attention to his great erudition. Later, through the influence of the Cardinal de Richelieu, he was appointed historiographer and geographer to the king.

Duchesne's numerous works include general histories, genealogies, and family histories, as well as many folio volumes of manuscript extracts. Among the more noteworthy are *Historiae Normannorum Scriptores Antiqui* (1619; "Ancient Writers of the History of the Normans"), now the only source for some of the texts, and *Historiae Francorum Scriptores,* 5 vol. (1636–49; "Writers of the History of the Franks"), a projected 24-volume comprehensive collection of narrative sources of French history, of which only five volumes were written (the last three by Duchesne's son François).

Duchesne, Louis-Marie-Olivier (b. Sept. 13, 1843, Saint-Servan, Fr.—d. April 21, 1922, Rome), church historian, a leading figure in the 19th- and early 20th-century Roman Catholic revival of learning, who pioneered in the application of archaeological, topographical, liturgical, theological, and social studies to church history.

Ordained a priest in 1867, he studied in Rome and in Paris (1871–73), where he was appointed professor at the Catholic Institute (1877–85) and where in 1881 he founded the *Bulletin Critique de Littérature, d'Histoire et de Théologie.* Persuaded to resign after criticism of his lectures, he taught at the École Supérieure des Lettres from 1885 to 1895, when he was appointed director of the École Française de Rome; he served there until his death. In 1910 he was elected to the French Academy and was made a prothonotary apostolic by Pope Leo XIII.



Louis Duchesne, drawing by an unknown artist, 1903

Harlingue—H. Roger-Viollet

Duchesne's works include the authoritative edition of the *Liber Pontificalis,* 2 vol. (1886–92); *Autonomies ecclésiastiques: églises séparées* (1896; "Ecclesiastical Autonomies: Detached Churches"), dealing with the origin of the Greek and Anglican churches; and *Histoire ancienne de l'église chrétienne (Early History of the Christian Church),* of which the first three volumes (1905–08) were put on the *Index of Forbidden Books,* the fourth volume being published posthumously (1925).

Duchesne, Père (Father): *see* Hébert, Jacques-René.

Duchesne, Saint Rose Philippine (b. Aug. 29, 1769, Grenoble, Fr.—d. Nov. 18, 1852, St. Charles, Mo., U.S.; canonized July 3, 1988; feast day November 17), missionary who founded the first Sacred Heart convents in the United States.

Duchesne was born into a wealthy family with high political and financial connections. In 1780 she went to study at a convent and, despite her father's opposition, entered the Visitation Order in Grenoble in 1788. When the community was dispersed by the French Revolution (1792), she did charitable works for nine years. After vainly trying to reestablish the Visitandines in their convent of Sainte-Marie-d'en-Haut, she turned the convent over to the newly founded Society of the Sacred Heart in 1804 and was received by its founder, St. Madeleine Sophie Barat.

For 14 years Mother Duchesne prepared for a missionary career, during which time she founded the first Sacred Heart convent in Paris (1815). In 1818 she headed a band of five nuns, the first to pioneer U.S. territory west of the Mississippi. At St. Charles, in the soon-to-be state of Missouri, the women opened a free school and a boarding academy, moving in 1819 to Florissant, Mo., where they founded an orphanage and a novitiate. Two convent schools were founded in Louisiana, at Grand Coteau (1821) and St. Michael's (1825), and an academy and orphanage in St. Louis, Mo. (1827). The house at St. Charles was reopened in 1828.

At the invitation of the Jesuit missionary Father Pierre-Jean de Smet, Mother Duchesne in 1841 was sent to the Indian mission among the Potawatomi at Sugar Creek (in present-day Kansas), remaining there in ill health for one year. She spent the last decade of her life at St. Charles, where a memorial church was built in her honour.

duchess: *see* duke.

duchesse lace, a Belgian lace, named after Marie-Henriette, duchess of Brabant (later queen of the Belgians). It was made from *c.* 1840 throughout the 19th century both at Brussels and (particularly) at Bruges. Much inferior (except for a few Brussels specimens) to the lace that had made Brussels famous, it was cheap and commercially successful. In

Duchesse lace from Brussels, second half of the 19th century; in the Rijksmuseum, Amsterdam
By courtesy of the Rijksmuseum, Amsterdam

duchesse lace, floral motifs, bobbin-made and sometimes resembling tape motifs, are joined by thread bars (brides).

Ducis, Jean-François (b. Aug. 22, 1733, Versailles, Fr.—d. March 31, 1816, Versailles), French dramatist who made the first sustained effort to present William Shakespeare's tragedies on the French stage. Although he remodelled the tragedies to the French taste

Ducis, portrait by François Gérard
J.E. Bulloz

for witty, epigrammatic style and attempted to confine the plays within the "classical unities" (of time, place, and action), such critics as Voltaire still raged against Shakespeare's "barbarous histrionics." Nonetheless, Ducis achieved great success with his principal adaptations—from *Hamlet* (1769), which he saw mainly as a lesson in filial piety, through his works titled *Roméo et Juliette* (1772), *Le Roi Lear* (1783), *Macbeth* (1784), and *Othello* (1792).

Ducis came from a bourgeois family, rising through his position as secretary to several powerful figures of the court. He knew no English and thus was hampered from the start by having to work with the mediocre translations of Pierre-Antoine de La Place (1707–93) and those of Pierre Le Tourneur (1736–88). Aware of his uncomfortable position between an audience with specific tastes and a body of brilliant but largely unfamiliar works in an alien style, he attempted to compromise the plays, buying exposure for them by revising the texts and, in some cases, even by changing the catastrophes. Nevertheless, his adaptations have a certain vigorous eloquence.

Of Ducis's original tragedies, *Oedipe chez Admète* (1778; "Oedipus at the home of Admetus") and *Abufar* (1795) are considered his best; the first earned him election to the Académie Française in succession, ironically, to Voltaire. His complete works, including his beautifully written letters, were edited and published by his friend François-Vincent Campenon (1818 and 1826).

duck, any of nearly 90 species of relatively small, short-necked, and large-billed waterfowl of the subfamily Anatinae (family Anatidae). In true ducks, *i.e.,* those classified in Anatinae, the legs are placed rearward, as in swans, resulting in a waddling gait. Most true ducks, including a few inaccurately called geese by reason of size and build, differ from swans and true geese in having two annual molts in males; in laying a larger clutch of eggs, which are smooth-shelled; in having overlapping scales on the skin of the leg; and in showing some degree of sexual differentiation in plumage and in call. All true ducks, except those in the shelduck (*q.v.*) group and sea ducks, mature in the first year and pair only for the season—unlike the late-maturing, life-mating true geese and swans. (For further information about the relationship of ducks, geese, and swans, *see* Anatidae).

The ducks are generally divided into three major groups, dabbling, diving, and perching ducks, based on their various life-styles. The mallard (*q.v.*), a typical dabbling duck, is one of the most popular game birds and is the ancestor of most domestic ducks (*see* fowl, domestic). Perching ducks such as the muscovies have long claws and are the most arboreal of ducks, often roosting in trees. The diving ducks include the greatest number of marine species, such as the eider and the scoter (*qq.v.*), but also includes the merganser (*q.v.*) group, most of which prefer freshwater areas. Members of the stifftail (*q.v.*) group, typified by the ruddy duck, are highly aquatic ducks, characterized by legs set far toward the rear of the body. The whistling duck (*q.v.*) species, also called tree ducks, are not true ducks but are more closely related to the geese and swans. *See also* dabbling duck; diving duck; perching duck; poultry.

duck (probably from Dutch *doek*, "cloth"), any of a broad range of strong, plainwoven fabrics made originally from tow yarns and subsequently from either flax or cotton. Duck is lighter than canvas or sailcloth and differs from these in that it is almost invariably single in both warp and weft, or filling.

The fabric, in its various qualities and colours, is used for an enormous variety of purposes, including tents, wagon and motor hoods, light sails, belting, bicycle tubes, mailbags and other bags and pocketings, and clothing; the plural form is used colloquially for trousers made of the material. Russian duck is a fine white linen canvas.

duck hawk: *see* peregrine falcon.

Duck Lake, town, central Saskatchewan, Canada, between the North and South Saskatchewan rivers, 33 mi (53 km) southwest of Prince Albert. Originally settled about 1870 on nearby Duck Lake, the town was the site of the first clash (Mar. 26, 1885) of the Riel (North West) Rebellion between Métis (half-breeds) led by Gabriel Dumont and a detachment of the North West (later Royal Canadian) Mounted Police, who were forced to retreat. It is now a local market town for a grain-growing and mixed-farming area and a service centre for nearby Okemasis and Beardy Indian reservations. The Métis association is commemorated by Duck Lake Historic Park which includes a museum displaying relics of the period. Batoche (*q.v.*), site of the decisive battle of the Riel Rebellion, is a few miles southeast. Inc. village, 1903; town, 1952. Pop. (1981) 699.

Duck Mountain, plateau in southwestern Manitoba, Canada, forming the highest part of the Manitoba Escarpment. It extends southwestward from the Saskatchewan border for 50 mi (80 km), culminating in Baldy Mountain (*q.v.*; 2,727 ft [831 m]), 36 mi northwest of Dauphin. A large part of the plateau is embraced by Duck Mountain Provincial Park (492 sq mi [1,274 sq km]), established in 1962 to preserve the region's dense forests, numerous lakes, and abundant wildlife; both are named for the numerous wild ducks found there.

duckbill (mammal): *see* platypus.

duckbill cat (fish): *see* paddlefish.

duckpins, bowling game played on a standard tenpin lane with smaller pins and balls; the pins are 9.4 inches (23.3 centimetres) tall and the ball, with no finger holes, is a maximum of 5 inches in diameter and 3 pounds 12 ounces (1.7 kilograms) in weight. Three balls may be rolled in each frame of the ten-frame game. There is no bonus for knocking down all 10 pins with three balls. Other rules are similar to those of tenpins. A perfect game is 300 as in tenpin bowling.

The game is most popular in the United States, where it is governed by the National Duck Pin Bowling Congress (founded Sept. 8, 1927). The game was introduced in 1900 at a bowling alley owned by professional baseball players Wilbert Robinson and John J. McGraw.

A popular variation of the game is rubberband duckpins. The pins are the same height as in duckpins, but there is a hard rubber band about the belly of each pin, giving it greater rebounding action when hit by a ball. The ball is also the same size as in duckpins but may weigh no more than 3 pounds 8 ounces. Only two balls are bowled in each frame.

Ducommun, Élie (b. Feb. 19, 1833, Geneva—d. Dec. 7, 1906, Bern), Swiss writer and editor, co-winner (with Charles-Albert Gobat) of the 1902 Nobel Peace Prize.

After working as a magazine and newspaper editor in Geneva and Bern, Ducommun spent most of his career as general secretary of the Jura-Simplon Railway. His spare time, however, was spent on peace activities. He took an active part in the movement for European union, editing *Les États-Unis d'Europe,* periodical of the International League of Peace and Freedom, founded in 1867.

In 1889 Ducommun participated in the first of the regular International Peace congresses. Two years later he became honorary general

Ducommun, detail of an engraving
By courtesy of the Bibliotheque Nationale Suisse, Bern

secretary of the newly founded International Peace Bureau. After 1895 he published the bureau's *Correspondance bi-mensuelle.* In this period Ducommun also wrote a number of works on the peace movement.

Ducos du Hauron, (Arthur-)Louis (b. 1837, Langon, Fr.—d. October 1920, Agen), French physicist and inventor who in 1869 developed the so-called trichrome process of colour photography, a key 19th-century contribution to that branch of technology.

Son of a tax collector, Ducos du Hauron

began experimenting in his 20s and on March 1, 1864, patented (but did not build) a device for taking and projecting motion pictures. Four years later, on Nov. 23, 1868, he was granted a patent on a process for making colour photographs. He photographed each scene through green, orange, and violet filters, then printed his three negatives on thin sheets of bichromated gelatin containing carbon pigments of red, blue, and yellow, the complementary colours of the negatives. When the three positives, usually in the form of transparencies, were superimposed, a full-colour photograph resulted. Another French experimenter, Charles Cros, discovered the process independently, publishing his findings just 48 hours after Ducos du Hauron received his patent. Ducos du Hauron described his results in *Les Couleurs en photographie: Solution du problème* (1869; "Colours in Photography: Solution of the Problem") and *Les Couleurs en photographie et en particulier l'héliochromie au charbon* (1870; "Colours in Photography: Colour Reproduction with Carbon Pigments").

Continuing his research, Ducos du Hauron devised improvements and cost reductions for printed colour reproductions. In 1891 he patented a device for three-dimensional photography called an anaglyph. Though he realized little profit from his inventions, he did receive a pension from the government and in 1912 was made a Chevalier of the French Légion d'Honneur.

Ducrow, Andrew (b. Oct. 10, 1793, London—d. Jan. 27, 1842, London), spectacular British equestrian performer and an originator of horsemanship acts.

His father, a Belgian strong man who came to England in 1793, trained him from infancy in tumbling, riding, and rope dancing.

Ducrow, engraving by T.C. Wageman

By courtesy of the Raymond Mander and Joe Mitchenson Theatre Collection, London

Ducrow later developed a horsemanship act, "The Courier of St. Petersburg," variations of which are still performed in 20th-century circuses. A rider straddled two cantering horses while other horses bearing the flags of the countries through which a courier would pass on his way to Russia passed between his legs. He appeared in European circuses and in spectacles at Covent Garden and Drury Lane in London, but he is best remembered for his long career as proprietor and chief performer at the famous Astley's Amphitheatre, a permanent modern circus (1824–41). When Astley's was destroyed by fire for the third time in 1841, Ducrow suffered a mental breakdown and died soon after.

A.H. Saxon's *The Life and Art of Andrew Ducrow* was published in 1975.

ductus deferens, also called VAS DEFERENS, thick-walled tube in the male reproductive system that transports sperm cells from the epididymis, where the sperm are stored prior to ejaculation (*q.v.*). Each ductus deferens ends in an enlarged portion, an ampulla, which acts as a reservoir. There are two ductus deferentes, identical in structure and function, which emerge from the two epididymides.

The channel of the ductus deferens is slightly larger than that of the ductus epididymidis, the tube found in the epididymis gland from which it originates. The tissue lining the inside wall is a moist and folded layer of mucous membrane. Surrounding the mucous membrane are three layers of circular and longitudinal muscle fibres. These fibres cause the ducts to contract and thus allow the sperm and fluids to be transported. The ductus deferens begins at the tail of the epididymis, in the lower region of the scrotal sac, the pouch of thin skin that covers the testes and epididymides. It extends into the pelvic region. While ascending to the level of the bladder, the ductus deferens is surrounded by a network of arteries, veins (pampiniform plexus), and nerve fibres, and the whole is covered by layers of connective tissue. (This complex tubular structure, called the spermatic cord, also serves to suspend the testes.) At the level of the bladder, each duct separates from its sheath of connective tissue and travels back over the top of the bladder; the two ducts turn downward at the rear of the bladder, and their channels enlarge to form the two ampullae attached to the outside left and right walls of the bladder.

The ampullae act as storage chambers for the semen and contribute secretions to it. The yellow secretions of the ampullae include ergothioneine, a substance that reduces chemical compounds, and fructose, a sugar and nutrient. Both secretions moisten the sperm and help to keep them viable. The inside cavities of the ampullae have several meshlike partitions and folds. The walls of the ampulla are thinner than the rest of the sperm canal, and the channel is usually larger. The size of the ampulla varies with different animal species; in the stallion the ampullae are relatively large, whereas in man they are only about twice the size of the ductus deferentes. The ampullae join the ducts of the seminal vesicles to form the ejaculatory ducts.

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

Dudek, Louis (b. Feb. 6, 1918, Montreal), major figure in the Canadian poetry renaissance of the 1940s.

Educated at Columbia University and McGill University (where he later taught), Dudek worked as an editor and wrote criticism. His poetic output includes *East of the City* (1946); *The Transparent Sea* (1956), love poems; and *Laughing Stalks* (1958), a social satire that includes parodies of certain Canadian poets and critics. His *Collected Poems* appeared in 1974. Dudek's poems reflect his power of observation of people, places, and objects. The influence of Ezra Pound is evident in *Europe* (1955), a travelogue poem in 99 cantos inspired by observations of several countries on the Continent, and in other works. Another anthology, *Cross Section* (1980), contains poems written between 1940 and 1980.

Dudinka, city and administrative centre of Taymyr autonomous *okrug* (area), northern Krasnoyarsk *kray* (territory), Russian Soviet Federated Socialist Republic. A port on the lower Yenisey River, it was founded in 1667 and became a city in 1951. Dudinka exports nickel from the mines at Norilsk, with which it is connected by rail. It also has a natural-gas plant, using gas from fields about 100 mi (160 km) west of the city. Dudinka has a regional museum. Pop. (1970) 19,701.

Dudley, district (borough), western edge of the metropolitan county of West Midlands, England, covering 38 sq mi (98 sq km). The borough is bisected by the Sedgley-Northfield ridge. To the south and west lies the fertile countryside around the River Severn; on the River Stour, a tributary of the Severn in the south of the borough, are the towns of Stourbridge and Halesowen. North and east of the ridge is the industrial Black Country plateau, dominated by Dudley Castle Hill, the site of Saxon and Norman fortifications and, since 1935, of a zoological garden.

Coal and ironstone have been mined since the Middle Ages, although the coal was not used for iron smelting until the 18th century. The tremendous expansion of industry after 1700 was stimulated by the building of canals, which transformed the communications of the area, as well as by the rich mineral resources. By the first half of the 19th century there were numerous blast furnaces, whose pollution helped to give the Black Country its name. Nail making was an important domestic industry from the 17th century; chains and anchors were also made. Glassmaking dates from the early 17th century, and crystal glassware is produced today.

Metalworking remains the main industry of the district; products range from heavy engineering castings to tubes, chains, cables, nuts, and bolts. Other industries include plastics, textiles, chemicals, and electronics. Within the district is the Wren's Nest Nature Reserve, a classic example of the exposure of Silurian limestone, which was extensively quarried until 1924. Pop. (1982 est.) 300,100.

Dudley, Caroline Louise: *see* Carter, Mrs. Leslie.

Dudley, Charles Benjamin (b. July 14, 1842, Oxford, N.Y., U.S.—d. Dec. 21, 1909, Altoona, Pa.), American chemical engineer who helped found the science of materials testing.

Entering Yale College in 1867, Dudley worked his way through school as a night editor on the *New Haven Palladium* and eventually earned his Ph.D. from the Sheffield Scientific School, as well as election to Phi Beta Kappa. In 1875 he was appointed chemist to the Pennsylvania Railroad Company, where he instituted a program of research on the composition and properties of rails.

Publication of Dudley's study "The Chemical Composition and Physical Properties of Steel Rails" in the *Transactions of the American Institute of Mining Engineers* (1878) created a sensation. The steel producers viewed with disfavour the invasion of their metallurgical domain by an outsider; but Dudley continued to publish his findings, and the principle he stood for, the enforcement of rigorous standards, prevailed. Eventually he developed a complete set of standard specifications for fuels, lubricants, paints, and lighting devices, as well as for mechanical components of locomotives and rolling stock. In 1898 he helped found the American Society for Testing and Materials, serving as president from 1902 until his death.

Dudley, Dud (b. 1599, England?—d. 1684 England?), English ironmaster usually credited with having been the first to smelt iron ore with coke, a hard, foamlike mass of almost pure carbon made from bituminous coal. Charcoal, made from wood, had been exclusively used for smelting iron until Dudley began experimenting with coke, or, as he called it, "pit-coal." Such experimentation had been encouraged by the English government, which was concerned about the rapid destruction of forests for fuel. Dudley obtained a patent for his innovation in 1621 and was soon producing a record seven tons of pig iron per week at the Hasco Bridge ironworks owned by his father, Edward Sutton, 5th Baron Dudley.

Dudley, Edmund (b. *c.* 1462—d. Aug. 18, 1510, London), minister of King Henry VII

of England and author of a political allegory, *The Tree of Commonwealth* (1509).

In 1506 Dudley was "president of the king's council," a small body of lawyers and fiscal administrators that helped reestablish the payment of feudal dues and of fines for lawbreaking. Charges that he defrauded the King—he amassed a fortune—and was otherwise guilty of corruption were not proved. In April 1509, just after the death of Henry VII, Dudley and Sir Richard Empson, another leader in the council, were arrested. Both were convicted of treason and were executed, largely because of Henry VIII's desire for popularity.

Dudley wrote *The Tree of Commonwealth* (ed. D.M. Brodie, 1948) while in the Tower. It is informed with the irony and wit of a great advocate. In the work Dudley insists on punctual performance of duties by all ranks of society, inveighs against administrative abuses sanctioned by law, and urges moderation in the use of royal powers.

Dudley was the father of John Dudley, duke of Northumberland.

Dudley, Lady Jane: *see* Grey, Lady Jane.

Dudley, John: *see* Northumberland, John Dudley, duke of.

Dudley, Sir Robert: *see* Leicester, Robert Dudley, earl of.

Dudley, Sir Robert (b. Aug. 7, 1574, Richmond, Surrey, Eng.—d. Sept. 6, 1649, Florence), English sailor, engineer, and titular duke of Northumberland and earl of Warwick who wrote a well-known treatise, *Dell'Arcano del mare* (3 vol., 1646–47; "Concerning the Secret of the Sea"), that contained the sum of contemporary knowledge of navigation.

Proposing to explore Guiana, he voyaged to Trinidad and sent a boat some distance up the Orinoco River (1594). In 1596 he was knighted for his part in England's naval operations against Spain. He later attempted to establish his legitimacy and claim to the titles of his father, Robert Dudley, earl of Leicester, basing his claims on an alleged marriage between his parents in 1573 (a marriage that his father had denied).

In 1605 he went to Italy, where he entered the service of the Grand Duke of Tuscany and was employed in draining the marshes between Pisa and Leghorn (1620) and in constructing the port of Leghorn. Published near the end of his life, his *Arcano* considered ship construction, a plan for building a navy of five classes of ships, and naval discipline; it also contained determinations of longitude, charts based on the map projections of Gerardus Mercator, and designs for instruments.

Dudley, Thomas (b. 1576, Northampton, Eng.—d. July 31, 1653, Roxbury, Mass.), British colonial governor of Massachusetts, for many years the most influential man in the Massachusetts Bay Colony, save John Winthrop.

Dudley was the son of a country gentleman in England and for a time was the steward of the earl of Lincoln's estates. After being converted to Puritanism he joined with other Lincolnshire gentlemen in 1629, entering into an agreement to settle in New England provided they were allowed to take a charter with them. This proposal the general court of the Massachusetts Bay Company agreed to, and in April 1630 Dudley sailed to America in the same ship with Winthrop, the newly appointed governor. Dudley was elected deputy governor 13 times between 1629 and 1650, and served as governor 4 times.

Soon after his arrival in the colony Dudley settled at New Towne (later Cambridge), which he helped found. He was also one of the promoters of the plan to establish Harvard College. Winthrop's decision to make Boston instead of New Towne the capital precipitated the first of many quarrels between the two and prompted Dudley to move his residence to Roxbury.

From Dudley, an earnest and persistent heresy hunter, New England Puritanism derived some of its harshest aspects; his sterner Puritanism stood in strong contrast to Winthrop's more tolerant and liberal views.

Dudley diamond (gem): *see* Star of South Africa.

Dudo OF SAINT-QUENTIN, also spelled DUDON (b. *c.* 960, Vermandois, Picardy, Fr.—d. before 1043, Rouen, Normandy), historian of the first dukes of Normandy; his chronicle is a primary source for the early history of the Norman state.

A canon of Saint-Quentin, Dudo was sent by the count of Vermandois to Rouen in 986 to petition for Norman aid against Hugh Capet, founder of the Capetian dynasty. He began to frequent the court of Richard I, duke of Normandy, and was employed to write a history of the Norman dukes. The work, *De moribus et actis primorum Normanniae ducum* ("Concerning the Customs and Deeds of the First Dukes of the Normans"), was completed sometime between 1015 and 1026. Trained as a poet, Dudo wrote his history as an apologetic for the Norman dukes. Its inaccurate and legendary character makes it a relatively untrustworthy document; but, as a record of local oral tradition, contemporary chansons de geste, and rare firsthand information on the emerging Norman court, the chronicle remains highly important.

Dudok, Willem Marinus (b. July 6, 1884, Amsterdam—d. April 6, 1974), Dutch architect whose work is related both to the school of Amsterdam, which emphasized individual expression, and to the De Stijl group, which stressed geometric form. He attended the Royal Military Academy at Breda and remained in the army until 1913. He became municipal architect of Hilversum in 1915 and thereafter designed many buildings for the city, notably the Dr. H. Bravink School (1921), the Vondel School (1928–29), and the Town Hall (1928–30). These structures, though compositions of cubes, convey solidity and texture through the use of solid brick.

Other Dudok works include The Netherlands House, Cité Universitaire, Paris (1927–28); the Bijenkorf department store, Rotterdam (1929–30), which was destroyed in World War II; and the Erasmus Huis, Rotterdam (1939–40).

due process, a course of legal proceedings according to rules and principles that have been established in a system of jurisprudence for the enforcement and protection of private rights. In each case, due process contemplates an exercise of the powers of government as the law permits and sanctions, under recognized safeguards for the protection of individual rights.

Principally associated with one of the fundamental guarantees of the United States Constitution, due process derives from early English common law and constitutional history. The first concrete expression of the due process idea embraced by Anglo-American law appeared in the 39th article of Magna Carta (1215) in the royal promise that "No freeman shall be taken or (and) imprisoned or disseised or exiled or in any way destroyed . . . except by the legal judgment of his peers or (and) by the law of the land." In subsequent English statutes, the references to "the legal judgment of his peers" and "laws of the land" are treated as substantially synonymous with due process of law. Drafters of the U.S. federal Constitution adopted the due process phraseology in the Fifth Amendment, ratified in 1791, which provides that "No person shall . . . be deprived of life, liberty, or property, without due process of law." Because this amendment was held inapplicable to state actions that might violate an individual's constitutional rights, it was not until the ratification of the Fourteenth Amendment in 1868 that the several states became subject to a federally enforceable due process restraint on their legislative and procedural activities.

The meaning of due process as it relates to substantive enactments and procedural legislation has evolved over decades of controversial interpretation by the Supreme Court. Today, if a law may reasonably be deemed to promote the public welfare and the means selected bear a reasonable relationship to the legitimate public interest, then the law has met the due process standard. If the law seeks to regulate a fundamental right, such as the right to travel or the right to vote, then this enactment must meet a stricter judicial scrutiny, known as the compelling interest test. Economic legislation is generally upheld if the state can point to any conceivable public benefit resulting from its enactment.

In determining the procedural safeguards that should be obligatory upon the states under the due process clause of the Fourteenth Amendment, the Supreme Court has exercised considerable supervision over the administration of criminal justice in state courts, as well as occasional influence upon state civil and administrative proceedings. Its decisions have been vigorously criticized, on the one hand, for unduly meddling with state judicial administration and, on the other hand, for not treating all of the specific procedural guarantees of the first 10 amendments as equally applicable to state and to federal proceedings.

Some justices have adhered to the proposition that the framers of the Fourteenth Amendment intended the entire Bill of Rights to be binding on the states. They have asserted that this position would provide an objective basis for reviewing state activities and would promote a desirable uniformity between state and federal rights and sanctions. Other justices, however, have contended that states should be allowed considerable latitude in conducting their affairs, so long as they comply with a fundamental fairness standard. Ultimately, the latter position substantially prevailed, and due process was recognized as embracing only those principles of justice that are "so rooted in the traditions and conscience of our people as to be ranked as fundamental." In fact, however, almost all of the Bill of Rights has by now been included among those fundamental principles.

duel, a combat between persons, armed with lethal weapons, which is held according to pre-arranged rules to settle a quarrel or a point of honour. It is an alternative to having recourse to the usual process of justice.

The judicial duel or trial by battle was the earliest form of duelling. Caesar and Tacitus report that the Germanic tribes settled their quarrels by single combat with swords, and with the Germanic invasions the practice became established in western Europe early in the Middle Ages. The judicial duel was adopted because solemn affirmation, or swearing of oaths, in legal disputes had led to widespread perjury and because the ordeal (*q.v.*) seemed to leave too much to chance or to manipulation by priests. If a man declared before a judge that his opponent was guilty of a certain crime and the opponent answered that his accuser lied, the judge ordered them to meet in a duel, for which he established the conditions as to place, time, and arms; both combatants had to deposit sureties for their appearance. The throwing down of a gauntlet was the challenge, which the opponent accepted by picking it up. As it was believed that in such an appeal to the "judgment of God" the defender of the right could not be

worsted, the loser, if still alive, was dealt with according to law.

This form of trial was open to all free men and even, in certain cases, to serfs. Only ecclesiastics, women, the sick, persons under 20 years of age, and men over 60 could claim exemption. In certain circumstances, however, persons under trial could appoint professional fighters or "champions" to represent them, but the principal as well as his defeated champion was subjected to the legal punishment.

In most countries duels also served to decide impersonal questions. In Spain, for example, a duel was fought in 1085 to decide whether the Latin or the Mozarabic rite should be used in the liturgy at Toledo: the Mozarabic champion, Ruiz de Mastanza, won. The procedure of these duels was laid down in great detail. They took place in *champs clos* (lists), generally in the presence of the court and high judicial and ecclesiastical dignitaries. Before combat each participant swore that his case was just and his testimony true and that he carried no weapons other than the stipulated ones and no magical aids. When one of the combatants was wounded or thrown, his opponent usually placed his knee on his chest and, unless asked for mercy, drove his dagger through a joint in the armour.

William I introduced the judicial duel or trial by battle to England in the 11th century; it was finally abolished in 1819. In France, fatal judicial duels became so frequent that, from the 12th century, attempts were made to reduce them. The last one to be authorized by a French king took place on July 10, 1547.

Duels of honour were private encounters about real or imagined slights or insults. The practice, considerably facilitated by the fashion of wearing a sword as part of everyday dress, seems to have spread from Italy from the end of the 15th century. Men fought on the slightest pretext and often, at first, without witnesses; as this secrecy came to be abused (*e.g.*, by ambushes) it soon became usual for duelists to be accompanied by friends or seconds. Later, these seconds also fought, to prove themselves worthy of their friends.

Duels of honour became so prevalent in France that Charles IX issued an ordinance in 1566 that applied the death penalty to anyone taking part in a duel. This ordinance became the model for later edicts against duelling. Duelling, however, survived longer than did the monarchy in France. From the Revolutionary period onward, it came to be a feature of political disputes, and political duels were frequent in the 19th century. In the 20th century, duels still took place occasionally in France—often however for form's sake alone, with such precautions that neither sword nor pistol could prove fatal—or even for purposes of publicity. In Germany duels of honour were authorized by the military code up to World War I and were legalized again (1936) under the Nazis. The Fascist regime in Italy also encouraged duelling. The *Mensur* (student duel) is still a feature of German university life. Most German universities have long-established *Verbindungen* (fighting corps) with strict rules, secret meetings, distinctive uniforms, and great prestige. The method of swordplay differs from that of normal fencing, and students can obtain the scars on head and cheek that are prized as marks of courage.

Duels among women, although rare, have been recorded.

Duellona (Roman goddess): *see* Bellona.

Duero River (Europe): *see* Douro River.

Duese, Jacques, Duèse also spelled D'EUZE: *see* John XXII *under* John (papacy).

Dufaure, (Jules-) Armand (-Stanislas) (b. Dec. 4, 1798, Saujon, Fr.—d. June 28, 1881, Rueil, near Paris), French political figure whose longevity as a conservative republican—his career bridged the July Monarchy and the early years of the Third Republic—reflected the variable fortunes of republicanism in 19th-century France.

After a legal career in Bordeaux, Dufaure was elected to the Chamber of Deputies in 1834. He joined Marshal Soult's government as minister of public works (1839) and was an important influence in the development of the French railway system. In 1840 he joined

Dufaure, detail from a lithograph by Charles-Jérémie Fuhr, *c.* 1861–74
H. Roger-Viollet

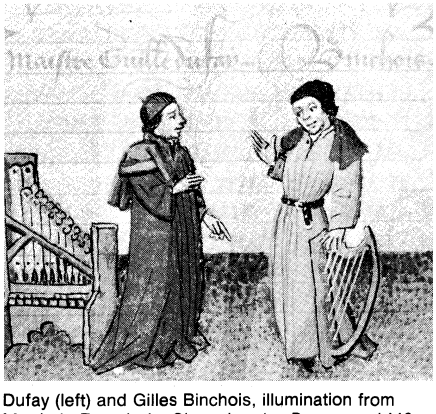
the opposition to King Louis-Philippe, and he was elected vice president of the Chamber in 1845.

Dufaure joined the republican cause in the revolutionary year of 1848. He served in the Legislative Assembly and then was minister of the interior in the provisional government of Gen. Louis Cavaignac during the early stages of the Second Republic. The accession of Napoleon III to the imperial throne forced him into political retirement. Returning to the bar, he was elected to the Académie Française in 1864.

When the Second Empire collapsed, Dufaure joined the aged republican Adolphe Thiers in the formation of a new republic. He served both Thiers and Louis Buffet as minister of justice. He became premier in March 1876, resigned the following February 12, and then returned to power on Dec. 13, 1877. Dufaure was especially influential in the series of events that forced the resignation of Marshal Mac-Mahon from the presidency (January–February 1879), because of Mac-Mahon's alleged anti-republican intentions. Soon after, he, too, went into a final political retirement.

Dufay, Guillaume, Dufay also spelled DU FAY (b. *c.* 1400—d. Nov. 27, 1474, Cambrai, Bishopric of Cambrai), French composer noted for both his church music and his secular chanson.

Dufay was chorister at the Cambrai cathedral (1409), entered the service of Carlo Malatesta



Dufay (left) and Gilles Binchois, illumination from Martin le Franc's *Le Champion des Dames*, *c.* 1440; in the Bibliothèque Nationale, Paris (Ms. Fr. 12476)
By courtesy of the Bibliotheque Nationale, Paris

of Rimini *c.* 1420, and in 1428 joined the papal singers. In 1426 he became a canon of Cambrai. After seven years with the Duke of Savoy he lived at Cambrai from about 1440 and supervised the music of the cathedral. He took a degree in canon law about 1445 and in 1446 became a canon of Mons. Dufay's surviving works include 87 motets, 59 French chansons, 7 Italian chansons, 7 complete masses, and 35 mass sections. He often used, and may have originated, the technique of fauxbourdon, a style of composition based on the sonorities of the third and sixth and derived from English descant, an improvisational practice.

During his Italian period Dufay composed a number of ceremonial motets for public celebrations, among them the election of Pope Eugenius IV (1431), the Treaty of Viterbo (1433), and the dedication of Brunelleschi's dome for Sta. Maria del Fiore, Florence (1436). For the brilliant "Feast of the Pheasant" held in 1454 by Philip the Good of Burgundy and intended to initiate a crusade to recapture Jerusalem, Dufay composed a lamentation for the Church in Constantinople.

Dufay's chansons, normally in three voices, deal with subjects such as springtime, love, and melancholy. Most use the poetic-musical forms of the ballade, rondeau, and virelai; a few are written in freer form.

Dufay's masses laid the foundation for the rapid musical development of the mass in the second half of the 15th century. His complete mass settings are in four voices and use a cantus firmus placed in the tenor line. His canti firmi include secular songs such as *L'homme armé* (used by many composers up to Palestrina) and his own ballade *Se la face ay pale*, and sacred melodies such as *Ave Regina coelorum*.

In these and other works of his Cambrai period Dufay perfected a graceful and expressive style that incorporated into continental music the sweet harmonies of the *contenance angloise* or "English manner" that according to Martin le Franc's *Le Champion des Dames* (*c.* 1440) he had adopted from John Dunstable. In his music he created the characteristic style of the Burgundian composers that links late medieval music with the style of later Franco-Flemish composers of the Renaissance.

"De," "la," and similar components of a name, when followed by a space, are alphabetized as separate words (e.g., *De Forest, Lee*). *When they are joined to the following part of a name, the combination is treated as a single word* (e.g., *DeForest, John William*).

Duff, Alexander (b. April 26, 1806, Moulin, Perthshire, Scot.—d. Feb. 12, 1878, Edinburgh), first Presbyterian foreign missionary of the Church of Scotland, highly influential on later missionary endeavours through his promotion of higher education.

Duff was twice shipwrecked before reaching Calcutta (May 1830), where he opened an English language school for Hindus and Muslims, combining Bible studies with aspects of Western science that challenged local religious beliefs.

In 1844 Duff cofounded the *Calcutta Review* and served as editor from 1845 to 1849, after which time he returned to Scotland. In 1851 he was elected moderator of the Free Church assembly but returned to India in 1856, the year the Bengal army mutinied against the British colonial government. Condemnation of the government's policy was voiced in *The Indian Mutiny: Its Causes and Results* (1858). Duff was offered the post of vice chancellor of the University of Calcutta in 1863 but declined because of poor health. He returned to Scotland, where in 1873 he was again appointed moderator of the Free Church assembly.

Dufferin and Ava, Frederick Temple Hamilton-Temple-Blackwood, 1st Marquess of, EARL OF AVA, EARL OF DUFFERIN, VISCOUNT CLANDEBOYE, BARON CLANDEBOYE, BARON DUFFERIN AND CLAN[D]EBOYE OF BALLYLEIDY AND KILLYLEAGH (b. June 21, 1826, Florence, Grand Duchy of Tuscany [Italy]—d. Feb. 12, 1902, Clandeboye, near Belfast, Ire.), British diplomat who was a distinguished governor-general of Canada and viceroy of India.

The son of the 4th Baron Dufferin, he was educated at Eton and Christ Church College,

1st Marquess of Dufferin and Ava, detail of a portrait by George Frederic Watts; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Oxford. He held undersecretaryships in 1864–66 and was William Ewart Gladstone's chancellor of the duchy of Lancaster, outside the Cabinet, from 1868 to 1872. He was created Earl of Dufferin in 1871.

As governor-general of Canada from 1872 to 1878, Dufferin did much to unite the newly formed dominion. In 1881 he became British ambassador to Ottoman Turkey and dealt with the problems raised by the British occupation of the Ottoman dependency of Egypt. He succeeded Lord Ripon as viceroy of India in 1884 and placated the British community there, which had been antagonized by Ripon's reforms. By the annexation of Burma (Myanmar) in 1886, he consolidated British territories. For his services he was made Marquess of Dufferin and Ava when, in 1888, he retired from India. He then spent three years (1889–91) as Britain's ambassador to Italy and four years (1892–96) as ambassador to France. He retired in 1896.

Duffy, Sir Charles Gavan (b. April 12, 1816, County Monaghan, Ire.—d. Feb. 9, 1903, Nice, Fr.), Irish nationalist who later became an Australian political leader.

While studying law in Dublin, Duffy, along with John Blake Dillon and Thomas Davis, founded the *Nation* (1842), a weekly journal of Irish nationalist opinion. Later he and his two colleagues formed the "Young Ireland" party, which advocated Irish independence. Duffy was seized just before an abortive attempt at insurrection (August 1848) and imprisoned until 1849. In 1852 he was elected to Parliament for New Ross, County Wexford, and in that body he organized an independent opposition of some 50 Irish members to obstruct any government that did not support the demands of the Irish Tenant League. His tactics foreshadowed those of Charles Stewart Parnell, but Duffy's efforts were frustrated by factionalism and by lack of support from the Irish clergy, who thought him too radical.

Duffy retired from Irish politics in 1855, and, leaving Ireland, he said, "as a corpse on a dissecting table," he went to Australia. He practiced law in Melbourne and was elected to the Victoria House of Assembly in 1856. After becoming minister of that state's land and works (1857), he promoted an important land act. He served as prime minister of Victoria in 1871–72, was knighted in 1873, and was speaker of the Victoria House of Assembly from 1877 to 1880. He thereafter retired to southern France to write his memoirs, which form a principal source for the history of Ireland in the period. His books include *The League of North and South, 1850–54* (1886) and *My Life in Two Hemispheres* (1898).

Dufour, Guillaume-Henri (b. Sept. 15, 1787, Konstanz, Austrian Empire [now in Germany]—d. July 14, 1875, Les Contamines, near Geneva, Switz.), engineer and army officer who was elected four times to supreme command of the Swiss army.

After studying in Geneva, at the École Polytechnique in Paris, and at the École du Génie in Metz, Dufour served in Napoleon's army, defending Corfu in 1813 and taking part in the campaigns in France in 1814. He resigned in 1817 and returned to Switzerland, where he was appointed *ingénieur cantonal,* supervising the construction of public works that greatly improved Geneva. He also helped to form the military school at Thun in 1819, where he became chief instructor. Appointed chief of staff of the Swiss army in 1831, he commanded a division sent to restore order in Basel in 1833. In the same year, he began his pioneer topographical survey of Switzerland (published 1842–64). In 1847 Dufour was elected general of the federal army to act against the separatist confederation of Roman Catholic cantons known as the Sonderbund, and he displayed skill and moderation in its suppression. He was elected general for the second time in 1849 to maintain Swiss neutrality in the face of insurgents from Baden; again in 1857, during the conflict with Prussia over Neuchâtel; and finally in 1859, when

Dufour, portrait by Anne-Octavie Dufour; in the Bibliothèque Publique et Universitaire, Geneva

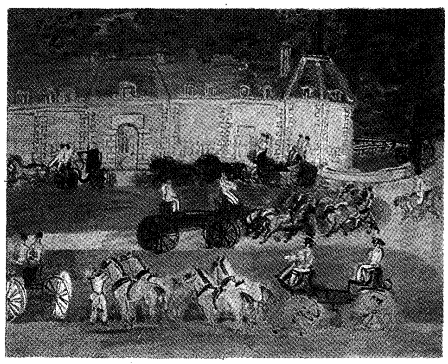
By courtesy of the Bibliotheque Publique et Universitaire, Geneva; photograph, Jean Arlaud

the French were about to annex Savoy. He presided over the international congress in Geneva in 1864 that drew up the convention for the wounded in time of war and resulted in the creation of the Red Cross. He also sat in the federal assembly as a Conservative.

Dufourspitze (German), Italian PUNTA DUFOUR, highest peak (15,203 feet [4,634 m]) of Switzerland and second highest of the Alps, lying 28 miles (45 km) south-southwest of Brig in the Monte Rosa Massif of the Pennine Alps near the Italian border. The summit of the mountain was first reached by an English party in 1855. The peak was named after General Guillaume-Henri Dufour, the head of the survey that first fixed instrumentally the positions of several Monte Rosa peaks.

Dufy, Raoul (b. June 3, 1877, Le Havre, Fr.—d. March 23, 1953, Forcalquier), French painter and designer noted for his brightly coloured and highly decorative scenes of luxury and pleasure.

In 1900 Dufy went to Paris to attend the École des Beaux-Arts, but the conventional art of the past did not attract him. Rather he was fascinated by the vibrant colour juxtapositions of the Impressionists and Post-impressionists, whose styles he adopted. By 1904 Dufy had abandoned the Impressionist style and had begun to work in the flat



"Château and Horses," oil on canvas by Raoul Dufy, 1930; in the Phillips Collection, Washington, D.C.

By courtesy of the Phillips Collection, Washington, D.C.

areas of bright colour typical of the Fauvist style. But in 1908–09, while working with the Cubist painters Georges Braque and Émile-Othon Friesz, he changed his style again and temporarily adopted subdued colours and a Cubist manner of composition. He then did woodcuts as illustrations for books, and his success in this medium encouraged him to design textiles and eventually to produce ceramics and tapestries.

In the early 1920s Dufy rededicated himself to painting and began producing what are now his best-known works. His distinctive style is characterized by bright, decorative colours thinly spread over a white ground, with objects sketchily delineated by sensuously undulating lines. Dufy took as his subjects scenes of recreation and spectacle, including horse races and regattas, parades, and concerts. He spent much time on the French Riviera and produced series of paintings of Nice (1927), the Bois de Boulogne (1929), and Deauville (1930). Though very popular, his lively, carefree, elegant paintings have been criticized as occasionally bordering on the superficial.

Dugdale, Sir William (b. Sept. 12, 1605, Shustoke, Warwickshire, Eng.—d. Feb. 10, 1686, Blythe Hall, Warwickshire), English antiquary who was preeminent among the medievalist scholars in his time. An authority on genealogy and charters, he displayed accurate scholarship and insight unusual for his period.

Dugdale married early and settled as a small landowner at Blythe Hall, Warwickshire. Gradually he became the centre of a scholarly circle, and, following an introduction to the antiquary Sir Henry Spelman in London, he

Dugdale, detail of an engraving by Wenzel Hollar, frontispiece to the first edition of Dugdale's *Antiquities of Warwickshire,* 1656

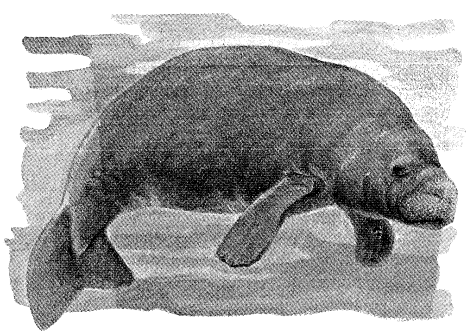
By courtesy of the Trustees and Guardians of Shakespeare's Birthplace

compiled, with the help of Roger Dodsworth, *Monasticon Anglicanum,* 3 vol. (1655–73), a collection of records relating to medieval English religious houses. Among his other important works are the *Antiquities of Warwickshire* (1656), which became a model for large-scale county histories, and *The Baronage of England* (1675–76). He was knighted in 1667.

Dughet, Gaspard, also called GASPARD POUSSIN, byname LE GUASPRE (b. 1615, Rome, Papal States [Italy]—d. 1675, Rome), landscape painter of the Baroque period known for his topographic views of the Roman Campagna. He worked chiefly in Rome and its vicinity throughout his life, but, because his father was French, it is usual to class him among the French school. Dughet's sister married Nicolas Poussin, and he called himself after his famous brother-in-law.

Dughet's style is familiar, being composed mainly of elements derived from Poussin, with whom he studied, and from Claude Lorrain. He tended sometimes toward the former's architectonic grandeur, sometimes toward the latter's more lyrical style, but as a rule produced a compromise between them. Most of his paintings express the character of the countryside near Rome. He excelled at depicting storms in his landscapes. Major series of his works are in galleries and churches in Rome. Brought back by English travelers, many of Dughet's works are still in England where, in the 18th century, they were taken as models for garden and landscape designs.

dugong (species *Dugong dugon*), large marine mammal of the order Sirenia that is the sole extant member of the family Dugongidae. It



Dugong (*Dugong dugon*)
Painting by Donald C. Meighan

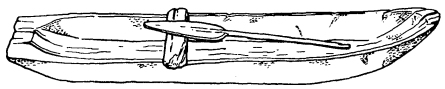
inhabits shallow coastal waters from the Red Sea and eastern Africa to the Philippines, New Guinea, and northern Australia.

The dugong ranges in length from about 2.2 to 3.4 m (7 to 11 feet) and usually weighs from 230 to 360 kg (500 to 800 pounds). It has a round, tapered body that ends in a flipper with paired, pointed, horizontal branches. The forelimbs are rounded flippers; there are no hind limbs. The head, which blends into the body with no visible neck, has a broad, square, bristled snout. A single calf is born after a gestation period of about 11 months, after which it nurses on its mother's two pectoral (chest) teats.

Dugongs live in pairs or in groups of up to six individuals. They graze on green algae and marine grasses, remaining submerged up to 10 minutes. When resting, they may "tail stand" in water of proper depth, keeping their heads out of the water. Sightings of dugongs by early seafarers are believed to have given rise to the extensive mythology of mermaids and sirens.

Dugongs were heavily hunted for their meat, hides, and oil. Although they are now protected by law throughout most of their range, some populations remain in danger of extermination through overhunting.

dugout, boat made from a hollowed log. Of ancient origin, the dugout is still used in many parts of the world. The hull may be as much as 100 feet (30 m) long; it is streamlined



Dugout
From Bjorn Landstrom, *The Ship,* illustration copyright © 1961 by Bjorn Landstrom; reproduced by permission of Doubleday & Company, Inc.

outside and is dug out by burning, chipping, and scraping. The dugout formed the basis for more complicated construction by the addition of planking to the sides, such as in the pirogue (*q.v.*). *See also* canoe.

Duguit, Léon (b. Feb. 4, 1859, Libourne, Fr.—d. Dec. 18, 1928, Bordeaux), French jurist, one of the most revolutionary legal thinkers of his generation, who elaborated an influential natural-law philosophy.

Duguit studied law at the University of Bordeaux and was appointed professor in the faculty of law at Caen in 1883. In 1886 he returned as professor to Bordeaux, where he became dean of the faculty of law and remained until his death.

Discarding traditional theories that looked upon law as deriving from the authority of the monarch or the state, Duguit instead found the basis of law in the fact that humans are social animals endowed with a universal sense or instinct of solidarity and social interdependence. Out of this sense came the recognition of certain rules of conduct as essential for living together in a society. In Duguit's view, the state is not a sovereign power but is rather an institution that has arisen out of mankind's social needs; governments, like individuals, are bound by the rules of law derived from social necessity. Duguit's work remains an important and original contribution to legal thought. One of his most important works is *Traité de droit Constitutionnel,* 5 vol. (1921–25; *Treatise on Constitutional Law*).

Duhamel, Georges (b. June 30, 1884, Paris, Fr.—d. April 13, 1966, Valmondois, near Paris), French author most noted for two novel cycles: *Vie et aventures de Salavin,* 5 vol. (1920–32), and *Chronique des Pasquier,* 10 vol. (1933–44).

Duhamel took a science degree in 1908 and qualified as a doctor of medicine in 1909. He began by writing poetry, plays, and literary criticism, and in 1906 he joined with several other writers and artists in founding a short-lived community at Créteil-sur-Marne, known as the Abbaye. Duhamel served as a front-line surgeon during World War I. Deeply moved by the sufferings of war and oppressed by its futility, he recorded his experiences treating the wounded in two short-story collections, *Vie des martyrs* (1917; *The New Book of Martyrs*) and *Civilisation 1914–1917* (1918); the latter book was awarded the Goncourt Prize.

In 1920 Duhamel decided to make writing his career. Henceforth he chiefly wrote novels and a great variety of essays and miscellaneous

Duhamel
H. Roger-Viollet

works on social and moral issues. Among his writings is a five-volume autobiography, *Lumières sur ma vie* ("Lights on My Life"). His two novel cycles also contain many reflections of his own experiences. The *Salavin* cycle describes the frustrations and perplexities of a "little man" of the 20th century trying to work out his own salvation with no religious faith to sustain him. In the *Pasquier* cycle, Duhamel relates the history of a French middle-class family from the 1880s to the 1920s. In this work, critics have found his gifts of humour, sympathy, and observation particularly apparent. Duhamel became a member of the Académie Française in 1935.

Duhamel, Jean-Marie-Constant (b. Feb. 5, 1797, Saint-Malo, Fr.—d. April 29, 1872, Paris), French mathematician and physicist who proposed a theory dealing with the transmission of heat in crystal structures based on the work of the French mathematicians Jean-Baptiste-Joseph Fourier and Siméon-Denis Poisson.

Duhamel entered the École Polytechnique in 1814 but was forced to return to Rennes in 1816. In 1830 he began teaching analysis at the École Polytechnique, a position he held for 39 years. While at the École he engaged in acoustical studies involving vibrating strings and the vibration of air in cylindrical and conical pipes, as well as the physics of harmonic overtones. Duhamel also researched the distribution of heat in a solid with a variable boundary temperature, which led to a principle in partial differential equations known as Duhamel's principle. He also taught at the École Normale Supérieure and at the Sorbonne. He was a member of the French Academy of Sciences.

Duhem, Pierre(-Maurice-Marie) (b. June 10, 1861, Paris, Fr.—d. Sept. 14, 1916, Cabrespine), French physicist, mathematician, and philosopher of science who emphasized a history of modern science based on evolutionary metaphysical concepts. He maintained that the role of theory in science is to systematize relationships rather than to interpret new phenomena.

Duhem studied at the Collège Stanislas and École Normale Supérieure before teaching at Lille and Rennes. As professor of theoretical physics at the University of Bordeaux (1894), he was also known for work in thermodynamics and hydrodynamics. Among his voluminous writings are *Études sur Léonard de Vinci* (1906–13; "Studies on Leonardo da Vinci") and *La Théorie physique, son objet et sa structure* (1906; "Physical Theory, Its Aim and Structure"). In 1913 he began publication of *Le Système du monde; Histoire des doctrines cosmologiques, de Platon à Copernic* (1913–17; "The World System; History of Cosmological Doctrines from Plato to Copernicus"), which eventually comprehended 10 volumes; but only five were completed by the time of his death.

duḥkha (Buddhism): *see* dukkha.

Dühring, (Karl) Eugen (b. Jan. 12, 1833, Berlin, Prussia [Germany]—d. Sept. 21, 1921, Nowawes, Ger.), philosopher, political economist, prolific writer, and a leading German adherent of positivism, the philosophical view that positive knowledge is gained through observation of natural phenomena.

Dühring practiced law from 1856 to 1859 and lectured on philosophy at the University of Berlin from 1864 to 1877. He was an unflinching critic whose targets included militarism, Marxism, religion, Judaism, and universities. A versatile scholar, he wrote treatises on philosophy, economics, mathematics, physics, and literature.

Dühring maintained the optimistic view that men possess instincts that naturally make them sympathetic to one another. This attitude has led some critics to call his socialism

Dühring, *c.* 1900
Archiv fur Kunst und Geschichte, Berlin

excessively utopian. The same notion, transferred to his economic theory, led him to reject the social Darwinist concept of a constant struggle for existence among men in favour of a "free society," in which all human relations based on power are abolished.

Disagreement between Dühring and Marxian socialists was also reflected in Dühring's "ethics of sympathy," by which he asserted that the Marxist dichotomy between capitalist and proletariat was unnecessary. Friedrich Engels in his renowned book *Anti-Dühring,* first entitled *Herrn Eugen Dührings Umwälzung der Wissenschaft* (1877–78; "Eugen Dührings's Revolution in Science"), attacked Dühring's socialist ideas and his "vulgar Materialism."

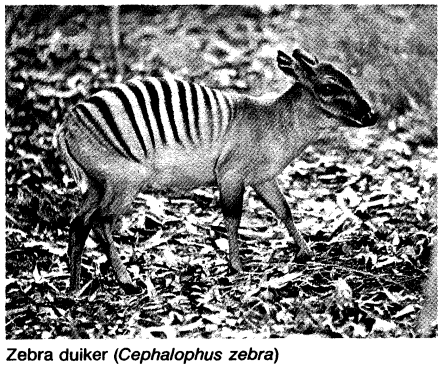
Among Dühring's major works are *Capital und Arbeit* (1865; "Capital and Labour"); *Natürliche Dialektik* (1865); *Kritische Geschichte der Philosophie* (1869; "Critical History of Philosophy"); and *Cursus der National- und Socialökonomie* (1873–92; "Course of National and Social Economy").

dui (Chinese vessel): *see* tui.

duiker, any of the small, shy antelopes of the family Bovidae (order Artiodactyla) belonging either to the species *Sylvicapra grimmia* (gray duiker) or to approximately 13 species of the genus *Cephalophus* (forest duikers); they are named duiker (Afrikaans: "diver") because they dive, or dart, for cover when they are frightened.

The duikers inhabit most of Africa but are rarely encountered by humans. The gray, or bush, duiker is long-legged and inhabits regions with bush or grass cover. The forest duikers are short-legged, hunchbacked animals that frequent forests and dense brush. Duikers are nocturnal, live alone or in pairs, and eat a variety of plants; at times, they eat small animals or carrion.

The gray duiker stands 57–67 cm (22–26 inches) at the shoulder and has a grizzled yellowish to brownish gray coat. Horns, borne by males only, are straight and spikelike. The forest duikers are 36–46 cm (14–18 inches)



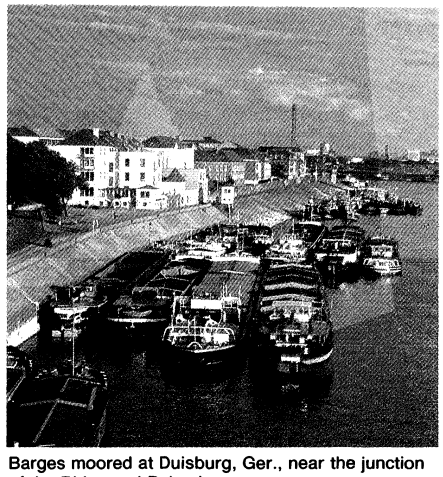
Zebra duiker (*Cephalophus zebra*)
Kenneth W. Fink from The National Audubon Society Collection/Photo Researchers—EB Inc.

tall at the shoulder and vary from pale brown through reddish brown to nearly black. Both sexes have short, spikelike horns. Representative forest duikers include the yellow-backed duiker (*C. silvicultor*), a dark brown form with an erectile yellow triangle of hair on the lower back; the blue duiker (*C. monticola*), a blue-tinged, grayish or brown duiker; and the zebra, or banded, duiker (*C. zebra*), a bright reddish brown animal with vertical black stripes on its body.

Duilius, Gaius (fl. 3rd century BC), Roman commander who won a major naval victory over the Carthaginians during the First Punic War (264–241).

As consul in 260, Duilius was in charge of the army in Sicily when he was assigned to command Rome's newly created fleet. Realizing that his forces lacked skill in naval warfare, he decided that they must fight under conditions as similar as possible to those of a land engagement. Hence, he invented boarding bridges fitted with grappling irons (*corvi*). With these devices he decisively defeated the Carthaginian fleet off Mylae on the north coast of Sicily. He celebrated a triumph at Rome that was the first naval triumph in Roman history. In 258 Duilius was censor.

Duisburg, city, North Rhine-Westphalia *Land* (state), western Germany. Duisburg lies at the junction of the Rhine and Ruhr rivers and is connected with the North Sea German ports by the Rhine-Herne Canal, which links it to Dortmund and thus with the Dortmund-Ems Canal. Known to the Romans as



Barges moored at Duisburg, Ger., near the junction of the Rhine and Ruhr rivers
E. Winter—ZEFA/EB Inc.

Castrum Deutonis, it was mentioned in 740 as Diuspargum, a seat of the Frankish kings. Chartered in 1129, it became a free imperial city until it passed to Cleves (Kleve) in 1290 and, with Cleves, to Brandenburg in 1614. After suffering heavily in the Dutch wars of independence and the Thirty Years' War, it revived as the seat of a Protestant university from 1655 to 1818.

Its modern importance dates from increasing industrialization after 1880 and its absorption of the outer communities of Ruhrort (which includes the harbour) and Meiderich in 1905 and Hamborn (the chief industrial area), Hochfeld, Neudorf, and Duissern in 1929. Duisburg was occupied by Belgian troops (1921–25) and was called Duisburg-Hamborn from 1929 to 1934. The union of Duisburg and the outlying centres made it one of the world's largest inland ports and one of western Europe's principal iron and steel centres. In 1975 the outlying cities of Rheinhausen, Homberg-Niederrhein, Rumeln-Kaldenhausen, and Walsum were annexed, enlarging the city yet again.

Although the centre of the city, the Burgplatz, is on the site of the Frankish court and a later foundation (1253) of the Knights of the Teutonic Order, there are few traces of Duisburg's preindustrial past. Surviving the destruction of World War II are the 14th-century Gothic Salvator Church and the 12th-century Romanesque Premonstratensian Abbey Church. There are museums for municipal arts (the Lehmbruck Museum honours famed local sculptor Wilhelm Lehmbruck) and local history and a zoo with Germany's largest aquarium. A *Gesamthochschule* (a university-level institution for advanced technical training) was founded in 1972 by the union of existing teachers and technical colleges.

Duisburg is a coal-mining and iron- and steel-manufacturing centre and also manufactures heavy machinery, chemicals, textiles, and wood and metal products. The Duisburg–Neuenkamp Bridge across the Rhine is one of the world's longest span truss structures (1,148 feet [350 m]). Pop. (1989 est.) 527,447.

Duitama, city, northwestern Boyacá *departamento,* north-central Colombia. It lies along the Chicamocha River in the Cordillera Oriental of the Andes Mountains, at an elevation of 8,300 feet (2,530 m) above sea level. Duitama is a resort and a commercial and manufacturing centre; flour milling and cigar making are the chief industries. Silver and copper deposits are nearby. Duitama is on the Pan-American Highway and the railroad linking Bogotá and Paz de Río. Pop. (1985) 56,390.

Dujardin, Félix (b. April 5, 1801, Tours, Fr.—d. April 8, 1860, Rennes), French biologist and cytologist, noted for his studies in the classification of protozoans and invertebrates.

Largely self-educated, Dujardin was appointed to the chair of geology and mineralogy on the faculty of sciences at the University of Toulouse (1839) and professor of botany and zoology and dean of the faculty of sciences at the University of Rennes (1840).

His studies of infusoria (microscopic animal life frequently found in infusions of decaying organic materials) led Dujardin in 1834 to propose a new group of one-celled animals (called protozoans) that he called the Rhizopoda (meaning "rootfeet"). In the group Foraminifera, he observed the seemingly formless life substance that exuded outward through openings in the calcareous shell and named the substance sarcode, later known as protoplasm. This work led him in 1835 to refute the theory (reintroduced by Christian Ehrenberg) that microscopic organisms have the same organs as higher animals. He also studied cnidarians (*e.g.,* jellyfish and corals) and echinoderms (*e.g.,* starfish); his study of helminths (flatworms) laid the foundation for the later development of parasitology.

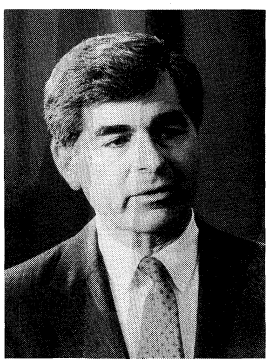
Dujardin, Karel, Dujardin also spelled DU JARDIN (b. 1622, Amsterdam, Neth.—d. Nov. 20, 1678, Venice [Italy]), Dutch Romanist painter and etcher, best known for his spirited representations of Italian peasants and shepherds with their animals.

Dujardin was a son of the painter Guilliam Dujardin. After a trip to Italy, he worked in Amsterdam and The Hague from 1652 until 1674; after that he returned to Rome, where he stayed until shortly before his death. He also painted religious, mythological, and allegorical subjects; genre scenes; and a number of excellent likenesses, notably a large group portrait (Rijksmuseum, Amsterdam).

Dukakis, Michael S(tanley) (b. Nov. 3, 1933, Brookline, Mass., U.S.), American politician and lawyer who was the Democratic Party's nominee for president in 1988.

The son of Greek immigrants, Dukakis graduated from Swarthmore College in 1955. After serving in the U.S. Army in South Korea, he attended Harvard Law School, earning his law degree in 1960. He subsequently became active in Massachusetts Democratic politics and served eight years (1962–70) in the state's House of Representatives. He lost a bid for the Massachusetts lieutenant governorship in

1970 but in 1974 won election to the governorship, in which post he coped with a serious budgetary crisis and restored the state's fiscal health. He lost his bid for reelection in 1978 but was again elected governor of Massachusetts in 1982. During his second term as governor he coordinated the government's policies so as to greatly strengthen the state's economic base, saving old industries and encouraging the growth of new ones. He was overwhelmingly reelected in 1986. Partly as a result of his efforts, Massachusetts for a brief



Dukakis, 1988
Rick Friedman/Black Star

time had one of the nation's healthiest state economies.

In April 1987 Dukakis declared his candidacy for the presidency. He emerged as the most popular candidate in the 1988 Democratic primaries and won his party's nomination for president. Dukakis lost the November 1988 presidential election to the Republican candidate, George Bush. He later announced that he would leave office at the expiration of his term as governor in January 1991.

Dukas FAMILY (Byzantine family): *see* Ducas family.

Dukas, Paul (-Abraham) (b. Oct. 1, 1865, Paris, Fr.—d. May 17, 1935, Paris), French composer whose fame rests on a single orchestral work, the dazzling, ingenious *L'Apprenti sorcier* (1897; *The Sorcerer's Apprentice*).

Dukas studied at the Paris Conservatory and, after winning a second Grand Prix de Rome with his cantata *Velléda* (1888), established his position among the younger French composers with the overture, first performed in 1892, to Pierre Corneille's *Polyeucte* and with the *Symphony in C Major* (1896). The rest of his output (never large, owing to his own strict censorship of his works) was mainly dramatic and program music and compositions for piano. Dukas, a master of orchestration, was from 1910 to 1912 professor of the orchestral class at the Paris Conservatory, and from 1927 until his death he was professor of composition there. He also contributed musical criticism to several Paris papers, and his collected writings, *Les Écrits de Paul Dukas sur la musique* (1948), include some of the best es-

Dukas
The Bettmann Archive

says ever published on Jean-Philippe Rameau, Christoph Gluck, and Hector Berlioz.

Dukas's *L'Apprenti sorcier* (based on J.W. von Goethe's "Zauberlehrling") was a piece of descriptive music written at the same time and in much the same style as Richard Strauss's *Till Eulenspiegel.* Yet Dukas's musicianship was of a considerably wider range than this brilliant period piece suggests. His *Sonate* (1901) is one of the last great works for piano that prolong the tradition of Ludwig van Beethoven, Robert Schumann, and Franz Liszt; his *Variations, interlude et final pour piano sur un thème de Rameau* (1903) represent an elegant translation into French musical idiom and style of Beethoven's *Diabelli Variations,* Opus 120. The ballet *La Péri* (1912), on the other hand, displays mastery of Impressionist scoring; and, in his opera *Ariane et Barbe-Bleue* (1907), on the play of Maurice Maeterlinck, the atmosphere and musical texture make up for the lack of dramatic impact.

After 1912 Dukas ceased publishing his compositions—except for a piano piece written in memory of his admirer Claude Debussy, the evocative *La Plainte au loin du faune* (1920), and a song setting, the charming "Sonnet de Ronsard" (1924). A few weeks before his death, he destroyed several of his musical manuscripts. Dukas collaborated with the Paris publishing firm of Durand in preparing modern editions of some of the works of Jean-Philippe Rameau, François Couperin, and Domenico Scarlatti and of the piano works of Beethoven.

duke, feminine DUCHESS, a European title of nobility, having ordinarily the highest rank below a prince or king (except in countries having such mediant titles as archduke or grand duke).

The title of *dux,* given by the Romans to high military commanders with territorial responsibilities, was taken over by the barbarian invaders of the Roman Empire and was used in their kingdoms and also in France and Germany for rulers of very large areas. The early Carolingian sovereigns in France and in Germany continued to appoint dukes, but their weaker successors found themselves constrained to free the dukes more and more from royal control in the areas that they had to defend.

Germany. Franconia, Swabia, Bavaria, and Saxony, originally the homes of distinct tribes, emerged as the great "stemduchies" of Germany as the dukes appointed by the Carolingians as military governors made themselves increasingly independent.

In the 12th century the Hohenstaufen emperors, who created the new duchies of Austria (1156) and Styria (1180), seemed likely to succeed in reducing the dukes to genuinely obedient vassalage; and, at the same time, the lesser noble families began to consolidate their own holdings and jurisdiction at the expense of the ducal authority. The growth of these smaller territorial principalities (countships, etc.) naturally diminished the real prestige of the dukes. Despite the collapse of the Hohenstaufen design after 1250 and the success of the dukes in securing their independence in their own principalities, their title came no longer to denote greater power under the king but to signify only a higher rank than that of the princely counts. Furthermore, with the extensive privileges accorded the electors (only one of whom was a duke) by the Golden Bull of 1356, the duke had ceased even in theory to be the highest-ranking of the princes of the empire; the Austrian dukes indeed assumed the new title of archduke, claiming equal rights with electors.

From the 16th to the 19th century, lords of even comparatively small territories were granted or took the ducal title. Eleven duchies survived until 1918: Oldenburg, the two Mecklenburgs, Saxe-Weimar (as the grand duchy of Saxony), Baden, and Hesse-Darmstadt were grand duchies; and Anhalt, Brunswick, Saxe-Altenburg, Saxe-Meiningen, and Saxe-Coburg-Gotha were sovereign duchies.

France. The dukes of Normandy, Aquitaine, and Burgundy were practically independent of the French crown in the early feudal period, as also was the duke of Brittany, though the French royal chancellery at first accorded him only the style of count. Gradually, however, these great fiefs were reunited to the French crown. Thereafter they were granted only in appanage, as *duchés-pairies,* or peerage duchies—initially to princes of the blood royal but, from the 16th century onward, also to bastard princes of the blood, to foreign princes, and to other noble subjects of the French king. *Duchés-pairies* were hereditary, but there were also hereditary duchies that were not peerages, as well as life duchies (*à brevet,* or *par lettres*). Apart from those in the royal house of France, there were more than 30 ducal titles dating from the *ancien régime* still being borne (unofficially) in the 1980s, the premier duchy of France being that of Uzès (1565; registered 1572).

Italy. The great territorial duchies of Italy that survived into modern times were those of Milan, Florence (as the grand duchy of Tuscany), Lucca, Mantua, Modena, and Parma-Piacenza. The popes, the emperors, and the kings of Naples, however, could all bestow the ducal title as they wished and often did so; consequently, the title is now fairly widespread. The kings of the house of Savoy gave the title of *duca* occasionally to their offspring.

Spain. The Visigothic duchies of Spain disappeared under the Muslims. During the Christian reconquest the title *duque* was revived for honorific purposes. Apart from the Castilian duchy of Soria y Molina, created in 1370 for Bertrand du Guesclin, the title was at first usually reserved for royal princes, but, from the middle of the 15th century onward, it was accorded more and more frequently to other nobles. Of these latter creations, the premier surviving is that of Medina Sidonia (1445). The Spanish kings also created duchies very liberally in their Neapolitan and Sicilian dominions. By virtue of the right accorded to him by the *Cortes,* General Francisco Franco created three duchies in 1948: those of Calvo Sotelo, of Mola, and of Primo de Rivera.

Portugal. John I of Portugal created the duchies of Coimbra and Viseu for his sons Dom Pedro and Dom Henrique after their capture of Ceuta from the Moors (1415), and in 1442 the duchy of Bragança was created for his illegitimate son Afonso. Six more duchies were created for branches of the royal house before the Spanish annexation of Portugal. Thereafter duchies were accorded outside the royal house, but the total number of creations was far less than in Spain.

The British Isles. There were no English ducal titles (the duchies of Normandy and Aquitaine held by the English kings being, of course, French fiefs) until 1337, when Edward III erected the county of Cornwall into a duchy for his son Edward, the Black Prince. There followed the duchies of Lancaster (1351), Clarence (1362), York (1385), Gloucester (1385), Bedford (1st creation; 1413), and Somerset (1st creation; 1443), all for descendants of the royal house in the male line. In 1444, however, Humphrey Stafford, of royal blood only through his mother, was made Duke of Buckingham (1st creation). From the creation of the dukedom of Norfolk (1483) onward, the ducal title was quite regularly bestowed outside the royal house, though creations were not frequent.

In Scotland the title was first bestowed in 1398 by Robert III on his eldest son, David, who was made Duke of Rothesay, and on his brother Robert, Duke of Albany.

In the late 20th century, apart from royal dukedoms, there were nine dukedoms in the

Duke, duchess
foreign-language equivalents

	masculine	feminine
Czech	vévoda	vévodkyně
Danish	hertug	hertuginde
Dutch	hertog	hertogin
French	duc	duchesse
German	Herzog	Herzogin
Hungarian	herceg	hercegnö
Italian	duca	duchessa
Japanese	kōshaku	kōshaku-fujin
Latin	dux	ducissa
Norwegian	greve	grevinne
Polish	książę	księżna
Portuguese	duque	duquesa
Romanian	duce	ducesă
Russian	gertsog knyaz	gertsogynya knyaginya
Serbo-Croatian	vojvoda	vojvotkinja
Spanish	duque	duquesa
Swedish	hertig	hertiginna

peerage of England (Norfolk, 1483; Somerset, 1546; Richmond, 1675; Grafton, 1675; Beaufort, 1682; St. Albans, 1684; Bedford, 1694; Devonshire, 1694; and Rutland, 1703); eight in that of Scotland (Hamilton, 1643; Buccleuch, 1663; Lennox, 1675; Queensberry, 1684; Argyll, 1701; Atholl, 1703; Montrose, 1707; and Roxburghe, 1707); six in that of Great Britain (Marlborough, 1702; Brandon, 1711; Portland, 1716; Manchester, 1719; Newcastle, 1756; and Northumberland, 1766); two in that of Ireland (Leinster, 1766; and Abercorn, 1868); and six in that of the United Kingdom (Wellington, 1814; Sutherland, 1833; Westminster, 1874; Gordon, 1876; Argyll, 1892; and Fife, 1900). However, the duke of Richmond was also duke of Lennox and duke of Gordon; the duke of Buccleuch was also duke of Queensberry; the duke of Hamilton was also duke of Brandon; and the dukedom of Argyll belonged to two peerages. As a result, the 31 peerages provided only 26 dukes.

Duke, James Buchanan (b. Dec. 23, 1856, Durham, N.C., U.S.—d. Oct. 10, 1925, New York, N.Y.), American tobacco magnate and philanthropist.

The son of Washington Duke, who had entered the tobacco business after the American Civil War, James entered the family business with his brother Benjamin (1855–1929). When the principal American cigarette-manufacturing companies merged to form the American Tobacco Company in 1890, James became its president. He later helped to organize the American Snuff Company (1900) and the American Cigar Company (1901). In 1911 the U.S. Supreme Court ordered the dissolution of the monopolistic American Tobacco Company, and Duke bore the chief task of breaking the company up into the separate corporations that henceforth became the principal cigarette manufacturers of the United States.

The Duke family contributed heavily to Trinity College in Durham, which was later expanded and renamed Duke University under provisions of a fund created by James Duke in 1924.

Duke, Vernon, original name VLADIMIR ALEKSANDROVICH DUKELSKY (b. Oct. 10, 1903, Parfyanovka, near Pskov, Russia—d. Jan. 16, 1969, Santa Monica, Calif., U.S.), Russian-born American composer noted for his sophisticated melodies for films, Broadway musicals, and revues. Among his most popular songs are "April in Paris" from the revue *Walk a Little Faster* (1932) and "I Can't Get Started" from *Ziegfeld Follies of 1936*.

After training at the Kiev Conservatory, Dukelsky at age 16 fled the Russian Revolution and settled in Constantinople (now Istanbul). Impressed upon hearing George Gershwin's "Swanee," he developed a lasting interest in American popular music. In 1921 he traveled to the United States and met Gershwin, who suggested the Americanization of his name and advised him, "Do not be scared about going low-brow." However, Duke returned to Europe and concentrated on classical music, composing the ballet *Zéphyr et Flore* (1925) for Serge Diaghilev's Ballets Russes as well as two symphonies.

Duke settled in the United States in 1929, and throughout the 1930s he composed background music for films and theatrical productions. His lyricists included John Latouche, E.Y. Harburg, Ira Gershwin, Ogden Nash, and Howard Dietz. His song "Banjo Eyes" was adopted by the comedian Eddie Cantor as his theme. In 1940 Duke received critical acclaim for his score for *Cabin in the Sky* (filmed 1943), a musical with an all-black cast that featured Ethel Waters.

In 1944 Duke composed the score to *Sadie Thompson*. He translated American popular songs into Russian for Radio Liberty broadcasts to the Soviet Union; wrote his autobiography, *Passport to Paris* (1955); and in 1957 composed music for the Broadway production of Jean Anouilh's *Time Remembered*.

Duke of York Islands, also called DUKE OF YORK GROUP, formerly NEU LAUENBURG, coral formations of the Bismarck Archipelago in the southwestern Pacific, eastern Papua New Guinea. The Duke of York Islands are situated in St. George's Channel between the islands of New Ireland (east) and New Britain (southwest). The low, wooded islands, which include Duke of York (the largest, 5 miles [8 km] by 5 miles), Makada, Ulu, Kabakon, Kerawara, and Mioko, have a total land area of 23 square miles (60 square km). They were first sighted in 1767 by the British navigator Philip Carteret. The area's first Methodist mission was established there in 1880. European settlement on the islands expanded and eventually spread to New Britain. Pop. (1980 prelim.) 6,368.

Duke University, American private coeducational institution of higher learning in Durham, N.C., affiliated with but not controlled by the United Methodist Church. In 1838 the Union Institute Society was established in Randolph county, N.C., and in 1859 was reorganized as Trinity College. In 1892 the college moved to Durham. When a new charter was issued in 1924, the college became, under an endowment from the tobacco magnate James B. Duke, Duke University.

Duke maintained separate campuses for undergraduate men and women, Trinity College and Woman's College, until they were merged in the 1970s into Trinity College. Besides Trinity (liberal arts), the university includes schools of engineering, law, business, nursing, and forestry. Cooperative programs are conducted with other North Carolina universities.

Dukenfield, William Claude (American actor): *see* Fields, W.C.

Dukhobor (Russian: "Spirit Wrestler"), member of a Russian peasant religious sect, prominent in the 18th century, that rejected all external authority, including the Bible, in favour of direct individual revelation.

The liturgical reforms of Patriarch Nikon in 1652 and the opening of Russia to Western influences by Tsar Peter the Great (reigned 1682–1721) provoked an opposition that manifested itself in the proliferation of mystical—usually either orgiastic or rationalist—evangelist sects. The Dukhobors, combining features of both types of reaction, lived mainly in southern Russia. They rejected the authority of both church and state, relying instead on direct individual revelation supplemented by a growing body of canticles and proverbs handed down orally, called the "Book of Life." Priests and sacraments were abolished, the only ceremony being the *sobraniye* ("meeting"), at which prayers were chanted around a table laid with bread, salt, and water. Their egalitarian and pacifist beliefs, together with their proselytizing activities and refusal to accept conscription, provoked sporadic persecutions from 1773 onward. They were several times deported and resettled in unfamiliar territory.

Leo Tolstoy, the Russian novelist whose principles of moral and spiritual reform found eager acceptance among the Dukhobors in the late 19th century, successfully petitioned the tsar to allow the persecuted Christian Community of Universal Brotherhood, as they were known after 1886, to emigrate. Through funds collected by English Quakers, 7,500 reached Canada by 1899; 12,000 remained in Russia. The Canadian government granted them land on easy terms in Saskatchewan and exemption from conscription. Some settled well, but one group started a series of nudist protest pilgrimages, prompting Peter Verigin, the leader of the "large party" faction of the Dukhobors, to go to Canada to restore order. In 1908 he founded a communal settlement of 6,000 in British Columbia, which prospered until his death in 1924. His son's lack of leadership and the Great Depression of the 1930s ruined the communal enterprises, and they were not later restarted.

The Dukhobors, renamed in 1939 the Union of Spiritual Communities of Christ, have clashed with the Canadian government because of their noncompliance with land, tax, and education laws. They have striven to avoid schooling on the ground that "the letter killeth" and that "schools teach war." Since World War II the sect has become more prosperous, but extremist elements still survive in a distinct group called the Sons of Freedom. The Sons of Freedom have continued nudist parades, arson, and dynamiting, burning their own as well as their neighbours' and government property to show contempt for material goods. Another group of independents has assimilated into Canadian society.

Dukhonin, Nikolay Nikolayevich (b. Dec. 13 [Dec. 1, Old Style], 1876—d. Dec. 3 [Nov. 20], 1917, Mogilyov, Russia), last commander of the tsarist army, killed by a mob during the Russian Revolution.

One of the youngest generals in the Russian army, Dukhonin held various posts during World War I before being appointed chief of staff by Aleksandr Kerensky's provisional government in September 1917. After the Bolsheviks seized power in Petrograd, then the Russian capital, on November 7 (October 25, Old Style), Dukhonin appealed to the troops to remain loyal to the provisional government but with little success. By November 13 (October 31) efforts to oust the Bolsheviks had clearly failed, and Kerensky went into hiding, appointing Dukhonin supreme commander in chief.

In the ensuing confusion Dukhonin attempted to keep army units in place against the Germans but in a status of political neutrality. On November 20 (November 7), however, he was ordered by the Bolsheviks to negotiate a truce with the Germans. This he refused to do, whereupon he was dismissed. On December 2 (November 19) he was arrested and ordered transferred from his headquarters at Mogilyov to a prison in Petrograd. While he was preparing to leave the next day, a crowd of soldiers and sailors, angered that he had previously released several generals who had led the Kornilov Mutiny against the provisional government, dragged him from his train and bayoneted and trampled him to death.

dukkha (Pāli), Sanskrit DUḤKHA ("sorrow," "suffering," "imperfection," or "spiritual anguish"), in Buddhist thought, the true nature of all existence. The whole of Buddhist doctrine is based on the fact of suffering; its reality, cause, and means of suppression formed

the subject of the Buddha's first sermon (*see* Four Noble Truths). Recognition of the fact of suffering as one of three basic characteristics of existence—along with impermanence (*anicca*) and the absence of a self (*anattā*)—constitutes the "right knowledge" that is the first step along the course of spiritual development known as the Eightfold Path that leads ultimately to Enlightenment (Nirvāṇa). Three types of suffering are distinguished: they result, respectively, from torment, such as old age, sickness, and death; from the absence of pleasure; and from the necessity of giving up what one loves and has become attached to, because of the inescapable transitory quality of all phenomena.

Dukla Pass, Polish PRZEŁĘCZ DUKIELSKA, Slovak PRŮSMYK DUKELSKÝ, passage through the Carpathian Mountains (locally, the eastern Beskids), on the frontier between Slovakia and Poland. The Russian army used the pass to cross Slovakia southward into Hungary in 1849 and utilized it again in World Wars I and II. It constitutes a major commercial route for traffic and goods between Czechoslovakia and Poland.

Dulany, Daniel (b. 1685, Queens County, Ireland—d. Dec. 5, 1753, Annapolis, Md.), Irish-American colonial lawyer, landowner, and public official.

Daniel Dulany went to Maryland in 1703, studied law, and was admitted to the bar in 1709. He soon became prominent and wealthy from his legal practice. A year after Dulany moved to Annapolis, he was elected to represent the town in the Maryland Assembly. At first, Dulany became a leader of the legislative faction that opposed proprietorial authority in the colony, and he argued that the citizens of Maryland were entitled to the benefits of all English legal statutes. During the next decade, however, Dulany crossed over to support the proprietorial faction and was rewarded with successively higher offices in the colony. In 1742 he became a member of the Governor's Council, where he took a leading role in securing the passage in 1747 of a tobacco inspection law that considerably enhanced the quality of the colony's tobacco crop.

Dulany, Daniel (b. June 28, 1722, Annapolis, Md.—d. March 17, 1797, Baltimore, Md., U.S.), American lawyer who was an influential political figure in the period just before the War of Independence.

The son of the Maryland official of the same name, Daniel Dulany was educated at Eton and at the University of Cambridge in England and became a lawyer after returning to Maryland. He was a member of the Maryland legislative assembly from 1751 to 1754, and he was appointed to the Governor's Council in 1757 in recognition of his support for the colony's proprietary government. In the following years he held other high offices and also became known as one of the best lawyers in the American Colonies. Though his sympathies were those of a loyal British subject, Dulany was critical of some policies of the British government, and during the crisis over the Stamp Act of 1765 he wrote *Considerations on the Propriety of Imposing Taxes in the British Colonies* (1765), which was the most influential pamphlet that appeared in opposition to the Stamp Act. He opposed revolutionary action against British rule, however, and during the American War of Independence he remained a Loyalist, being deprived of his property in 1781 on account of this.

Dulbecco, Renato (b. Feb. 22, 1914, Catanzaro, Italy), Italian virologist who shared the Nobel Prize for Physiology or Medicine in 1975 with Howard M. Temin and David Baltimore, both of whom had studied under him.

Dulbecco, with Marguerite Vogt, pioneered the growing of animal viruses in culture in the 1950s and investigated how certain viruses gain control of the cells they infect. They showed that polyoma virus, which produces tumours in mice, inserts its DNA into the DNA of the host cell. The cell then undergoes transformation (a term used in this restricted sense by Dulbecco) into a cancer cell, reproducing the viral DNA along with its own and producing more cancer cells. Dulbecco suggested that human cancers could be caused by similar reproduction of foreign DNA fragments.

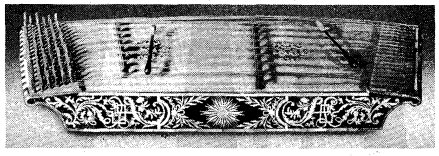
Dulbecco began his career in Italy, obtaining his M.D. from the University of Turin in 1936 and remaining there several years as a member of its faculty. He came to the United States in 1947 and studied viruses, first with Salvador Luria (a Nobel laureate, 1969) at Indiana University, then at the California Institute of Technology (1949–63). He was a fellow at the Salk Institute for Biological Studies in La Jolla, Calif. (1963–72), and returned there in 1977 as a distinguished research professor after serving for five years as a director of the Imperial Cancer Research Fund in London. During his second tenure at the Salk Institute, he served also on the faculty of the medical school of the University of California at San Diego (1977–81).

Dulce, Gulf of, Spanish GOLFO DULCE, also called OSA GULF, long, narrow inlet of the Pacific Ocean, bounded on the north, east, and west by southwestern Costa Rica. Extending northwestward from Cape Matapalo and Banco Point for 30 miles (50 km), it measures about 15 miles (24 km) from the Osa Peninsula on the west to the mainland on the east. The principal ports are Golfito, on the small inlet of El Golfito, and Puerto Jiménez, on the Osa Peninsula.

dulce melos, also spelled DOULCEMELE (French: "sweet song"), a rectangular stringed keyboard musical instrument of the late Middle Ages, known entirely from written records; no original examples are extant. It is possible, however, that the instrument presented to the king of France by King Edward III of England in 1360 and called *échiquier d'Angleterre* was a *dulce melos.*

In the famous manuscript of Henri Arnaut of Zwolle *(c.* 1435), the *dulce melos* is pictured and described. It appears that its 12 pairs of strings stretched over the tails of 35 keys. The strings passed over bridges that divided each pair of strings into three sections, each producing a different pitch and controlled by a different key. Each section was caused to vibrate by means of a weighted wooden shaft that sat on the end of each key; when the key was depressed and suddenly halted (or checked), the shaft continued to fly upward, and a brass attachment on its side struck the string. The shaft then rebounded to rest on the key. In principle this action anticipated the modern piano's hammer action; as in the piano and clavichord, the loudness of each note was controlled by the force with which the finger depressed the key.

dulcimer, stringed musical instrument, a version of the psaltery in which the strings are beaten with small hammers rather than plucked. European dulcimers—such as the Alpine *hackbrett,* the Hungarian cimbalom, the Romanian *ţambal,* the Greek *santouri,* and the Turkish and Persian *santūr,* as well as the Chinese *yang-ch'in*—have for each note two or more metal strings stretched across a flat, usually trapezoidal sound box. They pass over one and under the other of two long bridges, sloping alternately to right and left to facilitate rapid playing with the light beaters. Dulcimers probably entered central Europe from Persia in about the 15th century.



Turkish *santūr* dulcimer inlaid with mother-of-pearl, 19th century; in the Cincinnati Art Museum, Ohio

By courtesy of the Cincinnati Art Museum, Ohio, William H. Doane, donor

The pianoforte is a dulcimer in which a keyboard mechanism operates the beaters. One of its immediate predecessors was the pantaleon, a 5-foot (1½-metre) or longer dulcimer fashionable in the early 18th century.

The Appalachian, or mountain, dulcimer of the United States is a narrow folk zither with three to five metal strings running over a fretted fingerboard. The player's right hand strums while the left uses a small stick or quill for a stop.

DuLhut, Daniel Greysolon, sieur, DuLhut also spelled DU LHUT, DU LUTH, or DULUTH (b. *c.* 1639, Saint-Germain-Laval, Fr.—d. Feb. 25/26, 1710, Montreal), French soldier and explorer who was largely responsible for establishing French control over the country north and west of Lake Superior. The city of Duluth, Minn., was named for him.

DuLhut became an ensign in the regiment at Lyon in 1657, and *c.* 1665 he became an officer in the royal household regiment. He fought against the Dutch under the Great Condé in 1674—by which time he had already made two voyages to New France.

In 1675 he returned to Montreal until September of 1678, when he led a party of Frenchmen and three Indian slaves to the Lake Superior country, where he hoped to negotiate peace among the Indian tribes north and west of the lake—a rich source of beaver pelts. In September 1679 DuLhut was able to bring the Indians together in a seemingly successful assembly in which amity was declared among the tribes. After wintering in the West, DuLhut decided to move farther west the next summer in search of the western ocean. The party penetrated well into what is now Minnesota and reached the Mississippi River.

On returning to Montreal, DuLhut found himself accused as a renegade trader, in violation of a 1676 edict prohibiting Frenchmen from venturing into the woods as traders. He returned to France to clear his name but was back in 1682 and the next year went off again to the West to renew his peacemaking efforts and to try to dissuade the Indians from trading their pelts to the English. He also raised Indian support for French troops and campaigned with Louis de Frontenac against the Indian allies of the British, the Oneida and Onondaga. In 1696 he was in command at Fort Frontenac. Thereafter he retired to spend his waning years in Montreal.

Dulkadir DYNASTY, Turkmen dynasty (1337–1522) that ruled in the Elbistan-Maraş-Malatya region of eastern Anatolia. Its lands were the focus of rivalry between the Ottoman Empire and the Mamlūks of Syria.

The dynasty was founded by Karaca, the chief of the Bozok Turkmen, who was recognized as *nā'īb* (deputy) by the Mamlūk sultan in 1337 but who, with his sons, later was defeated and killed in a revolt against the sultan. In 1399 the Ottoman sultan Bayezid I, challenging Mamlūk influence, installed Dulkadir Mehmed as ruler. He tried to maintain peaceful relations with both powers.

After 1450 Ottoman–Mamlūk rivalry intensified, resulting in dynastic struggles and frequent changes in Dulkadir leadership. When Ali, the last Dulkadir prince, was overthrown by his grand vizier in 1522, the principality was incorporated into the Ottoman Empire, the Dulkadir family was accorded vassal status, and its members were appointed to high offices.

dull coal: *see* durain.

Dull Knife, also called MORNING STAR (d. 1883, Tongue River Indian Reservation, Montana Territory), chief of the northern Cheyenne who led his people on a desperate trek from confinement in Indian Territory (Oklahoma) to their home in Montana.

Five months after Lieutenant Colonel George A. Custer's defeat at the Battle of the Little Big Horn, the cavalry, on a punitive expedition, attacked Dull Knife's camp on the Red Fork of Powder River (Nov. 25–26, 1876). Most of his tribe escaped, but their shelters, clothing, blankets, and stores of food were destroyed. By the time that Dull Knife surrendered to the Army, many of his people had succumbed to starvation or exposure. In 1877 the U.S. Army sent him and his tribe to a reservation of southern Cheyenne in Indian Territory. The land was unprofitable, there was little food, and the climate was unhealthy; within two months of their arrival in Oklahoma, two-thirds of the tribe were sick and many died. Dull Knife and other exiled northern Cheyenne leaders pleaded for a reservation for their people in their former territory, but to no avail.

Fearing that his tribe would die out, Dull Knife, along with Little Wolf, a war chief of the northern Cheyenne, determined to go home, despite Army opposition. On Sept. 9, 1878, he and Little Wolf led what was left of their people from the reservation. Their combined band consisted of 89 warriors and 246 women and children. They traveled more than 400 miles, managing to defeat or elude the various Army detachments sent to bring them back (more than 10,000 soldiers were employed for this task). In October the Cheyenne crossed the South Platte River of Nebraska, and the followers of Little Wolf and Dull Knife separated. (Little Wolf's band headed northwest, surrendered to the Army on March 25, 1879, and was allowed to remain in Montana.) Dull Knife and his people headed for the Red Cloud Agency, not knowing it had been discontinued. On Oct. 23, 1878, he and his people surrendered peaceably to the Army and were imprisoned in nearby Fort Robinson (Nebraska). When they refused to return to Oklahoma, an attempt was made (from Jan. 5, 1879) to starve them into submission, and the Indians were deprived of heat, food, and water. They broke out of prison on January 9, and, in their dash for freedom, 64 were killed and 78 were eventually recaptured (most of them wounded). Six people, including Dull Knife and surviving members of his family, escaped and made it to the relative safety of the Pine Ridge Reservation in South Dakota. By this time, public opinion was on the side of the Indians, forcing the Bureau of Indian Affairs to abandon its plans to relocate them, and a reservation was established for the northern Cheyenne on the Tongue and Rosebud rivers, where Dull Knife and his people (fewer than 80 remaining) were finally allowed to settle, rejoining Little Wolf's band.

The flight of the Cheyenne was described by Mari Sandoz in her work *Cheyenne Autumn* (1953).

Dulles, Allen W(elsh) (b. April 7, 1893, Watertown, N.Y., U.S.—d. Jan. 29, 1969, Washington, D.C.), U.S. diplomat and intelligence expert who was director (1953–61) of the Central Intelligence Agency (CIA) during its early period of growth.

The younger brother of U.S. Secretary of State John Foster Dulles, Allen Dulles received his M.A. from Princeton in 1916 and then served in various diplomatic posts until 1922, when he was named chief of the State Department's Near Eastern Division. After receiving his law degree in 1926, he served briefly as counselor to the U.S. delegation in Peking and then joined the New York law firm of which his brother was a member.

When the United States entered World War II, Dulles was recruited by Colonel William J. Donovan for the Office of Strategic Services (OSS), an intelligence service. From October 1942 to May 1945 he served as chief of the OSS office in Bern, playing, in particular, a notable role in the events that led to the surrender of German troops in northern Italy.

In 1948 Dulles was made chairman of a three-man committee charged with surveying the U.S. intelligence system. After the CIA was established in 1951, he served as deputy director under General Walter Bedell Smith, and in 1953 he was appointed director by President Dwight D. Eisenhower. The agency was effective in a number of major operations, notably the overthrow of the governments of Mohammad Mosaddeq in Iran in 1953 and Jacobo Arbenz in Guatemala in 1954. It also succeeded in obtaining a copy of Nikita Khrushchev's secret speech of 1956 denouncing Stalin. It was, however, embarrassed by the downing of a U-2 intelligence plane over the Soviet Union on the eve of a scheduled summit conference in June 1960.

Reappointed by President John F. Kennedy, Dulles was implicated in the failure of the Bay of Pigs invasion of Cuba in April 1961 and resigned that autumn. He was the author of many articles and a number of books on foreign affairs, notably *Germany's Underground* (1947), *The Craft of Intelligence* (1963), and *The Secret Surrender* (1966).

Dulles, John Foster (b. Feb. 25, 1888, Washington, D.C.—d. May 24, 1959, Washington, D.C.), U.S. secretary of state (1953–59) under President Dwight D. Eisenhower.

John Foster Dulles

By courtesy of U.S. Information Agency; photograph, Harris and Ewing

He was the architect of many major elements of U.S. foreign policy in the Cold War with the Soviet Union after World War II.

Early Career. Dulles was one of five children of Allen Macy and Edith (Foster) Dulles. His maternal grandfather was John Watson Foster, who served as secretary of state under President Benjamin Harrison. Robert Lansing, Dulles' uncle by marriage, was secretary of state in the Cabinet of President Woodrow Wilson.

Dulles was educated in the public schools of Watertown, N.Y., where his father served as a Presbyterian minister. A brilliant student, he attended Princeton and George Washington universities and the Sorbonne, and in 1911 he entered the New York law firm of Sullivan and Cromwell, specializing in international law. By 1927 he was head of the firm.

But Dulles, who never lost sight of his goal of becoming secretary of state, actually started his diplomatic career in 1907 when, aged 19, he accompanied his grandfather John Foster, then a private citizen representing China, to the second international peace conference at The Hague. At 30 years of age Dulles was named by President Woodrow Wilson as legal counsel to the U.S. delegation to the Versailles Peace Conference, at the end of World War I, and afterward he served as a member of the war reparations commission.

In World War II, Dulles helped prepare the United Nations charter at Dumbarton Oaks, in Washington, D.C., and in 1945 served as a senior adviser at the San Francisco United Nations conference. When it became apparent that a peace treaty with Japan acceptable to the United States could not be concluded with the participation of the Soviet Union, President Harry Truman and his secretary of state, Dean Acheson, decided not to call a peace conference to negotiate the treaty. Instead, they assigned to Dulles the difficult task of personally negotiating and concluding the treaty. Dulles traveled to the capitals of many of the nations involved, and in 1951 the previously agreed to treaty was signed in San Francisco by Japan and 48 other nations.

Secretary of state. Emboldened by his formidable achievements, Dulles viewed his appointment as secretary of state by President Eisenhower, in January 1953, as a mandate to originate foreign policy, which is normally regarded as the domain of the president. "The State Department," Dulles once told an aide, "can only keep control of foreign policy as long as we have ideas." A man bent on realizing his ideas, he was an assiduous planner, and, once he enjoyed President Eisenhower's complete confidence, policy planning flourished during his administration.

Dulles, fully aware that the North Atlantic Treaty Organization (NATO) would be effective only for the defense of western Europe, leaving the Middle East, the Far East, and the Pacific islands unprotected, was eager to fill these gaps. He initiated the Manila conference in 1954, which resulted in the Southeast Asia Treaty Organization (SEATO) pact that united eight nations either located in Southeast Asia or with interests there in a neutral defense pact. This treaty was followed in 1955 by the Baghdad Pact, later renamed the Central Treaty Organization (CENTO), uniting the so-called northern tier countries of the Middle East—Turkey, Iraq, Iran, and Pakistan—in a defense organization.

In Europe, Dulles was instrumental in putting into final form the Austrian State Treaty (1955), restoring Austria's pre-1938 frontiers and forbidding a future union between Germany and Austria, and the Trieste agreement (1954), providing for partition of the free territory between Italy and Yugoslavia.

Three factors determined Dulles' foreign policy: his profound detestation of Communism, which was in part based on his deep religious faith; his powerful personality, which often insisted on leading rather than following public opinion; and his strong belief, as an international lawyer, in the value of treaties. Of the three, passionate hostility to Communism was the leitmotiv of his policy. Wherever he went, he carried with him Joseph Stalin's *Problems of Leninism* and impressed upon his aides the need to study it as a blueprint for conquest similar to Adolf Hitler's *Mein Kampf.* He seemed to derive personal satisfaction from pushing the Soviet Union to the brink. In fact, in 1956 he wrote in a magazine article that "if you are scared to go to the brink, you are lost." Once, during the Austrian State Treaty negotiations, he refused to compromise on some minor points, even though the Austrians themselves pleaded with him to do so for fear the Soviets would walk out. Dulles stood his ground, and the Soviets yielded.

But Dulles could be equally intransigent with the allies of the United States. His insistence upon the establishment of the European Defense Community (EDC) threatened to polarize the free world, when in 1953 he announced that failure to ratify EDC by France would result in an "agonizing reappraisal" of

the United States' relations with France. That expression, and Dulles' announcement in a Paris speech that the United States would react with "massive nuclear retaliation" to any Soviet aggression, found a permanent place in the vocabulary of U.S. foreign policy. It can also be argued that Dulles' brusque rejection in July 1956 of the Egyptian president Gamal Abdel Nasser's request for aid in building the Aswān Dam was the beginning of the end of the influence that the U.S. had exerted in the Middle East. In a complete reversal of his former pro-Egyptian policy, Dulles claimed that Nasser was "nothing but a tin-horn Hitler." Although Dulles later conceded that his refusal could have been more subtle, he never wavered in his belief that Nasser, who had already purchased arms from the Soviet bloc, was bound to turn decisively against the U.S. because he felt that he had the Soviet Union on his side.

Assessment. Dulles' detractors in the U.S. and abroad viewed him as harsh, inflexible, and a tactician, rather than an architect of international diplomacy. But President Eisenhower ignored all criticisms. He said of his secretary of state, "He is one of the truly great men of our time." Whatever their opinion of the man and his policies, many leading statesmen of the non-Communist nations have credited his firmness with having checkmated Communist Cold War strategy. Seriously ill with cancer, Dulles resigned his Cabinet position on April 15, 1959. Shortly before he died in the following month, he was awarded the Medal of Freedom. (E.W.)

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Dulong, Pierre-Louis (b. Feb. 12, 1785, Rouen, Fr.—d. July 18, 1838, Paris), chemist and physicist who helped formulate the Dulong–Petit law of specific heats (1819), which proved useful in determining atomic weights.

He was an assistant to Claude-Louis Berthollet, eventually became a professor of physics at the Polytechnical School, Paris (1820), and was appointed its director (1830). While working in chemistry he impoverished himself purchasing equipment. During investigations of the highly explosive nitrogen trichloride, which he discovered in 1813, he lost the sight in one eye and nearly lost a hand. His important research in physics was carried out with Alexis-Thérèse Petit. In 1817 they showed that Newton's law of cooling was true only for small differences in temperature. Their work on the measurement of temperature and the transfer of heat (1818) was honoured by the French Academy.

A paper with Jöns Berzelius (1820) was concerned with fluid densities and water. With Louis-Jacques Thenard he explored the property of certain metals to facilitate combinations of gases. He also studied the refracting power of gases (1826) and the specific heat of gases (1829). He published a study with François Arago of the elasticity of steam at high temperatures (1830). His last paper (1838) described experiments determining the heat evolved in a chemical reaction.

Dulong, lithograph
Boyer—H. Roger-Viollet

Dulong–Petit law, statement that the gram-atomic heat capacity (specific heat times atomic weight) of an element is a constant; that is, it is the same for all solid elements, about six calories per gram atom. The law was formulated (1819) on the basis of observations by the French chemist Pierre-Louis Dulong and the French physicist Alexis-Thérèse Petit. If the specific heat of an element is measured, its atomic weight can be calculated using this empirical law; and many atomic weights were originally so derived. Later it was modified to apply only to metallic elements, and later still low-temperature measurements showed that the heat capacity of all solids tends to become zero at sufficiently low temperature. The law is now used only as an approximation at intermediately high temperatures.

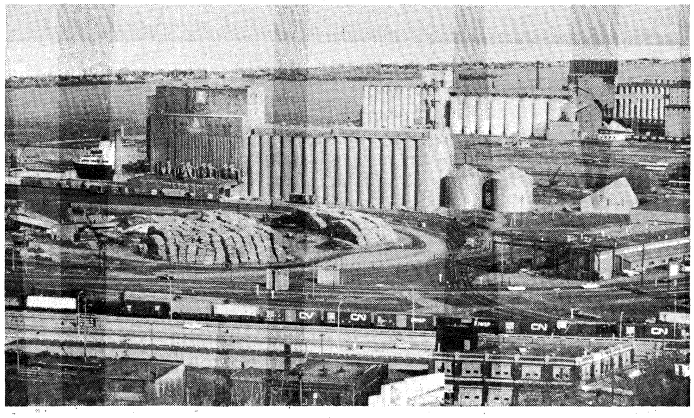
dulse (*Rhodymenia palmata*), red seaweed found along both coasts of the North Atlantic; a salty confection made from this red algae is also called dulse. Shaped like the palm of a hand, it has the texture of thin rubber; both the amount of branching and size (ranging from 12 to about 40 centimetres [5 to 16 inches]) vary. Growing on rocks, mollusks, or larger seaweeds, dulse attaches by means of disks or rhizomes. It is commonly dried and eaten raw by North Atlantic fishermen; the flavour becomes evident after prolonged chewing. Dulse is eaten also with fish and butter, boiled with milk and rye flour, or as a relish. The gelatinous substance contained in dulse is a thickening agent and imparts a reddish colour to the food with which it is mixed.

Duluth, city, seat of St. Louis County, northeastern Minnesota, U.S., and a major inland port on Lake Superior at the mouth of the St. Louis River opposite Superior, Wis. Elevation is abrupt, rising 600 to 800 ft (180 to 240 m) above the level of the lake in high rock bluffs, once the shoreline of glacial Lake Duluth. Along the crest a 30-mi (48-km) skyline boulevard commands an excellent view of both city and harbour. The combined Duluth–Superior harbour results from a natural breakwater formed by deposits left where river and lake meet. This resulting 9-mi strip, Minnesota Point, or Park Point, extends toward Wisconsin Point, separating St. Louis Bay from Lake Superior. The narrow channel between the two points forms the Superior harbour entrance, and a dredged 300-ft ship canal across the Minnesota Point, spanned by an aerial lift bridge, forms the Duluth harbour entrance. The combined harbour is the western terminus of the St. Lawrence Seaway and, although icebound during the winter months, it ranks second only to New York, among U.S. ports, in tonnage handled. Through it are shipped: iron ore from the Mesabi, Cuyuna, and Vermilion ranges; coal from Lake Erie ports; grain from the Red River Valley, Manitoba, and the Dakotas; and crude oil from Canada refined at Wrenshall, Minn., and at Superior. Harbour facilities include coal docks, grain elevators, and iron-ore docks (which receive ore and taconite from processing plants in northeastern Minnesota). Industry is highly diversified. Tourism, merchandising, conventions, and a military air-defense installation at Duluth International Airport are economic assets. It is the site of a branch of the University of Minnesota, established in 1947; the College of St. Scholastica, founded in 1912; the Duluth Institute of Technology; Chisholm Museum (natural history); and Tweed Museum of Art. It also supports a symphony orchestra and playhouse. Duluth is the headquarters of Superior National Forest.

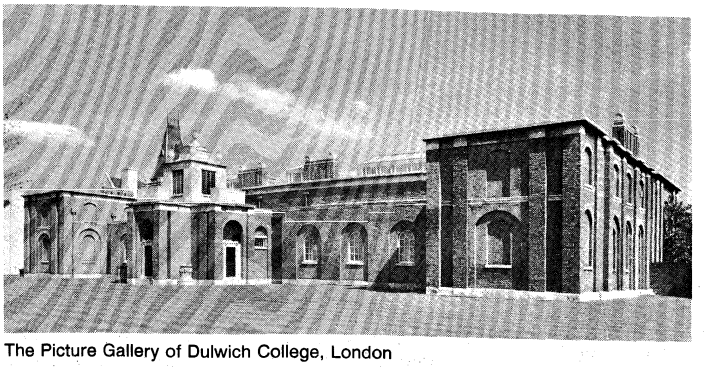
The area, occupied originally by the Sioux and then by the Ojibwa Indians, was visited in the 17th century by French voyageurs including Daniel Greysolon, sieur DuLhut (or Du Luth), for whom Duluth was named. The fur-trading post of Fond du Lac, on the St. Louis River, was controlled by the Hudson's Bay Company in 1692, the North West Company in 1793, and by John Jacob Astor's American Fur Company from 1817 until 1854. Another post on Minnesota Point was established in 1852 by George R. Stuntz, surveyor of the Minnesota–Wisconsin boundary. The following year brought many settlers in search of copper deposits. Duluth was laid out in 1856 and incorporated as a city in 1870, with a population of 3,131; was relegated to a village in 1877; and was reincorporated in 1887. Railway extension into the northwestern wheat region, increased lake commerce following the cutting of the Duluth Ship Canal in 1871, and development of the iron ranges brought increasing prosperity. Pop. (1980) city, 92,811; metropolitan area (SMSA), 266,650.

Duluth, Daniel Greysolon, sieur: *see* Dulhut, Daniel Greysolon, sieur.

Dulwich, fashionable residential neighbourhood surrounding Dulwich School in the south



Grain elevators, Duluth, Minn.
Milt and Joan Mann from CameraMann



The Picture Gallery of Dulwich College, London
A.F. Kersting

of the Greater London Borough of Southwark, England. Edward Alleyn, a successful Shakespearean actor, bought Dulwich Manor in 1605 and founded the College of God's Gift to provide education for "12 poor scholars" and almshouses for "6 poor brethren and 6 poor sisters." The foundation, reconstituted in 1857, now comprises three schools: Dulwich College, Alleyn's School, and James Allen's Girls' School. The present college was built in 1866–70 to designs of Sir Charles Barry. Dulwich College Picture Gallery (1814), fully restored after World War II, is a leading private art gallery.

The College Estates Governors have contained development and preserved the area's rural character. Dulwich Village is noted for its historic houses, and Dulwich Tollgate (*c.* 1800) is the last tollgate still in use in the London area.

dulzian (musical instrument): *see* curtal.

Dum Dum, the industrial suburbs of Calcutta, southeastern West Bengal state, northeastern India. The name was derived from the Persian word *damdama,* which refers to a raised mound or battery. The four towns that bear the name are Dum Dum, North Dum Dum, South Dum Dum, and Dum Dum Aerodrome Area (the site of Calcutta's international airport). All of the towns are part of the Calcutta urban agglomeration. North Dum Dum still contains large rural enclaves. South Dum Dum constitutes the northern fringe of Greater Calcutta.

The best known of the towns is Dum Dum, founded in 1783. It was the headquarters of the Bengal artillery until 1853 and has an ammunition factory in which the dumdum expanding bullet was first made. Jute mills, a tannery, iron- and steel-rolling works, glass, match, and soap factories, and several large engineering concerns are also located there. The town has several hospitals and a college affiliated with the University of Calcutta. The town was enlarged by the amalgamation of Kadihati municipality in 1883. Pop. (1981) Dum Dum, 33,604; North Dum Dum, 96,418; South Dum Dum, 230,266; Dum Dum Aerodrome Area, 3,159.

Dum-Dum fever (disease): *see* kala-azar.

Duma, Russian in full GOSUDARSTVENNAYA DUMA (State Assembly), elected legislative body that, along with the State Council, constituted the imperial Russian legislature from 1906 until its dissolution at the time of the February (March) 1917 Revolution. As a traditional institution, the Duma (meaning "deliberation") had precedents in certain deliberative and advisory councils of pre-Soviet Russia, notably in the boyar dumas (existing from the 10th to the 17th century) and the city dumas (1785–1917). The Gosudarstvennaya Duma, or state duma, however, constituted the first genuine attempt toward parliamentary government in Russia.

Initiated as a result of the 1905 revolution, the Duma was established by Nicholas II in his October Manifesto (Oct. 30 [Oct. 17, Old Style], 1905), which promised that it would be a representative assembly and that its approval would be necessary for the enactment of legislation. But the Fundamental Laws, issued in April 1906, before the First Duma met (May 1906), deprived it of control over state ministers and portions of the state budget and limited its ability to initiate legislation effectively.

Four Dumas met (May 10–July 21, 1906; March 5–June 16, 1907; Nov. 14, 1907–June 22, 1912; and Nov. 28, 1912–March 11, 1917). They rarely enjoyed the confidence or the cooperation of the ministers or the emperor, who retained the right to rule by decree when the Duma was not in session. The first two Dumas were elected indirectly (except in five large cities) by a system that gave undue representation to the peasantry, which the government expected to be conservative. The Dumas were, nevertheless, dominated by liberal and socialist opposition groups that demanded extensive reforms. Both Dumas were quickly dissolved.

In 1907, by a virtual coup d'état, Prime Minister Pyotr Arkadyevich Stolypin restricted the franchise to reduce the representation of radical and national minority groups. The Third Duma, elected on that basis, was conservative. It generally supported the government's agrarian reforms and military reorganization; and, although it criticized bureaucratic abuses and government advisers, it survived its full five-year term.

The Fourth Duma was also conservative. But as World War I progressed, it became increasingly dissatisfied with the government's incompetence and negligence, especially in supplying the army. By the spring of 1915 the Duma had become a focal point of opposition to the imperial regime. At the outset of the February (March) Revolution of 1917, it established the Provisional Committee of the Duma, which formed the first Provisional Government and accepted the abdication of Nicholas II.

Dumaguete, city, southeastern Negros Island, Philippines. On the Bohol (Mindanao) Sea at the southern entrance to Tanon Strait, it is the second leading port in the central Visayas (after Cebu City), serving both interisland and overseas vessels. Despite its commercial and administrative functions, the city is probably best known nationally as an educational centre. Silliman University, an American Presbyterian missionary school with a well-known liberal arts college, was founded there in 1901. Its presence has resulted in a considerable degree of Americanization. This university and the Foundation College (1949) attract students from various sectors of the archipelago, particularly the southern island of Mindanao. Dumaguete is also noted for its pottery, matting, and basketry industries, and it has regular air service. Inc. city, 1948. Pop. (1989 est.) 78,782.

Dumas, Alexandre, PÈRE (French: "Father") (b. July 24, 1802, Villers-Cotterêts, Aisne, Fr.—d. Dec. 5, 1870, Puys, near Dieppe), one of the most prolific and most popular French authors of the 19th century. Without ever attaining indisputable literary merit, Dumas succeeded in gaining a great reputation first as a dramatist and then as a historical novelist, especially for such works as *The Count of Monte Cristo* and *The Three Musketeers.* His memoirs, which, with a mixture of candour, mendacity, and boastfulness, recount the events of his extraordinary life, also provide a unique insight into French literary life during the Romantic period. He was the father of the dramatist and novelist Alexandre Dumas, called Dumas *fils.*

Dumas's father, Thomas-Alexandre Davy de La Pailleterie (who was the natural son of the Marquis de La Pailleterie and Marie Cessette Dumas, a black of Santo Domingo), was a common soldier under the ancien régime who assumed the name Dumas in 1786 and later became a general in Napoleon's army. The family fell on hard times, however, especially after General Dumas's death in 1806; and the young Alexandre went to Paris to attempt to make a living as a lawyer. He managed to obtain a post in the household of the Duke d'Orléans, the future King Louis-Philippe, but tried his fortune in the theatre. He made contact with the actor François-Joseph Talma and with the young poets who were to lead the Romantic movement.

Dumas's plays, when judged from a modern viewpoint, are crude, brash and melodramatic, but they were received with rapture in the late 1820s and early 1830s. *Henri III et sa cour* (1829) portrayed the French Renaissance in garish colours; *Napoléon Bonaparte* (1831) played its part in making a legend of the recently dead emperor; and in *Antony* (1831) Dumas brought a contemporary drama of adultery and honour to the stage.

Though he continued to write plays, Dumas next turned his attention to the historical novel, often working with collaborators (especially Auguste Maquet). Considerations of probability or historical accuracy generally were ignored, and the psychology of the characters was rudimentary. Dumas's main interest was the creation of an exciting story set against a colourful background of history, usually the 16th or 17th century.

The best known of his works are *Les Trois Mousquetaires* (published 1844, performed 1845; *The Three Musketeers*), a romance about four swashbuckling heroes in the age of Cardinal Richelieu; *Vingt Ans après* (1845; "Twenty Years After"); *Le Comte de Monte Cristo* (1844–45; *The Count of Monte Cristo*); *Dix Ans plus tard ou le Vicomte de Bragelonne* (1848–50; "Ten Years Later; or, The Vicomte de Bragelonne"); and *La Tulipe noire* (1850; "The Black Tulip").

When success came, Dumas indulged his extravagant tastes and consequently was forced to write more and more rapidly in order to pay his creditors. He tried to make money by journalism and with travel books but with little success.

Dumas *père*
Gramstorff Bros.

Dumas, Alexandre, FILS (French: "Son") (b. July 27, 1824, Paris, Fr.—d. Nov. 27, 1895, Marly-le-Roi), French playwright and novelist, one of the founders of the "problem play"—that is, of the middle-class realistic drama treating some contemporary ill and offering suggestions for its remedy.

Dumas *fils*
H. Roger-Viollet

Dumas *fils,* the illegitimate son of Alexandre Dumas *père,* possessed a good measure of his father's literary fecundity, but the work of the two men could scarcely be more different. His first success was a novel, *La Dame aux camélias* (1848), but he found his vocation when he adapted the story into a play, known in English as *Camille,* first performed in 1852. (Giuseppe Verdi based his opera *La Traviata,* first performed in 1853, on this play.) Although his father had written colourful historical plays and novels, Dumas *fils* specialized in drama set in the present. The unhappy witness of the ruin brought on his father by illicit love affairs, Dumas *fils* devoted his plays to sermons on the sanctity of the family and of marriage; *Le Demi-Monde* (performed 1855), for example, dealt with the threat to the institution of marriage posed by prostitutes. Modern audiences usually find Dumas's drama verbose and sententious, but in the late 19th century eminent critics praised his plays for their moral seriousness. He was admitted to the French Academy in 1875.

Among his most interesting plays are *Le Fils naturel* (1858; "The Natural Son") and *Un Père prodigue* (1859), a dramatization of Dumas's interpretation of his father's character.

Dumas, Jean-Baptiste-André (b. July 14, 1800, Alais, Fr.—d. April 10, 1884, Cannes), French chemist who pioneered in organic chemistry, particularly organic analysis.

Before Dumas was 21 he had done original work in biochemistry and embryology; in 1818, with Charles Coindet, he introduced the use of iodine in the treatment of goitre. In 1832 he became a professor at the University of Paris and the Collège de France.

Jean-Baptiste-André Dumas, engraving
Boyer—H. Roger-Viollet

Dumas originated a combustion method for determining the nitrogen content of organic compounds (1830), isolated anthracene (1831), discovered the formula for camphor (1832), and showed that halogens could replace hydrogen in organic compounds (1834). With Eugène-Melchior Péligot he isolated methyl alcohol (1834) and established the alcoholic series (1836).

With Justus von Liebig, Dumas showed that, in organic chemistry, groups of atoms can act in unison, remaining unchanged during chemical reactions that alter other parts of molecules containing the groups. He demonstrated atomic weights that differed from those of Jöns Berzelius, whose theories came to be replaced by the ideas of Dumas, Liebig, Auguste Laurent, and Charles Gerhardt.

Dumas became a member of the National Assembly in 1849 and was later a senator, president of the city council of Paris, and master of the French mint.

dumb barter: *see* silent trade.

dumb cane, any of several species of *Dieffenbachia* valued as indoor foliage plants that tolerate low light intensities. The term refers to the temporary speechlessness that can follow from chewing a piece of the stem, which contains oxalates that cause swelling and inflammation of the tongue and throat. The name mother-in-law's tongue, sometimes used for these plants, is also applied to *Sansevieria* species.

Dieffenbachia includes about 30 species of erect tropical American herbs in the arum or aroid family (Araceae). Only a few display fancy, large, more or less variegated leaves; they include *D. maculata* (formerly *D. picta*) and *D. seguine,* both of which have yielded colourful varieties of horticultural interest. *D. amoena* is a plant of large size, up to 6 feet (180 cm) or more, with 20-inch- (50-centimetre-) long leaves, having creamy markings along the larger veins.

Dumbarton, district, Strathclyde region, southwestern Scotland, created by the reorganization of 1975 from most of the former county of Dunbarton. The district covers an area of 184 square miles (477 square km) extending from the River Clyde in the south to Ben Vorlich (3,088 feet [941 m]) in the north and is bisected by the Highland Boundary Fault running northeastward from Helensburgh. Dumbarton district contains Loch Lomond, Scotland's largest loch, the hydroelectric-power scheme at Loch Sloy, and Finnart, the deepwater oil importing port on Loch Long, which is connected by overland pipeline to the oil refinery and petrochemical complex at Grangemouth. The hills of the north and west support forestry and sheep raising, while the lower ground supplies Glasgow with milk and vegetables. The northern shore of the River Clyde around Dumbarton, the seat of the district authority, formerly a thriving shipbuilding area, now depends largely on the blending and distilling of whisky, but the Strathleven Industrial Estate provides more diversified employment in the Vale of Leven, which was formerly a textile-producing area. Helensburgh is a dormitory town for Glasgow and a popular holiday resort. Pop. (1987 est.) 79,704.

Dumbarton, royal burgh (1222) and seat of the district of Dumbarton, Strathclyde region, Scotland. It lies north-northwest of the metropolitan complex of Glasgow, on the banks of the River Leven near its confluence with the Clyde. The site is dominated by a hill (240 feet [75 m]) of basalt, which has long been a defensive stronghold.

The Alcluith ("Hill of the Clyde") of the Britons and Dunbreatain ("Fort of the Britons") of the Celts became (from the 5th to the 8th century) the capital of the kingdom of Strathclyde. As a medieval royal fortress, Dumbarton was alternately in the hands of the English and the Scots. Its municipal privileges were confirmed by a charter of James V of Scotland (1513–42). Shipbuilding, formerly an important industry, declined after World War II. Dumbarton's main industry is now the blending and distilling of whisky. Pop. (1981) 23,430.

Dumbarton Oaks Conference (Aug. 21–Oct. 7, 1944), meeting at Dumbarton Oaks, a mansion in Georgetown, Washington, D.C., where representatives of China, the Soviet Union, the United States, and the United Kingdom formulated proposals for a world organization that became the basis for the United Nations.

This conference constituted the first important step taken to carry out paragraph 4 of the Moscow Declaration of 1943, which recognized the need for a postwar international organization to succeed the League of Nations. The Dumbarton Oaks proposals (Proposals for the Establishment of a General International Organization) did not furnish a complete blueprint for the United Nations. They failed to provide an agreed arrangement on such crucial questions as the voting system of the proposed Security Council and the membership provisions for the constituent republics of the Soviet Union. These issues were resolved at the Yalta Conference in February 1945, which also resulted in the proposal of a trusteeship system under the new agency to take the place of the League mandate system. The proposals, as thus supplemented, formed the basis of negotiations at the San Francisco Conference, out of which came the Charter of the United Nations in 1945.

Dumbarton Oaks Research Library and Collection, in Washington, D.C., institution in a Georgian-style mansion built in 1801 and housing Byzantine art (4th–15th century), pre-Columbian art (in an addition of eight circular glass galleries designed by Philip Johnson), and three libraries: a 100,000-volume Byzantine collection, an 18,000-volume pre-Columbian collection, and a 13,000-volume gardening and landscape architecture collection. The mansion (originally the home of William Hammond Dorsey), art collections, and book collections were all owned by Mr. and Mrs. Robert Woods Bliss, who presented them (along with funds to maintain them) to Harvard University in 1940. In 1944 the conference of representatives of the United States, the United Kingdom, China, and the Soviet Union that led to the founding of the United Nations was held at the mansion.

Dumbartonshire, also called DUNBARTONSHIRE, DUNBARTON, or DUMBARTON, historic region and former county of western Scotland. The county had a land area of 244 square miles (632 square km) and embraced the Vale of the Leven and the basin of Loch Lomond, located northwest of Glasgow. With the reorganization of 1975, it was divided between the districts of Dumbarton, Cumbernauld, Beardsden and Milngavie, Strathkelvin, and Clydebank. The northwest and west of the region are mountainous, the highest point exceeding 3,200 feet (975 m).

Prehistoric peoples left rude forts and tumuli, and there are several remains of the Antonine Wall, built between the Firth of Forth and the Clyde River. Other Roman relics were found at Duntocher, Cumbernauld, and elsewhere. The shire formed part of the old Scottish territory of Lennox. It gave the title of the earldom created in 1174 by William the Lion and of the dukedom conferred by Charles II on his natural son, Charles, Duke of Richmond and Lennox. Robert the Bruce is said to have mustered his forces at Dullatur prior to the Battle of Bannockburn, and he died at Cardross Castle in 1329. The Covenanters, in their flight from the field of Kilsyth, where in 1645 Montrose had defeated them, made their way through the southern districts. The

clans of Macgregor and Macfarlane made their home in the Highland and raided their Central Lowland neighbours.

Dumesnil, Mademoiselle, original name MARIE-FRANÇOISE MARCHAND (b. Jan. 2, 1713, Paris—d. Feb. 20, 1803, Paris), French tragic actress best known for her roles in the plays of Voltaire and Jean Racine.

Mlle Dumesnil, detail of an engraving
BBC Hulton Picture Library

She made her Paris debut in 1737 at the Comédie-Française as Clytemnestre in Racine's *Iphigénie en Aulide.* A fiery actress who scorned tradition, she played Cléopâtre in Corneille's *Rodogune* and played Racine's Phèdre, Athalie, and Hermione, with great effect. She retired in 1775 and 25 years later authorized publication of *Mémoires de Marie-Françoise Dumesnil,* in reply to an attack by her rival, the actress Mlle Clairon.

Dumfries, royal burgh (1186), seat of Nithsdale district, of Dumfries and Galloway region, and largest burgh in southwestern Scotland. Situated near the border with England on the left bank of the River Nith, 8 miles (13 km) from the Solway Firth, an Irish Sea inlet, it is the main market centre for an intensive livestock farming region.

As a border town, it suffered during the Wars of Scottish Independence and also from frequent raids. In 1745 the rebellious national leader Prince Charles Stuart held the town for ransom to obtain funds.

Robert Burns, Scotland's national poet, had close associations with Dumfries and lived there from 1791 until his death in 1796. His remains were buried there in 1815, and his house is now a museum.

Hosiery and knitwear are the traditional crafts of the town, but the production of tweed has been replaced by new industries.

No fewer than five bridges, including the 15th-century Old Bridge, span the River Nith. Pop. (1981) 30,208.

Dumfries and Galloway, region of southwestern Scotland, created by the administrative reorganization of 1975, with an area of 2,460 square miles (6,370 square km). It embraces the former counties of Dumfries, Kirkcudbright, and Wigtown. The region extends eastward from The Rinns, a hammer-shaped peninsula and the most southerly point in Scotland, in the North Channel to include the hills and moors of Galloway Forest Park to the north and the coastal plain and river valleys to the south. The town ("royal burgh") of Dumfries on the River Nith near the border with England is the region's major settlement. Agriculture is the area's single most important industry, in particular diary farming and forestry. Pop. (1987 est.) 147,036.

Dumfriesshire, also called DUMFRIES, former county, southwestern Scotland, since the reorganization of 1975 divided between the districts of Nithsdale and Annandale and Eskdale of Dumfries and Galloway (*q.v.*) region. It consisted of 1,067 square miles (2,764 square km).

The early populations of Dumfriesshire left hill forts in the north, stone circles, camps, tumuli and cairns, and sculptured stones. The British inhabitants of the region were called Selgovae by the Romans, who built many forts in the upper basin of the Annan. There are traces of Roman roads, and at Birrens there is a well-preserved Roman camp. Many Roman artifacts have been found. Upon the withdrawal of the Romans, the Selgovae were conquered by Scots from Ireland. The Saxon conquest of Dumfriesshire does not seem to have been thorough, the people of Nithsdale and elsewhere maintaining their Celtic institutions up to the time of David I (*c.* 1082–1153). The border clans were continually at strife until the 18th century. Famous men of the region include historian Thomas Carlyle (born at Ecclefechan), Thomas Telford, civil engineer, and William Paterson, founder of the Bank of England.

Dumka, also called NAGA DUMKA, town, east-central Bihār state, northeastern India, east of the Mor River. It is a road junction and major agricultural-trade centre. A weekly cattle mart is held. There is a college affiliated with Bhāgalpur University. Dumka was constituted a municipality in 1903. Pop. (1981) 31,068.

Dummer, Jeremiah (b. 1681, Boston, Mass.—d. May 19, 1739, Plaistow, Essex, Eng.), British-American colonial agent, author, and benefactor of Yale College.

Jeremiah Dummer, the son of Jeremiah Dummer, Sr., a prosperous Boston silversmith and engraver, graduated from Harvard University in 1699 and afterward studied in Holland and received a doctorate from the University of Utrecht in 1703. He returned to Boston but was unsuccessful in efforts to obtain a prestigious Congregational pulpit or a professorship at Harvard.

Dummer traveled to England in 1708 to defend Massachusett's claim to Martha's Vineyard. In London he engaged in commercial enterprises and wrote a Tory political polemic. Near the end of 1710, Governor Joseph Dudley appointed him colonial agent for Massachusetts. Two years later he was also made Connecticut's agent in England.

Dummer has been considered one of the best colonial agents prior to Benjamin Franklin. He laboured diligently to promote and protect the interests of the colonies he represented before the British government. His most notable action was his *A Defence of the New-England Charters,* a work written in 1715. This pamphlet used Lockean precepts to argue against any alterations of existing New England charter rights, after they had been attacked in Parliament. The work was later praised by John Adams, who called it "one of our most classical American productions." As agent, Dummer also was quite active in securing books and patrons for the Collegiate School of Connecticut. The school was later named for his principal patron, Elihu Yale. Dummer's political fortunes began to decline after the Hanoverian succession in England, and the Massachusetts lower house voted to discontinue his services in 1721. He remained Connecticut's agent until 1730; he then retired to Plaistow, near London.

Dumont, Alberto Santos (flight pioneer): *see* Santos-Dumont, Alberto.

Dumont, François (b. Jan. 7, 1751, Lunéville, Fr.—d. Aug. 27, 1831, Paris), one of the greatest miniature painters.

He studied for a time under Jean Girardet and in 1788 was accepted as an academician and granted an apartment in the Louvre. He painted portraits of Louis XVI, Marie Antoinette, Louis XVIII, and Charles X and of almost all the important persons of his day. A younger brother, known as Tony Dumont, was also a miniature painter, a pupil of his brother, a frequent exhibitor, and the recipient of a medal from the French Academy in 1810. Each artist signed with the surname only, and there is some controversy concerning the attribution to each of his own canvases.

Dumont d'Urville, Jules-Sébastien-César (b. May 23, 1790, Condé-sur-Noireau, Fr.—d. May 8, 1842, near Meudon), French navigator who commanded voyages of exploration to the South Pacific (1826–29) and the Antarctic (1837–40), resulting in extensive revisions of existing charts and discovery or redesignation of island groups.

In 1820, while on a charting survey of the eastern Mediterranean, d'Urville helped the French government gain possession of what became one of the best-known Greek sculptures, the Venus de Milo, which had been unearthed on the Aegean island of Mílos in that year. In 1822 he served on a voyage around the world and returned to France in 1825. His next mission took him to the South Pacific, where he searched for traces of explorer Jean-François La Pérouse, lost in that region in 1788. On this voyage he charted parts of New Zealand and visited the Fiji and Loyalty islands, New Caledonia, New Guinea, Amboyna, Van Diemen's Land (now Tasmania), the Caroline Islands, and the Celebes. In February 1828 d'Urville sighted wreckage, believed to be from the frigates of La Pérouse, at Vanikoro in the Santa Cruz Islands. The expedition returned to France on March 25, 1829. The voyage resulted in extensive revision in charts of South Sea waters and redesignation of island groups into Melanesia, Micronesia, Polynesia, and Malaysia. D'Urville also returned with about 1,600 plant specimens, 900 rock samples, and information on the languages of the islands he had visited. Promoted to *capitaine de vaisseau* (captain) in 1829, he conveyed the exiled king Charles X to England in August 1830.

Dumont d'Urville, engraving by Émile Lassalle after Maurin
By courtesy of the Bibliotheque Nationale, Paris

In September 1837 d'Urville set sail from Toulon on a voyage to Antarctica. He hoped to sail beyond the 74°15′ S reached by James Weddell in 1823. After surveying in the Straits of Magellan, d'Urville's ships reached the pack ice at 63°29′ S, 44°47′ W, but they were ill-equipped for ice navigation. Unable to penetrate the pack, they coasted it for 300 miles to the east. Heading westward, they visited the South Orkneys and the South Shetlands and discovered Joinville Island and Louis Philippe Land before scurvy forced them to stop at Talcahuano, Chile. After proceeding across the Pacific to the Fiji and Pelew (now Palau) islands, New Guinea, and Borneo, they returned to the Antarctic, hoping to discover the magnetic pole in the unexplored sector between 120° and 160° E. In January 1840 they sighted the Adélie coast, south of Australia, and named it for Mme d'Urville. The expedition reached France late in 1841. The following year d'Urville was killed, with his wife and son, in a railway accident.

Dumont d'Urville's chief works include (with others) *Voyage de la corvette "l'Astrolabe," 1826–1829* (1830–34; "Voyage of the Corvette 'Astrolabe,' 1826–1829") and *Voyage au Pole Sud et dans l'Océanie, 1837–1840* (1841–54; "Voyage to the South Pole and in Oceania, 1837–1840").

Dumouriez, Charles-François du Périer (b. Jan. 25, 1739, Cambrai, Fr.—d. March 14, 1823, Turville Park, Buckinghamshire, Eng.), French general who won signal victories for the French Revolution in 1792–93 and then traitorously deserted to the Austrians.

The son of a war commissary, Dumouriez entered the French army in 1758 and served with distinction against the Prussians in the Seven Years' War (1756–63). King Louis XV sent him on secret diplomatic missions to Madrid (1767), Poland (1770–72), and Sweden (1773), but he was recalled and imprisoned (1773–75) for engaging in intrigues. In 1778 he was appointed commander at Cherbourg, where for the next 11 years he supervised the development of the port.

Dumouriez, detail of a portrait by J. Rouillard; in the Musée National de Versailles et des Trianons

H. Roger-Viollet

The Revolution of 1789 opened new opportunities to the ambitious Dumouriez. He joined the Jacobin Club in 1790, and in March 1792 he was appointed minister of foreign affairs at the head of a predominantly Girondin Cabinet. On April 20, 1792, war was declared on Austria. Dumouriez probably planned to win the conflict quickly and then to use his army to overthrow the Legislative Assembly (successor to the National Assembly) and rule in the king's name. Nevertheless, French forces suffered a series of setbacks in the initial campaign. Dumouriez was made minister of war on June 12, 1792, but he resigned three days later and assumed command of the army in the north. Meanwhile, Prussia had entered the conflict on the side of Austria. With François-Christophe Kellermann, Dumouriez was able to defeat an invading Prussian army in the Battle of Valmy (September 20) and force it to withdraw from French soil. Dumouriez then conquered Belgium by crushing an Austrian army in the Battle of Jemappes (November 6).

On Feb. 26, 1793, Dumouriez invaded Holland. Forced to retreat into Belgium, he was defeated by the Austrians at Neerwinden (March 18) and at Louvain (March 21). He then concluded an armistice with the enemy and made plans to march on Paris and overthrow the National Convention, which had succeeded the Legislative Assembly in September 1792. When the Convention sent the minister of war, Pierre Riel, Count de Beurnonville, and four commissaries to relieve him of his command, Dumouriez handed them over to the Austrians on April 2. His troops deserted, and on April 5 he went over to the Austrians. His defection discredited his Girondin associates, and on June 2 the Jacobins had the leading Girondins expelled from the Convention.

After living for a time in Germany and Switzerland, Dumouriez settled in England, where he was granted a pension in 1800. Upon the restoration of the French monarchy in 1814, King Louis XVIII refused to allow him to return to France.

dumpling, small mass of leavened dough that is either boiled or steamed and served in soups or stews or with fruit. Dumplings are most commonly formed from flour or meal bound with egg and then simmered in water or gravy stock until they take on a light, cakey texture. Many recipes call for herbs, onions, grated cheeses, or chopped meats to be rolled into the dough before cooking.

Many ethnic varieties of the dumpling have found their way into popular U.S. cookery. Most cookbooks include the Hungarian *nockerl,* which often contains grated cheese, and the central European *spaetzle,* made by forcing batter through a colander into boiling water. *Gnocchi,* an Italian variety, often contain potato or pumpkin pulp. Unleavened matzo meal is used to make dumplings served by Jewish peoples on holidays or the traditional Sabbath eve. Both the Jewish *kreplach* and the Chinese *won ton,* usually served in soups, are filled noodle pockets rather than dumplings. Oriental dumplings are typically filled with a combination of shrimp, pork, beef, and vegetables and flavoured with soy. Apple and other fruit dumplings are desserts made by baking fruit wrapped in biscuit dough.

Dumuzi (Mesopotamian deity): *see* Tammuz.

Dumyāṭ, *muḥāfaẓah* (governorate) in the Nile delta, Lower Egypt, on the Mediterranean coast. It was formed out of al-Daqahlīyah *muḥāfaẓah* in 1955 and is bisected by the Damietta branch of the Nile, which empties into the Mediterranean Sea 8 miles (13 km) northeast of the capital, Damietta (*q.v.*). Its area is 227 square miles (589 square km).

Fishing and agriculture are the main industries outside of Damietta. The Al-Salaam Canal was opened in 1979 to bring water from the Damietta branch to the Suez Canal zone and Sinai. Reclamation from Lake Al-Manzilah to the east has brought more land under cultivation, but there are still extensive salt marshes in the north. The capital is the only important urban centre. Pop. (1986 est.) 747,000.

Dumyāṭ (Egypt): *see* Damietta.

Dun Cow, The Book of the, Irish Gaelic LEABHAR NA H-UIDHRE, oldest surviving miscellaneous manuscript in Irish literature, so called because the original vellum upon which it was written was supposedly taken from the hide of the famous cow of St. Ciarán of Clonmacnoise. Compiled about 1100 by learned Irish monks at the monastery of Clonmacnoise from older manuscripts and oral tradition, the book is a collection of factual material and legends that date mainly from the 8th and 9th centuries; it is interspersed with religious texts. It contains a partial text of *The Cattle Raid of Cooley* (*Táin Bó Cuailnge*), the longest tale of the Old Irish Ulster cycle and the one that most nearly approaches epic stature, as well as other descriptions of the conflict between Ulster and Connaught. The book also includes a poem praising St. Columba, credited to Dallán Forgaill; a poem on winter, ascribed to Finn MacCool, the legendary hero of the Fenian cycle; historical accounts of Mongan, an Ulster king of the 7th century, and of the Battle of Cnucha; and the story of the court of Dá Derga, an Irish romantic saga.

Dun Karm (Maltese poet): *see* Karm, Dun.

Dún Laoghaire, seaport and borough of County Dublin, Ireland, on Dublin Bay, 7 miles (11 km) southeast of Dublin. Tradition has it that King Laoghaire of Tara had a fort there in the 5th century. Formerly a fishing village called Kingstown, it grew into a large, ribbonlike residential town after the construction of an extensive harbour begun in 1816. Dun Laoghaire is on the terminus of the passenger and car-ferry shipping services from Holyhead, Wales; a new car-ferry terminal was completed in 1969. The harbour is much used by yachtsmen, and the town has a number of hotels and boardinghouses. Pop. (1986) 54,715.

Dünaburg (Latvian S.S.R.): *see* Daugavpils.

Dunajec River, river in southern Poland, rising in the Tatra Mountains near the Czechoslovak border and flowing about 156 miles (251 km) northeast into the Vistula. It is dammed for hydropower at Rożnów, Czchów, and Czorsztyn. It was the scene of heavy fighting in World War I when the Germans broke through the Russian trenches. In March 1975 Czechoslovakia and Poland modified their border along the Dunajec to permit Poland to construct a dam for irrigation in the Czorsztyn region, southeast of Kraków.

Dunant, (Jean-)Henri (b. May 8, 1828, Geneva, Switz.—d. Oct. 30, 1910, Heiden), Swiss humanitarian, founder of the Red Cross (now Red Cross and Red Crescent), a founder of the World's Young Men's Christian Association, and cowinner of the first Nobel Prize for Peace in 1901.

An eyewitness of the Battle of Solferino, June 24, 1859, which resulted in nearly 40,000 casualties, Dunant organized emergency aid services for the Austrian and French wounded. In *Un Souvenir de Solférino* (1862) he proposed the formation in all countries of voluntary relief societies for the prevention and alleviation of suffering in war and peacetime, without distinction of race or creed; he also proposed an international agreement covering the war wounded. In 1864, the year he founded the Red Cross, the first national societies and the first Geneva Convention came into being.

Dunant, 1901

By courtesy of the American Red Cross

Having gone bankrupt because he neglected his business affairs, Dunant left Geneva in 1867 and spent most of the rest of his life in poverty and obscurity. He continued to promote interest in the treatment of prisoners of war, the abolition of slavery, international arbitration, disarmament, and the establishment of a Jewish homeland. In 1895 a newspaperman "rediscovered" him at Heiden.

Dunántúl (Hungary): *see* Transdanubia.

Dunash BEN LABRAT, Labrat also spelled LIBRAT, also called AL-ABRAD, or ADONINA HA-LEVI (b. *c.* 920, Fès, Mor.?—d. *c.* 990, Córdoba?), Hebrew poet, grammarian, and polemicist who was the first to use Arabic metres in his verse, thus inaugurating a new mode in Hebrew poetry. His strictures on the Hebrew lexicon of Menahem ben Saruq provoked a quarrel that helped initiate a golden age in Hebrew philology.

Dunash was born either in Fès or in Baghdad

and after travelling to Sura, Babylonia, studied there under a renowned master of Jewish learning, Sa'adia ben Joseph. It was in Sura that he first composed his poems in Arabic metres, an innovation that amazed Sa'adia.

After a time, Dunash migrated to Córdoba, in Moorish Spain, then experiencing a renaissance of Jewish culture under a powerful Jewish statesman and adviser to the caliph, Ḥisdai ibn Shaprut (*c.* 915–975?).

A favourite of Ḥisdai's, the philologist Menahem ben Saruq, had written the first true Hebrew dictionary. Dunash wrote a devastating polemic against this work that combined personal attacks on Menahem with praise for Ḥisdai. Menahem lost favour with Ḥisdai and died not long afterward. Menahem's pupils answered with a polemic of their own, a quarrel that paved the way for a fresh examination of Hebrew grammar. Dunash also wrote an unpublished treatise on grammar in which he reveals his understanding (unusual for his time) that, although Hebrew verbs are based on three-consonant roots, in some conjugations a root letter may be dropped.

Dunash BEN TAMIM, also called ADONIM, or ABU SAHL (b. *c.* 900—d. *c.* 960), Jewish physician and one of the first scholars to make a comparative study of the Hebrew and Arabic languages.

He practiced medicine at the Fāṭimid court of al-Qayrawān, (now in Tunisia) and, like other educated Jews of his time, was versed in Hebrew. The work for which he is best known was written in Arabic, but the original was lost and it is known only in Hebrew translation. In it he advanced the view that Hebrew is an older language than Arabic, which he also considered to be a corruption of Hebrew. He was frequently quoted by Muslim writers.

Dunaújváros, town, Fejér *megye* (county), central Hungary, on the west bank of the Danube, 40 mi (65 km) downstream from Budapest. The town consists of Dunapentele (the original village [before 1950] on the site, now incorporated) and the new town sector of Komárom (where modern construction began in 1950), with extensive housing estates and large integrated ironworks and steelworks. Iron ore comes by river from the Ukraine, coking coal from the Pécs–Komló field in southwestern Hungary. The busy river port on the island of Szalki is linked by a bridge to the town. Other industries are a prefabricated house factory, textiles, and ready-to-wear clothing. Rail connections are via the new town, road and river links via the old town. A Roman city, Intercisa, located on a ford at the site of Dunapentele, perished about the 4th century, but ruins of the old fort are visible. Dunapentele, called Sztálinváros between 1950 and 1961, has a Greek Orthodox church (1696) and old peasant houses, some of which are cave dwellings carved in the soft loess. Pop. (1949) 3,949; (1970) 44,721; (1983 est.) 62,000.

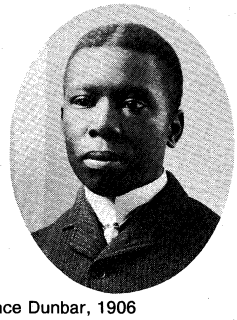
Dunbar, royal burgh (1369) and fishing port, East Lothian district, Lothian region, eastern Scotland, on the southern shore of the Firth of Forth. Dunbar Castle, built *c.* 856, was an important stronghold against English invasion, and the town developed under its protection. In 1568 the castle was destroyed for political reasons, notably because of its close association with Mary, Queen of Scots. The old Town House, built in 1620, is still in use. Dunbar has two harbours, the Old Harbour, extended by Oliver Cromwell before the Battle of Dunbar, and the Victoria Harbour—both with difficult access because of submerged reefs. A cluster of modern fishermen's cottages, designed by Basil Spence in 1951, were erected as part of the redevelopment of the old town. Apart from tourism, the chief industries are fishing, agriculture, brewing, and malting.

The Battle of Dunbar (1650) was fought between the English under Oliver Cromwell and the Scots under the national leader David Leslie, at a site 3 mi (5 km) southeast of the town. The Scots were eventually scattered and utterly defeated; Cromwell estimated that the Scots lost 3,000 killed and 10,000 prisoners, while he put his own casualties as low as 20. Pop. (1981) 6,386.

Dunbar, Patrick Dunbar, 9th earl of: *see* March, Patrick Dunbar, 2nd earl of.

Dunbar, Paul Laurence (b. June 27, 1872, Dayton, Ohio, U.S.—d. Feb. 9, 1906, Dayton), U.S. author whose reputation rests upon his verse and short stories written in black dialect. He was the first black writer in the U.S. to make a concerted attempt to live by his writings and one of the first to attain national prominence.

Both of Dunbar's parents were former slaves; his father escaped to freedom in Canada and



Paul Laurence Dunbar, 1906
By courtesy of the Library of Congress, Washington, D.C.

then returned to the U.S. to fight in the Civil War. The young Dunbar was the only black student in his Dayton high school, where he was the popular editor of the school paper. He published his first volume of poetry, *Oak and Ivy* (1893), at his own expense while working as an elevator operator and sold copies to his passengers to pay for the printing. His second volume, *Majors and Minors* (1895), attracted the favourable notice of the novelist and critic William Dean Howells, who also introduced Dunbar's next book, *Lyrics of Lowly Life* (1896), which contained some of the finest verses of the first two volumes.

A vogue sprang up for Dunbar's poems; he read them to audiences in the U.S. and England, and when he returned from abroad he was given a job in the reading room of the Library of Congress in Washington, D.C. (1897–98). He turned to fiction as well as verse, publishing four collections of short stories and four novels before his early death. Writing for a largely white readership, Dunbar made use of the then current plantation tradition in both his stories and his poems, depicting the pre-Civil War South in pastoral, idyllic tones. Only in a few of his later stories did a suggestion of racial disquiet appear.

His first three novels—including *The Uncalled* (1898), which reflected his own spiritual problems—were about white characters. His last, sometimes considered his best, was *The Sport of the Gods* (1902), concerning an uprooted black family in the urban North.

Dunbar, William (b. 1460/65, Scotland—d. before 1530), Middle Scots poet attached to the court of James IV who was the dominant figure among the Scottish Chaucerians (*see* makaris) in the golden age of Scottish poetry.

He was probably of the family of the earls of Dunbar and March and may have received an M.A. degree from St. Andrews in 1479. It is believed that he was a Franciscan novice and travelled to England and France in the King's service. In 1501 he was certainly in England, probably in connection with the arrangements for the marriage of James IV and Margaret Tudor, which took place in 1503. In 1500 he was granted a pension of £10 by the King. By 1504 he was in priest's orders, and in 1510 he received, as a mark of royal esteem, a pension of £80. In 1511 he accompanied the Queen to Aberdeen and celebrated in the verse "Blyth Aberdeen" the entertainments provided by that city. After the King's death at the Battle of Flodden (1513), he evidently received the benefice for which he had so often asked in verse, as there is no record of his pension after 1513.

With few exceptions the more than 100 poems attributed to Dunbar are short and occasional, written out of personal moods or events at court. They range from the grossest satire to hymns of religious exaltation. Of his longer works, some are courtly Chaucerian pieces like the dream allegory *The Goldyn Targe,* which wears its allegory very lightly and charms with descriptive imagery. *The Thrissill and the Rois* is a nuptial song celebrating the marriage of James IV and Margaret Tudor.

In a quite different vein, the alliterative *Flyting of Dunbar and Kennedie* is a virtuoso demonstration of personal abuse directed against his professional rival Walter Kennedy, who is, incidentally, mentioned with affection in *The Lament for the Makaris,* Dunbar's reminiscence of dead poets. Dunbar's most celebrated and shocking satire is the alliterative *Tretis of the tua mariit Wemen and the Wedo* ("Treatise of the Two Married Women and the Widow").

Dunbar's versatility was astonishing. He was at ease in hymn and satire, morality and obscene comedy, panegyric and begging complaint, elegy and lampoon. His poetic vocabulary ranged through several levels, and he moved freely from one to another for satiric effect. He wrote with uncommon frankness and wit, manipulating old themes and forms with imagination and originality. Like other Scots poets after him—notably Robert Burns—he was a vigorously creative traditionalist. In artistry and range, though not in humanity, he was the finest of Scotland's poets.

Dunbarton, also called DUMBARTON, DUNBARTONSHIRE, or DUMBARTONSHIRE, former county, western Scotland, since the reorganization of 1975 largely in Dumbarton (*q.v.*) district, of Strathclyde (*q.v.*) region.

Duncan, city, seat (1907) of Stephens County, south central Oklahoma, U.S. Once a cow town on Chisholm Trail, it was founded officially in 1892 when the Rock Island Railroad reached the site. It was named for William Duncan, a pioneer trader and tailor from Fort Sill. After the discovery of oil in 1921, the petroleum industry replaced agriculture as the primary economic activity. Erle Halliburton initiated and developed there an oil-well cementing business that grew to worldwide importance. Inc. town, 1898; city, 1910. Pop. (1980) 22,517.

Duncan I (d. Aug. 1, 1040, near Elgin, Moray, Scot.), king of the Scots from 1034 to 1040.

Duncan was the grandson of King Malcolm II (ruled 1005–34), who irregularly made him ruler of Strathclyde when that region was absorbed into the Scottish kingdom (probably shortly before 1034). Malcolm violated the established system of succession whereby the kingship alternated between two branches of the royal family. Upon Malcolm's death, Duncan succeeded peacefully, but he soon faced the rivalry of Macbeth, Mormaor (subking) of Moray, who probably had a better claim to the throne. Duncan besieged Durham unsuccessfully in 1039 and in the following year was murdered by Macbeth. Duncan's elder son later killed Macbeth and ruled as King Malcolm III Canmore (1058–93).

Duncan II (d. 1094), king of Scotland (1093–94), son of Malcolm III and grandson of Duncan I.

For many years (1072?–87) Duncan lived as a hostage of the Norman English, allegedly as a confirmation of his father's homage to William I of England. He became king of the Scots while driving out his uncle, Donald Bane, in 1094, an enterprise in which he was helped by some English and Normans. He was killed at the instigation of Donald Bane, possibly at Monthechin, making way for the restoration of Donald Bane.

Duncan, David Douglas (b. Jan. 23, 1916, Kansas City, Mo., U.S.), American photojournalist noted for his dramatic combat photography during the Korean War.

After graduation in 1938 from the University of Miami, Duncan was a free-lance photographer. During World War II he served with the U.S. Marine Corps, photographing Marine Corps aviation in the Pacific. In 1946 he became a staff photographer for *Life* magazine. He covered the Korean War in 1950; his photographs, which later appeared in the book *This Is War!* (1951), conveyed the life of the ordinary soldier in telling terms.

In 1955 Duncan resigned from *Life* and resumed free-lance work. His meeting with Pablo Picasso in 1956 resulted in an enduring interest in the artist's work reflected in Duncan's photographic essays *The Private World of Pablo Picasso* (1958), *Picasso's Picassos* (1961), *Goodbye Picasso* (1974), and *The Silent Studio* (1976). *The Kremlin* (1960) presented the history of Russia as seen through Kremlin art treasures. His autobiography, *Yankee Nomad; A Pictorial Odyssey,* was published in 1966. His pictures of the Democratic and Republican presidential conventions in 1968 appeared in *Self-Portrait, U.S.A.* (1969) and a selection of Vietnam war photographs in *War Without Heroes* (1971). Later experimental works were *Prismatics: Exploring a New World* (1973) and *Magic Worlds of Fantasy* (1978).

Duncan, Isadora, original name (until 1894) ANGELA DUNCAN (b. May 26, 1877, San Francisco—d. Sept. 14, 1927, Nice, Fr.), American dancer who was among the first to raise interpretive dance to the status of creative art. She met with little success at her first appearances in the United States, but her free style of performance was rapturously greeted in England and later in other parts of Europe, including Russia.

Duncan was one of four children brought up in genteel poverty by their mother, a music teacher. As a child she rejected the rigidity of the classic ballet and based her dancing on more natural rhythms and movements, an approach she later used consciously in her interpretations of the works of the great composers—particularly Brahms, Wagner, and Beethoven. Her earliest public appearances, in Chicago and New York City, met with little success, and at the age of 21 she left the United States to seek recognition abroad. With her meagre savings she sailed on a cattle boat for England.

At the British Museum her study of the sculptures of ancient Greece confirmed the classical use of those dance movements and gestures that hitherto instinct alone had caused her to practice and upon a revival of which her method was largely founded. Through the patronage of the celebrated actress Mrs. Patrick Campbell, she was invited to appear at the private receptions of London's leading hostesses, where her dancing, distinguished by a complete freedom of movement, enraptured those who were familiar only with the conventional forms of the ballet, which was then in a period of decay. It was not long before the phenomenon of a young woman dancing barefoot, as scantily clad as a woodland nymph, crowded theatres and concert halls throughout Europe. Her controversial first visit to Russia, in 1905, brought the dance to the attention of the art critic Sergey Diaghilev, who as impresario was soon to lead a resurgence of ballet throughout western Europe. At one time or another she founded dance schools in Germany, Russia, and the United States, but none of these survived.

Isadora Duncan dancing in an amphitheatre in Athens, Greece; photograph by Raymond Duncan, 1903

By courtesy of the Blair Collection

Her private life, quite as much as her art, kept her name in the headlines owing to her constant defiance of existing taboos. The father of her first child, Deirdre, was the stage designer Gordon Craig, who shared her abhorrence of marriage; the father of her second child, Patrick, was Paris Singer, the heir to a sewing machine fortune and a prominent art patron. In 1913 a tragedy occurred from which Duncan never really recovered; the car in which her two children and their nurse were riding in Paris rolled into the Seine and all three were drowned. In an effort to sublimate her grief she was about to open another school when the advent of World War I put an end to her plans. Her subsequent tours in South America, Germany, and France were less successful than before, but in 1920 she was invited to establish a school of her own in Moscow. To someone with her revolutionary temperament, the Soviet Union seemed the land of promise. There she met Sergey Aleksandrovich Yesenin, a poet 17 years younger than she, whose work had won him a considerable reputation. She married him in 1922, sacrificing her scruples against marriage in order to take him with her on a tour of the United States. She could not have chosen a worse time for their arrival. Fear of the "Red Menace" was at its height, and she and her husband were unjustly labeled as Bolshevik agents. When, at the Symphony Hall, Boston, she introduced him at one of her concerts, members of the audience shouted abuse at her. She harangued them from the stage and the evening ended in uproar. Leaving her native country once more, she told reporters: "Goodbye America, I shall never see you again!" She never did. There followed an unhappy period with Yesenin in Europe, where his increasing mental instability turned him against her. He returned alone to the Soviet Union and, in 1925, committed suicide.

During the last years of her life Duncan was a somewhat pathetic figure, living precariously in Nice on the French Riviera, where she met with a fatal accident: her scarf became entangled in the rear wheel of the car in which she was riding, and she was strangled.

Isadora Duncan was acclaimed by the foremost musicians, artists, and writers of her day. Although an inspiration to the intelligentsia, with whom she remained a cult figure, she was often an object of attack by the less broad-minded. Her ideas were too much in advance of their time, and she flouted social conventions too flamboyantly to be regarded by the wider public as anything but an advocate of "free love." Certainly her place as a great innovator in dance is secure: her repudiation of artificial technical restrictions and reliance on the grace of natural movement helped to liberate the dance from its dependence on rigid formulas and on displays of brilliant but empty technical virtuosity, paving the way for the later acceptance of modern dance as it was developed by Mary Wigman, Martha Graham, and others. (S.St.)

BIBLIOGRAPHY. The dancer's autobiography is Isadora Duncan, *My Life* (1927, reissued 1972). Accounts of her life and career include Alan Ross Macdougall, *Isadora: A Revolutionary in Art and Love* (1960); Walter Terry, *Isadora Duncan: Her Life, Her Art, Her Legacy* (1964, reprinted 1984); Victor Seroff, *The Real Isadora* (1971); and Frederika Blair, *Isadora: Portrait of the Artist as a Woman* (1986). Maurice Dumesnil, *An Amazing Journey* (1932), chronicles Duncan's South American tour; and Ilya Ilyich Schneider, *Isadora Duncan: The Russian Years* (1969), is an account of her years in the Soviet Union during the early 1920s. Studies of her dance philosophy and technique are Isadora Duncan, *The Art of Dance* (1928, reprinted 1970); and *The Technique of Isadora Duncan* by Irma Duncan (1937, reprinted 1970).

Duncan, Otis Dudley (b. Dec. 2, 1921, Nocona, Texas, U.S.), American sociologist whose study of the black population of Chicago (1957) demonstrated early in his career the validity of human ecology as an extension of the discipline of sociology.

Duncan received his B.A. from Louisiana State University (1941), his M.A. from the University of Minnesota (1942), and his Ph.D from the University of Chicago (1949). He became associate professor of human ecology at the University of Chicago (1957–60), where he had taught since 1951, becoming a full professor (1960–62). In 1973 he became professor of sociology of the University of Arizona. His widely referenced *The American Occupational Structure* (1967; with Peter M. Blau) advanced scientific understanding of the structure and development of the contemporary urban community by interpreting population as a mobile work force.

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

Duncan, Robert (Edward), original name EDWARD HOWARD DUNCAN, adopted name ROBERT EDWARD SYMMES (b. Jan. 7, 1919, Oakland, Calif., U.S.—d. Feb. 3, 1988, San Francisco), American poet, a leader of the Black Mountain group of poets in the 1950s.

Duncan attended the University of California at Berkeley in 1936–38 and 1948–50. He edited the *Experimental Review* from 1938 to 1940 and traveled widely thereafter, lecturing on poetry in the United States and Canada throughout the 1950s. He taught at Black Mountain College in North Carolina in 1956. He was a longtime resident of San Francisco and was active in that city's poetry community.

Duncan's poetry is evocative and highly musical and uses a rich fabric of associations and images whose meanings are sometimes obscure. Myths and a visionary mysticism inform much of his poetry, though his the-

matic concerns also include strong social and political statements. His earlier poems were collected in *The Years as Catches: First Poems, 1939–1946* (1966), and his poems of the 1950s appear in *Derivations: Selected Poems, 1950–56* (1968). *The Opening of the Field* (1960), *Roots and Branches* (1964), *Bending the Bow* (1968), and *Ground Work* (1984) are collections of his finest poems. He also wrote plays, including *Medea at Kolchis* (1965).

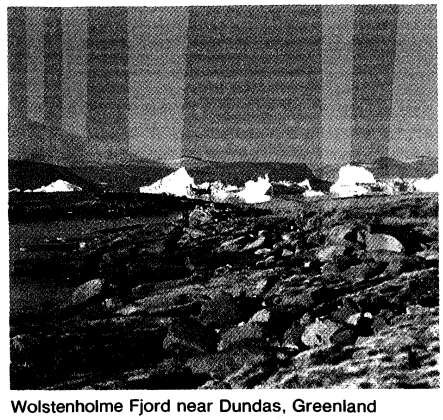
Duncan, Ronald (Frederick Henry) (b. Aug. 6, 1914, Salisbury, Rhodesia [now Harare, Zimb.]—d. June 3, 1982, Barnstaple, Devon, Eng.), British playwright, poet, and man of letters whose verse plays express the contrast between traditional religious faith and the materialism and skepticism of modern times.

From an early interest in socialism, Duncan moved to the expression of Christian and Buddhist convictions in his literary work. He is best known for a number of plays that express in intense, poetic language his sense of the decline of moral values and the growth of skepticism in contemporary society. Among these plays are *This Way to the Tomb* (1945), *Stratton* (1949), *Our Lady's Tumbler* (1951), *Don Juan* (1953), *The Death of Satan* (1954), and *The Catalyst* (1958). Duncan also wrote television plays, verse, short stories, novels, and many works of nonfiction. He wrote the libretto for the English composer Benjamin Britten's opera *The Rape of Lucretia* (1946), and he was a founder in 1955 of the English Stage Company. He served as poetry editor of *The Townsman* from 1938 to 1946.

Duncan Island (Galápagos Islands): *see* Pinzón Island.

Dundalk, Irish DÚN DEALGAN ("Dealgan's Fort"), seaport, urban district, and administrative centre of County Louth, Ireland. It lies near the mouth of the Castletown River on Dundalk Bay. It received charters from King John in about 1200 and from other monarchs. Dundalk is a railway junction and has railway workshops, distilleries, and breweries. Its industries produce bacon, shoes, clothing, cigarettes and tobacco, flour, computers, and electrical components. Trade is carried on in livestock and agricultural produce, and coal is imported. Pop. (1986) 26,669.

Dundas, formerly THULE, former Greenlandic (Eskimo) settlement of Umanak (Ũmánaq), now a major U.S. air base and communications centre, northwestern Greenland. It lies on Cape Atholl and the southern shore of Wolstenholme Fjord, an inlet of Baffin Bay. The region was explored (1912–24) by the expeditions of Knud Rasmussen, who brought in polar Eskimo and founded the original settlement of Umanak in 1910. The name was subsequently changed to Thule, derived from the prehistoric Thule culture. A U.S. air base, established there during World War II, was adapted in 1952 as an intermediate stop on the transpolar air route between North America and northern Europe. A ballistic missile early warning station was completed at Dundas in 1961. By the late 20th century there was no longer any civilian population at Dundas.



Wolstenholme Fjord near Dundas, Greenland

Ron Singer—Shostal/EB Inc.

Dundas, Henry: *see* Melville, Henry Dundas, 1st Viscount.

Dundee, major industrial city ("royal burgh") and seaport, in Dundee City district, Tayside region, Scotland. It was created a city in 1892 and an autonomous county burgh in 1894.

Dundee is the third largest city of Scotland by population and, after Glasgow, the second largest industrial city. It is situated on the northern bank of the North Sea inlet known as the Firth of Tay, which is crossed there by the modern Forth and Tay road bridges. It lies about 40 miles (64 km) north of Edinburgh. The city's river frontage exceeds 8 miles (13 km), and the city covers an area exceeding 20 square miles (52 square km) between the Tay and Dundee Law (571 feet [174 m]), which is a prominent volcanic plug.

The earliest mention of the town dates from the late 12th or early 13th century, when it was created a royal burgh. The next four or five centuries saw repeated sackings of the town and much bloodshed at the hands of the English. Fishing has been important in Dundee since early times, and one of Scotland's largest whaling fleets came to be based there. The city's traditional textile manufactures became closely linked with whaling in the 19th century after the discovery that jute fibre, when mixed with whale oil, could be woven into sacking for bags and carpet backing. Dundee then emerged as a world centre for jute manufacturing, and the city grew rapidly. Textiles, including linen, canvas, rope, and carpet, are still produced, but since World War II large numbers of workers have been employed in new light-engineering industries. Dundee is also known for its production of confectionery and preserves, particularly marmalade.

Few historic buildings and only one town gate (the East Port) have survived the city's turbulent past. The City Churches, a collection of three parish churches housed under one roof, remain as a focal point in the modern glass and concrete city centre. Slum clearance has removed many of Dundee's old streets, courtyards, and buildings.

The University of Dundee was founded in 1881, affiliated with the University of St. Andrews in 1897, and made independent in 1967. There are also technical colleges, a teacher-training college, a college of commerce, and a college of fine arts. Broughty Ferry, once a separate burgh and favourite residence of wealthy Dundee merchants, is now incorporated within the city. Pop. (1981) 174,346.

Dundee, John Graham of Claverhouse, 1st Viscount of, LORD GRAHAM OF CLAVERHOUSE (b. 1649?—d. July 17/18, 1689, Pass of Killiecrankie, Perth, Scot.), Scottish soldier, known as "Bonnie Dundee," who in 1689 led an uprising in support of the deposed Roman Catholic monarch James II of Great Britain. Graham's death at the outset of the revolt deprived the Scottish Jacobites, as James's adherents were called, of any hope of success in their resistance to King William III and Queen Mary II.

Coming from a noble family, Graham began his military career as a soldier of fortune in France and the Netherlands. He returned to Scotland by 1678 and was made captain of the dragoons sent to the southwest to suppress Presbyterian insurgents who opposed the Anglican regime of King Charles II. Although beaten by the rebels at Drumclog Moss, Lanark, on June 1, 1679, Graham helped defeat them at Bothwell Bridge on June 22.

He spent most of the next two years in England, where he won the favour of Charles's brother James, Duke of York. After the Duke of York assumed the throne as James II in 1685, Graham at first took little part in military or governmental affairs. But when the Dutch Protestant stadholder William of Orange invaded England in November 1688, Graham became second-in-command of the Scottish army sent to aid the king. He was created Viscount Dundee by James on November 12.

Lord Dundee, ink miniature by David Paton; in the Scottish National Portrait Gallery, Edinburgh

By courtesy of the Scottish National Portrait Gallery, Edinburgh

James fled from England in December, and Dundee then returned to Scotland to champion the cause of the exiled monarch. Rallying forces in the central Highlands, he ambushed General Hugh Mackay at the Pass of Killiecrankie on July 17, 1689. Dundee's forces were completely victorious, but he was shot and fell from his horse, mortally wounded. In August the Scottish resistance was crushed at the Battle of Dunkeld.

BIBLIOGRAPHY. Two biographies, Magnus Linklater and Christian Hesketh, *For King and Conscience* (1989); and Andrew Murray Scott, *Bonnie Dundee* (1989), reassess his life and actions.

Dundee City, district, Tayside region, eastern Scotland; created by the reorganization of 1975, it includes the former county of the city of Dundee and parts of the former counties of Angus and Perth. The district, with an area of 91 square miles (235 square km), lies on the north shore of the Firth of Tay and covers the city of Dundee, some of the surrounding countryside, and residential Monifieth. Pop. (1987 est.) 175,748.

Dunderlands, valley, along the lower course of the Rana River, Nordland *fylke* (county), north-central Norway. On the Arctic Circle, it extends about 30 miles (50 km) northeast from Rana, an inlet of the North Sea. Rich deposits of magnetite and hematite in the valley are mined to supply the ironworks and steelworks at Mo on the mouth of the river. Dunderlands valley is also known for its scenic limestone caverns and underground streams.

Dundo, mining town, northeastern Angola. It lies 15 miles (24 km) south of the Zaire border. Founded near a site where diamonds were first discovered in 1912, the town was developed as a planned community privately operated by Diamang (Companhia de Diamantes de Angola). This international consortium, monopolizing the exploitation of the area between the early 1920s and 1971, was nationalized by the Angolan government in 1977. Until 1980 the mines, generally southeast of Dundo in the alluvial till of riverbeds, annually produced nearly 10 percent of the world's total output of gem-quality diamonds. Since then, civil strife and a shortage of technical equipment and other economic problems have greatly reduced the area's diamond output. The Dundo National Museum (founded in 1947

by the mining company) has extensive ethnographic collections that include wooden traditional masks and wooden sculptures of the local heterogeneous Lunda-Chokwe peoples.

Dundonald, Thomas Cochrane, 10th earl of (b. Dec. 14, 1775, Annesfield, Lanarkshire, Scot.—d. Oct. 30, 1860, London), British admiral, who ranks among the greatest of British seamen.

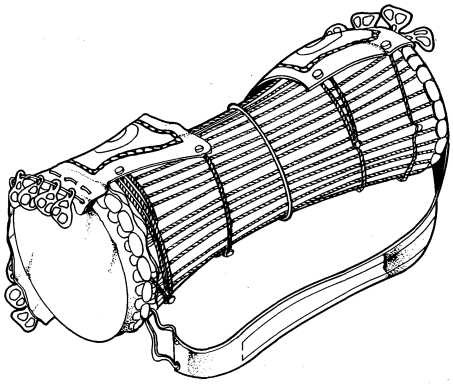
He was the eldest son of the 9th earl whose scientific experiments on his Scottish estates impoverished his family. In 1793 Thomas joined the ship commanded by his uncle, Alexander Cochrane, and thereafter served on other ships during the Napoleonic wars. In 1806 and again in 1807 he was elected member of Parliament. He led a hazardous fireship attack on the French fleet in the Aix roads in April 1809, but the fruits of his courage were thrown away by the commander in chief, Lord Gambier. Cochrane's ill-advised criticisms of Gambier resulted in the latter's court-martial, at which he was acquitted. This, together with Cochrane's unpopularity in government circles because of his demands for parliamentary and naval reform, resulted in his not being employed again at sea. In February 1814 Cochrane and others were involved in a plot to make money on the stock exchange by spreading false rumours about the abdication of Napoleon. In the trial that followed he was sentenced to a period of imprisonment, expelled from Parliament, and deprived of the order of the Bath, which had rewarded his exploit in 1809.

At this lowest point of his fortunes Cochrane accepted (May 1817) the invitation of Chile to command its fleet in the war of independence against Spain. His capture of the Spanish flagship "Esmeralda" in Callao harbour contributed largely to the independence of Chile and Peru. From 1823 to 1825 he transferred his services to Brazil in its war against Portugal. Soon after his return to Europe he was employed by the Greeks in their war of independence but resigned in 1828 because of factional disputes and delays in the delivery of steamships, which he proposed to use in war for the first time.

At home he campaigned vigorously for reinstatement in the navy, which he achieved in 1832, the year after he succeeded his father as earl of Dundonald. From 1848 to 1851 he commanded the American and West Indies station. He died in 1860 and was buried in Westminster Abbey.

Cochrane was the author of *Autobiography of a Seaman,* 2 vol. (1860–61) and *Narrative of Services in the Liberation of Chili, Peru and Brazil,* 2 vol. (1959).

dùndún pressure drum, double-membrane, hourglass-shaped drum of the Yoruba people of southwestern Nigeria. It is capable of imitating the tones and glides of the spoken language and is employed by a skilled musician to render ritual praise poetry to a deity or king. It has counterparts in East Africa, Asia, and Melanesia.



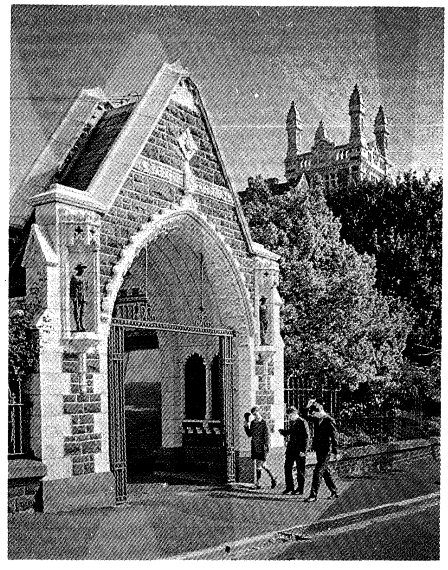
Dùndún pressure drum
From *Odu: A Journal of Yoruba and Related Studies*

The term pressure drum derives from the shape of the instrument's body, which is waisted, or smaller in diameter in the middle than it is at each end. The drum is suspended from the player's left shoulder; the left hand manipulates the leather tensioning thongs that connect the two membranes, while the drum is beaten with a curved stick held in the right hand. By tightening or loosening the thongs, the player is able to control (*i.e.,* to raise or lower) the pitch of the drum.

The set of six *dùndún* (called *ìyá ìlù, gùdùgùdù, kerikeri, ìṣájú, kànàngó,* and *gàngan*) is generally part of any Yoruba ceremony or festival, taking the lead in town processions. All except the *gùdùgùdù* can be used for "talking."

Dunedin, city and port, southeastern South Island, New Zealand, at the head of Otago Harbour (14 mi [23 km] long) with deepwater Port Chalmers at its mouth.

Founded in 1848 as a Scottish Free Church settlement, the town was chosen for its timber resources and potential for farm settlement. It was called Dunedin for the Gaelic word for Edinburgh (Duneideann). The discovery of gold in 1861 in Otago brought prosperity and migration to the town, making it New Zealand's leading city during the second half of the 19th century. A borough since 1855, it was proclaimed a city in 1865.



Memorial gateway to Otago Boys' High School, Dunedin, N.Z.
By courtesy of New Zealand National Publicity

Despite slow growth in recent decades the city remains an industrial centre with woollen, textile, home appliance, footwear, furniture, soap, fertilizer, chemical, flour-milling, and ship-repair plants, engineering works, and iron and brass foundries. Dunedin is served by the Picton-Bluff State Highway, the South Island Main Trunk Railway to Christchurch (228 mi north), and an airport, as well as by its excellent port.

Dunedin is also noted for its green "Town Belt," planned by the founders to surround the inner city with 500 ac (200 ha) of forest. Other prominent features include a botanic garden, art gallery, the University of Otago (1869; the oldest university in New Zealand), the Otago Museum, and the Early Settlers' Museum. The city is also a religious centre with Roman Catholic and Anglican cathedrals and the theological Knox, Selwyn, and Holy Cross colleges. Pop. (1983 est.) city, 77,500; urban area, 105,600.

Duneideann (Scotland): *see* Edinburgh.

Dunér, Nils Christofer (b. May 21, 1839, Billeberga, Swed.—d. Nov. 10, 1914, Stockholm), Swedish astronomer who made important studies of the rotational period of the Sun.

Dunér was senior astronomer (1864–88) at the Royal University Observatory in Lund, Swed. In 1867 he began his investigations of binary stars. He also performed pioneering stellar spectroscopy studies (studies of the individual characteristic wavelengths of light).

Shortly after he became professor of astronomy at the University of Uppsala, Swed., and director of the Uppsala Observatory in 1888, Dunér undertook a now-classic study of the Sun's rotation. Using the Doppler shift, he established that the Sun's rotational period is about 25½ days near the Equator but up to 38½ days near the Sun's poles.

Dunes, Battle of the (June 14, 1658), military victory of French and English forces led by Marshal Henri de Turenne, attacking Spanish forces near Dunkirk (then in the Spanish Netherlands). The victory contributed greatly to the surrender of Dunkirk by Spain and to the conclusion of the Peace of the Pyrenees by France and Spain (1659).

The battle occurred after Oliver Cromwell sent Gen. William Lockhart with 6,000 English infantry to reinforce Turenne, who was besieging Dunkirk. A Spanish force, under Don John the Younger of Austria and the Great Condé, with several corps of English royalists commanded by the Duke of York (later James II), arrived to relieve Dunkirk and took up positions on the dunes. Turenne attacked. Although Condé's cavalry gained an advantage, the rest of the Spanish force could not resist the Anglo-French troops and retreated, except for a corps of English royalists (who later rejoined their king, Charles II, at Ypres).

Dunfermline, district, Fife region, eastern Scotland; created by the reorganization of 1975, it is part of the former county of Fife. The district, area 117 sq mi (303 sq km), on the north side of the Firth of Forth, is generally low-lying. Coal mining and dairy farming are the principal economic activities. Dunfermline city is the seat of the district authority. Pop. (1982 est.) 126,971.

Dunfermline, royal burgh, city, and seat of the district authority of Dunfermline, in Fife region, Scotland, situated on high ground 3 mi (5 km) inland from the Firth of Forth.

Early Celtic monks had a settlement there, but the community really developed around the Benedictine Abbey (*c.* 1072). A fragment of the royal residence of that time survives in Pittencrief Park. Seven Scottish kings from Malcolm III Canmore to Robert I the Bruce are buried there.

The surviving abbey nave (a fine example of massive Norman architecture) served as a parish church until 1821. The guesthouse was rebuilt as a palace and became a favourite residence of Scottish kings.

After virtual destruction by fire in 1624, Dunfermline later developed as a centre for the manufacture of linen and damask, with the associated industries of bleaching and dyeing.

Andrew Carnegie, the millionaire industrialist and philanthropist, was born in Dunfermline (1835) and was especially generous to his hometown, which remains the headquarters of all the Carnegie Trusts. Pop. (1981 prelim.) 58,392.

dung beetle, also called DUNG CHAFER, or TUMBLEBUG, any member of the scarab subfamily Scarabaeinae (Coprinae) of the insect order Coleoptera. The dung beetle forms manure into a ball—sometimes as large as an

Earth-boring dung beetle (*Geotrupes*)
M.W.F. Tweedie—EB Inc.

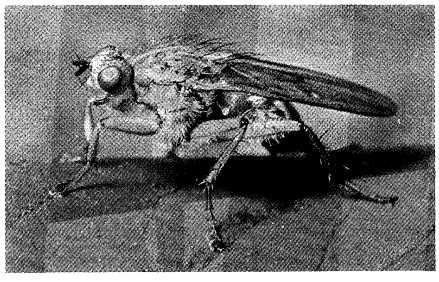
apple—with its scooper-like head and paddle-shaped antennae. In the early part of the summer the dung beetle buries itself and the ball and feeds on it. Later in the season the female deposits eggs in balls of dung, on which the larvae will later feed.

Dung beetles are usually round with short wing covers (elytra) that expose the end of the abdomen. They vary in size from 5 to 30 millimetres (0.2 to more than 1 inch) and are usually dark in colour, although some have a metallic lustre. On the top of the male's head is a long, curved horn. Dung beetles can eat more than their own weight in 24 hours and are considered helpful to man because they speed up the process of converting manure to substances usable by other organisms.

The sacred scarab of ancient Egypt (*Scarabaeus sacer*), found in many paintings and jewelry, is a dung beetle. Egyptian cosmogony includes the scarab beetle rolling its ball of dung; the ball represents the Earth and the beetle the Sun. The 30 segments of its six legs—actually, this species has only 20, but closely related ones do have 30—represent the 30 days of each month. An interesting member of this subfamily is the Australian *Macrocopris symbioticus,* which lives in the anus of the wallaby. The Indian scarabs *Heliocopris* and certain *Catharsius* species make very large manure balls and cover them with a layer of clay, which becomes so hard when dry that the balls were once thought to be old stone cannonballs.

Members of other scarab subfamilies are also called dung beetles; *e.g.,* Aphodiinae and Geotrupinae. Instead of forming balls, however, they excavate a chamber under a pile of dung that is used during feeding or for depositing eggs. The aphodian dung beetle is small (4 to 6 mm, or about 1/5 in.) and usually black with yellow wing covers. The earth-boring dung beetle (*e.g., Geotrupes*) is about 14 to 20 mm (about 1/2 to 3/4 in.) long and brown or black in colour. *Geotrupes stercorarius,* known as the dor beetle, is a common European dung beetle.

dung fly, also called CORDYLURID, any insect of the family Scatophagidae (order Diptera). These flies, common in pastures, breed and live in cow dung and speed its decomposition.



Dung fly (*Scatophaga stercoraria*)
E.S. Ross

The adult fly is yellow or brown and may be parasitic on insects; some feed on plants. Members of the Sphaeroceridae family are known as small dung flies.

Dungan (Chinese Muslims): *see* Hui.

Dungannon, Irish DÚN GEANAINN, town, seat, and district (established 1973; formerly astride Counties Armagh and Tyrone), Northern Ireland. Its early history is linked with the O'Neills, earls of Tyrone, whose chief residence was there; a large rath, or earthwork, north of the town, was the scene of the inauguration of their chiefs. The independence of the Irish Parliament was first proclaimed by Protestants at Dungannon in 1782. It is today a market town producing linens and cut crystal. A Royal School was founded there in the early 17th century.

Dungannon district covers an area of 352 sq mi (911 sq km); it extends from Lough (lake) Neagh in the east to the district of Fermanagh in the west and from the foothills of the Sperrin Mountains in the north to the Blackwater River and the Irish Republic in the south. The district is essentially a pastoral area; pigs, dairy cattle, and poultry are raised. The other main population centre, besides Dungannon town, is Coalisland, the centre of a coal region that has never been profitably exploited. A national highway from Belfast passes around Dungannon town. Pop. (1971) town, 7,634; (1981 prelim.) district, 41,087.

Consult the INDEX *first*

dungarees (apparel): *see* jeans.

Dungarpur, town, administrative headquarters of Dungarpur district, Rājasthān state, northwestern India. An agricultural market centre, it is linked by road with Udaipur, as well as with Vadodara, Ahmadābād, and Indore via Godhra (Gujarāt). Dungarpur, former capital of the Dungarpur princely state, was founded in the 14th century and was named after Dungaria, an independent chieftain of the Bhīl people. A hospital and a government college affiliated with the University of Rājasthān are located there.

Dungarpur district (1,456 sq mi [3,770 sq km]) consists of a hilly forested area drained by the Mahi River, which forms part of its eastern boundary. Agriculture is the principal occupation, and wheat, millet, rice, corn (maize), and pulses are the chief crops. Beryllium, lead, zinc, silver, iron-ore, and mica deposits are worked extensively. A former princely state, Dungarpur was included in Bānswāra state until *c.* 1530. Successively under Mughal, Marāṭhā, and British control, it became part of the state of Rājasthān in 1948. Pop. (1981) town, 27,556; district, 682,845.

Dungarvan, Irish DÚN GARBHÁN (Garbhan's Fort), market town, seaport, urban district, and administrative centre of County Waterford, Ireland, on the Bay of Dungarvan at the mouth of the River Colligan. The name is derived from St. Gervan, who founded a monastery there in the 7th century. Ruins include a castle built by King John *c.* 1200 and a keep and portions of an Augustinian friary. The town has a glue works, a tannery, a dairy-products factory, and a fruit-packing station. Pop. (1981) 6,631.

Dungeness, promontory on the south coast of the county of Kent, England. It is a bleak triangle of shingle (gravel), projecting southeastward into the English Channel where it narrows to the north into the Strait of Dover. Romney Marsh lies to its north and the River Tillingham below Rye to its south. There is a modern lighthouse, and near it a nuclear power station at Dungeness Point. A lifeboat station, signalling station, and a bird sanctuary are situated on the promontory.

Dungeness crab (*Cancer magister*), edible crab (order Decapoda of the class Crustacea), occurring along the Pacific coast from Alaska to lower California; it is one of the largest and, commercially, most important crabs of that coast.

The male is 18 to 23 centimetres (about 7 to 9 inches) in width and 10 to 13 cm (4 to 5 in.) long. The reddish-brown upper surface is lighter toward the back; the legs and undersurface are yellowish. It lives on sandy bottoms below the low-tide mark.

Closely related North American species are the rock crab of the Atlantic coast (*C. irroratus*); the Jonah crab (*C. borealis*), in coastal waters from New England to Canada; and the red crab (*C. productus*) and the Pacific rock crab (*C. antennarius*), both in Pacific coastal waters. All are edible but their commercial importance varies.

In Great Britain, *C. pagurus,* known as edible crab or common crab, is fished commercially. It grows to 25 cm (10 in.) in width and weighs up to 5 kilograms (11 pounds).

Dunham, Katherine (b. June 22, 1910, Joliet, Ill., U.S.), U.S. dancer, choreographer, and anthropologist noted for her innovative interpretations of primitive, ritualistic, and ethnic dances. The first person to organize a black dance troupe of concert calibre, she was both a popular entertainer who toured the U.S. and Europe with a spectacularly colourful program of dance forms and a serious artist intent on tracing the roots of black culture.

After receiving an M.A. and later a Ph.D. in anthropology from the University of Chicago, she studied primitive dances in the Caribbean on a fellowship. She established her first school in Chicago in 1931 and in 1936 she was awarded a Julius Rosenwald Foundation fellowship to study traditional dance in Haiti. In 1940 she formed an all-black company, which began touring extensively by 1943. *Tropics* (choreographed 1937) and *Le Jazz Hot* (1938) were among the earliest of many works based on her research.

Many of Dunham's students, trained in her studios in Chicago and New York City, have become prominent in the field of modern dance. She also choreographed for Broadway stage productions, opera, and films, including *Aida* (1963) for the New York Metropolitan Opera; conducted special projects for Chicago black high school students; was artistic and technical director to the president of Senegal; and artist-in-residence, and later professor, at Southern Illinois University, Edwardsville, and director of Southern Illinois' Performing Arts Training Centre and Dynamic Museum in

Katherine Dunham in *Tropical Revue,* 1945–46
By courtesy of the Dance Collection, New York Public Library, Astor, Lenox and Tilden Foundations

East St. Louis, Ill. Her writings include *Katherine Dunham's Journey to Accompong* (1946), an account of her anthropological studies in Jamaica; *A Touch of Innocence* (1959), an autobiography; and articles for popular and scholarly journals.

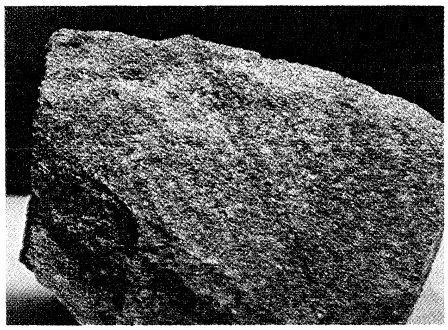
Dunhill, Thomas Frederick (b. Feb. 1, 1877, London, Eng.—d. March 13, 1946, Scunthorpe, Lincolnshire), British composer known for his light operas and songs.

Dunhill studied at the Royal College of Music in London and was assistant music master at Eton College, 1899–1908. His outstanding comic operas were *Tantivy Towers* (1931) and *Happy Families* (1933). Among his songs, "The Cloths of Heaven" and "The Fiddler of Dooney," set to poems by W.B. Yeats, were especially popular. He also wrote symphonies, chamber music, and a critical study, *Sullivan's Comic Operas* (1928).

Dunhuang (China): *see* Tun-huang.

Dunira, Henry Dundas, Baron: *see* Melville, Henry Dundas, 1st Viscount.

dunite, light yellowish green, intrusive igneous rock that is composed almost entirely of olivine. Dunite usually forms sills (tabular bodies intruded between other rocks) but may also occur as lenses (thin-edged strata) or pipes (funnels, more or less oval in cross section, that become narrower with increasing depth). Occurrences include Dun Mountain, New Zealand, from which the rock takes its name; the Bushveld Igneous Complex, South Africa; and Frostviken, Jämtland, Sweden. Chromite, picotite, and magnetite also occur in dunite, as do spinel, ilmenite, pyrrhotite,



Dunite from Jackson County, North Carolina

By courtesy of the Illinois State Museum; photograph, John H. Gerard—EB Inc.

and platinum in some cases. Dunites constitute an important source of chromium, a commercially valuable metal.

Dunk Island, island in the Family Islands group, 3 miles (5 km) off the coast of northeastern Queensland, Australia. It lies north of the entrance to Rockingham Bay, which is an inlet of the Coral Sea. Coral-fringed and composed of granite, Dunk Island has an area of 2 square miles (5 square km). Its surface, densely covered with vegetation, rises to 800 feet (240 m). The British navigator Captain James Cook named the island after George Montagu Dunk, Earl of Halifax. It is one of the least-spoiled resorts of the Great Barrier Reef. Its principal settlement is Bramma Bay in the west, which is accessible by air from Townsville and Cairns on the mainland. A bird sanctuary and national park, Dunk also has examples of cave art executed by its once-substantial Aboriginal population. The island was made famous by the writings of a British-Australian journalist and naturalist, Edmund James Banfield, who lived there from 1897 to 1923.

Dunkeld, historic cathedral city in Perth and Kinross district of Tayside region, Scotland. It is situated on the left bank of the River Tay and is surrounded by wooded mountains. The community was an early centre of the Celtic church, and in 850 the relics of St. Columba were transferred to Dunkeld. The church was made a cathedral in 1127 and enlarged during the 14th and 15th centuries. After the Reformation it fell into disrepair until it was restored in 1815 and 1908.

The town was made a royal burgh in 1704, but, in spite of the building of Telford Bridge over the Tay in 1809, Dunkeld has failed to develop and remains a small settlement. Pop. (1981) 590.

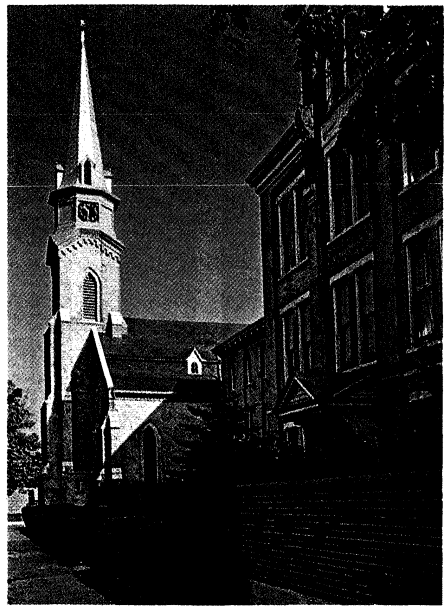
Dunkirk, French DUNKERQUE, town, seaport, in the Nord *département,* Nord-Pas-de-Calais *région,* northern France. It lies along the Strait of Dover between Calais and the Belgian frontier, 49 miles (79 km) northwest of Lille by road. First mentioned in 1067 as Dunkerk (Flemish: "Church of the Dunes"), the town was besieged and sacked six times during the Middle Ages and was in the centre of conflicts between France, Spain, England, and Holland in the 16th and 17th centuries before it was finally recovered by France in 1662. Louis XIV had important fortifications built there to make it a safe base for Jean Bart and other famous French corsairs who pillaged foreign ships. Forced to demolish the fortifications by the Treaty of Utrecht in 1713, France was not allowed to rebuild them until the late 18th century.

During World War II, in May–June 1940, the British Expeditionary Force and other Allied troops, cut off by the Germans, were evacuated from Dunkirk to England by naval vessels and hundreds of civilian boats. The town was liberated by the U.S. Army in May 1945, but more than three-quarters of its houses were destroyed in the fighting.

The town was subsequently rebuilt on a new plan, with the spacious Place Jean Bart in the centre. Near that square is a belfry, 131 feet (40 m) high, that was built in the 15th century and was restored after being severely damaged by fire in 1940. It was originally the western tower of the Gothic Church of Saint-Eloi (damaged in World Wars I and II) but was separated from it by a street in the 18th century. The town museum, also partly destroyed in 1940, has preserved a collection of 17th-century paintings by minor Dutch masters.

Dunkirk's great artificial port was largely rebuilt after 1945 and subsequently expanded. There are 8.5 miles (13.5 km) of quays with berths for ships of all sizes, including giant tankers. Well-equipped with modern machinery, the port has four dry docks, two floating docks for repairs, and storehouses for fruit, grain, and refrigerated products. A complex railway and canal network connects the docks with Belgium and with all important points of northern France. Dunkirk ranks as one of the largest French ports in its amount of cargo handled. The port's major imports are fuel oil, coal, phosphates, and minerals. Exports include sugar, cement, and chemical products. There are daily ferry services to Dover, Eng. The first French steel plant separated from the inland coalfields was opened in Dunkirk in the early 1960s. Dunkirk is also an industrial centre that has oil refineries, metallurgical works, and shipbuilding. Pop. (1982) 71,756.

Dunkirk, city, port of entry, Chautauqua county, western New York, U.S. It lies along Lake Erie, just north of Fredonia and 40 miles (64 km) southwest of Buffalo. First settled about 1805, it was known as Chadwick's Bay but was renamed because of the supposed similarity of its harbour to that of Dunkirk (Dunkerque), Fr. The opening of the Erie Canal (1825) and the arrival of the Erie Railroad (1851; now part of Consolidated Rail Corporation) stimulated Dunkirk's growth. It developed commercial fishing, shipped agricultural



St. Mary's Monastery, Dunkirk, N.Y.

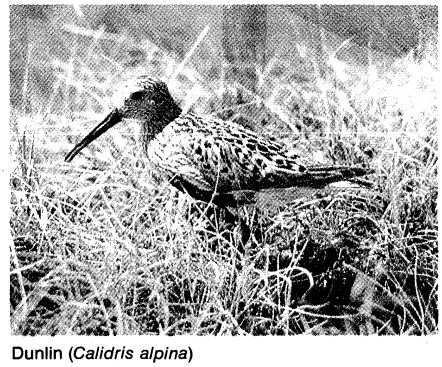
Milt and Joan Mann from CameraMann

products (particularly Concord grapes), and acquired diversified industry (chiefly stainless steel). Holy Cross and St. Columban's seminaries, St. Mary's Monastery, and the Conference Grounds of the Evangelical and Reformed Church are in the city. Dunkirk was the birthplace (1871) of Samuel Hopkins Adams, the noted author-journalist. Inc. village, 1837; city, 1880. Pop. (1988 est.) 14,625.

Dunkleosteus (extinct fishlike animal): *see* Dinichthys.

Dunkula (The Sudan): *see* Dunqulah.

dunlin, also called OXBIRD, OXEYE, or RED-BACKED SANDPIPER (*Calidris,* or *Erolia, alpina*), one of the most common and sociable birds of the sandpiper (*q.v.*) group. The dunlin is a member of the family Scolopacidae (order Charadriiformes). It is about 20 cm (8 inches) long and has a bill curved downward at the tip. In breeding plumage, the bird has a black belly and a reddish back (dun-coloured, hence the name). In the winter the plumage is gray



Dunlin (*Calidris alpina*)

Mary M. Tremaine from Root Resources—EB Inc.

above and white below. It breeds around the North Pole and also in the British Isles and the Baltic region and winters in great numbers on seacoasts, mainly north of the equator.

Dunlop Holdings PLC, subsidiary company of BTR PLC, and the major British manufacturer of tires and other rubber products. It is headquartered in London.

The company has been involved in rubber-tire manufacture since the late 19th century. Dunlop's founder, John Boyd Dunlop (1840–1921), who had constructed the first pneumatic (air-filled) tire, received a patent for the tire in 1888. The following year he formed a

company to manufacture pneumatic bicycle tires. In 1896 Dunlop registered the company in Great Britain as Byrne Brothers India Rubber Company, Ltd. The name was changed to Dunlop Rubber Company, Ltd., in 1900, and the company began making automobile tires six years later. To ensure that the company would have an uninterrupted supply of raw rubber, Dunlop started buying rubber plantations on the Malay Peninsula, and by 1926 the company held the largest acreage under one ownership anywhere in the British Empire. In 1981, however, the company sold its holdings there to Malaysian investors. That same year the company converted to a public limited company and assumed its current name.

In 1982 Dunlop sold a large portion of its European tire operations to Sumitomo Rubber Industries, Inc., of Japan—an associate company and former Dunlop subsidiary. BTR PLC, an industrial holding company, acquired Dunlop in 1985, selling off Dunlop's American tire company.

Dunmore, John Murray, 4th Earl of, VISCOUNT OF FINCASTLE, LORD MURRAY OF BLAIR, MOULIN, AND TILLEMOT (b. 1730?—d. Feb. 25 or Mar. 5, 1809, Ramsgate, Kent, Eng.), British royal governor of Virginia on the eve of the American Revolution.

A descendant of the Scottish house of Stuart, he was the eldest son of William Murray, the 3rd earl, whom he succeeded in 1756. He sat in the House of Lords from 1761 to 1770 and then was appointed governor first of New York in 1770 and then of Virginia in 1771. Personally interested in western lands as well as officially concerned with protection of the Virginia frontier to the west, he raised 3,000 militiamen to subdue the Shawnee Indians in the upper Ohio River valley in 1774, an action known as Lord Dunmore's War.

As the revolution approached, Dunmore's power declined rapidly, especially through his own rashness. He dissolved the Virginia Assembly in 1772, 1773, and 1774 on account of its revolutionary sentiments. In April 1775 he seized the colony's store of powder, thereby bringing about an armed uprising. Taking refuge aboard an English warship, he shortly declared martial law, proclaimed freedom to slaves who would join the British, and proposed to Lord Dartmouth the use of Indians against the rebels. Defeated at Great Bridge near Norfolk on Jan. 1, 1776, he ordered his ships to bombard Norfolk, thereby setting it afire. He returned to England in July 1776. After serving again in the House of Lords, he was royal governor of the Bahamas from 1787 to 1796.

Dunmow, Great (Essex, England): *see* Great Dunmow.

Dunne, Finley Peter (b. July 10, 1867, Chicago, Ill., U.S.—d. April 24, 1936, New York, N.Y.), American journalist and humorist who created the homely philosopher Mr. Dooley.

Dunne was born of Irish-immigrant parents. In 1884 he began working for various Chicago newspapers, specializing eventually in political reporting and editorial writing. In 1892 he began contributing Irish-dialect sketches to the *Chicago Evening Post* and five years later to the *Chicago Journal*. In these Dunne introduced Martin Dooley, a saloonkeeper who comments on politics and society in a rich Irish brogue. Dunne's sketches attained national circulation after the success of Mr. Dooley's comical observations on Admiral George Dewey's victory at Manila in 1898, and soon Dunne's witty penetration of shams and hypocrisies made Mr. Dooley a force for clear thinking and tolerance in public affairs. Many of Mr. Dooley's remarks, such as "th' supreme coort follows th' iliction [*i.e.,* election] returns," became part of American lore. Dunne wrote more than 700 dialect essays, some of which were republished in eight volumes from 1898 to 1919.

Finley Peter Dunne
Brown Brothers

Dunne, Irene (b. Dec. 20, 1904, Louisville, Ky., U.S.), American motion-picture and stage actress and singer, known for her leading roles as a gracious and well-bred woman and also well-known for her comedic roles.

Trained for a career in singing, Dunne went to New York City hoping to join the Metropolitan Opera Company. She was unsuccessful and instead joined the Chicago touring company of the musical comedy *Irene* in 1920. Several Broadway stage roles followed, most notably that of Magnolia Hawks in a touring production of *Show Boat* (1929), which won her a contract with RKO film studios.

Her first motion picture, *Leathernecking* (1930), was not memorable, but with the release of *Cimarron* in 1931, she became a popular success. After *Cimarron,* she appeared in some 40 feature-length films. These included both dramatic roles—as in *Back Street* (1932); *Magnificent Obsession* (1935), with Robert Taylor; *Love Affair* (1939), with Charles Boyer; *Anna and the King of Siam* (1946), with Rex Harrison; and *I Remember Mama* (1948)—and roles in a number of comedies—such as *Roberta* (1935), with Fred Astaire and Ginger Rogers; *Show Boat* (1936); and *The Awful Truth* (1937) and *My Favorite Wife* (1940), both with Cary Grant. She retired after making *It Grows on Trees* in 1952.

Dunnet Head, a rounded, cliffed sandstone headland in the district of Caithness, Highland region, Scotland, that is the northernmost point on the mainland of Britain. Dunnet Head juts out into Pentland Firth of the North Sea. The headland is about 3 miles (5 km) across and forms a plateau at an elevation of about 100 feet (30 m), with hills rising to 422 feet (128 m). The headland's northern tip is crowned by a 346-foot- (105-metre-) high lighthouse built in 1831.

Dunning, John: *see* Ashburton, John Dunning, 1st Baron.

Dunning, John R(ay) (b. Sept. 24, 1907, Shelby, Neb., U.S.—d. Aug. 25, 1975, Key Biscayne, Fla.), American nuclear physicist whose experiments in nuclear fission helped lay the groundwork for the development of the atomic bomb.

Dunning graduated from Nebraska Wesleyan University in 1929 and earned a Ph.D. in physics from Columbia University, New York City, in 1934. About the time he received his doctoral degree, he also became an instructor at Columbia. Dunning spent the years 1935–36 in Europe meeting with prominent nuclear physicists before he returned to Columbia University to direct the construction of Columbia's first cyclotron. In 1939 Dunning led the American research team that verified German physicists' report of the fission of the uranium atom. With Alfred Nier and other colleagues, he then showed in 1940 that it was mostly the uranium-235 isotope that was involved in the fission of the uranium nucleus. Dunning went on to direct the research team at Columbia that developed the gaseous-diffusion method of separating uranium-235 from the more abundant uranium-238 isotope. Gaseous diffusion is still the principal method for obtaining uranium-235. Dunning became a full professor of physics at Columbia in 1946 and headed its engineering faculty from 1950 to 1969.

dunnock, thrushlike bird, a species of accentor (*q.v.*).

Dunois, Jean d'Orléans, comte de (count of), byname THE BASTARD OF ORLEANS, French LE BÂTARD D'ORLÉANS (b. 1403, Paris, Fr.—d. Nov. 24, 1468, L'Haÿ-les-Roses), French military commander and diplomat who played a great part in his country's final victory over the English in the Hundred Years' War.

Jean was the natural son of Louis, Duke d'Orléans, by his liaison with Mariette d'Enghien. Jean entered the service of his cousin the dauphin, the future Charles VII, in 1420 and became his trusted adviser; he was later appointed grand chamberlain. His first notable success was the defeat of the English at Montargis (1427), and during 1427–28 he defended Orléans until Joan of Arc arrived. He then took part in the Battle of Patay and accompanied Charles to Reims for his coronation. He captured Chartres and Lagny in 1432 and engaged in a series of campaigns culminating in a triumphal entry into Paris in 1436.

Dunois, detail from a statue in the chapel of the castle at Châteaudun, Eure-et-Loir, France
H. Roger-Viollet—Hurault

He shared in the negotiations with the English at Gravelines (1439) and worked with Charles on the reorganization of the military. He received the countship of Dunois from his half brother, Charles, Duke d'Orléans, and later received the countship of Longueville (1443) from Charles VII. He helped negotiate the truce of 1444 with the English and in 1447–49 the abdication of the antipope Felix V. At the end of the truce, he served in the reconquest of Normandy (1449–50) and Guyenne (1451). Charles VII later entrusted him with the arrest of the Duke d'Alençon (Jean II) in 1456 and with measures against the intrigues of the dauphin, the future Louis XI. When Louis acceded to the throne, Dunois joined the League of the Public Weal against him, but he made his peace with him and returned to royal service. The future dukes de Longueville descended from his marriage to Marie d'Harcourt.

Dunoon, small burgh (town), Argyll and Bute district, Strathclyde region, western Scotland, on the northeastern shore of the Firth of Clyde. It has grown as a seaside resort, with a marine frontage of hotels and villas along the esplanade, which extends for 2 miles (3 km) to the entrance of Holy Loch at Hunters Quay,

site of the headquarters of the Royal Clyde Yacht Club. In Holy Loch itself is a U.S. Polaris (missile) submarine base, established in 1960. Pop. (1981) 9,840.

Dunqulah, also spelled DONGOLA, or DUNKULA, town, capital of ash-Shamālīyah *mudīrīyah* (province), Northern Region, northern Sudan, on the right bank of the Nile, about 278 mi (448 km) northwest of Khartoum. Located at an elevation of 748 ft (248 m), the town is an agricultural centre for the surrounding area producing cotton, wheat, barley, sugarcane, and vegetables. It is linked by road with Wādī Halfā' and Marawī and has a domestic airport.

The capital of the Christian kingdom of Makurra, Dunqulah was besieged in 652 by a Muslim army from Egypt under 'Abd Allāh ibn Sa'd ibn Abī Sarḥ, who agreed to raise the siege only after conclusion of a pact, which regulated relations between Egypt and Dunqulah for some six centuries thereafter. Medieval Dunqulah was described as having many churches, large houses, wide streets within a city wall, and, from 1002, a red-brick palace. After the Christian kingdom of Nubia collapsed (14th century), Dunqulah became a Muslim town. Upon the establishment at Sennār of the Funj dynasty (16th century), it emerged as the seat of a tributary king whose dominion extended northward to the third cataract of the Nile. Following the rise of the Shāyqīyah confederacy of Dunqulah in the late 17th century, the region was ruled by petty chiefs, and the principal north–south trade routes tended to skirt Dunqulah. In its subsequent decline Dunqulah was prey both to the Shāqīyah from within and to Mamlūk refugees. Pop. (1973) 5,626.

Duns, small burgh and seat of the district authority of Berwickshire, Borders region, Scotland. The old settlement, Duns Law, was the birthplace of the 13th-century philosopher John Duns Scotus. The town was destroyed by the English in 1545 and rebuilt in 1588. Pop. (1981 prelim.) 2,249.

Duns Scotus, John, Latin given name JOANNES, byname DOCTOR SUBTILIS (b. *c.* 1266, Duns, Lothian, Scot.—d. Nov. 8, 1308, Cologne), influential Franciscan Realist philosopher and Scholastic theologian who pioneered the classical defense of the doctrine that Mary, the mother of Jesus, was conceived without original sin (the Immaculate Conception) and argued that the Incarnation was not dependent on the fact that man had sinned, that will is superior to intellect and love to knowledge, and that the essence of heaven consists in beatific love rather than the vision of God.

Early life and career. As Ernest Renan, a 19th-century French historian and philosopher, noted, there is perhaps no other great medieval thinker whose life is as little known as that of Duns Scotus. Yet patient research during the past half-century has unearthed a number of facts. Early 14th-century manuscripts, for instance, state explicitly that John Duns was a Scot, from Duns, who belonged to the English province of Friars Minor (the order founded by Francis of Assisi), that "he flourished at Cambridge, Oxford, and Paris and died in Cologne."

Though accounts of his early schooling and entry into the Franciscan Order are unreliable, Duns Scotus' own remark that "a 13 year old today is better versed in sacred matters than a 20 year old adult in the primitive Church" does suggest an early interest in religion and entrance into the order. As a novice, Duns Scotus would have learned of St. Francis' personal love for Christ in the Eucharist, his reverence for the priesthood, and his loyalty to "the Lord Pope"—themes given special emphasis in Duns Scotus' own theology. In addition, he would have studied interpretations of St. Francis' thought, particularly those of St. Bonaventure who saw the Franciscan ideal as a striving for God through learning that will culminate in a mystical union of love. In his early *Lectura Oxoniensis,* Duns Scotus insisted that theology is not a speculative but a practical science of God and that man's ultimate goal is union with the divine Trinity through love. Though this union is known only by divine revelation, philosophy can prove the existence of an infinite being and herein lies its merit and service to theology. Duns Scotus' own intellectual journey to God is to be found in his prayerful *Tractatus de primo principio* (*A Treatise on God As First Principle,* 1966), perhaps his last work.

Jurisdictionally, the Scots belonged to the Franciscan province of England, whose principal house of studies was at Oxford where Duns Scotus apparently spent 13 years (1288–1301) preparing for inception as master of theology. There is no record of where he took the eight years of preliminary philosophical training (four for a bachelor's and four for the master's degrees) required to enter such a program.

After studying theology for almost four years, John Duns was ordained priest by Oliver Sutton, bishop of Lincoln (the diocese to which Oxford belonged). Records show the event took place at St. Andrew's Church in Northampton on March 17, 1291. In view of the minimum age requirements for the priesthood, this suggests that Duns Scotus must have been born no later than March 1266, certainly not in 1274 or 1275 as earlier historians maintained.

Duns Scotus would have spent the last four years of the 13-year program as bachelor of theology, devoting the first year to preparing lectures on Peter Lombard's *Sentences*—the textbook of theology in the medieval universities—and the second to delivering them. A bachelor's role at this stage was not to give a literal explanation of this work but rather to pose and solve questions of his own on topics that paralleled subject "distinctions" in Lombard. Consequently, the questions Duns Scotus discussed in his *Lectura Oxoniensis* ranged over the whole field of theology. When he had finished, he began to revise and enlarge them with a view to publication. Such a revised version was called an *ordinatio* in contrast to his original notes (*lectura*) or a student report (*reportatio*) of the actual lecture. If such a report was corrected by the lecturer himself, it became a *reportatio examinata.* From a date mentioned in the prologue, it is clear that in 1300 Duns Scotus was already at work on his monumental Oxford commentary on the *Sentences,* known as the *Ordinatio* or *Opus Oxoniense.*

Statutes of the university required that the third year be devoted to lectures on the Bible; and, in the final year, the bachelor *formatus,* as he was called, had to take part in public disputations under different masters, including his own. In Duns Scotus' case, this last year can be dated rather precisely, for his name occurs among the 22 Oxford Franciscans, including the two masters of theology, Adam of Howden and Philip of Bridlington, who were presented to Bishop Dalderby on July 26, 1300, for faculties, or the proper permissions to hear confessions of the great crowds that thronged to the Franciscans' church in the city. Because the friars had but one chair of theology and the list of trained bachelors waiting to incept was long, regent masters were replaced annually. Adam was the 28th and Philip the 29th Oxford master, so that Philip's year of regency was just beginning. It must have coincided with Duns Scotus' final and 13th year because an extant disputation of Bridlington as master indicates John Duns was the bachelor respondent. This means that by June of 1301 he had completed all the requirements for the mastership in theology; yet, in view of the long line ahead of him, there was little hope of incepting as master at Oxford for perhaps a decade to come.

Years at the University of Paris. When the turn came for the English province to provide a talented candidate for the Franciscan chair of theology at the more prestigious University of Paris, Duns Scotus was appointed. One *reportatio* of his Paris lectures indicates that he began commenting on the *Sentences* there in the autumn of 1302 and continued to June 1303. Before the term ended, however, the university was affected by the long smouldering feud between King Philip IV the Fair and Pope Boniface VIII. The issue was taxation of church property to support the King's wars with England. When Boniface excommunicated him, the monarch retaliated by calling for a general church council to depose the Pope. He won over the French clergy and the university. On June 24, 1303, a great antipapal demonstration took place. Friars paraded in the Paris streets. Berthold of Saint-Denis, bishop of Orleans and former chancellor of the university, together with two Dominicans and two Franciscans, addressed the meeting. On the following day royal commissioners examined each member of the Franciscan house to determine whether he was with or against the King. Some 70 friars, mostly French, sided with Philip, while the rest (some 80 odd) remained loyal to the Pope, among them John Duns Scotus and Master Gonsalvus Hispanus. The penalty was exile from France within three days. Boniface countered with a bull of August 15 suspending the university's right to give degrees in theology or canon and civil law. As a result of his harassment and imprisonment by the King's minister, however, Boniface died in October and was succeeded by Pope Benedict XI. In the interests of peace, Benedict lifted the ban against the university in April 1304, and shortly afterwards the King facilitated the return of students.

Where Duns Scotus spent the exile is unclear. Possibly his Cambridge lectures stem from this period, although they may have been given during the academic year of 1301–02 before coming to Paris. At any rate, Duns Scotus was back before the summer of 1304, for he was the bachelor respondent in the *disputatio in aula* (public disputation) when his predecessor, Giles of Ligny, was promoted to master. On November 18 of that same year, Gonsalvus, who had been elected minister general of the Franciscan order at the Pentecost chapter, or meeting, assigned as Giles' successor "Friar John Scotus, of whose laudable life, excellent knowledge, and most subtle ability as well as his other remarkable qualities I am fully informed, partly from long experience, partly from report which has spread everywhere."

The period following Duns Scotus' inception as master in 1305 was one of great literary activity. Aided by a staff of associates and secretaries, he set to work to complete his *Ordinatio* begun at Oxford, using not only the Oxford and Cambridge lectures but also those of Paris. A search of manuscripts reveals a magisterial dispute Duns Scotus conducted with the Dominican master, Guillaume Pierre Godin, against the thesis that matter is the principle of individuation (the metaphysical principle that makes an individual thing different from other things of the same species), but so far no questions publicly disputed *ordinarie—i.e.,* in regular turn with the other regent masters—have been discovered. There is strong evidence, however, that some questions of this sort existed but were eventually incorporated into the *Ordinatio.* Duns Scotus did conduct one solemn quodlibetal disputation, so called because the master accepted questions on any topic (*de quodlibet*) and

from any bachelor or master present (*a quodlibet*). The 21 questions Duns Scotus treated were later revised, enlarged, and organized under two main topics, God and creatures. Though less extensive in scope than the *Ordinatio,* these *Quaestiones quodlibetales* are scarcely less important because they represent his most mature thinking. Indeed, Duns Scotus' renown depends principally on these two major works.

The short but important *Tractatus de primo principio,* a compendium of what reason can prove about God, draws heavily upon the *Ordinatio.* The remaining authentic works seem to represent questions discussed privately for the benefit of the Franciscan student philosophers or theologians. They include, in addition to the *Collationes* (from both Oxford and Paris), the *Quaestiones in Metaphysicam Aristotelis* and a series of logical questions occasioned by the Neoplatonist Porphyry's *Isagoge* and Aristotle's *De praedicamentis, De interpretatione,* and *De sophisticis elenchis.* These works certainly postdate the Oxford *Lectura* and may even belong to the Parisian period. Antonius Andreus, an early follower who studied under Duns Scotus at Paris, expressly says his own commentaries on Porphyry and *De praedicamentis* are culled from statements of Duns Scotus *sedentis super cathedram magistralem* ("sitting on the master's chair").

Final period at Cologne. In 1307 Duns Scotus was appointed professor at Cologne. Some have suggested that Gonsalvus sent Scotus to Cologne for his own safety. His controversial claim that Mary need never have contracted original sin seemed to conflict with the doctrine of Christ's universal redemption. Duns Scotus' effort was to show that the perfect mediation would be preventative, not merely curative. Though his brilliant defense of the Immaculate Conception marked the turning point in the history of the doctrine, it was immediately challenged by secular and Dominican colleagues. When the question arose in a solemn quodlibetal disputation, the secular master Jean de Pouilly, for example, declared the Scotist thesis not only improbable, but even heretical. Should anyone be so presumptuous as to assert it, he argued impassionedly, one should proceed against him "not with arguments but otherwise." At a time when Philip IV the Fair had initiated heresy trials against the wealthy Knights Templars, Pouilly's words have an ominous ring. There seems to have been something hasty about Duns Scotus' departure in any case. Writing a century later, the Scotist William of Vaurouillon referred to the traditional account that Duns Scotus received the Minister General's letter while walking with his students and set out at once for Cologne taking little or nothing with him. Duns Scotus lectured at Cologne until his death. His body at present lies in the nave of the Franciscan church near the Cologne cathedral and in many places he is venerated as blessed.

Whatever the reason for his abrupt departure from Paris, Duns Scotus certainly left his *Ordinatio* and *Quodlibet* unfinished. Eager pupils completed the works, substituting materials from *reportationes examinatae* for the questions Duns Scotus left undictated. The critical Vatican edition begun in 1950 is aimed, among other things, at reconstructing the *Ordinatio* as Duns Scotus left it, with all his corrigenda, or corrections.

Despite their imperfect form, Duns Scotus' works were widely circulated. His claim that universal concepts are based on a "common nature" in individuals was one of the central issues in the 14th-century controversy between Realists and Nominalists concerning the question of whether general types are figments of the mind or are real. Later this same Scotist principle deeply influenced Charles Sanders Peirce, a U.S. philosopher, who considered Duns Scotus the greatest speculative mind of the Middle Ages as well as one of the "profoundest metaphysicians that ever lived." His strong defense of the papacy against the divine right of kings made him unpopular with the English Reformers of the 16th century for whom "dunce" (a Dunsman) became a word of obloquy, yet his theory of intuitive cognition suggested to John Calvin, the Genevan Reformer, how God may be "experienced." During the 16th to 18th century among Catholic theologians Duns Scotus' following rivalled that of Thomas Aquinas and in the 17th century outnumbered that of all the other schools combined. (A.B.W.)

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Dunsany, Edward John Moreton Drax Plunkett, 18th baron of (b. July 24, 1878, London—d. Oct. 25, 1957, Dublin), Irish dramatist and storyteller, whose many popular works combined imaginative power with intellectual ingenuity to create a credible world of fantasy.

Educated at Eton and Sandhurst, Dunsany served in the South African War and World War I. His first book of short stories was *The Gods of Pegana* (1905); his first play, *The Glittering Gate,* was produced by the Abbey Theatre in Dublin in 1909; and his first London production, *The Gods of the Mountain,* at the Haymarket Theatre in 1911. As in his more than 50 subsequent verse plays, novels, short stories and memoirs, in these works Dunsany explored in a richly coloured prose mysterious kingdoms of fairies and gods; he also introduced a characteristic element of the macabre.

Dunsinane, peak, in the Sidlaw Hills, about 8 mi (13 km) northeast of Perth, eastern Scotland. The peak, at an elevation of 1,012 ft (308 m) is surmounted by the ruins of an ancient fort, traditionally identified with the castle of Shakespeare's *Macbeth.* Both are in close proximity to Birnam Wood, about 12 mi to the northwest, which was part of the circumstances attending the traditional account of the defeat of Macbeth by Siward, Earl of Northumbria, in 1054.

Dunstable, town, South Bedfordshire district, county of Bedfordshire, England, on the northern slopes of the Chiltern Hills. Dunstable appears as a royal borough in the reign of Henry I (ruled 1100–35), who granted a charter to the Augustinian priory he had built. It once was known for its straw hat industry, but rapid modern growth has been centred on light engineering and motor vehicle industries. Nearby is an extensive cement works. Whipsnade Zoo, the country branch of the London Zoological Gardens, was opened in 1931; it occupies 500 acres (200 ha) on the Chiltern Hills near Dunstable. The London Gliding Club also has its headquarters nearby. Pop. (1981 prelim.) 30,912.

Dunstable, John (b. *c.* 1385, Eng.—d. Dec. 24, 1453, London), English composer who influenced the transition between late medieval and early Renaissance music. The influence of his sweet, sonorous music was recognized by his contemporaries on the Continent, including Martin le Franc, who wrote in his *Champion des dames* (*c.* 1440) that the leading composers of the day, Guillaume Dufay and Gilles Binchois, owed their superiority to what they learned from Dunstable's "English manner."

Information about Dunstable's life is scanty. He was in the service of the Duke of Bedford, who was regent of France from 1422 to 1435 and military opponent of Joan of Arc. Dunstable probably accompanied his patron to France; his music was well known on the Continent. His epitaph referred to him as skilled in mathematics and astronomy as well as in music.

Dunstable's influence on European music is seen in his flowing, gently asymmetrical rhythms and, above all, in his harmonies. He represents a culmination of the English tradition of full, sonorous harmonies based on the third and sixth that persisted through the 14th century alongside the starker, more dissonant style of continental music.

Dunstable left about 60 works, including mass sections, motets, and secular songs; they are largely in three parts. In the cantus firmus tenors of some of his mass sections he frequently used the continental device of isorhythm (rhythmic patterns overlapped with melodic patterns of different length). In many of his works the treble line, rather than the tenor line, dominates; it may be freely composed, or it may carry an ornamented version of the cantus firmus, an English innovation. Some of his motets show double structure: building the polyphonic composition on two melodies, a plainchant cantus firmus in the tenor and a melody in the treble that appears with variations. This structure, possibly invented by Dunstable, became popular with later composers.

Dunstan OF CANTERBURY, SAINT (b. 924, near Glastonbury, Eng.—d. May 19, 988, Canterbury; feast day May 19), English abbot, celebrated archbishop of Canterbury, and a chief adviser to the kings of Wessex, who is best known for the major monastic reforms that he effected.

Of noble birth, Dunstan was educated by Irish monks and visitors at Glastonbury. Later he entered first the household of his uncle, Archbishop Aethelhelm of Canterbury, and then the court of Athelstan, king of the English. Maliciously accused of practicing the black arts, he took refuge with his kinsman Aelfheah (Elphege), bishop of Winchester, who influenced him to become a monk and later ordained him.

Dunstan then lived as a hermit at Glastonbury, where he learned various crafts and music until Athelstan's successor, Edmund I, recalled Dunstan as one of his counsellors. About 943 Edmund made him abbot of Glastonbury, and under Dunstan the abbey became a famous school. Under Edmund's successor, Eadred, Dunstan became the chief minister of state, in which capacity he sought to establish royal authority, to conciliate the Danish section of the kingdom, to eradicate heathenism, and to reform clergy and laity.

On the accession in 955 of King Eadwig (Edwy), however, Dunstan's influence and office were temporarily eclipsed. He apparently quarrelled with Eadwig and was outlawed, be-

ing driven to Flanders. At the abbey of Blandinium he studied continental monasticism, which he used as a chief source in restructuring English monasticism when recalled by King Edgar in 957. In the same year, Edgar made him bishop of Worcester and London. In 959 Eadwig died, Edgar became sole king of the English, and Dunstan was appointed archbishop of Canterbury. During this period intellectual activity flourished, and Dunstan personally reformed and reestablished several celebrated monasteries and sponsored missionaries to Scandinavia.

On Edgar's death, in 975, Dunstan secured the crown for Edgar's elder son, later known as St. Edward the Martyr. When Edward was murdered (978) and was succeeded by Ethelred (Aethelred) II, Dunstan's public career abated, and he retired to Canterbury, where he taught at the cathedral school. Joseph Armitage Robinson's *Times of Saint Dunstan* appeared in 1923, followed by Eleanor Shipley Duckett's *Saint Dunstan of Canterbury* in 1955.

Dunster, parish, West Somerset district, county of Somerset, England. It lies at the edge of Exmoor National Park and 1½ miles (2.4 km) from Dunster Beach on the Bristol Channel. It is dominated by its hilltop castle, and remains of prehistoric Iron Age settlement have been discovered in the deer park. After the Norman Conquest (1066), the castle became the caput (administrative centre) of an honour (feudal administrative division) that included lands in the counties of Somerset, Dorset, Devon, and Wiltshire. The town was incorporated in the 12th century. A 16th-century octagonal building, the yarn market, lies in the main street. Dunster's main industry is tourism. Agriculture and forestry provide other employment. Pop. (1981) 807.

Dunster, Henry (baptized Nov. 26, 1609, Bury, Lancashire, Eng.—d. Feb. 27, 1659, Scituate, Massachusetts Bay Colony [now in Mass., U.S.]), American clergyman and first president of Harvard College.

He was educated at the University of Cambridge (B.A., 1631; M.A., 1634) and then taught school and served as curate of Bury. Dunster had a reputation as a learned man, and three weeks after his arrival in Massachusetts he was installed as president of Harvard (Aug. 27, 1640) in the town of Cambridge. The college was all but extinct, instruction having been given for one disastrous year (1638) and then suspended, so Dunster had to make a fresh beginning without students, faculty, buildings, income, curriculum, statutes, or charter. He proved to be an able teacher, administrator, and money raiser and gave to the college a form and character that was modeled on the English universities and that persisted at Harvard in all essential features until the 19th century.

In 1653 he scandalized the Massachusetts colony by adopting Baptist views and refusing to have his child baptized. In 1654 he was ejected from the presidency, brought to trial, sentenced to be publicly admonished, and put under bond to keep the peace. Although he had contributed generously out of his own limited means to the support of the college, there was delay in paying his back salary, and in the end he received only partial recompense. Removing to the more liberal atmosphere of Scituate, Mass., he continued to preach until his death.

Dunwich, parish, Suffolk Coastal district, county of Suffolk, England, on the North Sea coast. The first development on the site was probably a Romano-British community, and in Anglo-Saxon days it became the most important commercial centre in East Anglia. Early in the 7th century, when Sigebert became king of East Anglia, Dunwich was chosen as his capital, and a bishopric was founded before 650. The community received a charter from King John (reigned 1199–1216). Dunwich became a wealthy port, but severe coastal erosion caused its decline. In 1347 more than 400 houses were washed away in a storm, and similar disasters occurred in 1570. Until 1832, Dunwich returned two members to Parliament in spite of its small population. The corporation was abolished in 1886. Pop. (1981) 129.

duodenum, the first part of the small intestine, which receives partially digested food from the stomach and begins the absorption of nutrients. The duodenum is the shortest segment of the intestine and is about 9 to 11 inches (23 to 28 cm) long. It is roughly horseshoe-shaped, with the open end up and to the left, and it lies behind the liver. On anatomic and functional grounds, it can be divided into four segments: the superior, descending, horizontal, and ascending duodenum.

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

A liquid mixture of food and gastric secretions enters the superior duodenum from the pylorus of the stomach, triggering the release of pancreas-stimulating hormones from glands in the duodenal wall. Ducts from the pancreas and gallbladder enter at the descending duodenum, bringing bicarbonate to neutralize the acid in the gastric secretions, pancreatic enzymes to further digestion, and bile salts to emulsify fat. The mucous lining of the last two segments of the duodenum begins the absorption of nutrients, in particular iron and calcium, before the food contents enter the next part of the small intestine, the jejunum.

Its exposure to unneutralized stomach acid makes the duodenum, in particular the superior segment, especially susceptible to peptic ulcers, which are the most common health problem affecting this part of the intestine. The horizontal duodenum, because of its location between the liver, pancreas, and major blood vessels, can become severely compressed by these structures, requiring surgical release to eliminate painful duodenal dilatation, nausea, and vomiting.

Duolun (China): *see* To-lun.

Duonelaitis, Kristijonas: *see* Donelaitis, Kristijonas.

Duong, also spelled DUANG (b. 1796—d. Oct. 19, 1860, Oudong, Cambodia), king of Cambodia (now Kampuchea) by 1841, formally invested in 1848, the last Cambodian king to reign before the French-imposed protectorate.

Duong was the younger brother of King Chan II, who had ruled uncertainly in joint vassalage to Siam (Thailand) and Vietnam. Between 1841 and 1847 these two neighbours confronted each other in Cambodia in alternating periods of war and uneasy truce. With neither able to gain a decisive victory, they agreed to a dual hegemony over the Khmer state. By mutual agreement, Duong was crowned king at the new capital, Oudong (Ŏdŏngk), in 1848.

Duong's reign is idealized by modern Cambodians for the efforts he made to revitalize the state at a time when his more powerful neighbours were preoccupied with other concerns. To a considerable extent, however, his hopes were frustrated by the poverty of the state and by internal dissension. Duong showed his awareness of the outside world in his efforts to enlist assistance from Singapore to combat pirates operating along the Cambodian coast. Contrary to the repeated assertions of French authors writing in the colonial period, Duong did not seek the imposition of a French protectorate over his country. In the face of multiple problems he agreed to explore the possibility of some ill-defined relationship with France, but his death in 1860 came before any consideration to such an agreement had taken place. The French advance into Cambodia came in 1863 and 1864, after Duong's death, while his successor, Norodom, was on the throne.

Despite his own personal energy, Duong was at best able to preserve a shakily independent Cambodia. In the closing years of his reign there were already signs of dissension between his sons, and the kingdom was troubled by revolts by the Chams and the Malays living in the southeastern part of the state.

duoviri, also spelled DUUMVIRI, singular DUOVIR, or DUUMVIR, in ancient Rome, a magistracy of two men. *Duoviri perduellionis* were two judges, selected by the chief magistrate, who tried cases of crime against the state. *Duoviri navales,* at first appointed but later popularly elected (311–178 BC), had charge of a fleet. The two chief magistrates of the colonies and municipia (*i.e.,* communities under Roman domination) were often called *duoviri jure dicundo.*

Dupanloup, Félix-Antoine-Philibert (b. Jan. 3, 1802, Saint-Félix, Fr.—d. Oct. 11, 1878, Lacombe), Roman Catholic bishop of Orléans who was a clerical spokesman for the liberal wing of French Catholicism during the mid-19th century.

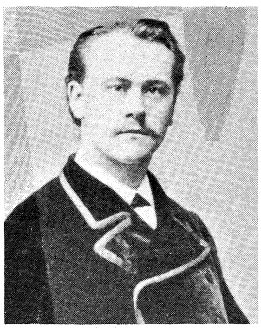
Dupanloup, engraving
J.E. Bulloz

Ordained priest in 1825, Dupanloup began his series of successful catechetical classes at the Parisian Church of the Madeleine. As director of the Parisian junior seminary of Saint-Nicolas-du-Chardonnet (1837–45), he attracted many lay students. He was prominent in the struggle for educational freedom under the July Monarchy and was an architect of the Falloux Law (1850), which gave legal status to independent secondary schools. While bishop of Orléans (consecrated 1849), and as a member of the French Academy (elected 1854), he helped reorganize the liberal Catholic journal *Le Correspondant.*

When papal temporal sovereignty was threatened by Emperor Napoleon III, Dupanloup defended it in a series of public letters (1860), but he supported Louis-Adolphe Thiers's refusal to reopen the issue after 1870. His explanation of Pope Pius IX's *Syllabus of Errors* under the terms thesis and hypothesis became famous. At the first Vatican Council (1869–70) he was one of the party that considered the definition of papal infallibility to be inopportune. His *Christian Marriage* and *The Studious Women* have been translated into English.

Duparc, (Marie-Eugène-)Henri, original name HENRI FOUQUES-DUPARC (b. Jan. 21, 1848, Paris—d. Feb. 12, 1933, Mont-de-Marsan, Fr.), French composer known for his original and lasting songs on poems of Charles Baudelaire, Leconte de Lisle, Théophile Gautier, and others.

Duparc studied with César Franck at the



Duparc
J.P. Ziolo

Jesuit College of Vaugirard. In 1869 he met Franz Liszt and Richard Wagner at Weimar and in 1870 published five songs (*Cinq Mélodies,* Opus 2). Two of them, "Soupir" and "Chanson triste," were later incorporated in his collection of songs, written between 1868 and 1884, including eight with orchestral accompaniment. In these songs, Duparc enlarged the French song into a *scena,* or operalike scene, and brought to it a poetic sense of musical prosody and a symphonic conception of form. In his youth Duparc wrote two orchestral works, *Aux Étoiles* (*To the Stars*) and *Lénore,* and a motet. He was also keenly interested in Russian literature, planning an opera, *Roussalka,* based on a narrative poem by Aleksandr Pushkin. About 1890 his creative faculties began to be undermined by doubts, and he thereafter produced little. In a spirit of severe self-criticism, he destroyed nearly all his subsequent works and sketches, together with his earlier unpublished manuscripts and the correspondence addressed to him by Wagner and contemporary poets. During the latter part of his life he was associated with two French Catholic writers, Francis Jammes and Paul Claudel, and composed the song "Testament" (1906–13), the text of which is a prose prayer.

Duperron, Jacques Davy (b. Nov. 25, 1556, Bern—d. Sept. 5, 1618, Paris), French cardinal, remembered especially for his part in the conversion of King Henry IV of France to Roman Catholicism.

The son of a Huguenot refugee from Saint-Lô, Normandy, who gave him an excellent humanist education, he returned to France in 1562 and was introduced to Henry III in 1576. He later abjured Protestantism, took holy orders, and, as a reader in Henry's service, developed a solid reputation as a Catholic churchman attached to the crown's interests.

After Henry's death in 1589, Duperron supported the claim of Charles, cardinal de Bourbon, but soon transferred his loyalty to Henry IV. As bishop of Évreux from 1591 he instructed the king in the Catholic religion, and Henry formally abjured his Calvinist faith in 1593. In 1594 Duperron was sent to Rome to obtain absolution for Henry from Pope Clement VIII, which was granted in 1595.

Duperron, detail from an engraving
By courtesy of the Bibliotheque Nationale, Paris

In 1600, at a conference at Fontainebleau, he eloquently defended the Catholic position against Protestants Philippe Duplessis-Mornay and Théodore-Agrippa d'Aubigné.

In 1604 Duperron was sent to Rome as chargé d'affaires and was made a cardinal. After Henry's death he served the regent, Marie de Médicis. During his life he published many philosophical and religious works as well as some dealing with diplomatic affairs. His collected works were published in 1622.

Dupin, Louis Ellies (b. June 17, 1657, Paris—d. June 6, 1719, Paris), French church historian whose history of Christian literature, *Nouvelle Bibliothèque des auteurs ecclésiastiques,* 58 vol. (1686–1704; "New Library of Ecclesiastical Writers"), broke with scholastic tradition by treating biography, literary and doctrinal criticism, and bibliography in one work and by writing in a modern language. The opinions he expressed in this work were strongly opposed by the renowned French historian and orator Jacques Bossuet and others. The work was censured by the archbishop of Paris in 1691, and, although Dupin retracted, it was suppressed in 1696.

An apologist for Gallicanism (the ecclesiastical doctrine advocating restriction of papal

Dupin, engraving
J.P. Ziolo

power), Dupin was exiled to Châtellerault, Fr., in 1713, charged with Jansenism (a heretical doctrine de-emphasizing the freedom of the will and teaching that redemption through Christ's death is limited to some) after he protested Pope Clement XI's anti-Jansenistic bull *Unigenitus.* He was freed by again retracting. His later years were spent on projects for the reunion of the Roman Catholic and Anglican churches. While visiting France in 1717, Tsar Peter I the Great commissioned Dupin to draft a plan for the reunion of the Eastern Orthodox and Roman churches. His works include a *Bibliothèque universelle des historiens,* 2 vol. (1707; "Universal Library of Historians"), and *L'Histoire de l'église en abrégé,* 4 vol. (1712; "A Brief History of the Church"). *Nouvelle Bibliothèque* was placed on the *Index of Forbidden Books* in 1757.

Dupleix, Joseph-François (b. 1697, Landrecies, Fr.—d. Nov. 10, 1763, Paris), colonial administrator and governor-general of the French territories in India who nearly realized his dream of establishing a French empire in India. Although he was an imaginative political visionary, he died in despair and comparative poverty.

His father, François, a director of the French East India Company, sent Dupleix on a voyage to India and America in 1715. His father's influence led to his appointment (1720) to the superior council of Pondicherry, the capital of French India. He was made superintendent of the French factory (trading station) in Chandernagore, Bengal, in 1731 and 11 years later was appointed governor-general of all French establishments in India. When fighting between France and Britain broke out in the War of the Austrian Succession in 1744, the

Dupleix, engraving by Marie Champion de Cernel after a portrait by Sergent
H. Roger-Viollet

French proposed neutrality in India, but this was rejected by the British. In 1746, with the help of a French fleet, Dupleix took Madras but failed to take the neighbouring British fort of St. David; he twice defeated armies sent to relieve Britain's ally, the nawab Anwār-ud-Dīn of the Carnatic (modern Karnataka state).

The Treaty of Aix-la-Chapelle ended the war in Europe in 1748 and restored Madras to the British, but Dupleix embarked on further schemes for French aggrandizement in India. Sensing the military weakness of the various contending princes in South India, he made local alliances with them that were aimed at ruining the British East India Company. He supported Chanda Sahib's claim to the nawabship of the Carnatic, and, when the British supported a rival candidate, a largely private war ensued (1751) between the two companies. Mostly as the result of the exploits of Dupleix's chief rival, the brilliant young British soldier Robert Clive, all the French forces except those in the Deccan were defeated. Dupleix's grand schemes continued toppling for two more years, and the French finances were exhausted in the struggle. In 1754 Dupleix was recalled to Paris, where he sued (unsuccessfully) the French East India Company for money he claimed he had spent on its account. Dupleix remained discredited in France and died in obscurity. He had displayed great talents as an organizer and diplomat, but he lacked military acumen and the ability to work with others.

Duplessis, Maurice (Le Noblet) (b. April 20, 1890, Trois-Rivières, Que., Can.—d. Sept. 7, 1959, Schefferville, Que.), Canadian politician who controlled Quebec's provincial government as its premier from 1936 until his death, except for the war years of 1940–44.

Educated at Laval University in Quebec, Duplessis was admitted to the bar in 1913 and made king's counsel in 1931. He practiced law in Trois-Rivières and was elected to the Quebec legislature in 1927 as a Conservative. By 1933 he was head of the provincial Conservative Party. Advocating French-Canadian autonomy, he led his followers into a new nationalist party, the Union Nationale, which won the 1936 election. He became premier and attorney general. After questioning Canadian policy before World War II, he lost office in the 1939 election but was reelected in 1944.

Although Duplessis had campaigned on an anticorruption, anti-big business platform, he quickly established a powerful political machine and made peace with the Canadian and U.S. interests he had denounced. By virtue of his commanding personality and his appeals to provincial interests, he and his Union Nationale swept the elections of 1948, 1952, and 1956. With his death, the Union Nationale went into rapid decline.

Duplessis-Mornay, Philippe: *see* Mornay, Philippe de.

Duplicate Bridge, also called TOURNAMENT BRIDGE, form of Contract Bridge played in all tournaments, in Bridge clubs, and often in the home; it is so called because each hand is played at least twice, although by different players, under the same conditions, with the same cards in each hand and the same dealer and vulnerability. Duplicate Bridge was designed to counter the major obstacle of Rubber Bridge—*i.e.,* that a run of good cards can nullify any difference between skillful and poor players. Since in Duplicate Bridge all players sitting in the same position will play the same cards throughout the course of a night, the object of play is not to amass the largest number of points, as in Rubber Bridge, but rather to bid and play the hands better than all the other pairs who play them; thus, it is immaterial whether one holds good or bad cards.

duplicating machine, a device for making duplicate copies from a master copy of printed, typed, drawn, or other material and utilizing various reproduction techniques to this end. The major types of duplicating machines are stencil (or mimeograph), hectograph, multilith (or offset lithograph), and imprinting (*qq.v.*). Regardless of the process used, all duplicating machines require the preparation of a master copy from which copies are made by a machine. Duplicating machines are thus differentiated from copying machines, in which copies are made from an original in an exposure-image-forming process.

Duport, Adrien (-Jean-François), Duport also spelled DU PORT (b. Feb. 5, 1759, Paris—d. Aug. 15, 1798, Appenzell, Switz.), French magistrate who was a leading constitutional monarchist during the early stages of the French Revolution of 1789.

A prominent member of the Parlement of Paris (one of the high courts of justice), Duport was elected for the nobility to the Estates-General of 1789. On June 25 he and 46 other representatives of the nobility joined the unprivileged Third Estate, which had already declared itself a revolutionary National Assembly. As one of the Assembly's most brilliant lawyers, Duport played a major role in creating the judicial machinery that supplanted the legal system of the ancien régime.

Nevertheless, by the spring of 1791, Duport and his two close associates, Antoine Barnave and Alexandre, comte de Lameth—the "triumvirate"—felt that further democratic reforms would endanger the monarchy and private property. They became secret advisers to King Louis XVI and formed the Club of the Feuillants with their royalist allies. Duport became president of the criminal court of Paris, but he fled to England—probably with the help of the democratic leader Georges Danton—soon after the fall of the monarchy on Aug. 10, 1792. He returned to France after the radical democrat Robespierre fell from power on 9 Thermidor (July 27, 1794). On the military coup d'état of 18 Fructidor, year V (Sept. 4, 1797), he fled to Switzerland.

Duport, Louis (-Antoine) (b. 1781/83, Paris—d. Oct. 19, 1853, Paris), French ballet dancer who refined classical technique, excelling particularly in multiple pirouettes and high, soaring leaps.

Duport was a child prodigy dancer and violinist. He danced in Paris from 1799 to 1806 and challenged Auguste Vestris's supremacy as leading male dancer at the Paris Académie (now Opéra). Duport danced in St. Petersburg (1808–12), where he was highly acclaimed for his performances in Charles Didelot's ballets, notably *Zéphyre et Flore.* He also danced in Vienna, Naples, and London, giving his last performance in 1830. Until 1836 he directed productions at the Kärntnerthor Theatre in Vienna, then retired to Paris with a great fortune.

Dupplin Moor, Battle of (Aug. 12, 1332), battle fought about 7 miles (11 km) southeast of Perth, Perthshire, a victory for Edward de Balliol, a claimant to the Scottish throne, over forces led by Donald, earl of Mar, regent for the young King David II. Secretly encouraged by King Edward III of England, Balliol and other knights who had been disinherited by David's father, Robert I the Bruce, landed at Kinghorn in Fifeshire, where they routed the local troops. They marched to Dunfermline and then northward and, reaching the River Eann, forded it on the night of August 11–12. Dawn revealed the main Scottish force arrayed in two divisions ready to attack. Greatly outnumbered, Balliol adopted tactics later copied by Edward III at the Battles of Halidon Hill (1333) and Crécy (1346); most of his men at arms dismounted, while archers were posted at either flank. When the first Scottish division charged, flights of arrows drove its flanks in upon its centre. The charge of the second division failed to renew the Scottish momentum, and their men trod one another underfoot, more dying by suffocation than by the sword. Pursuing the fugitives, Balliol's men entered Perth, and he was crowned king at Scone the next month. Although King David temporarily left the country, Balliol never received widespread recognition. In 1339 he lost Perth, and in 1356 he resigned his kingdom to Edward III.

Duprat, Antoine (b. Jan. 17, 1463, Issoire, Fr.—d. July 9, 1535, Nantouillet), chancellor of France and cardinal known for his service as one of Francis I's most trusted advisers.

Educated as a lawyer, Duprat began his government service as a judge in 1490 and served as attorney in the Parlement of Toulouse in 1495. Later he became a master of requests (in charge of petitions to the king) to Louis XII's household (1503) and a president—eventually premier—of the Parlement of Paris (supreme court). A favourite of Louise of Savoy, mother of the future Francis I, he was entrusted with Francis' education. On the latter's accession to the throne, Duprat became chancellor of France. In this capacity he negotiated the Concordat of Bologna, which gave the king the power to choose his own bishops (1516).

After the concordat was signed, Duprat took holy orders and was given the bishoprics of Valence and Die (1522), Albi (1528), and Meaux (1534) and the archbishopric of Sens (1525). He was made cardinal in 1527 and papal legate in France in 1530. A determined

Duprat, detail from a lithograph, 1527
H. Roger-Viollet—Harlingue

adversary of the Reformation, he influenced Francis considerably on that problem.

Dupré, Giovanni (b. March 1, 1817, Siena, Tuscany—d. Jan. 10, 1882, Florence), Italian sculptor whose success was due to his lifelike and original interpretation of form when Italian sculpture was deteriorating into a mannered imitation of the works of Antonio Canova.

Dupré was the son of a carver in wood. His first work of importance was "Abel" (1842; Pitti, Florence). The grand duchess Marie of Russia commissioned him to execute a statue of "Cain" (1844; Pitti), and the grand duchess of Tuscany commissioned one of "Giotto" (1845; arcades of the Uffizi, Florence). The mourning "Sappho" (1857) was his most notable work of this period. A visit in 1856 to Naples and Rome, where he admired Canova's monument to Pius VI, influenced him toward Neoclassicism. His monuments, *e.g.,* that of Cavour in Turin, suffer from the conflict between his temperamental naturalism and the necessities of allegory and ideal grandeur. Dupré also executed many portrait busts.

Dupré, Jules (b. April 5, 1811, Nantes, Fr.—d. Oct. 6, 1889, L'Isle-Adam), French artist who was one of the leaders of the Barbizon group of landscape painters.

The son of a porcelain manufacturer, Dupré started his career in his father's works, after which he painted porcelain at his uncle's china factory at Sèvres. He first exhibited paintings in 1831 and in 1834 was awarded a second-class medal at the Salon. Visiting England in the same year, he learned, from the landscapes of John Constable, how to express movement in nature. The districts of Southampton and Plymouth, with their wide expanses of water, sky, and ground, provided

"The Duck Pond," oil painting by Jules Dupré, *c.* 1846; in the Louvre, Paris
Lauros—Giraudon from Art Resource

his subjects. Late in life, he joined the artists' colony at Barbizon on the edge of the forest of Fontainebleau, where his style evolved, gaining in breadth, or largeness of treatment, and exhibiting greater simplicity in colour harmony.

Dupré, Marcel (b. May 3, 1886, Rouen, Fr.—d. May 30, 1971, Paris), foremost French organ virtuoso of his time, famed for his ability to improvise and influential as a teacher.

Dupré gave his first organ recital at age 10 and had his oratorio *Le Songe de Jacob* (*Jacob's Dream*) performed at 15. An organist at Saint-Sulpice and Notre-Dame, Paris, he gave (1920) a series of 10 recitals in which he played from memory the complete organ works of J.S. Bach. He toured as a virtuoso (U.S. debut, 1921), frequently improvising fugues and symphonies from themes suggested by musicians in the audience. His *Symphonie-Passion* and *Le Chemin de la croix* (*The Way of the Cross*) were first improvised in performance and later written down. His written compositions include a series of 76 chorales and a concerto for organ and orchestra. He also wrote several works on organ technique and improvisation. Dupré directed the American Conservatory at Fontainebleau, Fr. (1947–54), and the Paris Conservatoire (from 1954).

Dupré, Marie-Jules (b. Nov. 25, 1813, Albi, Fr.—d. Feb. 8, 1881, Paris), French naval officer who served as governor of French Cochinchina (southern Vietnam) in 1871–74. Despite official policy opposing imperialistic expansion, Dupré attempted to establish French dominance in Tonkin (northern Vietnam) with the hope of promoting trade and of finding a commercial route into China.

Dupré graduated from the naval school in 1831 as a midshipman; he attained the grade of lieutenant commander in 1847 and became a commander in 1854. He served in the Crimean War and took part in expeditions to Syria and Cochinchina in 1860. In 1864 he was named governor of Réunion. By 1867 he had attained the rank of rear admiral. In 1870 he commanded a naval blockade of ports in China and Japan, which the French were trying to keep closed to the Germans.

Dupré became governor of Cochinchina in April 1871. When a French trader, Jean Dupuis, became involved in a dispute with Vietnamese authorities as the result of efforts to use the Red River as a commercial route in 1873, Dupré seized the opportunity to extend French influence, disregarding the reluctance of the government in Paris. Instead of sending a diplomatic mission to Hanoi, he exceeded his authority and sent a small force under the command of Lieut. Comdr. Francis Garnier to Tonkin in response to Dupuis's appeal for help. After a brief period of success that included Garnier's capture of the Hanoi citadel, Dupré decided to seek some diplomatic agreement with the Vietnamese court rather than to rely on force. Before his envoy, Paul-Louis-Félix Philastre, had reached Hanoi, Garnier was killed. Dupré then disavowed his subordinates' actions.

After Garnier's death, Philastre negotiated a treaty by which the Vietnamese emperor, Tu Duc, agreed to recognize the French annexation, in 1867, of the three western provinces of Cochinchina and to open the northern centres of Hanoi, Haiphong, and Qui Nhon to foreign commerce. The treaty was ratified in 1874, but Tu Duc took advantage of continued anti-expansion feeling in France and ignored the treaty, and France failed to convey news of the treaty to China until the Chinese launched a bandit-suppression campaign in northwest Tonkin in 1877. When, by 1882, political attitudes in France had changed, the Vietnamese refusal to honour Philastre's treaty led to conflict, and in 1883–85 all of Vietnam passed under French rule.

Dupré's role in the affair of 1873, however, had led to his recall from Cochinchina in 1874. Though chiefly remembered for his attempt to expand into Tonkin, he had been an energetic administrator of the internal affairs of his domain. He had sponsored a public health program, planned realistic public education policy, and presided over the establishment of the Collège de Stagiaires (College of Probationers) in Saigon for the legal training of French administrative personnel. He also had supported Philastre's efforts to preserve the Vietnamese legal code.

After his return to France, Dupré was appointed a vice admiral and named maritime prefect of Rochefort, and later of Toulon, a position that he held until his retirement in 1878.

Duprez, Gilbert(-Louis) (b. Dec. 6, 1806, Paris—d. Sept. 23, 1896, Paris), French tenor, teacher of voice, and composer.

Duprez studied first with a violinist and then with the theorist Alexandre Étienne Choron at the Paris Conservatory. In 1825 he made his debut at the Odéon Theatre, Paris, as Almaviva in Gioacchino Rossini's *Il barbiere di Siviglia.* After limited success at the Odéon he went to Italy for further study and achieved considerable popularity, notably in Naples, where Gaetano Donizetti chose him for the role of Edgardo in the premiere of his *Lucia di Lammermoor* in 1835.

Duprez returned to France where, between 1837 and 1847, he was a leading member of the Paris Opéra and created such roles as Benvenuto Cellini in Hector Louis Berlioz' opera of the same name and Fernando in Donizetti's *La favorite.* He also sang in London and Germany before joining the Paris Conservatory, where he taught from 1842 to 1850. His success as a singing teacher led him in 1853 to found his own singing school. He composed six operas which were produced between 1826 and 1865 and at least two more that have remained unstaged and wrote several pedagogical and popular books, including *L'Art du chant* (1845), *Souvenirs d'un chanteur* (1880), and *Récréations de mon grand âge* (1888).

"De," "la," and similar components of a name, when followed by a space, are alphabetized as separate words (e.g., *De Forest, Lee*). *When they are joined to the following part of a name, the combination is treated as a single word* (e.g., *DeForest, John William*).

Dupuis, Jean (b. Dec. 8, 1829, Saint-Just-la-Pendue, Fr.—d. Nov. 28, 1912, Monte-Carlo), French adventurer, trader, and publicist who was associated with the unsuccessful effort to establish French influence in northern Vietnam in 1873.

Dupuis began his commercial career in Egypt in 1858 but in 1860 moved to China, where he established himself first in Shanghai and, a year later, in Hankow. Dupuis learned Chinese and developed good relations with local officials while running a moderately successful business selling military equipment. He later claimed that as early as 1864 he had begun a search for a river route to the southwestern Chinese province of Yunnan and concluded that the route would be provided by the Red River. The best evidence, however, suggests that Dupuis did not think of exploiting the Red River for commerce until a French expedition led by Ernest Doudart de Lagrée and Francis Garnier passed through Hankow in 1868. The group was returning from an ascent of the Mekong River into Yunnan, and its members pointed out to Dupuis that the Red River might be used for trade with that province.

In 1871 Dupuis travelled down the Red River from Yunnan into Vietnam. He planned to use the river for a large shipment of arms to his Chinese customers, the army of Ma Ju-lung, in K'un-ming, the capital of Yunnan, and he went to Paris to seek official assistance. Although the French authorities would not provide overt backing, they did approve Dupuis's purchase of cannon in France and were ready to give some help with transport.

In November 1872 Dupuis sailed from Hong Kong with a well-equipped force, determined to carry his goods up the Red River, though he had no permission to do so from the Vietnamese government. By threats and bribery he overcame Vietnamese opposition to his plans and delivered his cargo in Yunnan. Returning to Hanoi, he found his Vietnamese associates imprisoned and his ships and men prevented from further commercial ventures on the Red River. He appealed to Adm. Marie-Jules Dupré, the governor of French Cochinchina (southern Vietnam), for assistance.

Garnier, after serving in the Franco-German War, returned to the Far East; in November 1873 Dupré sent him with a small force of men to Hanoi. Garnier's official orders called on him to extricate Dupuis, but secret instructions given orally by Admiral Dupré apparently sanctioned aggressive action in northern Vietnam. With Dupuis's cooperation, Garnier attacked the Hanoi citadel and extended tenuous control over other parts of the Red River Delta. When Garnier was killed on December 21, Dupré, having risked open conflict with French governmental policy, disavowed Garnier's actions and refused to heed Dupuis's plea that a French force be maintained in northern Vietnam.

Dupuis was financially ruined by these events. He returned to France, where he became a tireless advocate of a French advance into northern Vietnam and of himself as the discoverer of the commercial possibilities of the Red River. Among the best known of his numerous publications were *Les Origines de la question du Tong-kin* (1896; "The Origins of the Tonkin Issue") and *Le Tonkin de 1872 à 1886: histoire et politique* (1910; "Tonkin from 1872 to 1886: History and Politics"). Despite his energy as an author and his earlier success in business, Dupuis faded into obscurity before his death in 1912.

Dupuit, Arsène-Jules-Étienne-Juvénal (b. May 18, 1804, Fossano, Piedmont, French Empire—d. Sept. 5, 1866, Paris), French engineer by training and profession, rising to be an inspector general of bridges and highways.

Through his professional work, Dupuit became interested in the economic problems associated with constructing public works and charging for their use. Deliberately disregarding the secondary effects of public works, he concentrated on the benefits to the users who were prepared to pay for their use and this led him to a number of steps which appear highly significant in the light of later developments in economics. He was one of the first to develop a demand curve and he pioneered the use of the concept of diminishing marginal utility. He was thus led to the concept of consumer surplus, *i.e.* the welfare enjoyed by a consumer in excess of the price paid. This concept would prove to be a major element in British economist Alfred Marshall's work, who would acknowledge his debt to Dupuit.

Dupuit is undoubtedly the founder of cost-benefit analysis of public works. He also analyzed price elasticity, leading to the invention of what has recently become known as the "Laffer curve" of tax yield at different rates of tax and to an analysis of monopoly discrimination.

Dupuy, Charles-Alexandre (b. Nov. 5, 1851, Le Puy, Fr.—d. July 23, 1923, Ille-sur-Têt), French political figure whose governments during the period of the Dreyfus affair failed to cope successfully with critical issues

arising from the political and social tensions that emerged during the long controversy.

A philosophy professor before his election to the Chamber of Deputies (1885) from the Haute-Loire *département,* Dupuy joined Jules

Charles-Alexandre Dupuy, engraving by Navellier, *c.* 1893

H. Roger-Viollet

Ferry's moderate republicans. He served as minister of education from December 1892 to April 1893; he then formed his own government in April 1893 but resigned at the end of November and on December 5 was elected president of the Chamber. During his first week of office the anarchist Auguste Vaillant threw a bomb at him, and Dupuy's calm words, "The debate continues, gentlemen," won him much credit. He became premier and minister of the interior in May 1894 and was by Pres. Sadi Carnot's side when the latter was assassinated at Lyon in June.

His Cabinet remained in office until January 1895, and it was under it that Capt. Alfred Dreyfus (*q.v.*) was arrested and, two months later, condemned (December 1894). In November 1898, and after the Dreyfus case had at last been remitted to the judgment of the Supreme Court of Appeal, Dupuy formed a government of republican concentration. A special law was passed that transferred the decision from the criminal section to the Court of Appeal sitting as a whole (*toutes chambres réunies*). The latter decided that there must be a new court-martial, for the *bordereau,* the document that had led to Dreyfus' court-martial, was the work of Maj. F.W. Esterhazy. This infuriated the anti-Dreyfusards, who staged demonstrations and insulted Pres. Émile Loubet at Auteuil. Dupuy resigned on June 12, 1899. From June 1900 until his death he was senator for Haute-Loire.

Dupuy, Pierre (b. Nov. 27, 1582, Agen, Fr.—d. Dec. 14, 1651, Paris), historian and librarian to King Louis XIV of France. He was first to catalog the royal archives (*Trésor des chartes*) and, with his brother Jacques, the king's library.

Pierre Dupuy, engraving by Robert Nanteuil

J.E. Bulloz

Little is known of Dupuy's life except that he travelled with his brothers all over France and amassed a collection of some 20,000 books and 1,200 manuscripts, many of great value, which they presented to the King in 1657. Dupuy's works, mostly documentations of legal problems, include *Traité des droits et libertés de l'Eglise gallicane* (1639; "Treatise on the Rights and Privileges of the Gallican Church") and books on the conflict (*c.* 1300) between Pope Boniface VIII and the French king Philip IV the Fair over the divine right of kings. Dupuy was also employed on the commission constituted to discover the legal titles of the king of France over the bishoprics of Metz, Toul, and Verdun, and a book on that subject (1655) is attributed to him.

Dupuytren, Guillaume, Baron (b. Oct. 5, 1777, Pierre-Buffière, near Limoges, Fr.—d. Feb. 8, 1835, Paris), French surgeon and pathologist best known for his description and development of surgical procedures for alleviating "Dupuytren's contracture" (1832), in which fibrosis of deep tissues of the palm

Dupuytren, lithograph by F.S. Delpech

Giraudon—Art Resource/EB Inc.

causes permanent retraction of one or more fingers.

In 1802 Dupuytren joined the staff of the Hôtel Dieu, which he attended for more than 30 years, becoming its surgeon in chief. He was surgeon to Louis XVIII, who created him a baron, and to Charles X.

Dupuytren was the first to excise the lower jaw (1812). He introduced a new classification of burns and provided the first clear description of the pathology of congenital dislocation of the hip (1826). He devised surgery for cancer of the uterine cervix and for the creation of an artificial anus (1828). Among his other triumphs were ligations of the subclavian artery (1812 and 1829), treatment of aneurysms by compression (1818), and surgical treatment of wry neck (1822).

Dupuytren's contracture, flexion deformity of the hands caused by thickening of the fascia, or fibrous connective tissue, of the palm. The proliferation of connective tissue causes the tendons of one or more fingers to shorten and tighten, leaving the finger permanently flexed. Disability may be as slight as inability to extend the ring finger completely or as severe as complete curling of the hand into a closed fist. The contracture does not affect neighbouring nerves and other structures. Dupuytren's contracture may be inherited or may occur as a symptom of scleroderma or rheumatoid arthritis. In some severe cases, incision and removal of some of the connective tissue may release the contracture.

Duque de Caxias, city, Rio de Janeiro state, southeastern Brazil, suburb of the city of Rio de Janeiro. Until 1931 it was known as Meriti Station and from 1931 to 1943 as Caxias; it became the seat of the district of Caxias in 1931 and seat of the municipality of Duque de Caxias in 1943. The Duquecaxiense Academy of Letters is located there. The duke for whom the city was named was Luis Alves de Lima e Silva, soldier and patron of the Brazilian army. It is a commercial and manufacturing centre, although the industries, including a large petroleum refinery, are located outside the city. Pop. (1980 prelim.) 306,057.

Duque de Estrada, Diego (b. Aug. 15, 1589, Toledo, Spain—d. after 1637, Sardinia), Spanish soldier and adventurer.

The son of a soldier of rank, he was left an orphan when very young and was educated by a cousin. While still young he was betrothed to his cousin's daughter. One night he found an intruder in the house, a gentleman with whom he was acquainted, and in a fit of jealousy killed both him and the young lady. The prevailing code of honour was considered a sufficient justification for Duque de Estrada's violence, but the law looked upon the act as an assassination, and he had to flee. After leading a vagabond life in the south of Spain, he was arrested at Ecija, was brought to Toledo, and was tortured with extreme ferocity in order to extort a general confession as to his life during the past months. He had the strength not to yield to pain and was finally able to escape from prison, partly by the help of a nun in a religious house which faced the prison, and partly by the intervention of friends.

He made his way to Naples, where he entered the service of the Duke of Osuna, at that time viceroy. Although Duque de Estrada saw much fighting with both the Turks and the Venetians, his most noteworthy act was his employment in the conspiracy against Venice. He was in the party of disguised Spanish soldiers who were sent by the viceroy into the town to destroy the arsenal and who were warned in time that the conspiracy had been betrayed, and therefore escaped. After the fall of his patron, Duque de Estrada resumed his vagabond life, serving in Transylvania and in the Thirty Years' War. In 1633 he entered the order of San Juan de Dios, and died at some time after 1637 in Sardinia, where he is known to have taken part in the defense of the island against an attack by the French. He left a book of memoirs, *Comentarios de el desengeñado de si Mismo prueba de todos estados, y eleccion del Mejor de ellos* ("The Commentaries of one who knew his own little worth, the touchstone of all the state of man, and the choice of the best").

Duquesne, Abraham, MARQUIS DU QUESNE (b. 1610, Dieppe, Fr.—d. Feb. 1/2, 1688, Paris), French naval officer during the administrations of Richelieu and Colbert who decisively defeated the combined fleets of Spain and Holland in 1676.

Duquesne served as a captain in the royal navy under two great commanders, Henri d'Escoubleau de Sourdis and Armand de Maille-Breze. From 1644 to 1647 he was an admiral in the service of the Swedish Queen Christina; later he returned to France and loyally supported the crown during the Fronde.

Early in the Dutch Wars (1672–78), Duquesne, a staunch Calvinist, was deprived of his command after being accused of reluctance to obey orders after the Battle of Solebay and for his refusal to renounce his Protestantism. Later in the war, however, Duquesne was chosen to help the Sicilian rebels against the Spaniards. He fought his way into Messina and took Agosta (Augusta) before returning to France for reinforcements and supplies. He then routed the combined Spanish and Dutch fleets in two engagements off Agosta and Palermo (April and June, 1676).

In 1681 Duquesne received the title of marquis. His Protestantism prevented his being made admiral, but, despite the revocation of the Edict of Nantes (1685), he was allowed to retire in peace.

Duquesnoy, François (b. 1597, Brussels—d. July 12, 1643, Livorno, Tuscany), Flemish-born Roman sculptor whose relatively restrained works reveal the influence of

"St. Susanna," marble statue by Duquesnoy, completed 1633; in the Church of Santa Maria di Loreto, Rome

Anderson—Alinari from Art Resource/EB Inc.

his close friend the painter Nicolas Poussin and helped to counter the influence of the more extravagantly emotional art prevailing in 17th-century Rome.

Duquesnoy was one of a family of sculptors and must have learned something of the art of Rubens while still in the family's Flemish workshop. He went to Rome in 1618 and during 10 years of obscurity was engaged in the restoration of classical sculpture. At the same time he also produced original small-scale works in bronze, ivory, and wood. In 1627–28 he worked with the dominant sculptor of the century, Gian Lorenzo Bernini, on the baldachin (altar canopy) for St. Peter's and in 1629 received commissions for his two outstanding monumental figures in marble. "St. Andrew," one of four colossal statues beneath the dome of St. Peter's, is in a restrained style still close to that of Bernini; but "St. Susanna," which was not completed until 1633 for the choir of Santa Maria di Loreto, Rome, shows a characteristic synthesis of the classical ideal and a sensitive study of nature. Much of Duquesnoy's output was in the form of small relief sculptures, illustrating mythological, bacchic, or religious themes. His rendering of *putti* on the altar (1642) in the Cappella Filomarina in Sant' Apostoli, Naples, was particularly renowned.

Dur-Kurigalzu, modern ʿAQARQŪF, fortified city and royal residence of the later Kassite kings, located near Babylon in southern Mesopotamia. This city was founded either by Kurigalzu I (flourished late 15th–early 14th century BC) or by Kurigalzu II (*c.* 1345–24). Between AD 1943 and 1945, Iraqi excavations unearthed a monumental ziggurat, three temples, and a palace with painted wall decorations and an ambulatory with square pillars. The temples, dedicated to Sumerian deities, housed numerous objects of value, including a life-sized statue of Kurigalzu II.

Dur Sharrukin (Akkadian: "Sargon's Fortress"), modern KHORSABAD, ancient Assyrian city located northeast of Nineveh, in Iraq. Built between 717 and 707 BC by the Assyrian king Sargon II (reigned 721–705), Dur Sharrukin exhibits careful town planning. The city measured about one mile square (2.59 square km); its outer walls were pierced by seven fortified gates. An inner wall enclosed a temple to Nabu (a god of vegetation and the patron of the art of writing), the royal palace, and the elaborate dwellings of important officials. Soon after the city was finished, however, Sargon was killed in battle, and Dur Sharrukin was quickly deserted.

Excavations at the site (the first archaeological excavations in Mesopotamia) were begun by the French consul Paul-Émile Botta in 1843 and were later continued (1858–65) by his successor, Victor Place, and by an American expedition (1928–35) from the University of Chicago. In addition to excellent wall reliefs, ivories, and monumental winged-bull statues

Winged bull with a human head, guardian figure from the gate of the Palace at Dur Sharrukin; in the Louvre

Cliche Musees Nationaux, Paris

uncovered at the site, one of the most valuable finds was the Assyrian King List, which recorded Assyrian kings from about 1700 BC to about the middle of the 11th century BC.

Dur Untashi (Iran): *see* Choga-Zambil.

Dura-Europus (ancient Syria): *see* Doura-Europus.

Duralumin, strong, hard, lightweight alloy of aluminum, widely used in aircraft construction, discovered and patented in 1910 by Alfred Wilm, a German metallurgist; it was originally made only at Düren in Germany. The original composition has been varied for particular applications; it may contain about 3 or 4 percent copper, ½ to 1 percent manganese, ½ to 1½ percent magnesium, and, in some formulations, some silicon. After heat treatment and aging, these alloys are comparable to soft steel in strength and hardness.

Duralumin alloys are relatively soft, ductile, and workable in the normal state; they may be rolled, forged, extruded, or drawn into a variety of shapes and products. Their light weight and consequent high strength per unit weight compared to steel suit them for aircraft construction. Because Duralumin loses strength in welding, a special laminated sheet form called alclad is used for aircraft construction; it has thin surface layers of pure aluminum or a corrosion-resistant aluminum alloy covering the strong Duralumin core.

duramen (botany): *see* heartwood.

Durán, Agustín (b. Oct. 14, 1793, Madrid—d. Dec 1, 1862, Madrid), Spanish literary critic, bibliographer, librarian, writer, and editor who was one of the major opponents of neoclassicism and a major theoretician of Spanish Romanticism. Perhaps Durán's best-known piece of criticism was his academy speech, *Sobre el influjo que ha tenido la crítica moderna en la decadencia del teatro antiguo español* (1828), in which he claimed that Spanish medieval and classical drama was more poetic and so otherwise unlike the classical drama of Greece and France as to demand appreciation by different rules. Between 1828 and 1832 Durán compiled and edited two collection of ballads, *Colección de romances antiguos* and *Colección de romances castellanas anteriores al siglo XVIII* (better known as *Romancero general*, or *Romancero de Durán*). In 1834 he became director of the National Library. He also was at least partly responsible for reviving the work of the Spanish dramatists Tirso de Molina and Lope de Vega.

Duran, Profiat, Hebrew name ISAAC BEN MOSES HA-LEVI, pseudonym EFOD, or EFODI (b. *c.* 1350—d. *c.* 1415), Jewish philosopher and linguist, the author of a devastating satire on medieval Christianity and of a notable work on Hebrew grammar.

Duran, the descendant of a scholarly Jewish family of southern France, may have been born at Perpignan. He was educated in Germany and then took a position as tutor with a wealthy family in Catalonia. There, in 1391, in a wave of Spanish religious persecution, he was compelled to profess Roman Catholicism. Like many other ostensibly converted Spanish Jews, he continued his own religious observances in secret, and, after leaving Spain, he openly resumed the practice of Judaism.

Earlier, however, he had planned to travel to Palestine with another forcibly converted Spanish Jew, but the journey was abandoned when Duran received a letter from his fellow convert indicating his desire to remain a Roman Catholic and urging Duran also to remain true to Christianity. Duran's response, the celebrated letter *ʿAl tehi ka-ʾavotekha* ("Be Not Like Thy Fathers"), portrayed with subtle irony what he saw as the irrationality of Christian doctrine and summarized with feigned naiveté the worst abuses of the contemporary church. So artful was the satire that the epistle, widely circulated in Spain, was initially greeted by Christians as a defense of their religion. Once its true nature was understood, copies of the work were publicly burned. (It was later published at Constantinople in 1554).

In conjunction with the letter, Duran also wrote an anti-Christian polemic, *Kelimat ha-Goyim* ("Shame of the Gentiles"), in about 1397, which discredited the Gospels and other early Christian writings, attacking them in historicocritical terms.

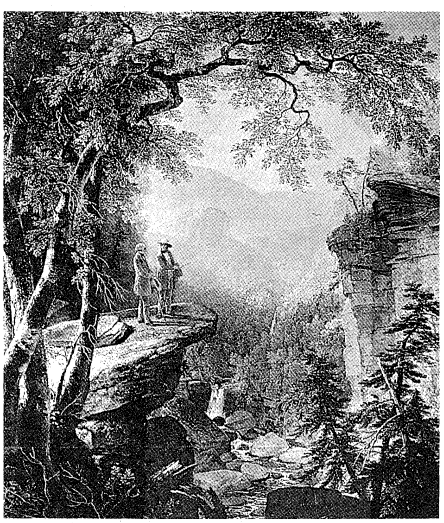
Duran's lasting reputation is based not so much on his polemical writings as on his Hebrew grammar, *Maʾaseh Efod* (1403), a work of the highest scholarship. His other written works include a history of Jewish martyrs, some exegeses, and a treatise on astronomy.

Duran, Simeon ben Zemah, also called (by acronym) RASHBAZ (b. 1361, Majorca, Balearic Islands [now part of Spain]—d. 1444, Algiers [Algeria]), first Spanish Jewish rabbi to be paid a regular salary by the community and author of an important commentary on *Avot* ("Fathers"), a popular ethical tractate in the Talmud, the rabbinical compendium of law, lore, and commentary. Before the 14th century, the rabbinical post had been almost invariably honorary; Duran set a precedent in accepting a salary. His commentary *Magen Avot* ("The Shield of the Fathers"), which influenced the great medieval Jewish philosopher Joseph Albo, is important for reducing the Thirteen Articles of Faith of Moses Maimonides (1135–1204) to three essential dogmas: the existence of God, the divine origin of Jewish law, and the reality of divine reward and retribution.

Durance, Latin DRUENTIA, principal river draining the French side of the Alps toward the Mediterranean. From its origin in the Montgenèvre region, Hautes-Alpes *département,* to its confluence with the Rhône below Avignon, it is 189 mi (304 km) long. The Clairée and Guisane rivers, both of which are longer and more powerful streams than the Durance, join it above and in Briançon, through which it flows as a torrent. Receiving other tributaries, it passes through spectacular gorges and a stony valley to skirt Embrun. There it is tamed by the Serre-Ponçon Dam, 16 mi downstream, which has formed a lake covering 10.5 sq mi (27 sq km) in the valleys of the Durance and of the converging Ubaye River.

After entering the Alpes-de-Haute-Provence *département,* it is joined by the wild Buech torrent above Sisteron. Dammed again below the town, it forms another artificial lake above the Château-Arnoux Dam, after which it is joined by the Bléone and the Asse rivers. After receiving the Vernon River, the Durance turns west along the departmental border of Bouches-du-Rhône and Vaucluse to join the Rhône River. Several other large dams were constructed on the lower Durance and its tributaries, and extensive hydroelectric-power and irrigation-water supply projects were established after World War II.

Durand, Asher B(rown) (b. Aug. 21, 1796, Jefferson Village, N.J., U.S.—d. Sept. 17, 1886, Jefferson Village), U.S. painter, engraver, and illustrator, one of the founders of the Hudson River school (*q.v.*) of landscape painting.



"Kindred Spirits," oil painting by Asher B. Durand, 1849; in the New York Public Library

By courtesy of the New York Public Library, Astor, Lenox and Tilden Foundations

He was apprenticed in 1812 to an engraver; by 1823 his reputation was established with his engraving of John Trumbull's painting "Declaration of Independence." For the next decade he continued to do engraved reproductions of paintings by American artists (*e.g.,* "Ariadne" by John Vanderlyn). He also illustrated gift books, or annuals, and engraved a popular series of 72 portraits of famous contemporary Americans.

With his brother Cyrus Durand (1787–1868), he formed a partnership for a banknote engraving company. Cyrus invented machines for the mechanical drawing of lines that revolutionized the art of currency engraving, while Asher's graphic work for the Federal Bureau of Printing and Engraving was influential in establishing the design tradition and many of the pictorial and ornamental devices for U.S. paper currency.

After 1835 he devoted himself chiefly to portraiture, painting several U.S. presidents and other Americans of political and social prominence. In 1840–41 he visited Europe to study the work of the old masters. After his return, he painted Romantic landscapes of the Hudson River area, the Adirondack Mountains, and New England in a precise style. He was among the earliest Americans to work from nature out-of-doors. His best known work, "Kindred Spirits" (1849; New York Public Library), shows two of his friends, landscape painter Thomas Cole and poet William Cullen Bryant, in a minutely realistic Catskill forest setting.

Durand was one of the founders of the National Academy of Design (1826) and was its president, 1845–61.

Durand, Guillaume, also called WILLIAM DURANDUS, OR DURANTI (b. *c.* 1230, Puymisson, Fr.—d. Nov. 1, 1296, Rome), French prelate who was a renowned canonist and medieval liturgist.

After receiving a doctorate in canon law at Bologna, Italy, Durand taught briefly there and later at Modena, Italy. Some time after 1260 he was appointed auditor (a judge commissioned to hear cases of appeal brought to the Holy See). At the second Council of Lyon (1274), he helped draft the statutes proclaimed in council by Pope Gregory X. In 1278, when Bologna and the Romagna were incorporated into the Papal States, Durand was one of the first group of commissioners sent there; subsequently he held various posts in the ecclesiastical and temporal administrations of the new province, becoming its governor general in 1283. He was consecrated (1286) bishop of Mende, in southern France, but did not take possession of his see until 1291.

Durand's fame as a writer rests chiefly on his *Speculum iudiciale* (first published 1271–76, revised and reissued *c.* 1289–91), an encyclopaedic treatise of canon law (and, to some extent, civil law) from the viewpoint of court procedure. The book remains valuable for its information on the judicial practice of the medieval church courts, especially of the Roman curia. Of his liturgical works, the *Rationale divinorum officiorum* (*c.* 1285–91), a general treatise on the liturgy and its symbolism, is considered one of the most important medieval books on divine worship. The *Speculum* was printed at least 39 times between 1473 and 1678, and the *Rationale* even more.

Durand Line, boundary established in the Hindu Kush in 1893 running through the tribal lands between Afghanistan and British India, marking their respective spheres of influence; in modern times it has marked the border between Afghanistan and Pakistan. The acceptance of this line—which was named for Sir Mortimer Durand, who induced ʿAbdor Raḥmān Khān, amir of Afghanistan, to agree to a boundary—may be said to have settled the Indo-Afghan frontier problem for the rest of the British period.

After the British conquered the Punjab in 1849, they took over the ill-defined Sikh frontier to the west of the Indus River, leaving a belt of territory between them and the Afghans that was inhabited by various Pashtun tribes. Questions of administration and defense made this area a problem. Some of the British, members of the so-called stationary school, wanted to retire to the Indus; others, of the forward school, wanted to advance to a line from Kābul through Ghaznī to Qandahār (Kandahār). The Second Anglo-Afghan War (1878–80) discredited the forward advocates, and the tribal area was divided into roughly equal spheres of influence. The British established their authority by indirect rule up to the Durand Line, at the cost of a number of tribal wars; the Afghans left their side untouched. In the mid-20th century the area on both sides of the line became the subject of a movement for Pashtun independence and establishment of an independent state of Pakhtunistan. In 1980 approximately 7.5 million Pashtuns were living in the area around the Durand Line.

Durand-Ruel, Paul (b. 1831, Paris—d. Feb. 5, 1922, Paris), French art dealer who was an early champion of the Barbizon artists and the Impressionists.

Durand-Ruel began his career in his father's art gallery, which he inherited in 1865. At the outset he concentrated on buying the work of the Barbizon artist—particularly Corot, Daubigny, and Dupré—and for many years was the only dealer to do so. In 1848 he bought every painting by Théodore Rousseau that he could locate; he was unable to sell a single one of them for the next 20 years. He also advanced money to Jean-François Millet, providing his sole support for many years.

In the early 1870s Durand-Ruel met Monet and Pisarro. Though they and the other Impressionists had been denounced by the art establishment and shunned by the buying public, Durand-Ruel courageously bought their work and that of Renoir, Degas, Sisley, Manet, and Puvis de Chavannes as well.

In 1886 Durand-Ruel went to New York City to exhibit the works of his painters at the National Academy of Design. The show was so well received that he established a branch of Durand-Ruel in New York City the following year. As a result of his persistence and foresight he gained a reputation as the principal agent for the success of the Impressionist painters.

Durandus OF SAINT-POURÇAIN, French DURAND DE SAINT-POURÇAIN (b. *c.* 1270, Saint-Pourçain, Auvergne—d. Sept. 10, 1334, Meaux, Fr.), French bishop, theologian, and philosopher known primarily for his opposition to the ideas of St. Thomas Aquinas.

Durandus entered the Dominican order and studied at Paris, where he obtained his doctorate in 1313. Shortly afterward Pope Clement V summoned him to Avignon as a lecturer in theology. He became successively bishop of Limoux (1317), of Le Puy (1318), and of Meaux (1326). His attack on the teachings of Aquinas came at a time when Aquinas already was accepted as the official theological doctor of the Dominican order. Durandus taught that a philosopher should prefer the conclusions of his own reason to any authority except in articles of faith; the acceptance of truths of faith, on the other hand, did not depend on reason at all. This separation of reason and faith undermined the position of Scholastic philosophy generally, because much of it represented an attempt to bolster articles of faith by speculative reasoning.

In some of his differences with Aquinas, Durandus took a position similar to Nominalism (the view that only individual things exist and not universal classes such as man, tree, animal, etc.). This approach had theological implications that sometimes brought on Durandus the censure of church authorities. His major works are a commentary, published posthumously in 1508, on the *Sentences* of the 12th-century Italian theologian Peter Lombard and *De origine potestatum et iurisdictionum* (1506; "On the Origins of Powers and Jurisdictions"), written in 1328 to support Pope John XXII in his jurisdictional dispute with King Philip VI of France.

Durandus, William: *see* Durand, Guillaume.

Durang, John (b. Jan. 6, 1768, York, Pa.—d. 1822, Philadelphia), the first U.S.-born professional dancer of note, who was best known for his hornpipe dance. In 1784, when Durang was 17 years old, he made his debut as a performer in Lewis Hallam's "lecture" and patriotic extravaganza. Plays and dances were banned by law at that time, and the

euphemism lecture was used for such events. Thus began Durang's dance career, and although he did study ballet with visiting European dancers, he was not a trained classical dancer.

The French acrobat and violinist Alexander Placide was influential in Durang's career. Placide's versatility was reflected in the many talents of Durang as acrobat, actor, juggler, writer, director, and stage manager. Another Frenchman, Jean-Baptiste Francisqui, who was the director of the Old American Company, also influenced Durang. Durang danced in his company, often with the ballerina Mme Anna Gardie from Santo Domingo. Francisqui's productions were Durang's inspiration for the ballets and pageants that he created in his later years.

Durango, state, north central Mexico. It is bounded by the states of Chihuahua (north), Coahuila and Zacatecas (east), Jalisco and Nayarit (south), and Sinaloa (west). The western portion of the state's 47,560 sq mi (123,181 sq km) of territory lies within the mineral-laden Sierra Madre Occidental; semiarid plains, used for ranching, comprise the eastern portion. Coursing eastward from the Sierra Madre, the Río Nazas, the largest river in the state, flows for approximately 375 mi (600 km); when swollen by spring rains, it is the main source of water for commercial crops of cotton, wheat, corn (maize), tobacco, sugarcane, vegetables, and fruits. Along its lower course is the Laguna cotton district, a large state-operated cooperative enterprise that Durango city, shares with Coahuila.

The state is rich in mineral resources. Although mining has been carried on for years, the deposits of silver, gold, sulfur, tin, coal, mercury, antimony, copper, and other minerals have been only partially exploited. Cerro del Mercado, a hill (700 ft [210 m] high) of nearly pure hematite iron ore 2 mi from Durango city, the state capital, supplies the local mills. The Caldelaria silver mine, near San Dimas, has long been famous for its output. Other mining districts are Mapimí, Cuencamé, Nombre de Dios, Papasquiaro, and San Juan del Río. An inadequate internal transportation network has hindered the exploitation of the mineral resources.

First explored by Europeans in 1562–63, Durango shared the colonial history of Chihuahua as a major part of Nueva Vizcaya; the two became sovereign and separate states in 1823. In their frontier areas, they were subject to Indian uprisings until late in the 19th century.

Railroads of the National Railways of Mexico traverse the state northeast to southwest, and another line crosses its eastern section. Durango is also crossed by two branches of the Pan-American Highway and has air routes. Pop. (1984 est.) 1,295,000.

Durango, in full DURANGO DE VICTORIA, city, capital of Durango state, north central Mexico. It lies in a fertile valley of the Sierra Madre, 6,197 ft (1,889 m) above sea level. North of the city is the Cerro del Mercado, a hill of nearly pure iron ore representing one of the world's largest deposits.

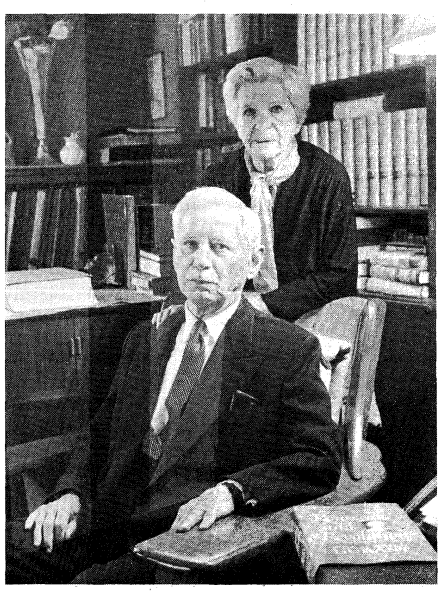
Although first settled in 1556, it was not officially founded until 1563. It was the political and ecclesiastical capital of Nueva Vizcaya, which included Durango and Chihuahua until 1823. The city, long known as a health resort, especially for the thermal springs nearby, is an important commercial and mining centre, with diversified local industries that include cotton and wool mills, glassworks, iron foundries, flour mills, sugar refineries, and tobacco factories. The Juárez University of Durango (1957) is located in the city, and because General Guadalupe Victoria International Airport is nearby, Durango is easily accessible by air as well as by highway and railroad. Pop. (1980) 257,915.

Durango, city, seat (1881) of La Plata County, southwestern Colorado, U.S., on the Animas River in the foothills of the La Plata Mountains at an altitude of 6,505 ft (1,983 m). Founded in 1880 during a mining boom by the Denver and Rio Grande Western Railroad, it was incorporated in 1881 and named for Durango, Mex. It developed as a shipping point for farm produce (including livestock) and local natural resources (timber, coal, oil and gas, gold, silver, lead, uranium, vanadium). The city is also a tourist centre and the headquarters of the San Juan National Forest. The Durango–Silverton narrow-gauge railway (1882; now used for sight-seeing), Mesa Verde National Park, the Southern Ute Tourist Centre, and Purgatory Ski Area are local features of interest. Durango is the seat of Fort Lewis College (1911) and has some light manufacturing. Pop. (1982 est.) 12,389.

Durānī (Afghan history): *see* Durrānī.

Durant, city, seat (1907) of Bryan County, southern Oklahoma, U.S., in the Red River Valley, a few miles north of the Texas border. Settled *c.* 1870 and named for a well-known Choctaw family, its growth was assured after the arrival of the Missouri–Kansas–Texas Railroad in 1872. It developed as a service centre for a diversified farming area, and in 1909 Southeastern State College (now Southeastern Oklahoma State University) was established there. Its economy has been sustained by oil, gas, and industry (including peanut and cotton processing and the manufacture of utility truck bodies, clothing, and cement blocks). With the completion of Lake Texoma, impounded on the Red River by Denison Dam (1943), 14 mi (22 km) west, Durant has also become the focus of a recreation area. Ft. Washita, on the east side of the lake (1843), was used as a Confederate military post during the Civil War. Pop. (1982 est.) 12,282.

Durant, Will and Ariel, in full respectively WILLIAM JAMES DURANT and ARIEL DURANT, *née* ADA, or IDA, KAUFMAN (respectively b. Nov. 5, 1885, North Adams, Mass., U.S.—d. Nov. 7, 1981, Los Angeles; b. May 10, 1898, Prosurov, Russia—d. Oct. 25, 1981, Los Angeles), American husband-and-wife writing collaborators whose *Story of Civilization,* 11 vol. (1935–75), established them among the best known writers of popular philosophy and history.



Will and Ariel Durant
AP/Wide World Photos

Will Durant's writing career began with the publication of *Philosophy and the Social Problem* (1917). His second book, *The Story of Philosophy* (1926), sold more than 2,000,000 copies in less than three decades and was translated into several languages. The following year his only novel, *Transition,* appeared. It is largely an autobiographical account of his own early social, religious, and political disillusionments. In 1970 Durant published *Interpretations of Life: A Survey of Contemporary Literature.* This work, an expansion of the notes of a lifetime of reading modern literature, is informal and anecdotal and is aimed at the general reader.

In 1913, while teaching at the Ferrer Modern School in New York City, Durant married one of his pupils, Ada (or Ida) Kaufman, whom he called Ariel; she later adopted the name legally. Though she had been involved in the writing of every volume of *The Story of Civilization,* Ariel Durant was not given formal recognition as Will Durant's collaborator until 1961, with publication of the seventh volume, *The Age of Reason Begins.* She continued as coauthor with her husband of the subsequent volumes in the series, including the Pulitzer Prize-winning 10th volume, *Rousseau and Revolution* (1967). They described their work together in *A Dual Autobiography* (1977).

Durant, William Crapo (b. Dec. 8, 1861, Boston—d. March 18, 1947, New York City), American industrialist and founder of General Motors Corporation, which later became one of the largest corporations in the world in terms of sales.

After establishing a carriage company in Michigan in 1886, Durant took over a small firm in 1903 and began to manufacture Buick motorcars. He brought together several automotive manufacturers to form the General Motors Company in 1908, but financial problems cost him control of the company in 1910. With Louis Chevrolet, however, he established the Chevrolet Motor Company, which acquired control of General Motors in 1915. From that base, Durant, as president, created the General Motors Corporation and launched a successful expansion program. Post-World War I difficulties again forced him out of General Motors in 1920, and he formed a new firm, Durant Motors, Inc., in 1921. This and later ventures, some of which were large, were generally unsuccessful.

Durante, Francesco (b. March 31, 1684, Naples—d. Aug. 13, 1755, Naples), Italian composer of religious and instrumental music who was especially known for his teaching.

Durante studied in Rome and probably in Naples and in 1710 taught at the San Onofrio Conservatory. He was chapelmaster at the Conservatorio dei Poveri in Naples (1728–39) and from 1742 taught at the Santa Maria di Loreto Conservatory. In 1745 he succeeded L. Leo as principal teacher at San Onofrio. There was much rivalry between Leo's students and his own pupils, among whom were many outstanding composers of the Neapolitan school of 18th-century opera: Jommelli,

Durante, engraving by Henrik van Winter
J.P. Ziolo

Piccinni, Pergolesi, Paisiello, Traetta, Vinci, and others. His compositions include motets, masses, oratorios, and a setting of the Lamentations of Jeremiah, as well as harpsichord pieces and music for strings.

Durante, Jimmy, byname of JAMES FRANCIS DURANTE, byname SCHNOZZOLA, or THE SCHNOZ (b. Feb. 10, 1893, New York City—d. Jan. 29, 1980, Santa Monica, Calif., U.S.), U.S. comedian whose career in every major entertainment performance medium spanned more than six decades.

As a boy, Durante wanted to become a saloon pianist. His father, a barber, bought him a piano and provided intermittent lessons. Although Durante left school in seventh grade for a miscellany of jobs, he kept up his piano study, and when he was 17 he realized his dream by playing the piano at Diamond Tony's Saloon in Brooklyn's Coney Island.

With the vaudevillians Eddie Jackson and Lou Clayton, he opened the Club Durant in New York in 1923. The partners performed there and in other clubs throughout the 1920s. Durante had roles in such Broadway productions as *Show Girl* and *The New Yorkers* and in the movie *Roadhouse Nights* (1929). He starred in several radio programs, including "The Jimmy Durante Show" and "The Camel Comedy Caravan." His closing line, "Good night, Mrs. Calabash, wherever you are!" became as famous as his felt hat, cane, and his persistent malapropisms and mispronunciations, and the line was used to close his various television shows, "The Four-Star Revue," "The All-Star Revue," and "The Jimmy Durante Show" (1954–1957). His outsize nose became his trademark.

His Broadway career included a role in *Jumbo*, a circus extravaganza; in 1962 he had a role in the film version of *Jumbo*. The following year he acted in the film *It's a Mad, Mad, Mad, Mad World.*

Duranti, William: *see* Durand, Guillaume.

Durão, José de Santa Rita (b. 1722?, Cata Prêta, Braz.—d. Jan. 24, 1784, Lisbon), Brazilian epic poet, best known for his long poem *Caramúru,* in which his use of the Indian as a literary character constituted his major contribution.

After an education at the Jesuit college in Rio de Janeiro, Durão obtained the degree of doctor of theology (1756) at the University of Coimbra, Portugal. Two years later he entered the Gratian convent of the Order of St. Augustine, where he offended his superiors by his openly expressed regard for the Jesuits, who had been expelled from Portugal and Brazil in 1759. He was forced in consequence to leave the country, and after detention in Spain as a spy (1762–63) he went to Rome, where he acted as a papal librarian and associated with the Roman literati. In 1778 he returned to Portugal as professor of theology at Coimbra but soon retired to the Gratian convent and became its prior.

In 1781 he published in Lisbon his epic *Caramúru: Poema Épico do Descubrimento da Bahia* ("Caramúru: Epic Poem of the Discovery of Bahia"), a poetic treatment in 10 cantos, frankly fictitious, of the discovery of Bahia (northeastern Brazil) by Diego Alvares. Caramúru (Dragon of the Sea) is the name bestowed on Diego Alvares by cannibals. The poem is notable for its descriptions of South American scenery and Indian life and the love it expresses for Brazil. Embittered by its failure to win immediate recognition, Durão burned most of his other works.

Duras, Marguerite, pseudonym of MARGUERITE DONNADIEU (b. April 4, 1914, Gia Dinh, Cochinchina), French novelist, screenwriter, scenarist, playwright, and film director, internationally known for her film plays of *Hiroshima mon amour* (1959) and *India Song* (book 1974, screenplay 1975).

Duras spent most of her childhood in Indochina, but at the age of 17 she moved to France to study at the University of Paris, Sorbonne, from which she received *licences* in law and politics. She favoured leftist causes and for 10 years was a member of the Communist Party. She began writing in 1942. *Un Barrage contre le Pacifique* (1950; *The Sea Wall,* 1952), her third published novel and first success, dealt semi-autobiographically with a poor French family in Indochina. It reflected the novels of "poor whites" by Erskine Caldwell and John Steinbeck, then popular in France. Her next successes, *Le Marin de Gibraltar* (1952; *The Sailor from Gibraltar,* 1966) and *Moderato Cantabile* (1958; Eng. trans. 1960), were more lyrical and complex and more given to dialogue. This splendid instinct for dialogue led her to produce the original screen scenario for Alain Resnais's critically acclaimed film *Hiroshima mon amour,* about a brief love affair in postwar Hiroshima between a Japanese businessman and a French actress. In the following decades she wrote several screenplays, some of them adaptations of her own novels and short stories.

Duras turned regularly to a more abstract and synthetic mode, with fewer characters, less plot and narrative, and fewer of the other elements of traditional fiction; her name was even associated with the *nouveau roman* ("new novel") movement, though she, as well as her critics, denied such a connection. Among her major novels are *L'Après-midi de Monsieur Andesmas* (1962; *The Afternoon of Monsieur Andesmas,* 1965), *Le Ravissement de Lol V. Stein* (1964; *The Rapture of Lol V. Stein,* 1967), *Detruire, dit-elle* (1969; *Destroy, She Said,* 1970), *L'Amour* (1972; "Love"), and *L'Été 80* (1980; "Summer 80"). Collections of her plays are included in *Theâtre I* (1965) and *Theâtre II* (1968). *India Song,* a play made into a beautifully photographed and edited film, directed as well as written by Duras, offers a static, moody portrayal of the wife of the French ambassador in Calcutta and her several lovers.

Durazno, department, central Uruguay, bounded on the north by the Río Negro reservoir. Much of the department's area of 4,495 sq mi (11,643 sq km) is covered with rolling hills, culminating in the Cuchilla (hills) Grande del Durazno, which cross Durazno east–west. As in much of Uruguay, the principal economic activity in Durazno is livestock raising (cattle and sheep); corn (maize), wheat, and other grains are also cultivated. Minerals in the department include iron ore, uranium, marble, and gravel. The railroad and highway linking Montevideo and Rivera pass through the capital, Durazno (*q.v.*). Pop. (1975) 55,-699.

Durazno, in full SAN PEDRO DE DURAZNO, capital of Durazno department, central Uruguay, on the Río Yi. Long part of an unclaimed area between Spanish and Portuguese territories, Durazno was not formally founded until 1821, when José Fructuoso Rivera established a settlement called San Pedro de Durazno, a name concocted from Dom Pedro de Alcântara, prince regent of Brazil, and *durazno* ("peach tree"), for the local fruit trees. During the fight for Uruguayan independence, Durazno was a republican headquarters.

A processing and trade centre for the cattle industry, the city has a livestock agricultural school, meat-packing plants, dairies, grain mills, and a cement factory. Pop. (1975 prelim.) 25,811.

Durazzo (Albania): *see* Durrës.

Durban, formerly PORT NATAL, largest city of Natal, South Africa, and chief seaport of South Africa, located on Natal Bay of the Indian Ocean. European settlement began with a band of Cape Colony traders led by F.G. Farewell, who charted the port in 1824 and named the site Port Natal. Land was ceded to the group by Shaka, the Zulu king (whose right to take that action is disputed), and the Old Fort (now a museum) was built. Durban was founded in 1835 on the site of Port Natal and was named for Sir Benjamin D'Urban, the governor of the Cape Colony. It became a borough (town) in 1854, and was created a city in 1935. Sprawling over 116 sq mi (301 sq km) along the coast, it is overlooked to the south by the Bluff (hills separating the landlocked bay from the sea) and stretches across the Umgeni River to the heights of Durban

Durban, S.Af.
By courtesy of the South African Tourist Corp.

North. Its civic and business centre is on flat land, rising gently to the slopes of the white residential district of the Berea, a ridge of hills encircling the harbour and beach. Durban's numerous parks include the Botanic Gardens with its orchid house, Jameson Park and its rose gardens, and Snake Park with its collection of poisonous reptiles. It has the University of Durban-Westville, primarily for Indian students, and shares with Pietermaritzburg the University of Natal (founded 1909), for whites. There are several museums and black and Indian markets.

Development of Durban's harbour, one of the world's major commercial ports, began in 1855. Serving the Witwatersrand industrial region, it is a major container port and point of entry for bulk raw materials, capital goods, and industrial equipment. Minerals, coal, sugar, and corn are exported, and oil is refined and piped to Johannesburg. After World War I Durban changed from a prim Victorian town to a modern metropolis with skyscrapers and multistoried buildings. It is the headquarters of South Africa's sugar industry and a centre of highly diversified manufacturing activity. Tourism is important and is based on the city's proximity to Natal's game and nature reserves and on the beaches and their facilities, such as an esplanade and an oceanarium. Durban (with adjacent Pinetown) has a larger Indian population than white. Ntuzuma, Umlazi, and Embumbulu districts to the immediate west have been developed as black (mostly Zulu) commuter suburbs and are part of the KwaZulu non-independent black state. Many blacks were moved from Durban to these areas in the late 1970s. Pop. (1980 prelim.) city, 505,963; Durban/Pinetown urban area, 960,-792.

D'Urban, Sir Benjamin (b. 1777, Halesworth, near Norwich, Norfolk, Eng.—d. May 25, 1849, Montreal), British general and colonial administrator chiefly remembered for his frontier policy as governor in Cape Colony, South Africa.

As a soldier D'Urban began his service in 1793 and fought in the Napoleonic Wars, where he won distinction in the Peninsu-

lar War as a quartermaster general. In 1820 D'Urban was sent to the West Indies as governor of Antigua, and later on to the newly created colony of British Guiana (1831; now Guyana).

Arriving in Cape Colony in January 1834, D'Urban assumed the dual role of governor and commander in chief. His administration was complicated by the exodus of Dutch farmers to the far north and east (known as the Great Trek) and the outbreak of the Cape Frontier War of 1834–35 created by incursions of Bantu-speaking Xhosa peoples. He drove back the invaders and annexed the territory between the Keiskamma and Great Kei (Groot-Kei) rivers. Although he was popular with the colonists, D'Urban's treatment of the Africans disturbed the missionaries and humanitarians, who had great influence with Lord Glenelg, the colonial secretary. D'Urban was dismissed as governor in 1838 but continued in his military capacity in South Africa until 1846. The following year he was transferred to command the British forces in Canada.

durbar (Persian: "court"), Hindi DARBĀR, in India, a court or audience chamber, and also any formal assembly of notables called together by a governmental authority. In British India the name was specially attached to formal imperial assemblies called together to mark state occasions.

The three best-known durbars were held in Delhi in 1877, 1903, and 1911. They celebrated Queen Victoria's assumption of the title of Empress of India (1876), the coronation of King Edward VII (1902), and the visit of King George V and Queen Mary to India (1911).

Düren, city, North Rhine-Westphalia *Land* (state), western Germany. It lies along the Ruhr River, on the northeastern slopes of the Eifel Hills. A Frankish settlement first mentioned in 748, it grew from the Villa Duria of Pepin III the Short, the king of the Franks. It was subsequently the seat of diets and synods under Charlemagne and the base for several of his Saxon campaigns. After passing to the dukes of Jülich in about 1242, it was destroyed (1543) in a war between William V of Jülich and the Holy Roman emperor Charles V and was later rebuilt. Almost totally destroyed again in World War II, Düren has been largely reconstructed.

The annexations in the early 1970s of Gurzenich and Birkesdorf enlarged the city's area by more than half. Düren produces paper, metal goods, textiles, glass, sugar, and chemicals. Pop. (1989 est.) 83,120.

Dürer, Albrecht (b. May 21, 1471, Imperial Free City of Nürnberg [Germany]—d. April 6, 1528, Nürnberg), painter and printmaker generally regarded as the greatest German Renaissance artist. His vast body of work includes altarpieces and religious works, numerous portraits and self-portraits, and copper engravings. His woodcuts, such as the *Apocalypse* series (1498), retain a more Gothic flavour than the rest of his work.

Education and early career. Dürer was the second son of the goldsmith Albrecht Dürer the Elder, who had left Hungary to settle in Nürnberg in 1455, and of Barbara Holper, who had been born there. Dürer began his training as a draughtsman in the goldsmith's workshop of his father. His precocious skill is evidenced by a remarkable self-portrait done in 1484, when he was 13 years old (Albertina, Vienna), and by a "Madonna with Musical Angels," done in 1485, which is already a finished work of art in the late Gothic style. In 1486, Dürer's father arranged for his apprenticeship to the painter and woodcut illustrator Michael Wohlgemuth, whose portrait Dürer would paint in 1516. After three years in Wohlgemuth's workshop, he left for a period of travel. In 1490 Dürer completed his earliest known painting, a portrait of his father (Uffizi, Florence) that heralds the familiar characteristic style of the mature master.

Dürer's years as a journeyman probably took the young artist to the Netherlands, to Alsace, and to Basel, Switz., where he completed his first authenticated woodcut, a picture of "St. Jerome Curing the Lion" (Kunstmuseum, Basel). During 1493 or 1494 Dürer was in Strasbourg for a short time, returning again to Basel to design several book illustrations. An early masterpiece from this period is a self-portrait with a thistle painted on parchment in 1493 (Louvre, Paris).

First journey to Italy. At the end of May 1494, Dürer returned to Nürnberg, where he soon married Agnes Frey, the daughter of a merchant. In the autumn of 1494 Dürer seems to have undertaken his first journey to Italy, where he remained until the spring of 1495. A number of bold landscape watercolours dealing with subjects from the Alps of the southern Tirol were made on this journey and are among Dürer's most beautiful creations. Depicting segments of landscape scenery cleverly chosen for their compositional values, they are painted with broad strokes, in places roughly sketched in, with an amazing harmonization of detail. Dürer used predominantly unmixed, cool, sombre colours, which, despite his failure to contrast light and dark adequately, still suggest depth and atmosphere.

The trip to Italy had a strong effect on Dürer; direct and indirect echoes of Italian art are apparent in most of his drawings, paintings, and graphics of the following decade. While in Venice and perhaps also before he went to Italy, Dürer saw engravings by masters from central Italy. He was most influenced by the Florentine Antonio Pollaiuolo, with his sinuous, energetic line studies of the human body in motion, and by the Venetian Andrea Mantegna, an artist greatly preoccupied with classical themes and with precise linear articulation of the human figure.

Dürer's secular, allegorical, and frequently self-enamoured paintings of this period are often either adaptations of Italian models or entirely independent creations that breathe the free spirit of the new age of the Renaissance. Dürer adapted the figure of Hercules from Pollaiuolo's "The Rape of Deianira" for a painting of "Hercules and the Birds of Stymphalis" (Germanisches Nationalmuseum, Nürnberg). A purely mythological painting in the Renaissance tradition, the "Hercules" is exceptional among Dürer's works. The centre panel from the "Dresden Altarpiece," which Dürer painted in about 1498, is stylistically similar to the "Hercules" and betrays influences of Mantegna. In most of Dürer's free adaptations the additional influence of the more lyrical, older painter Giovanni Bellini, with whom Dürer had become acquainted in Venice, can be seen.

Dürer, "Self-portrait in Furred Coat," oil on wood panel, 1500; in the Alte Pinakothek, Munich

Alte Pinakothek, Munich; photograph, Blauel/Gnamm—ARTOTHEK

The most striking painting illustrating Dürer's growth toward the Renaissance spirit is a self-portrait, painted in 1498 (Prado, Madrid). Here Dürer sought to convey, in the representation of his own person, the aristocratic ideal of the Renaissance. He liked the way he looked as a handsome, fashionably attired young man, confronting life rather conceitedly. In place of the conventional, neutral, monochromatic background, he depicts an interior, with a window opening on the right. Through the window can be seen a tiny landscape of mountains and a distant sea, a detail that is distinctly reminiscent of contemporary Venetian and Florentine paintings. The focus on his own figure in the interior distinguishes his world from the vast perspective of the distant scene, another world to which the artist feels himself linked.

Italian influences were slower to take hold in Dürer's graphics than in his drawings and paintings. Strong late Gothic elements dominate the visionary woodcuts of his *Apocalypse* series (the Revelation of St. John), published in 1498. The woodcuts in this series display emphatic expression, rich emotion, and crowded, frequently overcrowded, compositions. The same tradition influences the earliest woodcuts of Dürer's *Great Passion* series, also from about 1498. Nevertheless, the fact that Dürer was adopting a more modern conception, a conception inspired by classicism and humanism, is indicative of his basically Italian orientation. The woodcuts "Samson and the Lion" (*c.* 1497) and "Hercules Conquering Cacus" and many prints from the woodcut series *The Life of the Virgin* (*c.* 1500–10) have a distinct Italian flavour. Many of Dürer's copper engravings are in the same Italian mode. Some examples of them that may be cited are "Fortune" (*c.* 1496), "The Four Witches" (1497), "The Sea Monster" (*c.* 1498), "Adam and Eve" (1504), and "The Large Horse" (1505). Dürer's graphics eventually influenced the art of the Italian Renaissance that had originally inspired his own efforts. His painterly style, however, continued to vacillate between Gothic and Italian Renaissance until about 1500. Then his restless striving finally found definite direction. He seems clearly to be on firm ground in the penetrating half-length portraits of Oswolt Krel (Alte Pinakothek, Munich), in the portraits of three members of the aristocratic Tucher family of Nürnberg—all dated 1499—and in the "Portrait of a Young Man" of 1500 (Alte Pinakothek). In 1500 Dürer painted another self-portrait (Alte Pinakothek, Munich) that is a flattering, Christlike portrayal.

During this period of consolidation in Dürer's style, the Italian elements of his art were strengthened by his contact with Jacopo de' Barbari, a minor Venetian painter and graphic artist who was seeking a geometric solution to the rendering of human proportions; it is perhaps due to his influence that Dürer began, around 1500, to grapple with the problem of human proportions in true Renaissance fashion. Initially, the most concentrated result of his efforts was the great engraving "Adam and Eve" (1504) in which he sought to bring the mystery of human beauty to an intellectually calculated ideal form. In all aspects Dürer's art was becoming strongly classical. One of his most significant classical endeavours is his painting "Altar of the Three Kings" (1504),

which was executed with the help of pupils. Although the composition, with its five separate pictures, has an Italian character, Dürer's intellect and imagination went beyond direct dependence on Italian art. From this maturity of style comes the bold, natural, relaxed conception of the centre panel, "The Adoration of the Magi" (Uffizi), and the ingenious and unconventional realism of the side panels, one of which depicts the "Drummer and Piper" and the other "Job and His Wife" (Wallraf-Richartz-Museum, Cologne).

Second journey to Italy. In the autumn of 1505, Dürer made a second journey to Italy, where he remained until the winter of 1507. Once again he spent most of his time in Venice. Of the Venetian artists, Dürer now most admired Giovanni Bellini, the leading master of Venetian early Renaissance painting, who, in his later works, completed the transition to the High Renaissance. Dürer's pictures of men and women from this Venetian period reflect the sweet, soft portrait types especially favoured by Bellini. One of Dürer's most impressive small paintings of this period, a compressed half-length composition of the "Young Jesus with the Doctors" of 1506, harks back to Bellini's free adaptation of Mantegna's "Presentation in the Temple." Dürer's work is a virtuoso performance that shows mastery and close attention to detail. In the painting the inscription on the scrap of paper out of the book held by the old man in the foreground reads, "Opus quinque dierum" ("the work of five days"). Dürer thus must have executed this painstaking display of artistry, which required detailed drawings, in no more than five days. Of even greater artistic merit than this quickly executed work are the half-length portraits of young men and women painted between 1505 and 1507, which seem to be entirely in the style of Bellini. In these paintings there is a flexibility of the subject, combined with a warmth and liveliness of expression and a genuinely artistic technique, that Dürer otherwise rarely attained.

In 1506, in Venice, Dürer completed his great altarpiece "The Feast of the Rose Garlands" for the funeral chapel of the Germans in the church of St. Bartholomew. Later that same year Dürer made a brief visit to Bologna before returning to Venice for a final three months. The extent to which Dürer considered Italy to be his artistic and personal home is revealed by the frequently quoted words found in his last letter from Venice (dated October 1506) to Willibald Pirkheimer, his longtime humanist friend, anticipating his imminent return to Germany: "O, how cold I will be away from the sun; here I am a gentleman, at home a parasite."

Development after the second Italian trip. By February 1507 at the latest, Dürer was back in Nürnberg, where two years later he acquired an impressive house (which still stands and is preserved as a museum). It is clear that the artistic impressions gained from his Italian trips continued to influence Dürer to employ classical principles in creating largely original compositions. Among the paintings belonging to the period after his second return from Italy are "Martyrdom of the Ten Thousand" (1508) and "Adoration of the Trinity" (1511), which are both crowd scenes. Drawings from this period recall Mantegna and betray Dürer's striving for classical perfection of form through sweeping lines of firmly modeled and simple drapery. Even greater simplicity and grandeur characterize the diptych of "Adam and Eve" (1507; Prado), in which the two figures stand calmly in relaxed classical poses against dark, almost bare, backgrounds.

Between 1507 and 1513 Dürer completed a "Passion" series in copperplate engravings, and between 1509 and 1511 he produced the *Small Passion* in woodcuts. Both of these works are characterized by their tendency toward spaciousness and serenity. During 1513 and 1514 Dürer created the greatest of his copperplate engravings: the "Knight, Death and Devil," "St. Jerome in His Study," and "Melencolia I"—all of approximately the same size, about 24.5 by 19.1 cm (9.5 by 7.5 inches). The extensive, complex, and often contradictory literature concerning these three engravings deals largely with their enigmatic, allusive, iconographic details. Although repeatedly contested, it probably must be accepted that the engravings were intended to be interpreted together. There is general agreement, however, that Dürer, in these three master engravings, wished to raise his artistic intensity to the highest level, which he succeeded in doing. Finished form and richness of conception and mood merge into a whole of classical perfection. To the same period belongs Dürer's most expressive portrait drawing—one of his mother.

Service to Maximilian I. While in Nürnberg in 1512, the Holy Roman emperor Maximilian I enlisted Dürer into his service, and Dürer continued to work mainly for the emperor until 1519. He collaborated with several of the greatest German artists of the day on a set of marginal drawings for the emperor's prayer book. He also completed a number of etchings in iron (between 1515 and 1518) that demonstrate his mastery of the medium and his freedom of imagination. In contrast to these pleasing improvisations are the monumental woodcuts, overloaded with panegyrics, made for Maximilian. In these somewhat stupendous, ornate woodcuts, Dürer had to strain to adapt his creative imagination to his client's mentality, which was foreign to him.

Besides a number of formal show pieces—a painting entitled "Lucretia" (1518; Alte Pinakothek), and two portraits of the emperor (*c.* 1519)—during this decade Dürer produced a number of more informal paintings of considerably greater charm. He also traveled. In the fall of 1517 he stayed in Bamberg. In the summer of 1518 he went to Augsburg where he met Martin Luther, who had in the previous year posted his 95 Theses denouncing the sale of papal indulgences on the door of the Wittenberg Castle Church. Dürer later became a devoted follower of Luther. Dürer had achieved an international reputation as an artist by 1515, when he exchanged works with the illustrious High Renaissance painter Raphael.

Final journey to the Netherlands. In July 1520 Dürer embarked with his wife on a journey through the Netherlands. In Aachen, at the October 23 coronation of the emperor Charles V, successor to Maximilian I (who had died in 1519), Dürer met and presented several etchings to the mystical and dramatic Matthias Grünewald, who stood second only to Dürer in contemporary German art. Dürer returned to Antwerp by way of Nijmegen and Cologne, remaining there until the summer of 1521. He had maintained close relations with the leaders of the Netherlands school of painting. In December 1520 Dürer visited Zeeland and in April 1521 traveled to Bruges and Ghent, where he saw the works of the 15th-century Flemish masters Jan and Hubert van Eyck, Rogier van der Weyden, and Hugo van der Goes, as well as the Michelangelo Madonna. Dürer's sketchbook of the Netherlands journey contains immensely detailed and realistic drawings. Some paintings that were created either during the journey or about the same time seem spiritually akin to the Netherlands school—for example, the portrait of Anna Selbdritt (Metropolitan Museum of Art, New York City), a half-length picture of St. Jerome (1521; Museu Nacional de Arte Antiga, Lisbon), and the small portrait of Bernhard von Resten, previously Bernard van Orley (Gemäldegalerie, Dresden).

Final works. By July, the travelers were back in Nürnberg, but Dürer's health had started to decline. He devoted his remaining years mostly to theoretical and scientific writings and illustrations, although several well-known character portraits and some important portrait engravings and woodcuts also date from this period. One of Dürer's greatest paintings, the so-called "Four Apostles" (St. John, St. Peter, St. Paul, and St. Mark), was done in 1526. This work marks his final and certainly highest achievement as a painter. His delight in his own virtuosity no longer stifled the ideal of a spaciousness that is simple, yet deeply expressive.

Dürer died in 1528 and was buried in the churchyard of Johanniskirchhof in Nürnberg. That he was one of his country's most influential artists is manifest in the impressive number of pupils and imitators that he had. Even Dutch and Italian artists did not disdain to imitate Dürer's graphics occasionally. The extent to which Dürer was internationally celebrated is apparent in the literary testimony of the Florentine artist Giorgio Vasari (1511–74), in whose *Lives of the Most Eminent Italian Architects, Painters and Sculptors,* the importance of Albrecht Dürer, the "truly great painter and creator of the most beautiful copper engravings," is repeatedly stressed. Like most notable Italian artists, Dürer probably felt himself to be an "artist-prince," and his self-portraits seem incontestably to show a man sure of his own genius. (Eb.R./Ed.)

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D'Urfey, Thomas (b. 1653, Exeter?, Devon, Eng.—d. February 1723, London), English dramatist, satirist, and songwriter with a light satirical touch whose plays were very popular

D'Urfey, detail of an engraving by C. Pye after a drawing by J. Thurston

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

in their time; his comedies, with complicated plots carried forward by lively dialogue, to some extent point the way to sentimental comedy of the later 18th century.

Patronized by King Charles II, whom he entertained as a jester and singer, and more cautiously by James II, D'Urfey changed his religious and political allegiance on the accession of William and Mary and was, in turn, favoured by them. An attractive man, he was the friend of leading literary figures, including the essayists Richard Steele and Joseph Addison. He wrote 32 plays between 1676 and 1688. D'Urfey also wrote some 500 songs, many of which were inserted in contemporary ballad operas; he also wrote texts to be set to music by Henry Purcell, notably an ode, "The Yorkshire Feast Song," and an epilogue for Purcell's opera *Dido and Aeneas*.

Durfort, Louis de: *see* Feversham, Louis de Durfort, 2nd earl of.

Durg, formerly DRUG, town, administrative headquarters of Durg district, Madhya Pradesh state, central India, just east of the Seonāth River, part of the Durg–Bhilai Nagar urban agglomeration. The town is an agricultural market and is heavily engaged in milling rice and pigeon peas (*Cajanus cajan*). Its name is derived from the Hindi term *durga* ("fort"); there are remains of an ancient fortress used by the Marāṭhās as a base of operations in subjugating Chhattīsgarh. The town has three colleges affiliated with Ravishankar University.

Durg district (7,595 sq mi [19,670 sq km]) was constituted in 1906 and enlarged in 1948 with the inclusion of several Chhattīsgarh princely states. It comprises a plains region ringed by foothills of the Sātpura Range. Wheat, cotton, rice, and oilseeds are the chief crops. Iron-ore, limestone, sandstone, hematite, steatite, and clay deposits are worked. Rāj Nāndgaon and Khairāgarh are commercial centres. Bhilai, a planned industrial township, includes Bhilai Nagar, the largest urban centre in the district, and is the site of a large steel project. Pop. (1981) town, 114,637; Durg–Bhilai Nagar metropolitan area, 490,214; district, 1,890,467.

Durgā (Sanskrit: the Inaccessible), in Hindu mythology, one of the many forms of Śakti (the goddess), and the wife of Śiva. Her best known feat was the slaying of the buffalo-demon Mahiṣāsura. According to legend

Durgā, Rajasthani miniature of the Mewār school, mid-17th century; in a private collection
Pramod Chandra

she was created for this purpose out of flames that issued from the mouths of Brahmā, Vishnu, Śiva (Shiva), and the lesser gods. She was born fully grown and beautiful; nevertheless, she presents a fierce menacing form to her enemies. She is usually depicted in painting and sculpture riding a lion (sometimes shown as a tiger), with 8 or 10 arms, each holding the special weapon of one or another of the gods, who gave them to her for her battle against the buffalo-demon. The Durgāpūjā, held annually in September–October, is the greatest festival of northeastern India. A special image of the goddess is made that is worshipped for nine days, then immersed in water, all accomplished with large processions and much public and private festivity.

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Durgāpur, town, Burdwān district, West Bengal state, northeastern India, just north of the Dāmodar River. Connected by road and rail with Calcutta, Burdwān, and Asansol, Durgāpur is one of India's chief steel-producing centres. The main steel plant went into operation in 1962, and the population grew fivefold during the 1960s. Other major industries include a coal washery, an alloy and special steel plant, a coal-mining machinery plant, brick and tile manufacturing, and two large thermal-power units. Coke gas produced there is conveyed to Calcutta by pipeline. The Dāmodar provides canal irrigation and industrial power in the area. The town has an engineering college and a government college affiliated with the University of Burdwān and a school of music affiliated with Rabindra Bhārati University (Calcutta). Pop. (1981) 311,798.

Durham, county of northeastern England, lying adjacent to the North Sea coast. It has an area of 941 sq mi (2,436 sq km) and includes eight districts: Chester-le-Street, Darlington, Derwentside, Durham, Easington, Sedgefield, Teesdale, and Wear Valley.

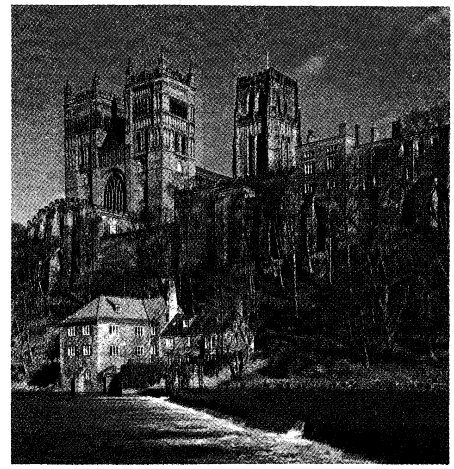
The county has two upland regions. In the west the limestones of the Pennines (2,452 ft [747 m] at Burnhope Seat) dip gently eastward and are dissected by the valleys of the Rivers Wear and Tees; basaltic rock intrusions are exposed at High Force waterfall and near Stanhope. In the east the limestones of the East Durham Plateau (more than 700 ft in the southwest) form a gently rolling landscape, with a marked escarpment in the west. Separating these upland areas are the glacial drift-covered lowlands of the Wear Valley. The Tees lowlands extend across the south of the county. The topography makes for a varied agriculture. In the western uplands, thin soils and ill-drained peat support only hill sheep grazing, but stock raising is possible in the valleys. In the lower eastern region, mixed farming, especially dairying, predominates.

Durham's location in the far north of England influenced its role in English history. In the Roman period it was a military outpost associated with Hadrian's Wall, which was erected to contain the peoples of what, in large part, became Scotland. The area was later incorporated into the Saxon kingdom of Northumbria. In the Middle Ages, Durham's marginal position between Scotland and England made it susceptible to invasions and rebellions. Responsibility for defense rested with the prince-bishops of the Durham county palatine, feudal lords whose kingly powers gave them complete control of the area. The region was unimportant economically until the 19th century, when exploitation of the coalfield made it one of the key areas of industrial growth in Britain. As coal seams became exhausted, there was a gradual movement from the west to deeper, thicker seams in the east. There are abandoned lead mines in the western dales (valleys).

Economic depression between World Wars I and II, followed by a steady decline of the traditional industries, demonstrated the need for diversification. Durham was designated a "special area" and in 1945 became part of the North East Development Area (NEDA). Two new towns, Aycliffe and Peterlee, were designated to absorb population from declining mining areas. Financial concessions and the establishment of trading estates have resulted in rapid expansion of new, lighter industries. The city of Durham is the administrative, ecclesiastical, and educational centre of the county. Pop. (1982 est.) 608,100.

Durham, district (city), county of Durham, England.

The historic core of the city is located on a peninsula in a bend of the River Wear. This natural defensive site, chosen by William I the Conqueror (reigned 1066–87) as a fortress and



The cathedral of the Church of Christ and Blessed Mary the Virgin at Durham, Eng.
A.F. Kersting

bulwark against the Scots to the north, soon became a seat of the feudal prince-bishops of Durham, entrusted with the defense of the northern region of the nation. The castle, built to protect the narrow neck of the peninsula on its northern side, was, until 1836, one of the palaces of the bishopric. Early in the 12th century the peninsula was fortified by a wall, much of which has been preserved. Besides its defensive role, medieval Durham was also a place of pilgrimage because it held the remains of St. Cuthbert, a 7th-century ecclesiastic, in the cathedral (begun in 1093 and dedicated to Christ and Blessed Mary the Virgin).

The strong ecclesiastical hold on the city during the Middle Ages reflected the wide secular powers of the bishopric. The fortified part on the peninsula was, in early times, governed by the constable (law officer) of the bishops' castle. On the east side of the river, Elvet was held by a Benedictine monastery established at Durham in 1083 (suppressed in 1540). The bishops controlled nearby St. Nicholas and Framwellgate. To the north, St. Giles was created a borough in the 12th century.

The bishops of Durham played an important part in establishing the city as an educational centre. A school, now Durham School, was founded in the 15th century; and a bishop was associated with the creation of the university in 1832 and the appropriation of the castle to the university's use in 1836. Originally compactly situated on the peninsula, the university has now developed on a site south of the river. The Gulbenkian Museum of Oriental Art and Archaeology, part of the university's School of Oriental Studies (opened 1960), contains important collections of Far Eastern material.

Modern Durham, reflecting its history, remains a religious and educational centre but also has important administrative functions for the county government. Development of marketing and service sectors in the local economy has been impeded by the proximity of the city to the metropolitan complexes of Newcastle upon Tyne and Teesside. Durham

has several small factories specializing in organ construction and carpet manufacture. It has never been an industrial city, however, and the coal-mining enterprise undertaken in Elvet in the 19th century proved short-lived. The area of the district is 73 sq mi (190 sq km). Pop. (1981 prelim.) city, 26,422; (1982 est.) district, 88,700.

Durham, town (township), Strafford County, southeastern New Hampshire, U.S., on the Oyster River, just south of Dover. Settled in 1635, it was known as the parish of Oyster River until it was incorporated in 1732 and named for Durham, Eng. A series of savage Indian attacks began in 1675; in 1694 the town was burned, and more than 100 residents were killed or captured. During the American Revolution, a large supply of gunpowder and weapons seized from the British in New Castle was hidden in the Durham Meetinghouse (a tablet marks the site). The town, now an agricultural trade centre, is also the seat of the University of New Hampshire (1866). The home (built 1716) of John Sullivan, Revolutionary general and the state's chief executive in 1786–87 and 1789, still stands on the river bank. Pop. (1980) 10,652.

Durham, city, seat (1881) of Durham County, north central North Carolina, U.S. Settled around 1750, it was first called Prattsburg for William Pratt, a landowner. When Pratt refused to give land for a North Carolina Railroad station, Bartlett Durham donated four acres about 2 mi (3 km) west. The town that

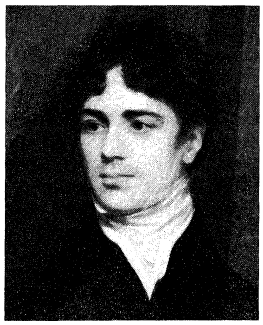
Davidson Building on the Duke University campus, Durham, N.C.
Frank J. Miller

grew up there was known as Durhamville and Durham Station. It was incorporated in 1867 and again in 1869, the first charter having been invalidated by Congress since North Carolina was not in the Union. The tobacco industry, which transformed Durham into a flourishing manufacturing centre by 1900, was pioneered by Robert F. Morris in 1858; John R. Green began making his famous Bull Durham blend after the Civil War. The leading role in the industry's development, however, was played by the Duke family after their factory opened in 1874. It also developed important textile manufactures.

Durham became an educational, medical, and research centre largely through the philanthropy of the Duke family. Duke University, established by James Buchanan Duke in 1924, was built around Trinity College (founded as Union Institute, 1838). North Carolina Central University (1909), Durham College (1947), and Durham Technical Institute (1961) are also in the city. Bennett Place State Historical Site, 6 mi northwest, commemorates the surrender (April 26, 1865) of Confederate general Joseph E. Johnston to Gen. William Sherman. Pop. (1982 est.) city, 101,242; Raleigh–Durham metropolitan area (MSA), 579,400.

Durham (livestock): *see* Shorthorn.

Durham, John George Lambton, 1st earl of, also called (1828–33) BARON DURHAM (b. April 12, 1792, London—d. July 28, 1840, Cowes, Isle of Wight, Eng.), British reformist Whig statesman sometimes known as "Radical Jack," governor general and lord high commissioner of Canada, and nominal au-



Durham, detail of an oil painting by T. Phillips (1819 replica); in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

thor of the *Report on the Affairs of British North America* (1839), which for many years served as a guide to British imperial policy. The "Durham Report" was largely written by his chief secretary in Canada, Charles Buller (1806–48).

The son of a great landowner in Durham County, Lambton sat in the House of Commons from 1813 to 1828, when he was raised to the peerage as Baron Durham. (He was created an earl in 1833.) By his second marriage he became the son-in-law of Charles Grey, 2nd Earl Grey, a leading Whig and future prime minister (1830–32), but his proposals for wide extension of the franchise and other radical measures were distasteful to Grey and other orthodox Whigs.

In 1830 Durham entered Grey's Cabinet as lord privy seal, and with Lord John Russell (afterward 1st Earl Russell and twice prime minister) and two others, he drafted the first parliamentary Reform Bill (1831; not enacted). After the passage of the third Reform Bill the following year, Durham was sent on diplomatic missions to Russia, Prussia, and Austria and then resigned as lord privy seal (1833). From July 1835 to June 1837 he was ambassador to Russia.

Appointed governor general and lord high commissioner of Canada, Durham arrived at Quebec in May 1838. Faced with French-Canadian hostility, virtual anarchy in Lower Canada (in the modern province of Quebec), and possible expansion of the United States into Canada, he was given almost dictatorial powers.

Durham organized a new and more conciliatory executive council, and on June 28, 1838, the day of Queen Victoria's coronation, he proclaimed an amnesty for all French-Canadian rebels except for 24 of their leaders. For his moderation he was reviled in England. The prime minister, Lord Melbourne, disavowed Durham's actions, whereupon the governor general resigned and issued a self-justifying proclamation.

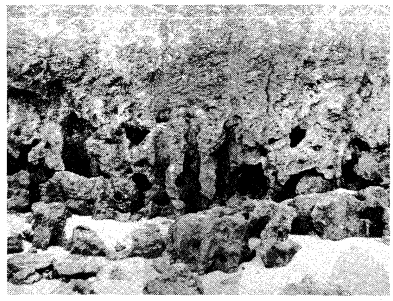
After returning to England, Durham submitted his memorable report to the colonial office on Jan. 31, 1839. He advocated the union of Lower Canada with Upper Canada (in present Ontario), with a large measure of self-government in order to preserve Canadian loyalty to Great Britain and thereby to forestall the annexation of Canada by the United States. Accepting the theory of imperial government put forth by Buller and Edward Gibbon Wakefield, Durham prescribed a Cabinet of colonists whose recommendations on internal affairs were to be executed by the governor general. Foreign policy and international trade were to continue to be regulated from London. He also strongly recommended that the French-Canadians be harassed into abandoning their language and become completely assimilated to the Anglo-Canadians. The union of the two Canadas (by proclamation in 1841) was intended in part to perpetuate the minority status of the French.

durian (*Durio zibethinus*), tree of the family Bombacaceae and its fruit. The durian is cultivated in Indonesia, the Philippines, Malaysia, and southern Thailand. The tree has oblong, tapering leaves, rounded at the base, and yellowish green flowers. Its shape resembles an elm.

The fruit is spherical and 15 to 20 centimetres (6 to 8 inches) in diameter. It has a hard external husk, or shell, covered with coarse spines, and contains five oval compartments, each filled with a cream-coloured, custard-like pulp, in which are embedded from one to five chestnut-sized seeds.

The pulp is edible, and the seeds may be eaten if roasted. The ripe fruits are eaten by many animals. Although the durian has a mild, sweet flavour, it also has a pungent odour, which has been compared to that of Limburger cheese. It is seldom exported.

duricrust, surface or near-surface of the Earth consisting of a hardened accumulation of silica (SiO_2), alumina (Al_2O_3), and iron oxide (Fe_2O_3), in varying proportions. Admixtures of other substances commonly are present and duricrusts may be enriched with oxides of manganese or titanium within restricted areas. Thus, siliceous, ferruginous, and aluminous crusts constitute duricrusts proper. Encrusted layers of calcium carbonate, gypsum, and salt,



(Top) Bouldery silcrust on summit of residual (vertical divisions on picket are 1 ft [25 cm]) and (bottom) coastal section of indurated plinthite, part of a ferricrust profile
By courtesy of George H. Dury

however, are often considered forms of duricrust.

The term duricrust (Latin *durus,* "hard") was first applied in Australia to layered materials at or near the Earth's surface, such as laterites, bauxites, and quartzites. These crusts are not of themselves landforms but represent the chemical alteration of the upper parts of

Classification of duricrusts

classification by			chemistry (not exclusive)
cement	content (i)	content (ii)	
	types of crust		
duricrusts proper			
silcrete	silcrust	silitic	SiO_2
		siallitic	SiO_2, $Al_2O_3/Al_2O_3 \cdot 2H_2O$
silcrete/ferricrete	silcrust/ferricrust	fersilitic	Fe_2O_3, SiO_2
ferricrete	ferricrust	fersiallitic*	$Fe_2O_3 \pm FeOOH$, SiO_2, $Al_2O_3 \cdot 2H_2O \pm AlOOH$
		ferrallitic	Fe_2O_3, $FeOOH$, $Al_2O_3 \cdot 2H_2O$, $AlOOH$
		ferritic	Fe_2O_3, $FeOOH$
		fermangitic	Fe_2O_3, MnO_2
		tiallitic	TiO_2, $Al_2O_3/Al_2O_3 \cdot 2H_2O$
		allitic	$Al_2O_3 \cdot 2H_2O$, $AlOOH$
calcrete	calcrust	calcitic	$CaCO_3$ (calcite)
		calcsilitic	$CaCO_3$, SiO_2 (calcite + chalcedonic silica)
gypcrete	gypcrust	gypsitic	$CaSO_4 \cdot 2H_2O$ (gypsum)
salcrete	salcrust	halitic	NaCl (usually impure; rock salt)

*Characteristic minerals in the fersiallitic range: SiO_2, quartz + chalcedonic silica; Al_2O_3, amorphous to $Al_2O_3 \cdot 2H_2O$, gibbsite, and $AlOOH$, boehmite; Fe_2O_3, hematite, to $FeOOH$, goethite, and $Fe_2O_3 \cdot 2H_2O$, limonite (where unhydrated); TiO_2, rutile/anatase; MnO_2, pyrolusite/psilomelane.

plains and other features of low relief. In this sense, they are soils of an extreme type.

Classification of duricrusts. Two partial classifications use compound names ending in *-crete* to indicate the kind of cementation, or in *-crust,* to indicate the basic chemical content (Table, first two columns). Both classifications are defective, although the working distinction between silcrusts and ferricrusts is useful. A more serviceable classification (Table, third column) adapts and extends the nomenclature developed by soil scientists in Africa. The type boundaries that fall within duricrusts proper must be considered transitional.

Where best preserved, duricrusts proper are the most continuous and extensive types of those listed in the Table. Representing the end-products of weathering, denudation, and soil formation, they occur mainly on erosional platforms such as pediments or as cappings and residuals on stream divides. The crusts usually form parts of deep-weathering profiles that may be as thick as 120 metres (400 feet). Alternatively, they occur at the bases of cliffs and scarps, in river terraces, or on valley bottoms, usually near to and lower than residual cappings. Except at the wasting or developing edges of crusts, the thickness ranges from about 0.5 m to at least 12 m. This contrasts with the platelike weathering rinds as thick as 15 centimetres (6 inches) that are often associated with cavernous (alveolar) weathering, particularly in arid areas.

Distribution of duricrusts. Duricrusts are concentrated in intertropical to subtropical areas, with notable extratropical extensions, especially in South Africa and Australia. They normally are absent from equatorial rain forests. Many are fossil crusts, in the sense that they relate to past climatic, biologic, and geomorphic environments and are not forming under present conditions in these areas.

Other types of crust are associated with subhumid to arid climates, although not necessarily with the arid climatic zones of today. Crusts of calcium carbonate (calccrusts) and calcium sulfate (gypcrusts), up to 4 m thick occur in basins of inland drainage, where they form initially as evaporites (*see* evaporite). Alternatively, calccrusts form as surface to subsurface soil horizons, or zones, at and near the extreme end of the calcium-rich soil range. Gypsum-rich horizons, common in many desert and semidesert soils, seem not resistant enough to erosion to become crusts. Calcsilitic crusts, which result from the silification of calccrusts or other surficial limestones, have been little studied in this context. Salcrusts (salt crusts) form in depressions along desert coasts or wherever saline groundwater emerges, but unless they crystallize into rock salt these crusts also lack resistance to erosion and can be ephemeral.

In Australia, India, Africa, and South America, the main expanses of duricrust tend to mantle pediments and plains in varying states of dissection, although some crusts occur in valleys in terrain of high relief. Allitic crusts yield commercial bauxite. Detrital and valley-floor duricrusts occur in all these countries, chiefly adjacent to the margins of residual caps. These crusts include economic reserves of manganese ore in western Africa and silicified terrace gravels in southern Australia. Possible combinations of terrain, weathering, erosion and dissection of duricrusts and continued or renewed duricrust formation are highly complex. Additionally, some duricrusts now lie buried beneath continental (nonmarine) sediments.

Rough limits to present-day ferricrust formation are the 500- to 700-millimetre (20- to 27.5-inch) isohyet (contour of equal rainfall values), below which iron is not readily mobilized, and the 1,200-mm, isohyet, above which dehydration is unusual. High mean annual temperatures, on the order of 20° to 25° C (68° to 77° F), also are necessary. Duricrusts that occur beyond the indicated limits are generally fossil (related to former climatic regimes), and many within these limits also are fossil. Ages determined by stratigraphic or radiometric methods are as great as 50,000,-000 years in western Africa and more than 23,000,000 years in Australia, but duricrust formation is occurring today in some places. Phenomena related to fossil crusts include the deep weathering of the southern Piedmont area of the United States and of massifs in western and northwestern Europe during the Tertiary Period (between 2,500,000 and 65,-000,000 years ago), and the Tertiary formation of residual bauxite at latitude 65° N in Siberia.

Factors involved in duricrust formation. The formation of crusts involves great loss of weathered material. A generalized example from the tropical weathering of a nephelinesyenite (intrusive igneous rock) shows a reduction of silica (SiO_2) from 55 percent in the fresh rock to 5 percent in the duricrust, but an increase of alumina (Al_2O_3) from 1 percent to 45 percent, of iron oxide (Fe_2O_3) from 5 percent to 23 percent, and of combined water from 1 percent to 25 percent.

The circulation of nutrients between plants and soil in tropical forests involves excess uptake by the plants, and this in turn promotes deep weathering. Within the deep-weathering profile, silt-size material is broken down or leached out. Clay minerals tend to be dispersed and moved downward, especially where high rainfall and vigorous plant growth lower the electrolyte concentration. The remaining oxides tend to aggregate into forms in which spheroidal microstructures are common.

Mechanisms that are capable of promoting dehydration and hardening of ferricrusts, whether before, during, or after stripping of the overlying soil, include the destruction of forest and lowering of the water table, both of which can occur in several ways. Aside from clearance by humans, forest destruction, for example, may be caused by climatic change and downcutting by fluvial processes.

Silcrust formation requires the selective concentration of silica, a fact that has led some experts to consider silcrusts as the lower parts of ferricrust profiles. The distributional contrast between silcrusts and ferricrusts is clear, however, and the transition between the types is well documented. Silcrusts often, but not invariably, result from the silicification of sandstones and quartzitic conglomerates. They occur in areas that are currently drier than those with ferricrusts, but the fossil nature of many, plus the deep-weathering profiles to which they usually belong, presumably indicate humid climates at the time of formation and inhibit direct reference to existing controls. Like ferricrusts, silcrusts are usually taken to have originated below the ground surface, possibly under a layer of erodible, fine material.

Mobilization, migration, and concentration of ions. Soil-formation processes of selective concentration of oxides of iron and aluminum, and in some circumstances of silica, include ion exchange as a most important factor. Although not yet completely understood, this involves the exchange of ions held by negative charges with other ions in the electrolyte (soil solution). Ion exchange is influenced by the fit of ions into a mineral structure. Relevant processes include hydration (adsorption of water), hydroxylation (adsorption of H^+ and OH^- ions), oxidation (combination of oxygen, with loss of electrons to weathering agents), and reduction (depletion of combined oxygen). Ion exchange is controlled by the cation exchange capacity (CEC) expressed as the amount of exchangeable cations in milliequivalents per 100 grams clay at pH 7. Low CEC values are typical of kaolinitic clays and of actual or potential duricrusts.

Soil water will separate into oppositely charged ions, H^+ and OH^-, and the CO_2 of the atmosphere and soil will yield HCO_3^- and free H^+ ions in solution. These products promote displacement of some metal cations, especially those in mineral silicates, largely by H^+ ions that combine with OH^- in removable solutes. The H^+ ions are small and highly charged in relation to their size and can readily enter many crystal lattices; OH^- ions neutralize the small charges of Na^+, K^+, and the larger charges of Ca^{++} and Mg^{++}. Positive charges in soil particles are partly related to hydrous oxides of iron, aluminum, and manganese. Negative charges, increasing with falling pH, are neutralized by positive ions, among which $Al(OH)_2^+$ is one of the more significant. Negatively charged colloidal SiO_2 and colloidal Al_2O_3 and positively charged Fe_2O_3 probably interact at high concentrations of H^+ ions to form clay minerals. Among these, the most stable are the one-to-one layer silicates of the kaolin family, in which each silicon–oxygen sheet is condensed with one aluminum hydroxide sheet.

At least part of the ion-exchange process involves organisms and organic substances. Chelating agents, complex amino acids, and allied compounds inactivate ions of aluminum and iron and hold them firmly in lattice structures. The ions then behave as if they were not present, except when acidity markedly decreases and they are redeposited. Manganese and silicon can be similarly treated. The combined processes of solution and eluviation (soluviation) and of chelation and eluviation

(cheluviation) appear to act powerfully in the formation of oxide-rich plinthite prior to duricrust formation. In the mobilization and fixing of iron, as in the general production of organic acids, bacteria also play a part. Some act to form soluble iron, others oxidize soluble ferrous iron ($Fe(OH)_2$) to insoluble ferric iron (Fe_2O_3); and soil microorganisms, including bacteria, are specifically involved in the production of a number of prominent chelating agents.

Rock type, terrain, and water table fluctuations. Duricrusts occur on a wide range of igneous, metamorphic, and sedimentary rocks, including granites, basalts and gabbros, arenites, and argillites. There is only the roughest of tendencies for duricrust chemistry to be controlled by bedrock chemistry, even in similar climates, although nephelinesyenites characteristically weather into allitic (aluminum-rich) crusts, basic igneous rocks into ferritic (iron-rich) to tiallitic (titanium–aluminum) crusts, and arenites and argillites, in some areas, into silitic (silica-rich) crusts. Ferritic crusts are more highly indurated, more variable in structure, and less strongly hydrated than aluminous crusts. Although structures in silitic crusts vary from pea-sized nodules to blocky and massive, with natural, subsurface erosion pipes at lower levels, these crusts are not hydrous.

Profile drainage is influential; ready leaching and alkaline to neutral conditions favour removal of silica and concentration of aluminum and also of titanium if available. Nearness to the water table promotes concentration of iron, whereas poor site drainage and acidity possibly favour accumulation of silica. Known distributions, however, suggest geographic contrasts between ferricrust and silcrust formation rather than lithological control, which appears to be effective only in transitional belts.

Terrain requirements for duricrust formation include gentle slopes or situations where groundwater can supply oxides of iron and manganese or both of these. Well-preserved fossil crusts on pediments or plains with maximum slopes of 8° to 10° (and average slopes of 2° or less) suggest feeble lateral movement of groundwater and relative enrichment of crusts by leaching. This contrasts with the active translocation responsible for the absolute enrichment of crusts at the base of scarps and on valley floors. Also indicative of groundwater action are the light-coloured and mottled zones of many deep-weathering profiles; the former are regarded as the result of kaolinization in a reducing (de-ionizing) environment, and the latter from seasonal fluctuation of the groundwater level. Incapacity of these zones to supply the iron content of numerous crusts confirms relative enrichment.

Effects of climate and time. Calcrusts, gypcrusts, and salcrusts are referable to dry climates, but duricrusts proper, at least in present and late Holocene occurrences (the Holocene Epoch began about 10,000 years ago), are referable to humid tropical climates, probably with seasonal dryness, coincident wet and warm seasons, and soil temperatures averaging 25° to 30° C (about 75° to 85° F). Under these conditions, 50 percent or more of the original rock volume can be lost during weathering, but the preservation of structures in some profiles indicates downward thickening rather than overall diminution.

A span of 30 to 50 years will convert a drying ferallitic clay to a ferallitic duricrust; but extrapolation from known values suggests that up to 15,000,000 years may be required to form really deep-weathering profiles. Such time spans seem to be well within the range of duration of humid tropical forests in the Tertiary, however.

Climatic change presumably is responsible for the presence of duricrusts in equatorial areas that now receive more than 1,200 mm mean annual precipitation. The former northward extension of aridity in Africa, with Kalahari sand extending 1,600–3,000 kilometres (1,000–1,900 miles) beyond its present limit, is well documented. Similarly, former climates of the current humid tropical type are probably responsible for the presence of fossil crusts outside the tropics and for relict Tertiary deep weathering. Such climates seem explicable in terms of reduced pole-to-Equator temperature gradients.

Although dehydration and hardening of duricrusts are often called irreversible, this is not true over the long term. Apart from disaggregation of eroding caps, residual ferricrusts can be attacked by renewed soil-formation processes, which remobilize iron and produce red-yellow soils called "lateritic podzolics" in older classifications.

Durie, John: *see* Dury, John.

Duris (Greek painter): *see* Douris.

Durius (Europe): *see* Douro River.

Dürkheim (Germany): *see* Bad Dürkheim.

Durkheim, Émile (b. April 1858, Épinal, Fr.—d. Nov. 15, 1917, Paris), French social scientist who developed a vigorous methodology combining empirical research with sociological theory. He is widely regarded as the founder of the French school of sociology.

Durkheim

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Childhood and education. Durkheim was born into a Jewish family of very modest means. It was taken for granted that he would study to become a rabbi, like his father. The death of his father before Durkheim was 20, which burdened him with heavy responsibilities, and the increased rivalrous tensions between France's eastern provinces and Germany, may have contributed to making Durkheim a severely disciplined young man. As early as his late teens Durkheim became convinced that effort and even sorrow are more conducive to the spiritual progress of the individual than pleasure or joy.

His outstanding success at school designated him clearly as a candidate to the renowned École Normale Supérieure in Paris—the most prestigious teachers' college in France. While preparing for the École Normale at the Lycée Louis le Grand, Durkheim took his board at the Institution Jauffret in the Latin Quarter, where he became acquainted with another gifted young man from the provinces, Jean Jaurès, later to lead the French Socialist Party and at that time inclined like Durkheim toward philosophy and the moral and social reform of his countrymen.

Durkheim passed the stiff competitive examination for the École Normale one year after Jaurès, in 1879. It is clear that his religious faith had vanished by then. His thought had become altogether secular but with a strong bent toward moral reform. Like a number of French philosophical minds during the Third Republic, he looked to science and in particular to social science and to profound educational reform as the means to avoid the perils of social disconnectedness or "anomie," as he was to call this condition in which norms for conduct were either absent, weak, or conflicting.

He enjoyed the intellectual atmosphere of the École Normale—the discussion of metaphysical and political issues pursued with eagerness and animated by the utopian dreams of young men destined to be among the leaders of their country. He soon enjoyed the respect of his peers and of his teachers, but he was impatient with the excessive stress then laid in French higher education on elegant rhetoric and surface polish. His teachers of philosophy struck him as too fond of generalities and of monotonous worship of the past.

Fretting at the conventionality of formal examinations, he passed the last competitive examination in 1882, but without the brilliance that his friends had predicted for him. He then accepted a series of provincial assignments as a teacher of philosophy at the state secondary schools of Sens, Saint-Quentin, and Troyes between 1882 and 1887. In 1885–86 he took a year's leave of absence to pursue research in Germany, where he was impressed by Wilhelm Wundt, pioneer experimental psychologist. In 1887 he was appointed as lecturer at the University of Bordeaux, where he subsequently became professor and taught social philosophy until 1902.

Analytic methods. Durkheim was familiar with several foreign languages and reviewed volumes in German, English, and Italian at length in the learned journal *L'Année Sociologique,* which he founded in 1896. But it has been noted, at times with disapproval and amazement, by non-French social scientists, that he travelled little and that, like many French scholars as well as the notable British anthropologist Sir James Frazer, he never undertook any fieldwork. The vast information he studied on the tribes of Australia or of New Guinea or on the Eskimos was all collected by other anthropologists, travellers, or missionaries.

This was not, in Durkheim's case, due to provincialism or lack of attention to the concrete. He did not resemble the French philosopher Auguste Comte in making venturesome and dogmatic generalizations and disregarding empirical observation. He did, however, maintain that concrete observation in remote parts of the world does not always lead to illuminating views on the past or even on the present. To him facts had no meaning for the intellect unless they were grouped into types and laws. He claimed repeatedly that it is from a construction erected on the inner nature of the real that knowledge of concrete reality is obtained, a knowledge not perceived by observation of the facts from the outside. He thus constructed concepts such as that of the sacred or of totemism, exactly in the same way that Karl Marx developed the concept of class.

In truth, Durkheim's vital interest did not lie in the study for its own sake of so-called primitive tribes, but rather in the light such a study might throw on the present. The outward events of his life as an intellectual and as a scholar may appear undramatic. Still, much of what he thought and wrote stemmed from the events that he witnessed in his formative years, in the 1870s and 1880s, and in the earnest concern he took in them.

The Second Empire, which collapsed in the French defeat of 1870 at the hands of Ger-

many, had seemed an era of levity and dissipation to the earnest young Durkheim. France, with the support of many of its liberal and intellectual elements, had plunged headlong into a war for which it was unprepared; its leaders proved incapable. The left-wing Commune that took over Paris after the French defeat in 1871 led to senseless destruction, which appeared to Durkheim's generation, in retrospect, as evidence of the alienation of the working classes from capitalist society.

The bloody repression that followed the Commune was taken as further evidence of the ruthlessness of capitalism and of the selfishness of the frightened bourgeoisie. Later, the crisis of 1886 over Georges Boulanger, minister of war, who demanded a centralist government to execute a policy of revenge against Germany, was one of several events that testified to the resurgence of nationalism, soon to be accompanied by anti-Semitism. Such major French thinkers of the older generation as Ernest Renan and Hippolyte Taine interrupted their historical and philosophical works, after 1871, to analyze those evils and to offer remedies.

Durkheim was one of several young philosophers and scholars, fresh from their École Normale training, who became convinced that progress was not the necessary consequence of the development of science and technology, that it could not be represented by an ascending curve, justifying complacent optimism. He perceived around him the prevalence of "anomie," a personal sense of rootlessness fostered by the absence of social norms. Material prosperity set free greed and passions that threatened the equilibrium of society.

These sources of Durkheim's sociological reflections, never remote from moral philosophy, were first expressed in his very important doctoral thesis, *De la division du travail social* (1893; *The Division of Labour in Society*), and in *Le Suicide* (1897; *Suicide*). In his view ethical and social structures were being endangered by the advent of technology and mechanization. The division of labour rendered workmen both more alien to one another and more dependent upon one another, since none of them any longer built the whole product by himself. Suicide appeared to be less frequent where the individual was closely integrated with his culture; thus, the apparently purely individual decision to renounce life could be explained through social forces.

Effect of the Dreyfus affair. These early volumes, and the one in which he formulated with scientific rigour the rules of his sociological method, *Les Règles de la méthode sociologique* (1895; *The Rules of Sociological Method*), brought Durkheim fame and influence. But the new science of society frightened timid souls and conservative philosophers, and he had to endure many attacks. The Dreyfus affair—resulting from the false charge against a Jewish officer, Alfred Dreyfus, of spying for the Germans—erupted in the last years of the century, and the slurs or outright insults aimed at Jews that accompanied it opened Durkheim's eyes to the latent hatred and passionate feuds hitherto half concealed under the varnish of civilization. He took an active part in the campaign to exonerate Dreyfus. He was not elected to the Institut de France, although his stature as a thinker suggests that he should have been named to that prestigious, learned society. He was, however, appointed to the University of Paris in 1902 and made a full professor there in 1906.

More and more, the sociologist's thought became concerned with education and religion as the two most potent means of reforming humanity or of molding the new institutions required by the deep structural changes in society. His colleagues admired Durkheim's zeal in behalf of educational reform. His efforts included participating in numerous committees to prepare new curriculums and methods; working to enliven the teaching of philosophy, which too long had dwelt on generalities; and attempting to teach teachers how to teach.

A series of courses that he had given at Bordeaux on the subject of *L'Évolution pédagogique en France* ("Pedagogical Evolution in France") was published posthumously in 1938; it remains one of the best informed and most impartial books on French education. The other important work of Durkheim's latter years dealt with the totemic system in Australia and bore the title of *Les Formes élémentaires de la vie religieuse* (1915; *The Elementary Forms of the Religious Life*). The author, despite his own agnosticism, evinced a sympathetic understanding of religion in all its stages. French conservatives, who in the years preceding World War I turned against the Sorbonne, which they charged was unduly swayed by the prestige of German scholarship, railed at Durkheim, who, they thought, was influenced by the German urge to systematize, making a fetish of society and a religion of sociology.

In fact, Durkheim did not make an idol of sociology as did the positivists schooled by Comte, nor was he a "functionalist" who explained every social phenomenon by its usefulness in maintaining the existence and equilibrium of a social organism. He did, however, endeavour to formulate a positive social science that might direct people's behaviour toward greater solidarity.

The outbreak of World War I came as a cruel blow to him. For many years he had expended too much energy on teaching, on writing, on outlining plans for reform, on ceaselessly feeding the enthusiasm of his disciples, and eventually his heart had been affected. His gaunt and nervous appearance filled his colleagues with foreboding. The whole of French sociology, then in full bloom thanks to him, seemed to be his responsibility.

Death and legacy. The breaking point came when his only son was killed in 1916, while fighting on the Balkan front. The father stoically attempted to hide his sorrow, but the loss, coming on top of insults by nationalists who denounced him as a professor of "apparently German extraction" who taught a "foreign" discipline at the Sorbonne, was too much to bear. He died in November 1917.

Durkheim left behind him a brilliant school of researchers. He had never been a tyrannical master; he had encouraged his disciples to go farther than himself and to contradict him if need be. His nephew, Marcel Mauss, who held the chair of sociology at the Collège de France, was less systematic than Durkheim and paid greater attention to symbolism as an unconscious activity of the mind. Claude Lévi-Strauss, who occupied the same chair of sociology and resembles Durkheim in the way he combines reasoning with intensity of feeling, also offered objections and corrections to Durkheim's views. With Durkheim, sociology had become in France a seminal discipline that broadened and transformed the study of law, of economics, of Chinese institutions, of linguistics, of ethnology, of art history, and of history. (H.M.P.)

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Durlas (Ireland): *see* Thurles.

Durmitor, mountain massif in Montenegro, Yugoslavia, part of the Dinaric ranges and a national park region that includes 15 peaks of more than 6,600 ft (2,000 m) in height, the highest, Bobotov Kuk, reaching 8,274 ft (2,522 m). Between the peaks are deep valleys and glacial lakes; dense pine and fir forests surround the lakes. The highest settlement in Yugoslavia, Žabljak, is a tourist centre; winter sports are popular. Livestock breeding is carried on in the valleys.

Durnovo, Pyotr Nikolayevich (b. 1845, Moscow province, Russia—d. Sept. 24 [Sept. 11, old style], 1915, Petrograd), Russian statesman and security chief under tsars Alexander III and Nicholas II, who brutally suppressed the revolution of 1905. He is also noted for a remarkable memorandum he wrote in 1914 in which he accurately foresaw the course of the coming World War, including the collapse of the Russian Empire.

Durnovo resigned from military service to enter the government. His rise thereafter was rapid, and he became director of the Russian police in 1883. During his tenure in this post he was instrumental in breaking up the terrorist organization that had assassinated Alexander II. Dismissed in 1893 after a sex scandal, Durnovo returned to the government in 1900, this time as assistant minister of the interior, becoming acting minister under the moderate prime minister S.Y. Witte in late October at the height of the Russian Revolution of 1905.

A determined rightist, Durnovo quickly won the confidence of Nicholas II by dint of his effective suppression of the St. Petersburg and Moscow soviets. Durnovo was dismissed along with Witte in 1906 in the aftermath of the disorders, but he was soon appointed to the State Council, and he quickly became the leader of its conservative elements. Serving on the council until his death in 1915, he opposed all efforts to dilute the power of the monarchy.

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Duroc, breed of pig developed between 1822 and 1877 from the Old Duroc pig of New York and the Red Jersey pig of New Jersey; it was formerly called the Duroc-Jersey. The Duroc proved particularly suitable for feeding in the United States Corn Belt; by the 1930s it was the predominant breed in the United States, a distinction it held intermittently throughout the century. Exportation has been extensive, especially to the temperate regions of North and South America.

Red is the preferred and predominant colour for the Duroc, though wide variations may occur. Recent breeding selection has emphasized length, trimness, fine muscling, and rapid weight gain.

Duroc, Géraud-Christophe-Michel, DUC (duke) DE FRIOUL (b. Oct. 25, 1772, Pont-à-Mousson, Fr.—d. May 23, 1813, Markersdorf, near Görlitz, Silesia), French general and diplomat, one of Napoleon's closest advisers.

The son of Claude de Michel, chevalier du Roc, who was a cavalry officer, Duroc went to the Châlons artillery school, emigrated in 1792, but changed his mind, returned to France, entered the Metz school (1793), and was drafted to the artillery of the army of Italy. In 1796 Napoleon took Duroc as his aide and made him a major in Egypt, a colonel in Syria, and, after the coup d'etat of 18 Brumaire (Nov. 9, 1799), senior aide-de-camp. All contemporaries praised this reserved, unambitious man who, as his best friend, so often checked Napoleon's angry impulses.

From 1804 he was grand marshal (lord high steward of the empire) and kept good order

Duroc, portrait by Jacques-Louis David; in the Musée Léon Bonnat, Bayonne, Fr.
Giraudon—Art Resource/EB Inc.

in the palaces. Furthermore, he was often on diplomatic missions, and it was he who signed the treaties of Fontainebleau and Bayonne (1807–08) determining the intervention in Spain. He was also general of division (1803), led a division at Austerlitz, and was in all the campaigns. He was usually consulted by Napoleon on questions of promotion and became the best channel by which Napoleon's lieutenants could approach him.

On his journey back from Russia in 1812, the Emperor chose Armand de Caulaincourt as his immediate companion; Duroc followed in another sledge. In 1813 Duroc, like Caulaincourt, was made a senator. He had heavy work in the organization of the new army and was with it at the battles of Lützen and Bautzen (1813). In the outposts in Silesia he came, by chance, under artillery fire and was mortally wounded. Napoleon deeply regretted his death.

Durrānī, also spelled DURĀNĪ, formerly ABDĀLĪ, one of the two chief tribal confederations of Afghanistan, the other being the Ghilzay. In the time of Nāder Shāh the Durrānī were granted lands in the region of Qandahār, which was their homeland; and they moved there from Herāt.

In the late 18th century they took up agriculture. Under Aḥmad Shāh Durrānī and Timur Shāh the Durrānī formed the major political and military support of the monarchy. Later 18th-century policy of reducing their power, with Durrānī resistance to the policy, was one of the chief causes of the 18th- and early 19th-century civil wars.

Durrānī, Aḥmad Shāh: *see* Aḥmad Shāh Durrānī.

Durrell, Lawrence (George) (b. Feb. 27, 1912, Darjeeling, India), English novelist, poet, and writer of topographical books, verse plays, and farcical short stories, widely regarded as one of the most original English novelists of the postwar period.

Durrell spent most of his life outside England and had little sympathy with the English character. He returned from India when he was 11 and later went to Paris. During World War II he was in Egypt, as press attaché to the British embassies in Cairo and Alexandria, and after the war in Yugoslavia, the Greek islands, and the south of France.

He achieved fame with *The Alexandria Quartet*, a novel in four parts—*Justine* (1957), *Balthazar* (1958), *Mountolive* (1958), and *Clea* (1960)—which became a best-seller and won high critical esteem. The first three volumes described, from different viewpoints, a series of events in Alexandria before World War II; the fourth carried the story forward into the war years. By its subjective narrative structure *The Alexandria Quartet* demonstrates one of its main themes: the relativity of truth. More important is the implied theme: that sexual experience, the practice of art, and love are all ways of learning to understand and finally to pass beyond successive phases of development toward ultimate truth and reality. Highly praised by critics elsewhere throughout the world, the work was received in Great Britain with some reserve.

Later novels, *Tunc* (1968) and its sequel, *Nunquam* (1970), were less well received than Durrell's earlier fiction. *Monsieur; or, The Prince of Darkness* (1975), *Livia; or, Buried Alive* (1978), and *Constance; or, Solitary Practices* (1982), somewhat reminiscent of the Alexandria novels, were part of a projected five-novel series.

Many critics in Britain regard Durrell's poetry and topographical books as his most enduring achievements. He first gained recognition as a poet with *A Private Country* (1943), and his reputation was established by *Cities, Plains and People* (1946), *The Tree of Idleness* (1953), and *The Ikons* (1966). His *Collected Poems* 1931–74 appeared in 1980.

In *Prospero's Cell* (1945), *Reflections on a Marine Venus* (1953), and *Bitter Lemons* (1957), Durrell describes three Greek islands: Corfu, where he lived with his first wife, 1937–38; Rhodes, where in 1945–46 he acted as press officer to the Allied government; and Cyprus, his home from 1952 to 1956.

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Dürrenmatt, Friedrich (b. Jan. 5, 1921, Konolfingen, near Bern), playwright whose tragicomic works were central to the post-World War II revival of German theatre.

Dürrenmatt, who was educated in Zürich and Bern, was fortunate to grow up in the only German-speaking country not overrun by National Socialism between 1933 and 1945. Switzerland was thus the only site where German drama flourished during those years, giving Dürrenmatt and his compatriot, Max Frisch, an upbringing in innovative German theatre denied other German-speaking writers. Dürrenmatt's technique was clearly influenced by the German expatriate writer Bertolt Brecht, as in the use of parables and of actors who step out of their roles to act as narrators. Dürrenmatt sees the world as essentially absurd and simply presents the grotesque and macabre excesses of the human situation without attempting to interpret their significance.

His plays often have bizarre settings. His first play, *Es steht geschrieben* (performed and published in 1947; "It Is Written"), is about the Anabaptist suppression in Münster in 1534–36. In it, as in *Der Blinde* (performed 1948, published 1960; "The Blind Man") and *Romulus der Grosse* (performed 1949, published 1958; *Romulus the Great*, 1962), comical liberties are taken with the historical facts. *Die Ehe des Herrn Mississippi* (performed and published 1952; *The Marriage of Mr. Mississippi*, published 1964 in *Four Plays*), a serious play in the guise of an old-fashioned melodrama, established his international reputation, being produced in the United States as *Fools Are Passing Through* in 1958. Among the plays that followed are *Der Besuch der alten Dame* (performed and published in 1956; *The Visit*, 1962); *Die Physiker* (performed and published 1962; *The Physicists*, performed and published 1963), a modern morality play about science, generally considered his best play; *Der Meteor* (performed and published in 1966; *The Meteor*, published 1974); and *Porträt eines Planeten* (produced 1970, published 1971; performed in England as *Portrait of a Planet*, 1973).

In 1970 Dürrenmatt wrote that he was "abandoning literature in favour of theatre," no longer writing plays but working to produce adaptations of well-known works. In addition to plays, Dürrenmatt wrote detective novels, radio plays, and critical essays.

Durrës, Italian DURAZZO, Serbo-Croatian DRAČ, primary seaport of Albania and capital of Rrethi i Durrësit (Durrës district), lying on the Adriatic coast, west of Tiranë.

Founded as Epidamnus by Greeks from Corcyra and Corinth in the 7th century BC, it was seized by the Illyrian king Glaucias in 312 BC. It later passed to the Romans, who called it Dyrrhachium and made it the terminus of their military highway (Via Egnatia), which led past Elbasan and Lake Ohrid across the Balkan Peninsula to Thessalonica (now Thessaloníki, Greece) and the east. It thereby became the most important port of Illyricum. In the 4th century AD it became capital of Epirus Nova (a Roman province), and an archbishopric was created there in 449. Several well-preserved Roman arenas have been excavated in the old quarter of the city.

The town was besieged by the Ostrogoth Theodoric in 481 and attacked by Bulgars in the 10th and 11th centuries. It was captured in 1082 by the Norman adventurer Robert Guiscard and, after passing to the Byzantines, fell (1185) to King William II of Sicily. Early in the 13th century, Durrës passed to the Venetians, in 1258 to King Manfred of Sicily, and in 1272 to Charles I of Anjou, king of Naples and Sicily. It was annexed (1333) by Achaea, a Greek principality, and was captured in 1336 by the forces of Stefan Dušan, king of the Serbs. Upon Dušan's death (1355) it passed to the Albanian family of Thopias. It was ceded to Venice in 1392, but the Turks captured it in 1501 and held it until their defeat in the First Balkan War (1912–13). It was declared capital of an independent Albania in 1913 but was occupied in 1914 by Prince Wilhelm zu Wied, who was sponsored by a conference of European powers. The town was taken in World War I by Austrian and then Italian forces, the latter withdrawing in 1920. On April 7, 1939, Durrës was the main port of disembarkation for Fascist Italy's invasion of Albania.

The port of Durrës has become the main channel for the import of foodstuffs into Albania. The port installations, destroyed by the Germans in 1944, have been rebuilt, and railway lines link the harbour with Tiranë and other parts of the interior. Industries include shipbuilding and the manufacture of tobacco, plastic, and leather products. Pop. (1980 est.) city, 65,900; (1978 est.) district, 202,000.

durukuli, also spelled DOUROUCOULI, also called OWL MONKEY, or NIGHT MONKEY (*Aotus,* or *Aotes, trivirgatus*), nocturnal Central and South American monkey. The durukuli is of the family Cebidae and is a round-headed animal with small ears and dense, soft, grizzled gray or brown fur. It is distinguished by large, yellow-brown eyes surmounted by white markings that separate three dark bands on the crown. The durukuli is about 25–50 centimetres (10–20 inches) long, excluding its bushy, nonprehensile tail of about the same length. A loud-voiced forest dweller, it lives in small family groups that sleep together in tree hollows. It emerges at night to feed on insects, fruit, and small animals.

durum wheat, also called DURUM (*Triticum durum*), species of wheat (*q.v.*) used in the production of semolina, from which pasta (*q.v.*) products are made.

Duruy, Victor (b. Sept. 11, 1811, Paris—d. Nov. 25, 1894, Paris), French scholar and public official who, as national minister of education (1863–69), initiated extensive reforms, one of which—the introduction of free, compulsory primary education—was ahead of

its time in France and failed, partly because Emperor Napoleon III declined to support it.

As a historian, he was perhaps best known for his writings on ancient Roman and Greek civilizations. While education minister he introduced secular secondary education for girls, added modern languages and contemporary history to lycée and college curricula, reorganized teacher training, and began a kind of extension-course service for the provinces.

Durūz (Islāmic sect): *see* Druze.

Durūz, ad-, Jabal, also spelled JEBEL ED-DRUZ, French LE DJEBEL DRUZE, mountain just east of as-Suwaydā', Syria. Located in the Ḥawrān region, Dar'ā *muḥāfaẓah* (governorate), it rises to 5,900 ft (1,800 m). The name in Arabic means Mountain of the Druzes.

The Druze, a sect derived from the Ismaʿīlī branch of Shīʿī Islām, have been settled in the area of the Jabal since the 11th century. There are some 120 Druze villages located on or near the Jabal, among them Sālah (Roman Salamanestha), the largest on the eastern slope, and Qanawāt (Roman Canatha), on the west, the seat of the highest ranking *jawwād* (spiritual leader) in the Jabal ad-Durūz. Qanawāt is a place of pilgrimage for the Druze. The entire area of Jabal ad-Durūz, located strategically on the north–south trade route, contains the remains of many Roman towns and forts.

Dury, John, Dury also spelled DURIE (b. 1596, Edinburgh—d. Sept. 26, 1680, Kassel, Hesse-Kassel), Scottish Protestant clergyman, a leading advocate of union of the Lutheran and Reformed churches. Dury was educated at Sedan, Leyden, and Oxford. By 1630 he had already begun working for unity between the churches, travelling among the courts and churches of the German states. His life became a constant round of travels, discussions, correspondence, and publishing in the pursuit of his cause. In 1645 he married a wealthy Irish woman. In 1654 he won the support of Oliver Cromwell and the English universities for a fresh effort and travelled through Switzerland, Germany, and the Low Countries, without success. He established a home in Kassel in 1661 and lived there until his death, still campaigning. He wrote that the only fruit of his efforts was "that I see the miserable condition of Christianity, and that I have no other comfort than the testimony of my conscience."

Duryea, Charles Edgar and J(ames) Frank (respectively b. Dec. 15, 1861, Canton, Ill., U.S.—d. Sept. 28, 1938, Philadelphia; b. Oct. 8, 1869, Washburn, Ill.—d. Feb. 15, 1967, Saybrook, Conn.), inventors of one of the first automobiles—the first that was actually built and operated in the United States.

Charles Duryea entered the rapidly growing bicycle business and displayed a marked inventive talent. In 1886 at the Ohio state fair, he saw a stationary gasoline engine that seemed to him to be sufficiently compact to power a carriage or wagon. By 1891 he had completed a design, and with his brother he then constructed a car and engine in a rented loft in Springfield, Mass. In later years a controversy marred relations between the brothers; Charles claimed that the model was completed to an operable state under his guidance, while Frank asserted that he perfected the engine and transmission while Charles was in Illinois. In any case the car made a successful run in the streets of Springfield on Sept. 22, 1893.

An improved version, largely the work of Frank Duryea, appeared in 1895 and won several races. Thirteen copies of it were manufactured and sold, but the company failed, and the brothers went separate ways. Charles made a number of vehicles, some three-wheeled, and Frank developed the Stevens-Duryea, one of the best known of the early standard makes, a high-priced limousine that continued in production into the 1920s.

Dušan, Stefan (Serbian emperor): *see* Stefan Dušan.

Duse, Eleonora (b. Oct. 3, 1858, near or in Vigevano, Lombardy, Austrian Empire—d. April 21, 1924, Pittsburgh), Italian actress who was acclaimed in many countries and found her great interpretive roles in the heroines of the Italian playwright Gabriele D'Annunzio and of the Norwegian playwright Henrik Ibsen, especially Ellida in *The Lady from the Sea* and the title role in *Hedda Gabler.*

Eleonora Duse
By courtesy of the Library of Congress, Washington, D.C.

Most of Duse's family were actors who played in the same touring troupe. She is said to have been born in a railway coach, although some biographers contend that she was born in a Vigerano hotel, and she made her first stage appearance at the age of four in a dramatization of Victor Hugo's *Les Misérables.* By the age of 14, when she played Juliet at Verona, her talents were already being recognized by critics; but after her family died she moved from one company to another, without a great deal of success, until her appearance at Naples in 1878. This marked the turning point of her career. Her performances there as Electra and Ophelia were admired, but it was her characterization of the title role in Émile Zola's *Thérèse Raquin* that won greatest acclaim, with audiences and critics united in the opinion that a woman's anguish had never before been played with such truth.

In 1882 Duse took an opportunity to watch Bernhardt perform. The French actress's success in modern roles gave Duse the idea also of appearing in plays by contemporary French dramatists (for she had discovered that Italian audiences were bored by the stale pieces that formed the traditional repertory), and so for three years she acted in a number of plays by the younger Dumas. The first of these was Lionette in *La Princesse de Bagdad,* a play from which Parisians had recoiled when a French actress played the lead. Duse, however, scored a triumph and followed it up with Cesarine in *La Femme de Claude;* in 1884 she created the title role of Dumas's latest play, *Denise,* and also the part of Santuzza in Giovanni Verga's *Cavalleria rusticana.* With Cesare Rossi, a prominent actor-manager, she toured South America in 1885, but after her return to Italy she formed her own company, the Drammatica Compagnia della Città di Roma, and with it toured Austria, Germany, England, France, Russia, Egypt, Belgium, and Portugal, making visits also to the United States in 1893, 1896, and 1902. Though idolized wherever she went, she felt most appreciated as an artist in the city of Vienna.

In 1894 she met and fell in love with a rising young poet, Gabriele D'Annunzio, and he wrote for her a number of plays. Her belief in his talent was boundless, and his cult of beauty added another dimension to her acting. A radiant glow is said to have emanated from her whenever she played one of his characters. D'Annunzio told the story of their love in his novel *Il fuoco* (1900; *The Flame of Life*).

Aside from D'Annunzio's plays, Duse found an inexhaustible source of self-expression in the dramas of Ibsen. She never tired of playing Nora in *A Doll's House,* Rebecca West in *Rosmersholm,* Ella Rentheim in *John Gabriel Borkman,* and, above all, Ellida in *The Lady from the Sea.* To the title role in *Hedda Gabler* she brought a demonic quality, a touch of the fantastic—deeply troubling to Ibsen when he saw her perform it—as though she had gone beyond the frontiers of realism.

The British playwright George Bernard Shaw was one of the many critics fascinated by Duse's ability to produce an illusion "of being infinite in variety of beautiful pose and motion." He confessed that "in an apparent million of changes and inflexions" he had never seen her at an "awkward angle" in defiance of the "natural gravitation towards the finest grace" (*Dramatic Opinions and Essays,* 1907). She had a thousand faces; her physical command, range, and choice of gesture were superb; she had a different way of walking for each part; she even mastered the colour of her face, which was unspoiled by makeup, and Shaw's professional curiosity was aroused when he pondered the question of whether Duse's blush could always be summoned at her will. Yet the total effect was of more than "naturalistic" acting: Duse acted not only the reality, she also commented on the characters she played—she "knew" far more about Nora, for instance, than Ibsen's heroine could possibly have known about herself. One of her critics wrote that Duse played what was between the lines; she played the transitions. A tremor of her lips could reveal exactly what went on in her mind; and, where the character's inner life was lacking, because the dramatist had failed his task, she supplied motivation herself. To watch her was to read a psychological novel.

In 1909 Eleonora Duse quit the stage, mainly for reasons of health. Financial losses incurred during World War I, however, obliged her to emerge from retirement in 1921. Her acting powers were undiminished, but her health was still not good and interfered with her late career. In 1923 she appeared in London for six matinee performances, then played three nights in Vienna, before she embarked upon her last tour of the United States. This began with an appearance at the Metropolitan Opera House in New York City and ended in Pittsburgh, where she collapsed. Her body was taken back to Italy, and, in compliance with her request, she was buried there in the small cemetery of Asolo.

The most fluent and expressive actress of her day, Eleonora Duse created afresh every role she played and was different in each of them. Her gift was in marked contrast to the talented contemporary star of the French theatre, Sarah Bernhardt, a great technician who always strove to project her own personality from the stage, whatever character she might be playing. (A.M.N.)

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Dušek, Jan Ladislav (Bohemian musician): *see* Dussek, Jan Ladislav.

Dushan, Stephen (Serbian emperor): *see* Stefan Dušan.

Dushanbe, also spelled DUŠANBE, formerly (until 1929) DYUSHAMBE, or DIUSHAMBE, or (1929–61) STALINABAD, city and capital of the Tadzhik Soviet Socialist Republic. It lies along the Varzob (Dushanbinka) River in the Gissar valley, in the southwest of the republic. It was built in the Soviet period on the site of three former settlements, of which the largest was named Dyushambe (Tadzhik *dush,* meaning "Monday," its bazaar day). Dyushambe was for long part of the khanate of Bukhara, and it suffered severely in the fighting that followed the overthrow of the emir by Soviet troops in 1920. In 1924 the site was chosen to serve as the capital of the new Tadzhik Autonomous S.S.R. (after 1929 the Tadzhik S.S.R.), and rapid industrial and population growth followed. The planned city has wide, straight, tree-lined streets, large public buildings, and several squares and parks. Except in the centre, most of the buildings are one-story because of the danger of earthquakes. The summer heat is mitigated by breezes from the mountains to the northeast.

An important transport junction, Dushanbe accounts for one-third of the republic's industrial output. The city's light industries include a large textile combine and plants producing automatic looms, electric cable, and domestic refrigerators. The city houses the Tadzhik Academy of Sciences (1951), the Tadzhik V.I. Lenin State University (1948), and medical,

Embroidery workshop in Dushanbe, Tadzhik S.S.R.
J. Allan Cash—EB Inc.

teacher-training, agricultural, and polytechnic institutes, as well as embroidery workshops; there are also several theatres. The population is predominantly Russian and Tadzhik; other nationalities include Tatars and Ukrainians. Pop. (1989 prelim.) 595,000.

Dushman, Saul (b. July 12, 1883, Rostov, Russia—d. July 7, 1954, Toronto, Ont., Can.), Russian-American physical chemist, author of several standard scientific textbooks.

Dushman immigrated to America in 1891, later entering the University of Toronto and receiving his doctorate in 1912. That year he joined the General Electric Research Laboratory, where he rose to the post of assistant director (1928–48). During the 1920s, he conducted significant research in thermionics, the study of the electrically charged emissions of incandescent substances. His first book, *The Production and Measurement of High Vacuum* (1922), was for many years a standard reference. He wrote *Quantum Theory and Atomic Structure* (1931) and *Elements of Quantum Mechanics* (1938) to provide the chemist with a basic knowledge of physics. He achieved international recognition for *Scientific Foundations of Vacuum Technique* (1949). Dushman's *The Fundamentals of Atomic Physics* (1951) was designed to spread an understanding of new developments in the physical sciences.

Dussek, Jan Ladislav, Dussek also spelled DUŠEK, or DUSIK (b. Feb. 12, 1760, Čáslav, Bohemia [now in Czechoslovakia]—d. March

Dussek, detail of a drawing by Pierre Condé, 19th century
The Andre Meyer Collection—J.P. Ziolo

20, 1812, St. Germain-en-Laye, Fr.), Bohemian pianist and composer, best-known for his piano and chamber music.

The son of a cathedral organist, Dussek studied music with his father and showed great skill as a pianist and organist at an early age. He sang in the choir at Iglau (Jihlava) and later studied theology at Prague. After working as an organist, in 1782 he made his debut as a virtuoso pianist in the Netherlands, where he attained a great reputation and wrote a large number of "accompanied sonatas" for pianoforte and strings. In Hamburg that same year he studied under C.P.E. Bach. He subsequently toured as a pianist in Berlin, St. Petersburg (now Leningrad), and Paris and in Italy. He made a successful debut in 1790 in London. There he established a music shop, but the business failed, and in 1799 Dussek fled from England to escape his creditors. He subsequently stayed in Hamburg and Berlin and lived in the household of Charles-Maurice de Talleyrand in Paris from about 1807 until his death.

As a pianist Dussek possessed great dexterity and could elicit a singing tone that was much praised by his contemporaries. He is said to have been the first pianist to place his piano sideways on the platform, so that the public could see a profile view of the performer. Dussek's own musical compositions include a considerable number of pianoforte sonatas and concerti and numerous chamber works for piano and strings. His piano sonatas represent him at his best; and, though his works are largely forgotten, he influenced the growth of piano technique, both as pianist and as composer.

Düsseldorf, *Regierungsbezirk* (administrative district), west-central North Rhine-Westphalia *Land* (state), western Germany. Düsseldorf is bordered by The Netherlands to the west and the *Regierungsbezirke* of Münster to the northeast, Arnsberg to the east, and Köln to the south. The district occupies an area of 2,042 square miles (5,288 square km) and consists of the northern portion of the larger historic region of the Rhineland (*q.v.*). Düsseldorf *Regierungsbezirk* takes its name from that of the capital city of the *Land* and administrative seat of the district.

Germany's two largest axes of population, aligned north–south along the Rhine River and east–west along the Ruhr River and foothills of the Middle Rhine Highlands, intersect in the district of Düsseldorf. One of Europe's leading industrial regions, the area owes its development to the immense Ruhr bituminous coalfield, which is situated largely between the Ruhr and Lippe rivers and extends west of the Rhine and east into Münster and Arnsberg. A dense network of roads, railroads, and inland waterways serves the Rhine-Ruhr industrial complex, which is centred primarily on iron and steel processing, chemical manufacturing, and engineering. Düsseldorf is the most densely populated *Regierungsbezirk* in Germany. Three cities in the Ruhr complex of Düsseldorf—Essen, the largest city in North Rhine-Westphalia, Düsseldorf, and Duisburg—have populations of more than 500,000. Essen's highly diversified industries produce iron and steel, machinery, chemicals, glass, electrical equipment, and consumer goods. The city of Düsseldorf produces iron and steel and is a banking and administrative centre. Duisburg, located at the confluence of the Rhine and Ruhr rivers, is the largest inland port in Europe and has industries producing iron and steel, machinery, chemicals, and textiles.

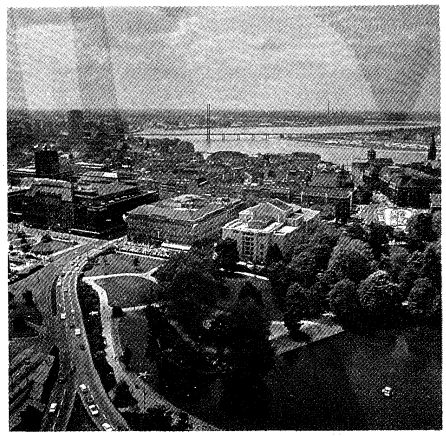
The northern extent of Bergisches Land, an area that was once the county and duchy of Berg, lies southeast of the Rhine–Ruhr intersection. This region's economy is largely dependent on the Ruhr coalfield. Light forms of iron and steel processing constitute its major economic activity. Products are generally of the highly finished variety, such as cutlery from Solingen, hand tools from Remscheid, and locks and keys from Velbert. Wuppertal is the chief city of Bergisches Land and is an important textile centre specializing in the manufacture of synthetic fibres.

The Lower Rhinelands border the Rhine-Ruhr complex to the west and north. Market gardens cultivated on the Rhine plain near the city of Düsseldorf supply fresh fruits and vegetables to the *Regierungsbezirk's* large urban centres. South of Düsseldorf, fertile loess-covered plains support large crops of wheat and sugar beets. North and west of Düsseldorf are less densely populated plains in which dairy farming and food processing are the primary sources of income, though the cities of Mönchengladbach and Krefeld are important textile centres.

The majority of the population of Düsseldorf *Regierungsbezirk* are descendants of the Rheinfranken (Rhineland Franks) and speak a Lower Franconian dialect. Cultural identity in the urban areas, however, has dissipated as a result of heavy immigration from a variety of foreign areas, including eastern Europe, the eastern Mediterranean, and The Netherlands. Roman Catholics and Protestants are about equally represented in the district. Large, irregular villages are the predominant form of rural settlement in the loess-covered agricultural regions south of Düsseldorf, while dispersed farmsteads are found to the north. Higher education in the district is centred at

universities in Essen, Düsseldorf, Wuppertal, and Duisburg. Pop. (1989 est.) 5,108,646.

Düsseldorf, city, capital (1946) of North Rhine-Westphalia *Land* (state), western Germany. It lies mainly on the right bank of the Rhine, 21 miles (34 km) northwest of Cologne. It is the administrative and cultural centre of the industrial Rhine-Ruhr area. First mentioned in 1159, Düsseldorf ("Village on the Düssel," a small tributary of the Rhine) was chartered in 1288 by the count of Berg and was the capital of the duchies of Berg and Jülich from 1511 until it passed to the Palatinate-Neuberg line in 1609. Although the town suffered considerably in the Thirty Years' War and the War of the Spanish Succession, it revived under the elector palatine Johann Wilhelm II (Jan Wellem). After being the capital of the short-lived Napoleonic grand



Düsseldorf, Ger.
Archiv fur Kunst und Geschichte, Berlin

duchy of Berg (1805–13), the town passed to Prussia in 1815. Rapid commercial and economic growth followed the establishment of iron and steel industries in the 1870s. After the widespread devastation suffered during World War II, many of the city's old buildings were repaired and many new buildings erected.

Düsseldorf's moated and tree-lined shopping street called the Königsallee is well known. Notable landmarks in the city include the 13th–14th-century St. Lambertuskirche, whose crooked tower has become the town symbol, and the old town hall (1567–88). Of the castle of the electors palatine, burned in 1872, only the tower survives. Other reminders of Düsseldorf's illustrious past include Jägerhof Castle (1752–63), which houses the town historical collection; Benrath Castle (1755–73), built by Nicolas de Pigage; and the remains of the palace of Frederick I Barbarossa.

In the nearby Neanderthal valley is the Feldhofer Cave, where the remains of Neanderthal man were first discovered in 1856. Düsseldorf claims the first German skyscraper, the Wilhelm-Marx-Haus (1924). Among the city's numerous cultural institutions, the museum of ceramics, the *Land* museum, and the city library (housing a collection of works by and about a native son, the poet Heinrich Heine) are particularly notable. The University of Düsseldorf was founded in 1965; there is also an academy of art (founded 1767), a conservatory, and several technical institutes.

Düsseldorf has three harbours on the Rhine and one of the nation's busiest civil airfields, at Lohausen. The city is a banking and wholesale centre and is the administrative seat of many of the Ruhr's businesses. Its chief industry is iron and steel. Other products include chemicals, glass, and textiles. Pop. (1989 est.) 569,641.

Düsseldorf school, painters who studied at the Düsseldorf academy (now Düsseldorf State Academy of Art) and whose work showed the influence of its insistence on hard linearism and elevated subject matter. The academy of painting in Düsseldorf was founded in 1767 and attracted students from throughout Europe and the United States from the early 1830s through the 1860s.

During the period of its greatest allure, the academy was directed by Wilhelm von Schadow, and many followers of the Nazarenes (a group that looked to pre-Renaissance styles and emphasized religious subject matter) were on the faculty. This, in large measure, accounts for the melodramatic compositions that the school's students of history painting exhibited. The Düsseldorf school's basic style combines elements of the linearism and drawing techniques of the Neoclassicists with the subject matter and gesture of the Romantics. Colour and texture were suspect, and a concentration on drawings and organized composition was stressed. Emanual Leutze's "Washington Crossing the Delaware" (1851; Metropolitan Museum of Art, New York City) is an example of this style.

In the mid-19th century the American contingent of students at Düsseldorf was so large that the academy was looked on as a normal experience for the American art student. Such notable American painters as George Caleb Bingham, Albert Bierstadt, and Worthington Whittredge all studied there and subsequently passed on the hard-edged, meticulous lines of the Düsseldorf school to countless other American painters.

Dust Bowl, a section of the Great Plains of the United States that extended over southeastern Colorado, southwestern Kansas, the panhandles of Texas and Oklahoma, and northeastern New Mexico.

The term Dust Bowl was suggested by conditions that struck the region in the early 1930s. The area's grasslands had supported mostly stockraising until World War I, when millions of acres were put under the plow in order to grow wheat. Following years of overcultivation and generally poor land management in the 1920s, the region—which receives an average rainfall of less than 20 inches (500 mm) in a typical year—suffered a severe drought in the early 1930s that lasted several years. The region's exposed topsoil, robbed of the anchoring, water-retaining roots of its native grasses, was carried off by heavy spring winds. "Black blizzards" of windblown soil blocked out the sun and piled the dirt in drifts. Occasionally the dust storms swept completely across the country to the East Coast. Thousands of families were forced to leave the region at the height of the Great Depression in the early and mid-1930s.

The wind erosion was gradually halted with federal aid; windbreaks were planted and much of the grassland was restored. By the early 1940s the area had largely recovered.

dust devil, also called SAND DEVIL, small, brief whirlwind commonly occurring in a desert in the early afternoon. *See* tornado.

Dusun, also called KADAZAN, largest indigenous ethnic group in the Sabah region of the island of Borneo that is part of Malaysia. The Dusun inhabit northern Borneo and are grouped along the coastal plain from Kudat to Beaufort and in the hills around Tambunan. The Dusun are of Proto-Malay stock; they migrated from Asia and were originally headhunters. In the late 20th century they numbered about 315,000 and made up about one-third of the population of Sabah. They speak Kadazan, an Austronesian language. Originally the Dusan lived in large kinship groups in longhouses with each village containing 150–200 persons. Many now have individual huts for smaller family units. Irrigated wet rice is the principal crop, supplemented by slash-and-burn agriculture, including dry rice, corn (maize), and sweet potatoes. They were the first native group in Borneo to use the plow. The western Dusun form much of the labour force in local rubber production. Dusun society is based on patrilineal descent groups; marriage within a descent group is forbidden. The Dusun are animists, though many have converted to Roman Catholicism; priestesses conduct a variety of agricultural and communal rituals.

Dutch barge dog: *see* Keeshond.

Dutch bond, also called FLEMISH BOND, form of bonding courses of stones or bricks in walling. *See* bond.

Dutch cheese: *see* cottage cheese.

Dutch East India Company, byname of UNITED EAST INDIA COMPANY, Dutch VEREENIGDE OOST-INDISCHE COMPAGNIE, trading company founded by the Dutch in 1602 to protect their trade in the Indian Ocean and to assist in their war of independence from Spain. The company prospered through most of the 17th century as the instrument of the powerful Dutch commercial empire in the East Indies. It was dissolved in 1799.

The Dutch government granted the company a trade monopoly in the waters between the Cape of Good Hope and the Straits of Magellan with the right to conclude treaties with native princes, to build forts and maintain armed forces, and to carry on administrative functions through officials who were required to take an oath of loyalty to the Dutch government. Under the administration of forceful governors-general, most notably Jan Pieterszoon Coen (1618–23) and Anthony van Diemen (1636–45), the company was able to defeat the British fleet and largely displace the Portuguese in the East Indies.

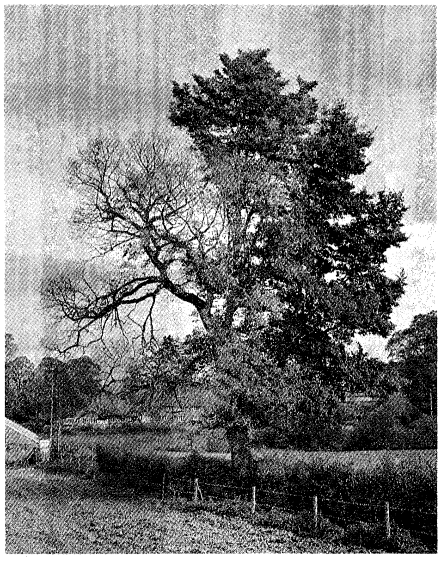
In 1619 the company renamed Jacatra Batavia (now Jakarta) and used it as a base to conquer Java and the outer islands. By the late 17th century the company had declined as a trading and sea power and had become more and more involved in the affairs of Java. By the 18th century the company had changed from a commercial-shipping enterprise to a loose territorial organization interested in the agricultural produce of the Indonesian archipelago. Toward the end of the 18th century the company became corrupt and seriously in debt. The Dutch government eventually revoked the company's charter and took over its debts and possessions in 1799.

Dutch East Indies, also called NETHERLANDS EAST INDIES, Dutch NEDERLANDS OOST-INDIË, or NEDERLANDSCH-INDIË, one of the overseas territories of The Netherlands until December 1949, now Indonesia. This territory was made up of Sumatra and adjacent islands, Java with Madura, Borneo (except for North Borneo, which is now part of Malaysia and of Brunei), Celebes with Sangihe and Talaud islands, the Moluccas, and the Lesser Sunda Islands east of Java (excepting the Portuguese half of Timor and the Portuguese enclave of Oé-Cusse). Netherlands New Guinea (renamed Irian Jaya) was also ceded to Indonesia in August 1962; this comprised the territory on the island of New Guinea west of 141° E, with the offshore islands of Waigeo, Salawati, and Misool.

During World War II the entire Dutch East Indies, excepting a part of southern Netherlands New Guinea, was occupied by Japan. The years 1945–49 formed a transition period in which The Netherlands unsuccessfully tried to regain control of the islands; the islands achieved independence as the new nation of Indonesia in 1949.

Dutch elm disease, widespread fungoid killer of elms, first described in The Netherlands. The causal fungus, *Ceratocystis ulmi,*

was probably introduced into Europe from Asia during World War I. The disease was first identified in the United States in 1930. A federal eradication campaign in the late 1930s and early '40s sharply reduced the numbers of infected elms but could not stop the disease's spread into regions wherever the very susceptible American elm (*Ulmus americana*) grows.



English elm afflicted with Dutch elm disease
A to Z Botanical Collection—EB Inc.

The leaves on one or more branches of a stricken tree suddenly wilt, turn dull green to yellow or brown, curl, and may drop early. Young, rapidly growing elms may die in one to two months; older or less vigorous trees sometimes take two years or more to succumb. A brown to black discoloration occurs in the white sapwood of wilting branches just under the bark. Because symptoms are easily confused with other diseases, especially elm phloem necrosis and diebacks, positive diagnosis is only possible through laboratory culturing. The fungus can spread up to 50 feet (15 m) from diseased to healthy trees by natural root grafts. Overland spread of the fungus normally occurs by the smaller European elm bark beetle (*Scolytus multistriatus*), less commonly by the American elm bark beetle (*Hylurgopinus rufipes*). Female beetles seek out dead or weakened elm wood to excavate an egg-laying gallery between the bark and the wood. If the fungus is present, tremendous numbers of fungal spores (conidia) are produced in the galleries. When young adult beetles emerge through the bark, many carry the spores on and in their bodies. The infection of healthy elms occurs when beetles feed in the leaf axils and young twig crotches of healthy trees. Some spores are dislodged and get into these trees' water-conducting vessels (xylem), in which they reproduce rapidly by yeastlike budding. The weakened elm is quickly colonized by hordes of beetles, and the cycle is repeated.

The control of Dutch elm disease largely involves the exclusion of beetles. All dead, weak, or dying elm wood with tight bark should be burned, debarked, or buried before elms leaf out in early spring. A single, annual dormant spray that coats all bark surfaces with long-lasting insecticide (*e.g.*, methoxychlor) can kill many beetles before they deposit fungus spores. Claims of fungal control have been made for certain fungicides that are injected into the sapwood. Such measures appear to be more protective than curative. Although other species of elms, as well as species of the related *Zelkova* and *Planera,* are susceptible in varying degrees, the smooth leaf (*Ulmus carpinifolia*), Chinese (*U. parvifolia*), and Siberian (*U. pumila*) elms have shown good resistance, and experiments with hybrids of American and Asiatic elms have met with much success.

Dutch language, the Netherlandic (Netherlandish) language as spoken in The Netherlands, together with the same language in northern Belgium, which is popularly called Flemish. In the European Middle Ages, the language was called *Dietsc,* or *Duutsc,* historically equivalent to German *Deutsch* and meaning simply "language of the people," as contrasted with Latin, which was the language of religion and learning. The form *Duutsc* was borrowed into English and gives modern "Dutch." The official name of the language is *Nederlands,* or Netherlandic. In The Netherlands it is also called *Hollands* (Hollandish), reflecting the fact that the standard language is based largely on the dialect of the old province of Holland (now North Holland and South Holland). *See* Netherlandic language.

Dutch literature, the body of written works in the Netherlandic language as spoken in The Netherlands and northern Belgium. Although the Flemish literature of Belgium is an integral part of Dutch literature, it is treated separately in the MACROPAEDIA article Belgian Literature.

A brief account of Dutch literature follows. For full treatment, *see* MACROPAEDIA: Dutch Literature.

The development of Dutch language and literature was gradual. Among the oldest Dutch texts to have survived are the early 10th-century "Wachtendonck Psalm Fragments" in Middle Low Franconian. Most medieval literature in Dutch, however, originated in what is now Belgium, and one of the earliest writers claimed by the Dutch, Heinrich von Veldeke, is also claimed by the Germans. The northern provinces gained prominence in the 14th century with Melis Stoke's rhyming chronicles and the religious writings of the Devotio Moderna ("Modern Devotion") movement. The lively prose of Dirc Potter's *Der minnen loep* ("The Lens of Love") was produced in the early 15th century, and for 200 years the crafted poetry and allegorical plays of the *rederijkerskamers,* or "chambers of rhetoric" (organized centres of culture), dominated literary life.

The Netherlands' revolt against Spanish rule in the 16th century produced a number of popular political songs, or *Geuzenliederen.* Jan van Hout became the first Dutch Renaissance poet. Dirk Volckertszoon Coornhert's pithy prose and Henric Laurenszoon Spieghel's difficult poetry were concerned with questions of moral philosophy. After the northern provinces gained independence from Spain, the Dutch republic rapidly became a major political and economic power in Europe and overseas. Culturally, too, the 17th-century "Golden Age" displayed an extraordinary wealth of talent. Gerbrand Adriaenszoon Bredero wrote touching lyrics and starkly realistic comedies such as *Spaanschen Brabander* (1617; *The Spanish Brabanter*), and Pieter Corneliszoon Hooft moved from Petrarchan love sonnets to classical drama and on to majestic historical prose. Whereas Joost van den Vondel's poems were direct and personal, his biblical tragedies, such as *Lucifer* (1654) and *Jeptha* (1659), struck a balance between Baroque grandeur and Aristotelian classicism. The wit, erudition, and versatility of Constantijn Huygens' verse is unparalleled in Dutch, although Jacob Cats, who wrote didactic poetry, and the more intimate Jan Luyken were perhaps more widely read.

In the early 18th century, French classicism proved a stifling influence, but the poet Hubert Poot combined elegance with naturalness. Justus van Effen's spectatorial prose proved more momentous, as did Betje Wolff and Aagje Deken's epistolary novel *Sara Burgerhart* (1782). By the end of the century the poets Antony Staring and Willem Bilderdijk foreshadowed the Romantic era. The first half of the 19th century was the heyday of the Dutch historical novel, as practiced by Jacob van Lennep, Aernout Drost, and Anna Bosboom-Toussaint, while Everhardus Johannes Potgieter, R.C. Bakhuizen van den Brink, and Conrad Busken Huet raised critical standards in the periodical *De Gids* ("The Guide"). The homely humour of Nicolaas Beets's *Camera obscura* (1839) found a receptive audience, but it is the revolutionary and hard-hitting novel *Max Havelaar* (1860) by Multatuli (pseudonym of Eduard Douwes Dekker) that became the lasting landmark of 19th-century Dutch prose. Toward the end of the century the periodical *De Nieuwe Gids* ("The New Guide") heralded a more general literary revival, with the poets Willem Kloos, Albert Verwey, and Herman Gorter; the dramatist Herman Heijermans; and the prose writers Lodewijk van Deyssel, Frederik van Eeden, Louis Marie Anne Couperus, and Marcellus Emants.

In the first decades of the 20th century the wry Nescio (pseudonym of J.H.F. Grönloh), the Neoromantic Arthur van Schendel, and the restless J.J. Slauerhoff continued this line, while the major poets were Jan Hendrik Leopold, A. Roland Holst, Hendrik Marsman, J.C. Bloem, and Martinus Nijhoff. In the interwar period Menno ter Braak and Edgar du Perron were mainly known for their essays, and about mid-century the outstanding figures were the prolific novelist Simon Vestdijk and the strikingly original poet Gerrit Achterberg. In the postwar years Willem Frederik Hermans, Harry Mulisch, and Gerard Reve were the leading prose writers, and among the poets, Lucebert (pseudonym of L.J. Swaanswijk) and Gerrit Kouwenaar came to the fore in the 1950s, later followed by Rutger Kopland, J. Bernlef, and H.C. ten Berge.

Dutch metal, brass with a yellow colour simulating that of gold. The percentage of copper ranges from 85 to 88, the remainder being zinc. As the zinc content becomes higher, the colour becomes paler. Highly ductile and malleable, Dutch metal is used in bronzing and in preparing imitation gold leaf. Gilding with Dutch metal is far less costly than gilding with gold, but the coating of Dutch metal tarnishes rapidly unless coated with lacquer. *See also* brass.

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

Dutch Reformed Church, Afrikaans NEDERDUITSE GEREFORMEERDE KERK (NGK), South African denomination that traces its beginnings to the Reformed tradition of the first white settlers who came to South Africa from the Netherlands in the mid-17th century. It is the main church of the Afrikaans-speaking whites, and its present membership covers about 40 percent of the Republic of South Africa's white population. Two smaller Reformed denominations are sometimes grouped as Dutch Reformed churches, namely, the more liberal Dutch Reformed Church (Nederduits Hervormde Kerk; NHK) and the more conservative Reformed Church of South Africa (Gereformeerde Kerk van Suid-Afrika). The NGK is governed by a general synod that meets every four years. Headquarters are in Cape Town.

The turbulent history of the church is closely intertwined with that of the country. While its 1857 synod resolved it is "desirable and scriptural (that) wherever possible our members from among heathen be received and incorporated in our existing congregations," subse-

quent resolutions led to the establishment of so-called daughter churches, notably the Dutch Reformed Church in Africa (also known as the Bantu Church) in 1859, the Dutch Reformed Mission Church (for Coloured, or racially mixed, persons) in 1881, and the Indian Reformed Church in Africa in 1947. The NGK until 1986 supported the government's policy of apartheid (separate development for the races) and had commissioned several studies to develop theological justification for it. Their findings were rejected by Reformed churches in Europe and the United States, and the NGK was excluded from membership in the World Alliance of Reformed Churches (WARC) at Ottawa in August 1982. At the same time, the WARC pronounced apartheid to be a heresy in violation of the Scriptures. The NGK withdrew from the World Council of Churches in 1961 and severed relations with the Netherlands Reformed Church in The Netherlands in 1978. In 1986, however, the Dutch Reformed Church denounced its own former attempts at the biblical justification of apartheid, and in 1989 it condemned apartheid as a sin.

Dutch Reformed Church in Africa, Afrikaans NEDERDUITSE GEREFORMEERDE KERK IN AFRIKA, denomination formed in 1859 by the all-white Dutch Reformed Church in South Africa for its black African mission congregations. It has the same structure, doctrine, traditions, and customs as the mother church, which retains extensive control over it by supplying 80 percent of its budget. Its clergy may not serve white congregations; intercommunion between the two churches is prohibited even as a symbol of ecumenical unity. Leaders of the Dutch Reformed Church in Africa protest apartheid (separate development for the races) in church and society and have endorsed the World Alliance of Reformed Churches' exclusion in 1982 of the mother church, an act that commits the daughter church eventually to the severance of all ties. The Dutch Reformed Church's decision in 1989 to condemn apartheid averted an irreparable split between it and its African daughter church, however. The headquarters of the Dutch Reformed Church in Africa are in Bloemfontein, S.Af.

Dutch Reformed Mission Church in South Africa, Afrikaans NEDERDUITSE GEREFORMEERDE SENDINGKERK IN SUID-AFRIKA, denomination established in 1881 by three congregations that separated from the white Dutch Reformed Church in South Africa to form the nucleus of a semiautonomous denomination for people of racially mixed parentage (Coloureds). The church parallels the mother church in structure, doctrine, and customs. Efforts to end its financial dependency on the white church and curtail the latter's influence mounted after the mid-20th century. At its Synod of 1962, the Dutch Reformed Mission Church declared its membership open to all races, including white opponents of apartheid. Headquarters are in Kakamas, Cape Province, S.Af.

Dutch Republic, formally UNITED PROVINCES OF THE NETHERLANDS (1579–1795), state whose area comprised approximately that of the present Kingdom of The Netherlands and which achieved a position of world power in the 17th century. The republic consisted of the seven northern Netherlands provinces that won their independence from Spain in the period from 1568 to 1609, and it developed out of the 1579 Union of Utrecht, which was designed to improve the military capability of its signatories within the larger union of the rebelling provinces. As the southern provinces (later Belgium and Luxembourg) were recovered by Spain, however, the provinces bound by the Utrecht pact became a new, independent state.

For the next two centuries political control of the decentralized state shifted repeatedly between the province of Holland and the princes of Orange, who held the office of stadholder and represented a greater degree of centralization. This internal political stress, however, did not prevent the ascendancy of the Dutch Republic in the 17th century. In this "Golden Age" the republic developed a world colonial empire far out of proportion to its resources, played a notable role in the coalition wars against Louis XIV of France, emerged as a centre of international finance, and served as a notable cultural centre.

The republic experienced an equally spectacular decline in the 18th century. It was exhausted by its long land wars, its fleet was in a state of neglect, and its colonial empire stagnated and was eclipsed by that of England. In 1795 the republic collapsed under the impact of a Dutch democratic revolution and invading French armies.

Dutch War, also called FRANCO-DUTCH WAR (1672–78), the second war of conquest by Louis XIV of France, whose chief aim in the conflict was to establish French possession of the Spanish Netherlands after having forced the Dutch Republic's acquiescence. The Third Anglo-Dutch War (1672–74) formed part of this general war.

After having signed (1670) the secret Treaty of Dover with England against the Dutch, Louis mounted an invasion of the Dutch Republic in May 1672 that was supported by the British navy. The French were able to quickly occupy three of the seven Dutch provinces, but then the Dutch opened the dikes around Amsterdam, flooding a large area, and their army, under William III of Orange, rallied behind this "Water Line." By autumn William had begun land operations against the French invaders. Meanwhile, the Dutch navy, under Admiral M.A. de Ruyter, managed to stave off attacking English and French fleets in battles off Sole Bay in 1672 and off Ostend and Kijkduin in 1673, each time frustrating an invasion of the republic. England then made peace with the Dutch in the Treaty of Westminster of February 1674. In 1673 Spain, the Holy Roman emperor, and Lorraine took the side of the Dutch against France, and so by the end of 1673 the French had been driven out of the Dutch Republic.

But from 1674 to 1678 the French armies, with Sweden as their only effective ally, managed to advance steadily in the southern (Spanish) Netherlands and along the Rhine, defeating the badly coordinated forces of the Grand Alliance with regularity. Eventually the heavy financial burdens of the war, along with the imminent prospect of England's reentry into the conflict on the side of the Dutch, convinced Louis to make peace despite his advantageous military position. The resulting Treaties of Nijmegen (1678–79) between France and the Grand Alliance left the Dutch Republic intact and France generously aggrandized in the Spanish Netherlands.

Dutch Wars: *see* Anglo-Dutch Wars.

Dutch West India Company, byname of WEST INDIA COMPANY, Dutch WEST-INDISCHE COMPAGNIE, Dutch trading company, founded in 1621 mainly to carry on economic warfare against Spain and Portugal by striking at their colonies in the West Indies and South America and on the west coast of Africa. While attaining its greatest success against the Portuguese in Brazil in the 1630s and '40s, the company depleted its resources and thereafter declined in power. It was dissolved in 1794.

Governed by a board representing various regions of the Netherlands, the company was granted a monopoly of the trade with the Americas and Africa and the Atlantic regions between them. With military and financial support from the States General (the Dutch national assembly), the company acquired ports on the west African coast to supply slaves for plantations developed in the West Indies and South America. The company's trade, however, was never sufficient to finance operations against Spain, Portugal, and England in areas where the latter were well equipped to defend themselves.

Using booty acquired from the capture by the Dutch seaman Piet Heyn of part of a Spanish treasure fleet off Cuba in 1628, the company challenged the Portuguese hold on Brazil beginning in 1630 and attained its greatest success during the administration of Count John Maurice (1636–44). The effort proved too costly, however, and the Dutch company capitulated to the Portuguese in 1654.

The company also established several colonies in the West Indies and Guiana between 1634 and 1648, including Aruba, Curaçao, and Saint Martin, but later lost many of them to the French. The Dutch colony in North America, New Netherland (New York after 1644), became a province of the company in 1623. A combination of low Dutch immigration, autocratic administration, and underinvestment, however, damaged the ability of New Netherland to compete with the neighbouring English colonies, and it was ceded to the English in 1667.

The Dutch West India Company was much less successful than the Dutch East India Company, its counterpart in Southeast Asia. The West India Company was taken over by the state in 1791 and was dissolved in the wake of the French invasion of the United Provinces of the Netherlands in 1794.

Dutchman's-breeches (*Dicentra cucullaria*), plant of the fumitory family (Fumariaceae) named for its sprays of tremulous, yellow-

Dutchman's-breeches (*Dicentra cucullaria*)
John H. Gerard—EB Inc.

tipped white flowers that fancifully resemble Dutchman's pantaloons hanging upside down. The plant is native throughout eastern and midwestern North America, usually in open woodlands. The gray-green foliage grows from white underground tubers and is not as tall as the flowering stalk, which also springs directly from the ground. The plant is grown best in the shady wild garden, preferably in a wind-free location.

Dutchman's-pipe, also called PIPE VINE (*Aristolochia durior*), climbing vine of the birthwort family (Aristolochiaceae), native to central and eastern North America. The heart-shaped or kidney-shaped leaves are about 15 to 35 cm (about 6 to 14 inches) wide. The yellowish brown or purplish brown tubular

flowers resemble a curved pipe and are about 8 cm (3 inches) long. Dutchman's-pipe is a

Dutchman's-pipe (*Aristolochia durior*)
A.J. Huxley—EB Inc.

rapid grower that is often planted as a screen or an ornamental on porches and arbors.

Dutra, Eurico Gaspar (b. May 18, 1885, Cuiaba, Braz.—d. June 11, 1974, Rio de Janeiro), soldier and president of Brazil (1945–50), whose administration was noted for its restoration of constitutional democracy.

Dutra was commissioned a second lieutenant in the cavalry in 1910 and received routine assignments and promotions for the next 22 years. He consistently supported the established government against all revolutionary movements. Dutra thus opposed Getúlio Dorneles Vargas, who seized power in a coup in 1930, but he later defended Vargas in the 1932 São Paulo revolt and became one of the principal figures in devising the 1937 constitution for Brazil under Vargas' rule. Eight years later (October 1945), when Vargas attempted to prevent elections, Dutra led a successful coup and was elected president in December with the support of the Social Democratic Party. He also gained the support of rural workers and, on Vargas' recommendation, of the Brazilian Labor Party.

Dutra
By courtesy of the U.S. Information Agency, National Archives, Washington, D.C.

Dutra's administration returned Brazil to normal functioning and respected democratic freedoms. Dutra also strove to improve relations with the United States through the Organization of American States. His administration, however, lacked direction in its financial policy, and, with the resulting public discontent, Vargas won the 1951 election for president.

Dutrochet, (René-Joachim-) Henri (b. Nov. 14, 1776, Néon, Fr.—d. Feb. 4, 1847, Paris), French physiologist who discovered and named the phenomenon of osmosis (the passage of solvent through a semipermeable membrane) and was the first to recognize the importance of green pigment in the use of carbon dioxide by plant cells.

Dutrochet studied medicine in Paris (M.D., 1806) and then served as a military medical officer in Spain for several years before giving up the practice of medicine to devote his career to scientific research. When Dutrochet noticed the similarity of physical and chemical processes in plants and animals, he directed his studies toward plant and animal physiology. He was the first to investigate thoroughly the mechanisms of respiration, light sensitivity, and geotropism (orientation in response to gravitation) in plants; and his classical experiments on osmosis included recognition of its role in internal plant transport and diffusion through semipermeable membranes. He constructed an osmometer (a device to measure osmotic pressure), developed a technique to detect heat production in muscle tissue and in individual plants, showed that mushrooms are the reproductive bodies of the mycelium (mass of fungal filaments), and was one of the first to recognize the importance of individual cells in the functioning of an organism.

Dutrochet's most valuable contributions to science were his emphasis on the similarity of basic processes in all living organisms and his belief that all such processes can be explained in terms of physical and chemical forces.

Dutt, Michael Madhusudan (Bengali poet): *see* Datta, Michael Madhusudan.

Duṭṭhagāmaṇī, also spelled DUṬUGÜMUNU (d. 77 BC, Anurādhapura, Ceylon [now Sri Lanka]), king of Ceylon (101–77 BC) who is remembered as a national hero for temporarily ending the domination of the Indian Tamil Hindus over the Sinhalese, most of whom were Buddhist.

The elder son of a petty Sinhalese king in the southeast, Duṭṭhagāmaṇī made plans to campaign against the Tamils in northern Ceylon by organizing 10 young chiefs to attack. His father opposed the plan and had him bound in chains; he escaped, however, and went into exile until after his father's death. He twice fought his brother, Saddhā Tissa, and won the crown, as well as the state elephant Kaṇḍula, which was instrumental in his later victories. Penitent, Saddhā Tissa returned and pledged his loyalty to Duṭṭhagāmaṇī's campaign. Duṭṭhagāmaṇī then led his troops and Kaṇḍula north to Anurādhapura, where he defeated and killed the Tamil leader Eḷāra. He later defeated Indian-recruited troops led by Eḷāra's nephew Bhalluka and restored Sinhalese control of the entire island.

Duṭṭhagāmaṇī constructed the 1,600-pillared Brazen Palace in Anurādhapura and commenced building the Ruanveli *dāgaba,* a colossal stupa (shrine) containing the Buddha's begging bowl and many of his bones. Duṭṭhagāmaṇī died before the shrine was completed, being deceived into thinking it had been finished by his followers, who had hastily constructed an imitation dome and spire before his death.

Dutton, Clarence Edward (b. May 15, 1841, Wallingford, Conn., U.S.—d. Jan. 4, 1912, Englewood, N.J.), American geologist and pioneer seismologist who developed and named the principle of isostasy. According to this principle, the level of the Earth's crust is determined by its density; lighter material rises, forming continents, mountains, and plateaus, and heavier material sinks, forming basins and ocean floors.

Dutton joined the U.S. Army as a second lieutenant in 1862. After the Civil War, he developed an interest in geology. In 1875 he joined the naturalist John Wesley Powell in the U.S. Geographical and Geological Survey of the Rocky Mountain region and spent 10 years exploring the plateaus of Utah, Arizona, and New Mexico. There he investigated volcanic action and the uplifting, sinking, twisting, and folding of the Earth's crust.

Dutton's study of the earthquake that affected Charleston, S.C., in 1886 led him to publish a report (1889) in which he advanced a method for determining the depth of the focal point of an earthquake and for measuring with unprecedented accuracy the velocity of waves. He proposed his principle of isostasy in the paper "On Some of the Greater Problems of Physical Geology" (1892). In 1904 he published the semipopular treatise *Earthquakes in the Light of the New Seismology.* Late in his career Dutton concluded that lava is liquefied by the heat released during decay of radioactive elements and that it is forced to the surface by the weight of overlying rocks.

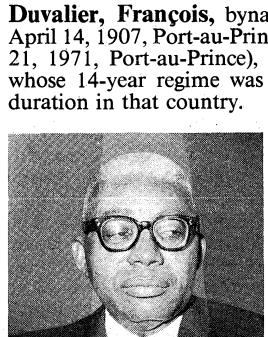
duumviri (ancient Roman magistrates): *see* duoviri.

Duun, Olav (b. Nov. 21, 1876, Fosnes, Jøa Island, Nor.—d. Sept. 13, 1939, Tønsberg), novelist who, after Knut Hamsun and Sigrid Undset, is the outstanding name in 20th-century Norwegian fiction.

Duun, a former cattle herder and fisherman, entered a seminary at the age of 26. He worked as a folk-school teacher until 1926, when he retired to Holmestrand on the Oslo Fjord to devote himself to writing. His many novels analyze the psychological and spiritual characteristics of peasant life. His masterpiece is a series of novels, *Juvikfolke* (1918–23; "The People of Juvik"), describing the development of a peasant family through four generations and symbolically tracing the development of the Norwegian people from a state of unself-conscious primitivism to a state of civilized humanism complicated by throwbacks to their earlier violent heritage. The novels in the series have been translated as *Trough of the Waves* (1930), *The Blind Man* (1931), *The Big Wedding* (1932), *Odin in Fairyland* (1932), *Odin Grows Up* (1934), and *Storm* (1935).

Duun wrote in Landsmål, an amalgam of peasant dialects that has developed into Nynorsk, one of the official languages of Norway. Although this was not the usual literary language, Duun's works have been influential in raising Nynorsk to literary eminence.

Duvalier, François, byname PAPA DOC (b. April 14, 1907, Port-au-Prince, Haiti—d. April 21, 1971, Port-au-Prince), president of Haiti whose 14-year regime was of unprecedented duration in that country.



François Duvalier, 1963
AP/Wide World Photos

Duvalier graduated (1934) from the University of Haiti School of Medicine, where he served as a hospital staff physician until 1943, when he became prominently active in the U.S.-sponsored anti-yaws campaign.

A contributor to the daily *Action Nationale* (1934), Duvalier was markedly influenced by the mystic scholar Lorimer Denis and became a member of Le Groupe des Griots, a circle of writers who embraced black nationalism and Voodoo as the key sources of Haitian culture.

A supporter of Pres. Dumarsais Estimé, Duvalier was appointed director general of the

National Public Health Service in 1946, and he directed the anti-yaws campaign in 1947–48. He was appointed underminister of labour in 1948 and the following year became minister of public health and labour, a post that he retained until May 10, 1950, when President Estimé was overthrown by a military junta under Paul E. Magloire, who was subsequently elected president. Duvalier returned to his former work with the American Sanitary Mission in 1951–54 and began organizing the resistance to Magloire. By 1954 he had become the central opposition figure and went underground.

After the resignation of Magloire in December 1956, Duvalier's followers participated in most of the six governments that were formed in the succeeding 10 months. Running on a program of popular reform and black nationalism, Duvalier was elected president in September 1957. Setting about to consolidate his power, he reduced the size of the army and, with his chief aide, Clément Barbot, organized the Tontons Macoutes (bogeymen), a private force responsible for terrorizing and liquidating alleged foes of the regime.

When Duvalier was stricken by a heart attack in 1959, Barbot acted in his stead. Upon recovery, the President promptly imprisoned his aide. His manipulation of legislative elections in 1961 to have his term extended to 1967 and other corrupt and despotic measures precipitated a termination of U.S. aid to Haiti. That summer he had Barbot murdered, after the latter, on his release from prison, had attempted an insurrection. Other attempts to overthrow Duvalier were equally unsuccessful.

Late in 1963 Duvalier moved further toward an absolutist regime, promoting a cult of his person as the semidivine embodiment of the Haitian nation. In April 1964 he was declared president for life. Although diplomatically almost completely isolated, excommunicated by the Vatican until 1966 for harassing the clergy, and threatened by conspiracies against him, Duvalier was able to stay in power longer than any of his predecessors. His regime of terrors quelched political dissent, at the same time achieving for Haiti an unusual degree of political stabilization. On Duvalier's death, power was transferred to his son, Jean-Claude ("Baby Doc"), who succeeded him as "president for life," though his rule was to last only 15 years.

Duvalier, Jean-Claude, byname BABY DOC, French BÉBÉ DOC (b. July 3, 1951, Port-au-Prince, Haiti), president of Haiti from 1971 to 1986.

The only son of François ("Papa Doc") Duvalier, Jean-Claude succeeded his father as president for life in April 1971, becoming at age 19 the youngest president in the world. Partly because of pressure from the United States to moderate the tyrannical and corrupt practices of his father's regime, Duvalier instituted budgetary and judicial reforms, replaced a few older cabinet members with younger men, released some political prisoners, and eased press censorship, professing a policy of "gradual democratization of institutions."

Nevertheless, no sharp changes from previous policies occurred. No political opposition was tolerated, and all important political officials and judges were still appointed by the president. Under Duvalier, Haiti continued a semi-isolationist approach to foreign relations, although the government actively solicited foreign aid to stimulate the economy. Duvalier graduated from secondary school in Port-au-Prince and briefly attended law school at the University of Haiti. In 1980 he married Michele Bennett, who later supplanted Duvalier's hard-line mother, Simone, in Haitian politics. In the face of increasing social unrest, however, Duvalier and his wife left the country early in 1986, and a six-member council replaced him.

Duvall, Gabriel (b. Dec. 6, 1752, Marietta, near Buena Vista, Md.—d. March 6, 1844, Prince George's County, Md., U.S.), associate justice of the United States Supreme Court (1811–35).

By the time that Duvall was admitted to the bar at the age of 26 he had already served for three years as clerk of the Maryland convention by virtue of his family connections and of his classical and legal education. He continued to serve in similar posts and, after its formation, in the state government; and he was among the Maryland associates of Charles Carroll who declined their appointments to the constitutional convention.

Duvall was elected to Congress in 1794. In 1796 he was named to the Maryland Supreme Court and in 1802 was named by Pres. Thomas Jefferson to be the first comptroller of the U.S. Treasury. He was appointed to the U.S. Supreme Court in 1812 by Pres. James Madison.

Being the colleague of Chief Justice John Marshall and Justice Joseph Story, Duvall wrote relatively few opinions. He is best remembered for his support of the rights of slaves in *Mima Queen and Child* v. *Hepburn* and *Le Grand* v. *Darnall.* Despite deafness and failing health, he kept his seat for a number of years to prevent the appointment of a political figure to the court. He resigned in 1835 after being informed that his replacement would be Roger B. Taney.

Duve, Christian René de (b. Oct. 2, 1917, Thames Ditton, Surrey, Eng.), Belgian cytologist and biochemist who discovered lysosomes (the digestive organelles of the cell) and peroxisomes (organelles that are the site of metabolic processes involving hydrogen peroxide). For this work he shared the Nobel Prize in Physiology or Medicine in 1974 with Albert Claude and George Palade.

In the course of research on the action of insulin upon liver tissue in 1949, de Duve observed a delay in the action of enzymes that break down cell material, suggesting the enzymes were enclosed within a membranous envelope. He calculated the probable size of this organelle, christened it the lysosome, and later identified it in electron microscope pictures. He refined the cell fractionation techniques of Claude to isolate the lysosomes and peroxisomes for study.

In 1947 de Duve joined the faculty of the Catholic University of Louvain, Belg., where he had received his M.D. in 1941 and a master's degree in chemistry in 1946. From 1962 he simultaneously headed research laboratories at Louvain and at Rockefeller University, New York City.

Duveen (of Millbank), Joseph Duveen, Baron (b. Oct. 14, 1869, Hull, Yorkshire, Eng.—d. May 25, 1939, London), British international art dealer who wielded enormous influence on art tastes in his time, especially in the United States.

The son of Sir Joseph Joel Duveen, of Dutch-Jewish descent, who established the family art business in London in 1877, Duveen began as a young man to buy and sell art on an unprecedented scale. Before 1914 he had established a virtual monopoly of old masters on both sides of the Atlantic. His principal headquarters were in New York City, where he built up the collections of such American collectors as Benjamin Altman, Henry Huntington, Joseph E. Widener, Henry Clay Frick, John D. Rockefeller, and Andrew Mellon. Largely as a result of Duveen's efforts, the great Italian, Dutch, French, and English masters became widely represented in American museums.

For his services to British art, for the Duveen Wing at the Tate Gallery in London, and for adding a gallery to the British Museum to house the Elgin Marbles, he was knighted in 1919, made a baronet in 1926, and raised to the peerage in 1933. He died without male issue, and the titles became extinct.

Duveneck, Frank (b. Oct. 9, 1848, Covington, Ky., U.S.—d. Jan. 3, 1919, Cincinnati, Ohio), painter, sculptor, and art teacher, who helped awaken American interest in European naturalism.

Duveneck studied with Wilhelm Dietz at Munich and was greatly influenced by the works of Frans Hals, Rembrandt, and Rubens. An exhibition in Boston in 1875 first attracted attention to his work, which was characterized by dark, earthy colours and broad, painterly brushwork clearly reminiscent of the European masters Duveneck so admired.

Many young American artists studied under him at Munich and Florence between 1878 and 1888, and at Cincinnati, where he was dean of the art academy for many years after 1888. The Cincinnati museum owns the largest collection of his works.

Duvergier de Hauranne, Jean, ABBÉ DE SAINT-CYRAN (b. 1581, Bayonne, Fr.—d. Oct. 11, 1643, Paris), French abbot of Saint-Cyran and a founder of the Jansenist movement. His opposition to Cardinal de Richelieu's policies caused his imprisonment.

Duvergier studied theology at Louvain, Belg., then settled in Paris after taking holy orders. His friendship with Cornelius Otto Jansen, a young champion of Augustinianism, led him to oppose the Louvain Jesuits who stood for Scholasticism. The two studied together from 1611 to 1616, after which Jansen returned to Louvain (1617), and Duvergier became confidential secretary to the bishop of Poitiers, where he met Cardinal de Richelieu. He was ordained priest in 1618 and was made sinecure abbot of Saint-Cyran (1620); thereafter, he was generally called Saint-Cyran.

As western Touraine was the headquarters of French Protestantism, Duvergier aimed his learning against the Huguenots. He dreamed of reforming Roman Catholicism on Augustinian lines. His zeal soon forced him out of Paris, where his attempt to gain the support of influential people led to his friendship with the Arnauld family, leading proponents of Jansenism. In 1637 he established a community that became known as the Solitaires (hermits) in the former convent at Port-Royal des Champs near Versailles.

Under the pseudonym of Petrus Aurelius, Duvergier attacked the Jesuits' precarious utilitarianism and their defiance of episcopal authority. This work so annoyed Richelieu, whom he openly opposed, that Duvergier was imprisoned (May 14, 1638) in Vincennes until Richelieu's death (1643).

Duvergier has always been a somewhat enigmatic figure. Many contemporary judges were impressed by him; others were bewildered by his lack of coherence. Perhaps no man of equal spiritual insight ever found it so difficult to state his meaning clearly. Nonetheless, the influence of Jansenism, as a practical religious revival, was largely his achievement.

Duvet, Jean (b. 1485, Langres, Fr.—d. 1561), French engraver whose style and subject matter had roots in the Middle Ages and in Florentine Mannerism and foreshadowed the highly charged work of late 16th-century France. He painted religious and mystical works at a time when his contemporaries were predominantly concerned with court art.

Very little is known about Duvet. He was a goldsmith and spent most of his life in Langres and Dijon and possibly in Geneva. There is also some evidence that he worked for the French kings Francis II and Henry II.

Duvet's earliest dated engraving, "Annunciation" (1520), is in a pure Italian style. The architectural setting is truly classical, and

the figures reflect a knowledge of contemporary Roman art. His engraving "Judgment of Solomon" is undated but is probably an early work based on Raphael's cartoon of Elymas the sorcerer and borrowings from northern Italian engravings. The depth of Duvet's understanding of High Renaissance Italian art suggests that he must have visited Italy and seen the works of Raphael and his colleagues.

Duvet's two best known later works are the unicorn series and the "Apocalypse." The former, probably done in the early 1540s, earned the artist the title of Master of the Unicorn. The unicorn engravings point stylistically toward his later works, with less defined space, congested composition, and a touch of the grotesque in the heads.

Duvet's "Apocalypse" reflects the full realization of his imagination. The 24 engravings were published in 1561, but the first plate (a self-portrait) is dated 1555. In subject matter he borrows from the German Albrecht Dürer's wood engravings, yet his style is highly individual. Duvet's work starts from the visionary source of his subject matter and allows that to dictate his composition. He does not try to make his visions believable, and thus he is not interested in space or accurate depictions of spatial relationships. In addition, human figures are distorted in any way that may enhance the symbolic expression of the work.

Duveyrier, Henri (b. Feb. 28, 1840, Paris—d. April 25, 1892, Sèvres, Fr.), French explorer of the Sahara whose observations of the Tuareg people contributed to African ethnology; his explorations, which took him from Morocco to Tunisia through the region south of the Atlas Mountains, also proved useful to the French in forming their plans for colonial expansion.

In his youth Duveyrier met the famed German explorer-geographer of western Africa Heinrich Barth. When he was 19, having learned to speak Arabic, Duveyrier began a journey of nearly three years' duration through the northern Sahara. After returning to France he published *Exploration du Sahara: Les Touâreg du nord* (1864; "Exploration of the Sahara: The Tuareg of the North").

On subsequent travels Duveyrier added considerably to the knowledge of the regions immediately to the south of the Atlas Mountains and explored the shallow salt lakes of Algeria and Tunisia. Duveyrier devoted special attention to the customs and speech of the Tuareg—pastoralists and brigands with a penchant for poetry—among whom he lived for months at a time. He also published *La Tunisie* (1881; "Tunisia") as well as a work on the Sanūsī Muslims (1884).

Duvivier, Julien (Henri Nicolas) (b. Oct. 8, 1896, Lille, Fr.—d. Oct. 29, 1967, Paris), motion-picture director who emerged as one of the "Big Five" of the French cinema in the 1930s. Duvivier's use of "poetic realism," which characterized the works of the avant-garde filmmakers of that decade, won him international acclaim.

Duvivier, who was educated at a Jesuit college and had a brief career as an actor on the Paris stage, began his film career as an assistant to such film directors as Marcel l'Herbier and Louis Feuillade and as an occasional script writer. Neither his first film, *Haceldama* (1919), nor the 20 other features he directed during the 1920s gained him much of a following, but with *Au bonheur des dames* (1929; "To the Happiness of the Ladies") Duvivier began a series of films that made his reputation. They included *Poil de carotte* (1932; "Carrot Top"), *Maria Chapdelaine* (1934), *Pépé le Moko* (1937), and *Un Carnet de bal* (1937). Then, in 1938 Duvivier was invited to Hollywood to direct *The Great Waltz*, a lavish, popularized version of Johann Strauss's life.

During World War II Duvivier returned to the United States, where he directed *The Tales of Manhattan* (1942), *Flesh and Fantasy* (1943), and *The Impostor* (1944). Returning to Europe after the war, Duvivier directed a number of successful films such as the British *Anna Karenina* (1948), *Sous le ciel de Paris* (1950; *Under the Paris Sky,* 1951), *Le Petit Monde de Don Camillo* (1951; *The Little World of Don Camillo*), which won a prize at Venice, and *Diaboliquement Vôtre* (1967; *Diabolically Yours*).

Duwaym, ad-, also spelled ED-DUEIM, city, capital of al-Baḥr al-Abyaḍ *mudīrīyah* (province), Central Region, central Sudan, on the western bank of the White Nile, about 87 mi (140 km) southwest of Wad Madanī and located at an elevation of 1,253 ft (382 m). It is an agricultural centre for the surrounding area, which produces cotton, cereals, oilseeds, peanuts (groundnuts), wheat, fruits, and vegetables. Industries include mechanized mills producing oils from sesame seeds and peanuts, soap factories, and food processing units. Ad-Duwaym is linked by road with Kūstī and Tandaltī; both are stations on the Kassalā–Nyala railway. A ferry service on the White Nile connects the city with al-Quṭaynah. Pop. (1973) 26,257.

Duxbury, town (township), Plymouth County, eastern Massachusetts, U.S., on Duxbury Bay (an inlet of Cape Cod Bay), 30 mi (48 km) southeast of Boston. It embraces the villages of Millbrook and South Duxbury. Settled around 1628, it counts among its founders the Pilgrim colonists Myles Standish, William Brewster, and John Alden. Named after Duxbury Hall in Lancashire, England, seat of the Standish family, it was chartered in 1637, becoming the second town in the Plymouth Colony. Following the Revolution, shipbuilding and fishing were significant activities. The town, now mainly residential, still maintains a provincial atmosphere, with tourism and local shops providing the main source of income. Colonial monuments include the Alden House (1653; last home of John and Priscilla Alden), the Standish Monument State Reservation, and the Old Burying Ground with the graves of Standish and Alden. Pop. (1980) 11,807.

Duy Tan, original name VINH SAN (b. 1899—d. Dec. 26, 1945), emperor of Vietnam, 1907–16, and symbol of the Vietnamese anticolonialist movement against the French before and during World War I; he became an officer and decorated hero in the French Army during World War II.

Vinh San was the son of Emperor Thanh Thai, who was deposed by the French. Seeking a more compliant figure to be their puppet king, the French proclaimed Vinh San emperor on Sept. 5, 1907. Upon his accession, he assumed the name Duy Tan, or reform(s), the Chinese characters of which were the same as the name of a radical nationalist organization, Duy Tan Hoi (Reformation Society), founded about that time by the Vietnamese patriots Nguyen Tham and Phan Boi Chau (*q.v.*).

Duy Tan was sympathetic to the plans of the Vietnamese liberation leaders, who needed the symbol and sanction of royalty to win popular support. He cooperated with rebel plans to stage revolts in the provinces of Thua Thien, Quang Nam, and Quang Ngai in central Vietnam in 1916. Details of the plot, however, leaked to the French. The attacks were unsuccessful, and Duy Tan was caught trying to escape to a mountain sanctuary; on May 13, 1916, he was dethroned by the French and exiled to Réunion island, off the coast of Madagascar, in the Indian Ocean.

In World War II, Duy Tan served in Europe with the Free French Army as Maj. Vinh San. He was among the early followers of the Free French leader Gen. Charles de Gaulle and was awarded the highest French honours for bravery, most importantly cited as "Companion of the French Liberation." He was killed in an airplane crash and is buried in what is now the Central African Republic.

Duyckinck, Evert Augustus (b. Nov. 23, 1816, New York City—d. Aug. 13, 1878, New York City), biographer, editor, and critic whose efforts contributed to the advance of U.S. literature in the mid-19th century. He knew most of the important writers of the day and fostered the careers of many—among them Herman Melville. Duyckinck's two-volume *Cyclopaedia of American Literature* (1855, supplement 1866), written with his younger brother George Long Duyckinck (1823–63), focussed scholarly attention on U.S. writing and continued to be of value to students into the 20th century.

The son of a publisher, he graduated from Columbia College in 1835, studied law for two years, and was admitted to the bar but never practiced, training duplicated by his brother. He spent 1838–39 in Europe studying literature and upon his return to New York was coeditor of *Arcturus: A Journal of Books and Opinion.* In 1847 he was briefly the editor of the *Literary World: A Journal of American and Foreign Literature, Science, and Art.* The following year he and his brother bought the journal and edited it together, making it the most influential literary weekly of the time, until 1853, when it failed financially despite its excellence.

The *Cyclopaedia of American Literature* included biographical and critical data on writers from colonial times and selections from their works. He also wrote several popular biographical compilations, including the *Lives and Portraits of the Presidents of the United States* and *Portrait Gallery of Eminent Men and Women of Europe and America,* 2 vol. (1873). His important collection of some 18,000 books is in the New York Public Library.

Duynefontein (South Africa): *see* Duinefontein.

Duyun (China): *see* Tu-yün.

Dvaita (Sanskrit: Dualism), an important school in the orthodox Hindu philosophical system of Vedānta. Its founder was Madhva, also called Ānandatīrtha (*c.* 1199–1278), who came from the area of modern Karnataka state, where he still has many followers. Already during his lifetime, Madhva was regarded by his followers as an incarnation of the wind god Vāyu, who had been sent to Earth by the lord Vishnu to save the good, after the powers of evil had sent the philosopher Śaṅkara, an important proponent of the Advaita (Nondualist) school.

In his expositions, Madhva shows the influence of the Nyāya philosophic school. He maintains that Vishnu is the supreme God, thus identifying the Brahman of the *Upaniṣads* with a personal God, as Rāmānuja (*c.* 1050–1137) had done before him. There are in Madhva's system three eternal, ontological orders: that of God, that of soul, and that of inanimate nature. The existence of God is demonstrable by logical proof, though only scripture teaches his nature. He is the epitome of all perfections and possesses a nonmaterial body, which consists of *saccidānanda* (being, spirit, and bliss). God is the efficient cause of the universe, but Madhva denies that he is the material cause, for God cannot have created the world by splitting himself nor in any other way, since that militates against the doctrine that God is unalterable; in addition, it is blasphemous to accept that a perfect God changes himself into an imperfect world.

The individual souls are countless in number and are of atomic proportions. They are a "portion" of God and exist completely by the

grace of God; in their actions they are totally subject to God. It is God, too, that allows the soul, to a limited extent, freedom of action in a way commensurate with one's past acts (karma).

Ignorance, which for Madhva as for many other Indian philosophers means mistaken knowledge (*ajñāna*), can be removed, or corrected, by means of devotion (bhakti). Devotion can be attained in various ways: by solitary study of the scriptures, by performing one's duty without self-interest, or by practical acts of devotion. This devotion is accompanied by an intuitive insight into God's nature, or it may be a special kind of knowledge. Bhakti may itself become a goal; for the devotee, his adoration of Vishnu is more important than the release that ensues from it.

The present-day following of Dvaita has as its centre a monastery at Udipi, in Karnataka state, which was founded by Madhva himself and has continued under an uninterrupted series of abbots.

Dvaravati, ancient kingdom of Southeast Asia, flourishing from the 6th to the 13th century, and the first Mon kingdom established in what is now Thailand. The kingdom played an important role as a propagator of Indian culture. Situated in the lower Chao Phraya River valley, Dvaravati extended westward to the Tenasserim Yoma (mountains) and southward to the Isthmus of Kra. The Mon, a Mongoloid people from western China, entered this area in the 1st millennium BC, penetrating westward from the upper Mekong River.

Dvaravati emerged as an independent entity late in the 6th century AD, maintaining its independence until late in the 11th century. Rarely politically dominant and continually under the shadow of stronger neighbours, Dvaravati was prevented by geographic barriers from establishing close political ties with other Mon states to the west in southern Myanmar (Burma) and with the Mon state in northern Thailand. Dvaravati experienced political domination by neighbouring peoples on three separate occasions: in the 10th century, when the Burmese conquered the Mon state of Thaton west of the Tenasserim Yoma; from the 11th to the 13th century, when the Khmer empire (Cambodia) arose in the east; and finally, in the late 13th century, when Dvaravati was absorbed by the Thai empire. Subjugation did not, however, mean extinction. The Dvaravati Mon retained their customs and a relative degree of racial homogeneity under their own rulers.

Dvaravati was historically important as a transmitter of Indian culture. Having had early commercial and cultural contact with India, the Mon assumed the role of disseminators of the main features of Indian culture. They were the most receptive of Southeast Asian peoples to Indian art and literature. Indian influence was apparent in matters of sculpture, writing, law, and governmental forms.

Despite political domination, Dvaravati exerted another important force in relation to its conquerors. Whereas contacts with India had contributed to the development and character of Mon civilization, Dvaravati Mon in their turn became the teachers of their conquerors, the Khmers, the Burmese, and the Thai. All three conquerors were influenced by Dvaravati in writing systems, art forms, government, religious terminology, and scholarship.

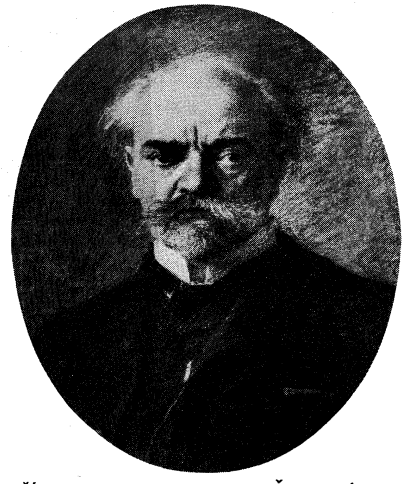
dvija (Sanskrit), English TWICE-BORN, in the Hindu social system, members of the three upper varnas, or social classes—the Brahmans (priests and teachers), Kshatriya (warriors), and Vaiśya (merchants)—whose sacrament of initiation is regarded as a second or spiritual birth. The initiation ceremony (*upanayana, q.v.*) invests the male caste members with a sacred thread, a loop worn next to the skin over the left shoulder and across the right hip. The lowest Hindu varna, the Śūdra (the artisan and labouring class), has no initiation ceremony, and its members are considered to be non-Aryan in origin. Theoretically they are not allowed to study or even to listen to the Vedas, the sacred revealed scriptures of the Indo-Aryans.

Dvina River, Northern: *see* Northern Dvina River.

Dvina River, Western: *see* Western Dvina River.

Dvinsk (Latvia, U.S.S.R.): *see* Daugavpils.

Dvořák, Antonín (Leopold) (b. Sept. 8, 1841, Nelahozeves, Bohemia, Austrian Empire [now in Czechoslovakia]—d. May 1, 1904, Prague [now in Czechoslovakia]), first Bohemian composer to achieve worldwide recognition, noted for turning folk material into the language of 19th-century Romantic music.



Dvořák, detail of a portrait by Max Švabinský, *c.* 1900; in the Antonín Dvořák Museum, Prague
By courtesy of the Antonin Dvorak Museum, Prague

Life. Dvořák was born in Nelahozeves, a Bohemian (now Czechoslovakian) village on the Vltava River north of Prague. He came to know music early, in and about his father's inn, and as a youngster became an accomplished violinist contributing to the amateur music making that accompanied the dances of the local couples. In 1857 a perceptive music teacher, understanding that young Antonín had gone beyond his own modest abilities to teach him, persuaded the elder Dvořák to enroll his son in an organ school in Prague. Later, without his father's financial assistance, Dvořák completed a two-year course and played the viola in various inns and with theatre bands, augmenting his small salary with a few private pupils.

The 1860s were trying years for Dvořák, who was hard pressed for both time and the means, even paper and a piano, to compose. In later years he said he had little recollection of what he wrote in those days, but around 1864 two symphonies, an opera, chamber music, and numerous songs lay unheard in his desk. The varied works of this period show, however, that his earlier leanings toward the music of Ludwig van Beethoven and Franz Schubert were becoming increasingly tinged with the influence of Richard Wagner and Franz Liszt. In November 1873, at a time when a few successful concerts of his works had begun to make his name well known in Prague, he married Anna Čermáková and began an unusually happy family life.

In 1875 Dvořák was awarded a state grant by the Austrian government, and this award brought him into contact with Johannes Brahms, with whom he formed a close and fruitful friendship. Brahms not only gave him valuable technical advice but also found him an influential publisher in Fritz Simrock, and it was with his firm's publication of the *Moravian Duets* (composed 1876) for soprano and contralto and the *Slavonic Dances* (1878) for piano duet that Dvořák first attracted worldwide attention to himself and to his country's music. The admiration of the leading critics, instrumentalists, and conductors of the day continued to spread his fame abroad, which led naturally to even greater triumphs in his own country. In 1884 he made the first of 10 visits to England, where the success of his works, especially his choral works, was a source of constant pride to him, although only the *Stabat Mater* (1877) and *Te Deum* (1892) continue to hold a position among the finer works of their kind. In 1890 he enjoyed a personal triumph in Moscow, where two concerts were arranged for him by his friend Peter Ilich Tchaikovsky. The following year he was made an honorary doctor of music of the University of Cambridge.

Dvořák accepted the post of director of the newly established National Conservatory of Music in New York in 1892, and, during his years in the United States, he traveled as far west as Iowa. Though he found much to interest and stimulate him in the New World environment, he soon came to miss his own country, and he returned to Bohemia in 1895. The final years of his life saw the composition of several string quartets and symphonic poems and his last three operas.

Works. Bedřich Smetana, Dvořák's senior by 17 years, had already laid the foundations of the Czech nationalist movement in music, but it was left to Dvořák to develop and extend this in an impressive series of works that quickly came to rank in popularity with those of his great German contemporaries. The reasons for Dvořák's popularity lie in his great talent for melody and in the delightfully fresh Czech character of his music, which offered a welcome contrast to the heavier fare of some of his contemporaries.

Dvořák's technical fluency and abundant melodic inspiration helped him to create a large and varied output. He composed in all the musical genres and left works that are regarded as classics in all of them, with the possible exception of opera. All of Dvořák's mature symphonies are of high quality, though only the sombre *Symphony No. 7 in D Minor* (1885) is as satisfactory in its symphonic structure as it is musically. (It should be explained that Dvořák's mature symphonies were long known as No. 1 to 5, even though he had written four earlier [and unnumbered] ones. All nine of his symphonies have since been renumbered from the traditional order to their actual order of composition.) Dvořák's *Symphony No. 9 in E Minor* (*From the New World;* 1893) remains his best-known work, partly, no doubt, because it was thought to be based on Negro spirituals and other influences gained during his years in the United States. Although this may be true to some extent, the music is also characteristically Bohemian in its themes. However, the *Symphony No. 9* is in no way superior to the *Symphony No. 6 in D Major* (1880) or the *Symphony No. 8 in G Major* (1889) and is actually less characteristic of the composer than these other works. Of the four concerti Dvořák wrote, only the *Cello Concerto in B Minor* (1895) can safely be called a classic.

In spite of the fact that his work in the medium is sometimes overstrained, Dvořák's chamber music is also of high quality. The *Piano Quintet in A Major* (1887) is one of the glories of chamber music, and the string quartets, Opuses 51 (1879), 105 (1895), and 106 (1895), the *String Sextet,* Opus 48 (1878), and the *Dumky Trio,* Opus 90 (1891), also rank high. The choral works, so popular when they

first appeared, have suffered the fate of most late-19th century choral music, yet the *Stabat Mater* (1877) and *Te Deum* (1892) are among the better examples of their kind. Opera remained the one medium that proved recalcitrant to Dvořák's genius, though he wrote 10 of them, notably *Rusalka* (1900). Many of Dvořák's most attractive works are among his miscellaneous, less ambitious ones—the *Slavonic Dances* (1878, 1886) and other piano duets, the *Symphonic Variations* (1877), the *Bagatelles* (1878), the *Gypsy Songs* (1880), and the *Scherzo Capriccioso* (1883).

Dvořák's chief faults are his overdiscursive and repetitive manner, occasional lapses in taste, and the weakness of design of his larger works. Such shortcomings, however, amount to little in the light of the astonishing fertility of his melody and the simplicity and directness with which he achieves his ends. As might be gathered from his music, Dvořák had an attractive personality; he was a humble and deeply religious family man of simple tastes and a great lover of nature. (D.M.L.-J.)

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Dvůr Králové nad Labem, city, Východočeský *kraj* (region), Czechoslovakia. The city lies just north of Hradec Králové, on the left bank of the Elbe (Czech: Labe) River. The name in both Czech and German (Königinhof an der Elbe) means "the court of the queen on the Elbe," recalling the founding of the town by King Wenceslas II at the end of the 13th century and the gift of the place to his queen, Elisabeth. It was the scene of a major Austrian defeat by the Prussians in 1866. The town is now a textile and linen centre. Pop. (1988 est.) 17,469.

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

Dwangwa River, river in Malawi that is a tributary of Lake Nyasa. It rises in the western watershed of Malawi's central plateau and flows in a northeasterly direction for about 100 miles (160 km) until it enters the lake. The river's upper reaches exhibit ancient broad valleys and meanders, while the gorge cut for the river's descent to the lake is narrow and recent. Dwangwa's drainage into Lake Nyasa occupies a flat swampy area 25 miles (40 km) north of Nkhotakota.

dwarf, an individual who is much below the ordinary stature or size for his race or species. (For the physiology of dwarf human beings, *see* dwarfism. *See also* pygmy.)

Folklore. In Teutonic and especially Scandinavian mythology and folklore, the term dwarf (Old Norse *dvergr*) denoted a species of fairy inhabiting the interiors of mountains and the lower levels of mines. Dwarfs were of various types, all of small stature, some being no more than 18 inches (45 cm) high and others about the height of a two-year-old child. In appearance they were sometimes beautiful, but more usually they resembled grave old men with long beards and, in some cases, humped backs.

A household dwarf (bottom right) pictured with the Gonzaga family, detail of "Ludovico Gonzaga, His Family and Court," fresco by Andrea Mantegna, 1474; in the Camera degli Sposi, Palazzo Ducale, Mantua, Italy

SCALA—Art Resource/EB Inc.

The mountain dwarfs were organized in kingdoms or tribes, with their own kings, chieftains, and armies. They lived in subterranean halls, believed to be full of gold and precious stones. They were principally famous for their skill in all kinds of metalwork and the forging of magical swords and rings, but they were also credited with profound wisdom and secret knowledge, having power to foresee the future, assume other forms, and make themselves invisible.

Many legends show them as kindly beings, generous to those who pleased them, but revengeful when offended. The Swiss dwarfs or "earth-men" sometimes helped in agricultural work, found straying animals, and put out firewood or fruit for poor children to find. In Scandinavia and Germany also they were friendly to men, but occasionally they stole corn, teased cattle, and abducted children and young girls. Services rendered to them were often repaid by gifts of gold from their hoards; but those who stole their treasures either met with great misfortune thereafter or found the gold turned to dead leaves when they reached home.

Mine-dwelling dwarfs are usually more capricious and spiteful than their mountain brothers. They could be heard moving about the lower levels and were sometimes seen by miners, who took care to placate them by gifts of food.

History. In some societies dwarfs have served as favourites, jesters, or entertainers in the courts of sovereigns and the households of important persons. Household dwarfs were kept by the early pharaohs of Egypt and still abounded at the courts of the Ptolemies. They played no part in Homeric and classical Greece but flourished in imperial Rome, where slave children were sometimes stunted to increase their price. Household dwarfs functioned in medieval Europe, and during the Renaissance their vogue increased and individual dwarfs became famous. Isabella d'Este designed part of her palace for them and remembered two in her will. The painter Diego Velázquez familiarized posterity with the appearance of the dwarfs of Philip IV of Spain. In the 18th and 19th centuries, the tsars and noblemen of Russia kept innumerable dwarfs. Elaborate dwarf weddings were celebrated at court, and in 1710 a dwarf couple spent their wedding night in the tsar's bedchamber.

Dwarfs occasionally held responsible positions but were primarily entertainers. In western Europe household dwarfs were still heard of in the 18th century; but the institution declined, and dwarfs such as Charles Stratton ("General Tom Thumb") who won money and reputation in the 19th century belong to a different category.

dwarf cornel (plant): *see* bunchberry.

dwarf mistletoe, any plant that is a member of the genus *Arceuthobium* (family Viscaceae), which contains about 8 to 15 species of small-flowered plants that are parasitic on coniferous trees. The species are distributed primarily throughout the Northern Hemisphere, though a few tropical species are present in the Caribbean, Mediterranean, and Southeast Asian areas. The common dwarf mistletoe, *A. minutissimum,* is one of the smallest plants having specialized water-conducting tissues. Its flowering stems extend less than 3 mm (about 1/8 inch) from its host plant. The fruits of most *Arceuthobium* species are about 4 mm long, and each contains a bullet-shaped seed covered with a sticky substance. Pressure that builds up inside the maturing fruit causes the thick skin to rupture, shooting the seed away from the plant at a high velocity. As the sticky seed covering dries, it attaches the seed to the surface on which it landed, usually the branch of a nearby tree. Dwarf mistletoes spread in this way throughout a forest without being transported by wind or animals. These parasites cause economic damage to many species of ornamental and timber trees.

Dwarf mistletoe (*Arceuthobium minutissimum*)

Delbert Wiens

dwarf star, any star of average or low luminosity, mass, and size. Important subclasses of dwarf stars are white dwarfs (*see* white dwarf star) and red dwarfs. The class of dwarfs includes most so-called main-sequence stars, among which is the Sun. The colour of dwarf stars can be anything from blue to red, the corresponding temperature varying from high (above 10,000 K) to low (a few thousand degrees).

dwarf yew: *see* American yew.

dwarfism, condition of growth retardation resulting in abnormally short adult stature caused by a variety of hereditary and metabolic disorders. Traditionally, the term "dwarf" was used to describe individuals with disproportions of body and limb, while "midget" referred to those of reduced stature but normal proportions; today neither word is used, and "little people" has become the preferred term for persons with extreme growth retardation.

Among the common forms of hereditary dwarfism are achondroplasia, hypochondroplasia, and diastrophic dwarfism. In achondroplasia, the trunk is of normal size, but because of a disturbance of the bone-producing cells of the growth plates (epiphyses) of the long bones, the limbs are extremely short; the head tends to be unusually large. Intelligence and life span are normal. Hypochondroplasia resembles achondroplasia except that the head is of normal size. Diastrophic dwarfism is

characterized by progressive, crippling skeletal deformities. There is a high risk of death from respiratory failure during early infancy; thereafter the prospect of a normal life span is good. Intelligence is unimpaired in diastrophic dwarfism.

Pituitary dwarfism, caused by a deficiency of pituitary growth hormone, is the chief endocrine form of dwarfism and may be hereditary; tumours, infections, or infarction (tissue death) of the pituitary can also induce dwarfism. In most cases, other endocrine and sexual functions remain normal. However, in panhypopituitarism all pituitary hormones are deficient, and sexual development is impaired.

In several hormonal disorders and hereditary conditions dwarfism is associated with subnormal intelligence. Inadequate production of thyroid hormone during gestation and early infancy results in a condition known as cretinism, which is characterized by growth retardation and severe mental retardation. Several of the mucopolysaccharidoses (disorders of mucopolysaccharide metabolism) are characterized by dwarfism, often with mental retardation. A number of infants having hereditary forms of dwarfism are stillborn or die soon after birth because of serious metabolic disorders.

Dwarfism may also result from inadequate nutrition during crucial phases of growth and development. A leading nutritional cause of dwarfism is vitamin-D-resistant rickets during childhood; intelligence is not affected by this condition.

Dwārkā, town, southwestern Gujarāt state, west-central India. It lies on the western shore of the Okhāmandal Peninsula, a small western extension of the Kāthiāwār Peninsula. Dwārkā, or the "City of Many Gates" (Sanskrit: Dvārakā, or Dvārāvatī), is also known as Jagat, or Jigat. Dwārkā was the legendary capital of the god Krishna, who founded it after his flight from Mathura. Its consequent sanctity makes it one of the seven great places of Hindu pilgrimage, although the town's original temples were destroyed in 1372 by the Delhi emperors. Most of the town's revenue is derived from the pilgrimage traffic; millets, ghee (clarified butter), oilseeds, and salt, however, are shipped from the port. Dwārkā also contains a large cement works. It is served by a railroad and a main highway. Pop. (1981) 21,375.

Dwārs (India): *see* Duārs.

Dwiggins, William Addison (b. June 19, 1880, Martinsville, Ohio, U.S.—d. Dec. 25, 1956, Hingham, Mass.), American typographer, book designer, puppeteer, illustrator, and calligrapher, who designed four of the most widely used Linotype faces in the United States and Great Britain: Caledonia, Electra, Eldorado, and Metro.

After studying with Frederic Goudy in Chicago, Dwiggins moved in 1906 to Hingham, Mass., where he earned his living doing advertising and lettering. He served as acting director of Harvard University Press in 1917–18 and then turned to book design. He was associated in various capacities with the Mergenthaler Linotype Company, Yale University Press, and the publishing firm of Alfred A. Knopf, whose house style he helped to establish. Each of the hundreds of books he designed carried a brief colophon on the history of the type employed; there was an attempt to use contemporary typographic decoration; and the bindings, using designs made of repeated decorative units like early printers' fleurons, were extremely popular.

Dwiggins also designed many deluxe editions for George Macy's Limited Editions Club, illustrated a number of works, and wrote such books as *Layout in Advertising* (1928), *Marionette in Motion* (1939), and *Millennium I* (1945).

Dwight, John (b. *c.* 1637—d. 1703, London), first of the distinguished English potters, producer of works in stoneware.

After taking the degree of bachelor of civil law at Christ Church, Oxford, Dwight was appointed registrar and scribe to the diocese of Chester. In 1665 he moved to Wigan and sometime between 1671 and 1674 moved to Fulham, London. In 1671 Dwight took out a patent for "transparent earthenware, commonly knowne by the names of porcelaine or china" and "stoneware, vulgarly called Cologne ware." He did not actually make porcelain; the partly translucent quality of his stoneware apparently led him to mistake it for that material. Between 1693 and 1696 he was involved in lawsuits with 19 other potters over infringements of his stoneware patent.

The most important works from Dwight's pottery are finely modeled stoneware busts and statues, including busts of Prince Rupert of the Rhine and Charles II, a recumbent half figure of his daughter, and various classical figures, all by an unknown modeler. Among the useful objects attributed to his pottery are various stoneware bottles and mugs.

Dwight, Timothy (b. May 14, 1752, Northampton, Mass.—d. Jan. 11, 1817, New Haven, Conn., U.S.), American educator, theologian, and poet who had a strong instructive influence during his time.

Educated by his mother, a daughter of the preacher Jonathan Edwards, Dwight entered Yale at age 13 and was graduated in 1769. He then pursued a variety of occupations, including those of a tutor at Yale, a school principal, a Massachusetts legislator, and a chaplain with the Continental Army. In 1783 he began a successful school in Greenfield Hill, Conn. There he became pastor of the Congregational Church.

In Connecticut, Dwight began to write poetry, such as *Greenfield Hill* (1794)—a popular history of and tribute to the village—and epics, including *The Conquest of Canaan* (1785)—a Biblical allegory of the taking of Connecticut from the British, which some critics regard as the first American epic poem. The poems are grandiose but morally inspiring. Dwight's political satire marks him as one of the Hartford wits (*q.v.*). Dwight served as president of Yale from 1795 to 1817; his administration had pervasive effects on the school, including the modernization of the curriculum. He fought religious apathy as an eloquent professor of theology; his sermons appear in *Theology; Explained and Defended,* 5 vol. (1818–19).

Dwyfor, district, Gwynedd County, northwestern Wales. It was created in 1974, covers an area of 239 square miles (618 square km), and extends westward from Mount Snowden, 3,560 feet (1,085 m) above sea level on the district's eastern border, to Bardsey Island, off the tip of the Llyen Peninsula. Dwyfor district is bordered by the districts of Arfon, Aberconwy, and Meirionnydd to the east, and its western, northern, and southern borders comprise more than 100 miles (160 km) of the coast of the Irish Sea. The seclusion of the region made it a gathering ground for Welsh resistance to the English from very early times. Bardsey Island was colonized by the early Celts, who built an abbey there *c.* AD 516. Criccieth Castle (built 1230) on the southern coast of what is now Dwyfor was captured from the Welsh by Edward I of England in 1282, and in 1404 it was retaken for the Welsh by Owen Glendower's rebel forces. Long after all formal resistance to English rule had ceased, Welsh nationalistic sentiment endured in the region.

Although Dwyfor is primarily an agricultural district, tourism has developed into a major economic activity. Tourist attractions include Snowdonia National Park (extending into western Dwyfor), a well-known bird refuge on Bardsey Island, and the resort towns of Criccieth and Porthmadog on the southern coast. The market town of Pwllheli is the administrative seat of the district and a popular resort with one of Britain's largest holiday camps located nearby. A highway traverses western Dwyfor from north to south, and a railroad extends onto the Llyen Peninsula to Pwllheli. Pop. (1985 est.) 26,300.

Dyak (people): *see* Dayak.

dyal, also spelled DAYAL, or DHYAL, popular species of magpie-robin (*q.v.*).

dyarchy, also spelled DIARCHY, system of double government introduced by the Government of India Act (1919) for the provinces of British India. It marked the first introduction of the democratic principle into the executive branch of the British administration of India. Though much-criticized, it signified a breakthrough in British Indian government and was the forerunner of India's full provincial autonomy (1935) and independence (1947). Dyarchy was introduced as a constitutional reform by E.S. Montagu (secretary of state for India, 1917–22) and Lord Chelmsford (viceroy of India, 1916–21).

The principle of dyarchy was a division of the executive branch of each provincial government into authoritarian and popularly responsible sections. The first was composed of executive councillors, appointed, as before, by the crown. The second was composed of ministers who were chosen by the governor from the elected members of the provincial legislature. These latter ministers were Indians.

The various fields, or subjects, of administration were divided between the councillors and the ministers, being named reserved and transferred subjects, respectively. The reserved subjects came under the heading of law and order and included justice, the police, land revenue, and irrigation. The transferred subjects (*i.e.,* those under the control of Indian ministers) included local self-government, education, public health, public works, and agriculture, forests, and fisheries. The system ended with the introduction of provincial autonomy in 1935.

dybbuk, also spelled DIBBUK, plural DYBBUKIM, in Jewish folklore, a disembodied human spirit that, because of former sins, wanders restlessly until it finds a haven in the body of a living person. Belief in such spirits was especially prevalent in 16th–17th-century eastern Europe. Often individuals suffering from nervous or mental disorders were taken to a miracle-working rabbi (*ba'al shem*), who alone, it was believed, could expel the harmful dybbuk through a religious rite of exorcism.

Isaac Luria (1534–72), a mystic, laid the grounds for Jewish belief in a dybbuk with his doctrine of transmigration of souls (*gilgul*), which he saw as a means whereby souls could continue their task of self-perfection. His disciples went one step further with the notion of possession by a dybbuk. The Jewish scholar and folklorist S. Ansky contributed to worldwide interest in the dybbuk when his Yiddish drama *Der Dybbuk* (*c.* 1916) was translated into several languages.

Dyce, Alexander (b. June 30, 1798, Edinburgh—d. May 15, 1869, London), Scottish editor whose works, characterized by scrupulous care and integrity, contributed to the growing interest in William Shakespeare and his contemporaries during the 19th century.

As an undergraduate at the University of Oxford, Dyce edited a dictionary of the language of Shakespeare. After serving as a curate in Cornwall and Suffolk, he settled in London and devoted himself to literature. In addition to completing William Gifford's *Dramatic Works and Poems of James Shirley* (1833)

and revising his own *Works of John Ford* (1869), he edited the works of the dramatists George Peele, John Webster, Robert Greene, Thomas Middleton, Beaumont and Fletcher, and Christopher Marlowe. Dyce's six-volume edition of the works of Shakespeare (1857; rev. 1864–67) was a notable contribution to 19th-century Shakespearean scholarship.

An industrious editor of the poets, Dyce published many 17th- and 18th-century works and an edition of John Skelton (1843) that revived interest in this 16th-century poet.

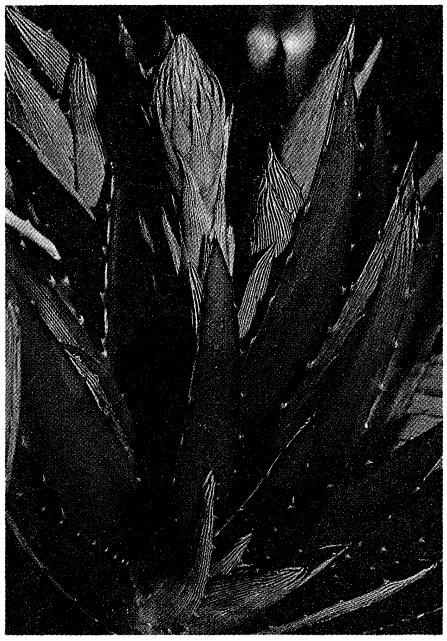
Dyce, William (b. Sept. 19, 1806, Aberdeen, Aberdeen, Scot.—d. Feb. 14, 1864, London), Scottish painter and pioneer of state art education in Great Britain.

Dyce studied at the Royal Scottish Academy, Edinburgh, and the Royal Academy schools, London. One of the first British students of early Italian Renaissance painting, he visited Italy in 1825 and 1827–28, meeting in Rome a group of young German painters, the Nazarenes. He exhibited regularly at the Royal Academy, being elected associate of the Royal Academy in 1844 and academician in 1848. In 1830–37 in Edinburgh he made portraits for a livelihood. But his Italian studies led him to anticipate the English Pre-Raphaelites in the quest for a primitivist simplicity and repose in his painting that harked back to the art of 14th- and 15th-century Italy.

At the time of his death Dyce was engaged in painting a series of frescoes for the Houses of Parliament, of which remain the "Baptism of Ethelbert" in the House of Lords (1846) and the "King Arthur" series (1848; unfinished) in the queen's robing room.

Dyck, Anthonie van, Anthonie also spelled ANTONIE, or ANTON (painter): *see* Van Dyck, Sir Anthony.

Dyckia, genus of usually stemless plants of the pineapple family (Bromeliaceae), consisting of about 80 South American species. These plants' long, stiff leaves, which grow in dense rosettes, are spiny-edged, sharp-tipped, and often fleshy. The small flowers usually are yellow or orange. Two species, *D. rariflora* and *D. sulphurea* (*D. brevifolia*), are commonly cultivated indoors as decorative plants. The leaves of both species are about 10–20 cm (about 4–8 inches) long and less than 0.8 cm (⅓ inch) wide. The flowers of *D. rariflora* are in a nearly stalkless cluster about 45 cm (17 inches) high that rises from the rosette. The flower stalk of *D. sulphurea* rises about 30 cm (12 inches) and bears 30 to 40 yellow blooms.



Dyckia
J.M. Langham

dye, any of a group of complex organic compounds that are intensely coloured and are utilized to colour other materials.

A brief treatment of dyes follows. For full treatment of their properties, *see* MACROPAEDIA: Chemical Compounds. For details on the methods of manufacturing dyes, *see* Industries, Chemical Process. For the principal uses of these substances, *see* Industries, Textile.

Dyes are used to colour textiles, paper, leather, and many other substances. During the process, dye molecules are deposited from solution onto the material in such a way that they cannot be subsequently removed by the solvent in which they were dissolved. Dyes are generally prepared synthetically from coal tar and petrochemicals.

The craft of dyeing is several thousand years old. The major dyes known to the ancients were those obtained from the madder and indigo plants, together with Tyrian purple (chemically, an indigo derivative), which was obtained from mollusks.

Many of the dyeing processes discovered during antiquity are still used today. An example is the application of an inorganic chemical called a mordant. This substance is applied to a material before the dye to help the dye adhere to the material by precipitating in it as an insoluble metal salt.

The first synthetic dye, mauveine, was discovered in 1856 by the British chemist William Henry Perkin. It was an unexpected product of a reaction with a coal-tar derivative. As a result, a large-scale coal-tar-dye industry arose during the latter part of the 19th century. The basic raw materials were organic substances containing so-called aromatic hydrocarbons in which carbon atoms are linked in six-membered rings. Aromatics are characteristic of most dyestuffs today, although the raw materials come from petroleum as well as from coal tar.

In addition to the aromatics, many dyestuffs contain a chemical subunit called a chromophore. The chromophore acts to produce strong absorption of radiation in the visible spectrum. Various categories of atomic groupings called auxochromes are also used to shift the absorption to make the colour more intense.

The chemical structure of dye molecules has proved to be relatively easy to modify, and a wide range of coal-tar dyes have become available. Developments in chemical synthesis have led to the production of many new dyes that adhere strongly to many different types of substances.

Fibres absorb dyes particularly well because they are porous and exert chemical forces on dye molecules. Dyes are held onto fibres by ionic forces, hydrogen bonding, or other attractive forces. One of the major advances in dye chemistry has been the development of fibre-reactive dyes. Here, the dye molecule forms a covalent chemical bond with the fibre that it colours. Such a bond is the strongest means of attaching a dye molecule to a fibre.

With natural materials such as cotton, wool, and silk, it is necessary to synthesize dyes that are suited to the specific chemical structures of those materials. On the other hand, it is possible to modify the chemical structure of synthetic fibres to alter their dyeing characteristics.

dye-transfer process, in photography, technique for preparing coloured photographic prints in which the colours of the subject are resolved by optical filters into three components, each of which is recorded on a separate gelatin negative. The three negatives are converted into relief positives in which the depth of the gelatin is related to the intensity of the colour component; each image is then saturated with a dye of complementary colour, and the finished print is assembled by transferring the dyes one at a time, and in register, to a suitable surface.

Up to 150 prints can be obtained from a set of gelatin-relief positives simply by redyeing them and repeating the transfer. In the late 20th century, the development of a panchromatic matrix film made it possible to produce the relief positives directly from a colour negative.

Dyer, Sir Edward (b. October 1543, Sharpham Park, Somerset, Eng.—d. May 1607, London), English courtier and poet whose reputation rests on a small number of ascribed lyrics in which critics have found great dexterity and sweetness.

Educated at the University of Oxford, Dyer went to court under the patronage of the Earl of Leicester. Dyer was a friend of Sir Philip Sidney, on whose death he wrote an elegy showing personal grief and a morbid melancholy. He was employed on missions to the Netherlands (1584) and Denmark (1589) and was knighted in 1596. His contemporary reputation as a poet was high, but little of his work, published anonymously or under initials in collections, is certainly identifiable. His best-known poem is "My Mynd to Me a Kingdom Is."

Dyer, Sir James (b. 1512, Roundhill, Somerset, Eng.—d. March 24, 1582, Great Staughton, Huntingdonshire), chief justice of the English Court of Common Pleas from 1559, who originated the modern system of reporting law cases to serve as precedents. His method superseded the recording of cases in yearbooks (begun in 1292), which were not intended as guides for future decisions.

Dyer's work, comprising three volumes of cases in the King's (Queen's) Bench and common pleas court, covers the years 1513–82, practically his whole lifetime, and thus is partly retrospective. His books were written in the Anglo-French then used in the English legal profession and were first translated into English by John Vaillant in 1794. Dyer was knighted in 1552.

Sir James Dyer, detail of a portrait by an unknown artist, 1575; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

Dyer, John (baptized Aug. 13, 1699, Aberglasney, Carmarthenshire, Wales—d. December 1757, Coningsby, Lincolnshire, Eng.), British poet chiefly remembered for "Grongar Hill" (1726), a short descriptive and meditative poem, in the manner of Alexander Pope's "Windsor-Forest," in which he portrays the countryside largely in terms of classical landscape. The poet describes the view from a hill overlooking the vale of Towy and uses this as a starting point for meditation on the human lot:

A little rule, a little sway,
A sunbeam in a winter's day,
Is all the proud and mighty have
Between the cradle and the grave.

Dyer's longest poem, *The Fleece* (1757), a blank-verse poem on the subject of tending sheep, is a typically 18th-century attempt to imitate Virgil's *Georgics*. Dyer also wrote *The Ruins of Rome* (1740), which again combines description and meditation.

Dyer, Reginald Edward Harry (b. Oct. 9, 1864, Murree, India—d. July 23, 1927, Long Ashton, near Bristol, Eng.), British general remembered for his brutal handling of the riots at Amritsar, India, in 1919.

Dyer was commissioned in the West Surrey Regiment in 1885 and subsequently transferred to the Indian Army. He campaigned in Burma in 1886–87 and took part in a blockade of Wazīristān in 1901–02. During World War I (1914–18) he had charge of the Eastern Persian cordon, the purpose of which was to prevent German crossings into Afghanistan.

Dyer was brigade commander at Jullundur during the Massacre of Amritsar (*q.v.*; April 13, 1919), when his troops killed 379 unarmed Indian protesters in an enclosed area, apparently in retaliation for the killing of four Europeans and the beating of a woman missionary. As a result Dyer was removed from command into enforced retirement. The matter received international attention, and Indian nationalists turned the site into a martyrs' memorial.

dyerswoad (herb): *see* woad.

Dyfed, county of southwestern Wales, created in 1974 from the former counties of Cardigan, Carmarthen, and Pembroke. The administrative seat is Carmarthen. The county has six administrative districts (Carmarthen, Ceredigion, Dinefwr, Llanelli, Preseli, and South Pembrokeshire) and covers an area of 2,227 square miles (5,768 square km).

Dyfed occupies a peninsula between Cardigan Bay (north) and Carmarthen Bay (south). The western end of the main peninsula is divided into smaller peninsulas, separated by inlets such as St. Brides Bay and Milford Haven. Several types of relief are apparent. The major rivers (Towy and Teifi) flow in broad alluvial valleys. The interior comprises the hill and mountain country on the southwestern fringe of the Welsh "heartland" (including Plynlimon, 2,468 feet [752 m]). Between are platforms of relatively subdued relief, below 200 m (650 feet). The coastline is attractive throughout, with cliffs, headlands, and sandy bays.

Evidence of Neolithic settlement is abundant in the southwestern part of the county, and the remains of Iron Age camps are widespread. Roman influence in the area was slight, but the influence of the early Celtic Christian missionaries was strong. The Anglo-Normans built many castles in the area. Tenby is an example of a well-preserved Anglo-Norman settlement, with its castle, town walls, and rectilinear street pattern. English immigrants settled in the extreme southwest of the county during the Middle Ages, earning it the title "Little England beyond Wales."

Agriculture is the major economic activity in Dyfed. The coastal areas, with their better soils, mildness, and annual rainfall of less than 45 inches (1,140 mm) are well-suited to arable farming. Potatoes, early vegetables, and flowers are grown. Dairying, especially in the Vale of Towy, is important. Inland, sheep and beef cattle are raised.

The Pembrokeshire Coast National Park has made the attractive coast accessible, while endeavouring to conserve it. The rapid expansion of tourism, with the associated proliferation of camp sites, since World War II has, however, presented planning problems.

Another postwar change has been the development of several large petroleum refineries on Milford Haven, an estuary deep enough to harbour huge modern oil tankers. Carmarthen is the chief administrative and service centre in the county, but Aberystwyth on the north remains a significant regional and educational centre, while Llanelli in the extreme south is a tinplate-manufacturing town of considerable importance. Pop. (1985 est.) 335,900.

Dygasiński, Adolf (b. March 7, 1839, Niegosławice, near Pińczów, Congress Kingdom of Poland—d. June 3, 1902, Grodzisk Mazowiecki, Pol., Russian Empire), Polish writer and poet.

A teacher by profession and a worshiper of science, Dygasiński is considered one of the outstanding Polish Naturalist writers. He published about 50 volumes of short stories of uneven literary quality, the best pieces of which deal with the lives of domestic and wild animals. His masterpiece is *Gody życia* (1902; "Feast of Life"), an allegorical prose poem about the struggle between a small bird and a powerful eagle-owl.

Dylan, Bob, original name ROBERT ZIMMERMAN (b. May 24, 1941, Duluth, Minn., U.S.), American singer and composer whose songs shaped a generation's music during the 1960s.

After a somewhat turbulent childhood in Duluth and in the iron-range town of Hibbing, Minn., Dylan, who adopted the name of the poet Dylan Thomas, traveled around the country. He lived and sang in conscious imitation of the folk-singer Woody Guthrie. He began performing professionally in Greenwich Village coffeehouses in New York City, singing Guthrie's Depression ballads and others of his own composition. Record albums in 1962, 1963, and 1964 brought him recognition, and two of his songs, "Blowin' in the Wind" and "The Times They Are a-Changin'," became anthems of the civil-rights movement. Grounded in the folk tradition, particularly in the use of simple melodies, many of Dylan's own songs employed metaphorical and allegorical lyrics that showed a poetic artistry and imagination rarely found in previous American folk music.

In 1965 Dylan adopted electronically amplified instruments and many of the rhythms of rock and roll in what marked a major departure from his past songs of social protest and use of acoustic instruments. The landmark record albums *Highway 61 Revisited* (1965) and *Blonde On Blonde* (1966), with their powerfully introspective and melancholy lyrics and blues-derived rhythms, established Dylan as a leading figure in rock music and brought him to the pinnacle of his popularity. Following a motorcycle accident in 1966 and a period of seclusion, Dylan underwent another musical turnabout and released several albums (notably *Nashville Skyline,* 1969) that again surprised with their muted, reflective tone and their use of country-and-western elements. During the 1970s and '80s Dylan continued to perform and to make influential recordings, notably those on the albums *Blood on the Tracks* (1975), *Desire* (1975), and *Infidels* (1983).

dynamical time, the time scale of dynamical astronomy (celestial mechanics). The orbital motions of celestial bodies subject only to Newton's laws of motion and law of gravitation, as modified by relativity, proceed as a function of dynamical time. In 1952 the International Astronomical Union (IAU) defined a dynamical time scale named Ephemeris Time (ET), which is based on the Earth's orbital motion as given by the American astronomer Simon Newcomb in his nonrelativistic tables of the Sun (1898). In practice, however, ET was determined more accurately by observing the Moon's motions and then using a lunar ephemeris. For this operation an empirical, nongravitational term was used to correct for the disturbing effect exerted by the Earth–Moon tidal couple, as given in the nonrelativistic *Improved Lunar Ephemeris* of 1954.

Highly accurate observations made since about 1967 by means of radar, lasers, radioastronomy, spacecraft, and atomic clocks have since made improved, relativistic ephemerides necessary. In 1984 ET was replaced in national almanacs by Barycentric Dynamical Time (TDB), whose equations of motion refer to the barycentre, or centre of mass, of the solar system and include relativistic terms. Different theories of relativity are used in the various forms of TDB, and the IAU did not specify a particular ephemeris with which to numerically define TDB. The IAU also defined an auxiliary scale, Terrestrial Dynamical Time (TDT), for use in apparent geocentric ephemerides (*i.e.,* those using equations of motion referring to the centre of the Earth). By definition, TDT = TAI + 32.184 seconds, with TAI denoting International Atomic Time. *See also* atomic time.

dynamics, branch of physical science and subdivision of mechanics that is concerned with the motion of material objects in relation to the physical factors that affect them: force, mass, momentum, energy.

A brief treatment of dynamics follows. For full treatment, *see* MACROPAEDIA: Mechanics.

Dynamics can be subdivided into kinematics, which describes motion, without regard to its causes, in terms of position, velocity, and acceleration; and kinetics, which is concerned with the effect of forces and torques on the motion of bodies having mass. The foundations of dynamics were laid at the end of the 16th century by Galileo Galilei who, by experimenting with a smooth ball rolling down an inclined plane, derived the law of motion for falling bodies; he was also the first to recognize that force is the cause of changes in the velocity of a body, a fact formulated by Isaac Newton in the 17th century in his second law of motion. This law states that the force acting on a body is equal to the mass of the body multiplied by the acceleration.

dynamite, blasting explosive, patented in 1867 by Swedish physicist Alfred Nobel, based on nitroglycerin but much safer to handle than nitroglycerin alone. By mixing the nitroglycerin with kieselguhr, a porous siliceous earth, in proportions that left an essentially dry and granular material, Nobel produced a solid that was resistant to shock but readily detonable by heat or percussion. Later, wood pulp was substituted as the absorbent, and sodium nitrate was added as an oxidizing agent to increase the strength of the explosive. Nobel also invented gelatinous dynamite, a mixture of nitrocellulose and nitroglycerine. Ammonium nitrate was later substituted for part of the nitroglycerine to give a safer and less expensive explosive called extra dynamite. *See also* explosive.

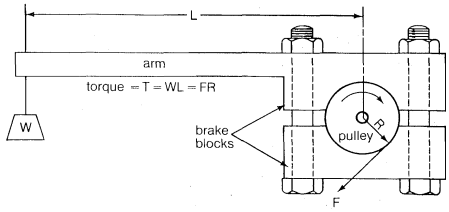
dynamo: *see* electric generator.

dynamo theory, geophysical theory that explains the origin of the Earth's main magnetic field in terms of a self-exciting (or self-sustaining) dynamo. In this dynamo mechanism, fluid motion in the Earth's outer core moves conducting material (liquid iron) across an already existing, weak magnetic field and generates an electric current. (Heat from radioactive decay in the core is thought to induce the convective motion.) The electric current, in turn, produces a magnetic field that also interacts with the fluid motion to create a secondary magnetic field. Together, the two fields are stronger than the original and lie essentially along the axis of the Earth's rotation.

The dynamo theory was proposed by the German-born American physicist Walter M. Elsasser and the British geophysicist Edward Bullard during the mid-1900s. Although various other mechanisms for generating the geomagnetic field have been proposed, only the dynamo concept is seriously considered today.

dynamometer, device for measuring mechanical force, or power, transmitted by a rotating shaft. Since power is the product of torque (turning force) and angular speed, all power-measuring dynamometers are essentially torque-measuring devices; the shaft speed is measured separately.

Among force-measuring devices are a flexible metallic ring that bends when a force is applied in such a manner as to tend to collapse it—the amount of bending being a measure of the applied force—and a hydraulic "load cell" that measures compressive loads in terms of fluid pressure.



Elements of a typical Prony brake

Power-measuring dynamometers may be transmission dynamometers or absorption dynamometers. The former utilize devices that measure torque, in terms of the elastic twist of the shaft or of a special torquemeter inserted between sections of the shaft. The torque is produced by the useful load that the prime mover, motor, or machine is carrying.

Absorption dynamometers, on the other hand, produce the torque that they measure by creating a constant restraint to the turning of a shaft by either mechanical friction, fluid friction, or electromagnetic induction. A Prony brake (*see* Figure) develops mechanical friction on the periphery of a rotating pulley by means of brake blocks that are squeezed against the wheel by tightening the bolts until the friction torque FR balances the torque WL. A water brake creates a resistance by circulating water between a rotating impeller and a stationary shell while an electric dynamometer generates and absorbs direct-current electricity or eddy currents. In each case, the element that exerts the restraining influence is freely cradled so that its tendency to rotate with the rotating body can be arrested and the arresting force measured at a known distance from the axis of rotation. The torque is the product of the spring load or weight and the distance from the axis of rotation.

dynamophone (musical instrument): *see* telharmonium.

dyne, unit of force in the centimetre–gram–second system of physical units, equal to the force that would give a free mass of one gram an acceleration of one centimetre per second per second, or approximately 2.248×10^{-6} pound. One dyne equals 0.00001 newton.

Dyott, Thomas W. (b. 1771, England—d. Jan. 17, 1861, Philadelphia), British-born American patent-medicine king, glassmaker, temperance advocate, and reformer. His "picture bottles" have special value as antiques.

A druggist's apprentice in London, Dyott arrived in Philadelphia in the 1790s almost penniless and rented a basement room where by day he polished shoes and by night manufactured shoeblack. In 1807 he opened a drugstore, added "M.D." to his name, and soon became the largest dealer of "family medicines" in the country. Among his better-selling products were Infallible Worm Destroying Lozenges and Vegetable Nervous Cordial. As his medicines required many bottles, in 1833 he purchased the Kensington (Pennsylvania) Glass Works, where he employed 400 workers. Here he found an outlet for his Utopian ambitions. No liquor was permitted in Dyottville, or "Temperanceville," as the factory community was called, although the "doctor's" own medicines had a high alcoholic content. Workers rose to a daylight bell, had set times for baths, were served refreshments during breaks, and after supper and an hour's leisure, attended night school and prayers. When the bank Dyott had established failed, he was sentenced to a short term in the penitentiary. Afterward, he returned to his drugstore and rebuilt his fortune before his death.

The Kensington output consisted of whiskey flasks, patent-medicine and pickle bottles, snuff jars, demijohns, and carboys in "bottle colours," ranging from clear and aquamarine to dark olive, amber, and sage green. The popular and widely imitated George Washington, Jenny Lind, and Louis Kossuth bottles originated there.

dysautonomia (neurological disease): *see* Riley–Day syndrome.

dysentery, infectious disorder characterized by inflammation of the intestine, abdominal pain and straining, and diarrhea with stools that often contain blood and mucus.

There are two major types of dysentery: bacillary and amebic, caused, respectively, by bacteria and amoebas. Bacillary dysentery, or shigellosis, is caused by bacilli of the genus *Shigella.* Symptomatically, the disease ranges from a mild attack to a suddenly commencing severe course ending in death caused by dehydration and poisoning by the bacterial toxins. After an incubation period of one to six days, the disease has an abrupt onset with fever and the frequent production of watery stools that may contain blood. Straining and vomiting may also occur, and dehydration soon becomes obvious owing to the copious loss of body fluids. In advanced stages of the disease, chronic ulceration of the large intestine causes the production of bloody stools. The most severe bacillary infections are caused by *Shigella shigae* (also called *S. dysenteriae* type 1), which is found chiefly in tropical and subtropical regions. *S. flexneri, S. sonnei,* and *S. boydii* are other *Shigella* bacilli that cause dysentery. The treatment of bacillary dysentery is based on the use of such antibiotic drugs as tetracycline, oxytetracycline, and chlortetracycline. The copious administration of fluids and, in some cases, blood transfusions may be necessary in cases where the patient is severely dehydrated.

Amebic dysentery, or intestinal amebiasis, is caused by the protozoan *Entamoeba histolytica.* This form of dysentery is usually much more chronic and insidious than is the bacillary disease and is more difficult to treat because the causative organism occurs in two forms, a motile one and a cyst, each of which produces a different disease course. The motile form causes an acute dysentery, the symptoms of which resemble those of bacillary dysentery. The cyst form produces a chronic illness marked by intermittent episodes of diarrhea and stomach cramps or other abdominal pains. Bloody stools occur in some patients. The chronic type is much the more common of the two and is marked by frequent remissions and exacerbations of symptoms. The chronic form may also produce ulcerations of the large intestine. Both forms of amoebic dysentery are treated with emetine, diodoquin, and other drugs that specifically kill the amoebic parasites that thrive in the intestines.

The transmission of both bacterial and amebic dysentery occurs through the ingestion of food or water that have been contaminated by the feces of a human carrier of the infective organism. The transmission is often by infected individuals who handle food with unwashed hands. The spread of amebic dysentery is often accomplished by people who are carriers of the disease but who currently show no symptoms. Dysentery is commonly found when people are crowded together and have access only to primitive sanitary facilities. It is one of the typical diseases found in prisoner-of-war camps, especially those in tropical climates.

dyslexia, a specific inability or pronounced difficulty in learning to read or spell, despite otherwise normal intellectual functions. Dyslexia is a chronic neurological disorder that inhibits a person's ability to recognize and process graphic symbols, particularly those pertaining to language. It can have many different symptoms. Chief among these are extremely poor reading skills owing to no apparent cause, a tendency to read and write words and letters in reversed sequences (such cases may be identified by distinctive transpositions and other forms of misspelling), similar reversals of words and letters in the person's speech, and illegible handwriting.

Dyslexia is found three times more often in boys than in girls and usually becomes evident in the early school years. The disorder tends to run in families. Only a minority of dyslexics remain nonreaders into adulthood, but many dyslexics continue to read and spell poorly throughout their lifetime. Dyslexics frequently perform above average on nonverbal tests of intelligence, however. Dyslexia is best treated by a sustained course of proper instruction in reading. The cause of the disorder is unknown, and even its diagnosis is a difficult task; dyslexia is usually diagnosed for children or adults who have reading difficulties for which there is no apparent explanation. Recent research points to anomalies in the respective functioning of the left and right hemispheres of the brain as possibly being the cause of the disorder, but a conclusive explanation has yet to be found.

dysmenorrhea, also spelled DYSMENORRHOEA, pain or painful cramps felt before or during menstruation. Dysmenorrhea may be primary or secondary. Primary dysmenorrhea is caused by specific imbalances in the woman's endocrine system during the menstrual cycle. Secondary dysmenorrhea denotes menstrual cramps caused by some other distinct organic disorder. In most cases dysmenorrhea is primary.

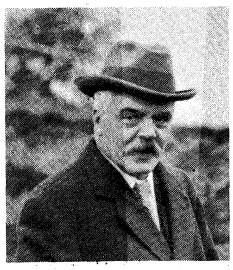
Primary dysmenorrhea may occur a few days before the period, at the onset of bleeding, or during the total episode. The pain varies from a severe incapacitating distress to relatively minor and brief intense cramps. Other symptoms may include irritability, fatigue, backache, headache, leg pains, nausea, vomiting, and cramping. The cause of primary dysmenorrhea was long unknown and was most often explained as being a product of psychological stress. Primary dysmenorrhea is now known to be caused by the endocrine system's release of excessive amounts of prostaglandins; these are hormonelike substances that stimulate the uterus to contract, thus causing the familiar cramps of the disorder. Drugs that block prostaglandin formation can decrease the severity of uterine contractions and can eliminate pain for many sufferers. Menstrual cramps also often diminish in severity or even disappear permanently after childbearing.

Secondary dysmenorrhea is much less common. It can be caused by genital obstructions, pelvic inflammation or degeneration, abnormal uterine wall separation or development, chronic infection of the uterus, polyps or tumours, or weakness of the muscles that support the uterus. Often the pain is dull, aching, and persistent. Tumours produce sharper pains. Treatment is directed toward the underlying disorder.

Dyson, Sir Frank (Watson) (b. Jan. 8, 1868, Measham, near Ashby-de-la-Zouch, Leicestershire, Eng.—d. May 25, 1939, at sea, en route from Australia to England), British as-

tronomer who in 1919 organized observations of stars near the Sun, which provided evidence supporting Einstein's prediction of the bending of light in a gravitational field.

In 1894 Dyson became chief assistant at the Royal Greenwich Observatory and was a member of eclipse expeditions to Portugal (1900), Sumatra (1901), and Tunisia (1905). His observations of the corona and chromosphere of the Sun were published in *Determination of Wave-Lengths from Spectra Obtained at the Total Solar Eclipses of 1900, 1901, and 1905* (1906). Dyson was elected a fellow of the Royal Society of London in 1901, and in 1905 he was appointed Astronomer Royal for Scotland. He returned to Greenwich in 1910 to become the ninth Astronomer Royal of England, and five years later he was knighted. In 1921 he was honoured for his investigations of the distribution and movements of stars and the relationship of these to the structure of the Galaxy. Dyson's *Eclipses of the Sun and Moon* (1937) was written with Richard van der Riet Woolley.



Dyson, 1927
BBC Hulton Picture Library

dyspareunia, painful or difficult sexual intercourse in the female. Disorders can be classified as functional or organic. The functional difficulties arise from psychological inhibitions, insufficient lubricating secretions as a result of hormonal deficiency or simply of aging, or, rarely, anatomical disproportion between partners; organic causes spring from anatomical abnormalities or pathologic conditions. Commonly, both functional and organic factors are present. Pain experienced in the first few attempts at sexual intercourse may lead to aversion from it and fear even after the pain is no longer encountered.

Most dyspareunia is emotionally or psychologically seated. Fear of pain is the commonest cause. Fear may be instilled in the child long before it is even understood what intercourse involves. Fear of pregnancy may manifest itself by dyspareunia. Unpleasant sexual experiences of childhood may instigate unpleasant apprehensions or guilt feelings. Women who are aggressive may experience dyspareunia because they are unwilling to submit to or totally reject intercourse; many find pleasure only when they assume the role of aggressor. Likewise, women marrying late in life may find it difficult or impossible to accept the intimacy of intercourse.

True organic difficulties are few. Cysts, tumours, sores, or scar tissue in the vagina may be sensitive. Mechanical contraceptive devices may produce irritation that is aggravated by intercourse. Infections and swelling of the vaginal walls may produce resistance to stretching. Finally, pathological conditions in the anus, such as hemorrhoids, or in the urinary tract may be the cause of dyspareunia. *See also* vaginismus.

dyspepsia: *see* indigestion.

dysphagia, difficulty in swallowing, caused by lesions or mechanical obstruction of the upper digestive tract or by disturbances in the nervous or muscular control of swallowing. Obstruction of the esophagus is the most common cause of dysphagia; often there is pain in swallowing and the dysphagia is usually a result of stricture, cancerous or benign growths, or the presence of foreign bodies.

dysphasia (neuropathy): *see* aphasia.

dysphemia: *see* stuttering.

dysplasia, malformation of some bodily structure or tissue; the term most commonly denotes a malformation of bone that may occur in any part of the body. Several dysplasias are well-defined diseases in humans.

Chondroectodermal dysplasia (Ellis–van Creveld syndrome) is a very rare, congenital disorder. It is heritable (autosomal recessive). Affected individuals exhibit heart abnormalities (which may cause early death), extra digits, defective dentition, poorly formed nails, dwarfing, and often knock-knees and fusion of hand bones. The disorder reaches its highest known frequency among the Old Order Amish in Pennsylvania, in which 5 in every 1,000 births are affected.

Progressive diaphyseal dysplasia (Engelmann's syndrome) is an uncommon heritable (autosomal recessive) disorder beginning in childhood. The shafts of the bones and the skull vault become thickened; there is no pain, but individuals grow to be taller than normal, have weak muscles, are easily fatigued, and exhibit a stiff, waddling gait.

Epiphyseal dysplasia is a not uncommon disorder in which the ends of bones (the epiphyses) in children grow and ossify very slowly; dwarfing is a common result but may be limited to the lower limbs. Degenerative joint disease usually develops by middle age, but individuals may be otherwise healthy.

Stippled epiphyses (dysplasia epiphysealis punctata) is a very rare, little understood disorder in which spots of opaque material are observed in the epiphyseal cartilage at birth. Many infants die within the first year; those who live may show dwarfism, mental retardation, and congenital cataracts.

Metaphyseal dysplasia is a very rare, familial disorder in which the cortex of the shafts of long bones is thin and tends to fracture; affected persons may be otherwise healthy.

Hip dysplasia is a hereditary condition in dogs, especially in large breeds such as the German shepherd, Old English sheepdog, and St. Bernard. It includes a range of abnormalities involving the head of the thigh bone and the receiving socket in the hip bone.

dysprosium (Dy), chemical element, rare-earth metal of transition Group IIIb of the periodic table. A relatively hard and very reactive metal, it is oxidized by air and by water. Its high melting point and ability to absorb neutrons make it useful in control rods for nuclear reactors. Its compounds have been used as catalysts in the oil-refining industry, as components in some electronic equipment, and as phosphor activators.

P.-É. Lecoq de Boisbaudran first found this element (1886) associated with holmium and other heavy rare earths; Georges Urbain later (1906) was able to prepare a reasonably pure fraction. Some important mineral sources of dysprosium are xenotime, euxenite, and monazite. It occurs also in the products of nuclear fission. Commercial separation is performed by ion-exchange methods. The metal has been prepared by thermoreduction of the anhydrous halides with alkali or alkaline-earth metals. Dysprosium metal at room temperature is crystallized in a hexagonal close-packed structure, below −168° C is ferromagnetic, and at very low temperatures is superconductive. The naturally occurring isotopes are all stable and have mass numbers 156, 158, 160, 161, 162, 163, and 164; the last four make up about 98 percent of natural dysprosium.

Chemically, dysprosium behaves as a typical trivalent rare earth and forms a series of pale-yellow compounds. The Dy^{3+} ion is strongly paramagnetic; this property has been harnessed to produce magnetic cooling to very low temperatures.

atomic number	66
atomic weight	162.500
melting point	1,409° C
boiling point	2,335° C
specific gravity	8.540 (25° C)
valence	3
electronic config.	2-8-18-28-8-2 or $(Xe)4f^{10}5d^{0}6s^{2}$

Dyula, also spelled DIULA, DIOULA, or JULA, a people of West Africa, who speak a Mande language of the Nilo-Congo family. They are chiefly Muslims and have long been noted as commercial traders.

The Dyula were active gold traders as long ago as the time of the ancient African kingdom of Ghana and flourished under the empire of Mali, when they provided a link between the gold-producing forest lands in the south and the trading network of the western Sudan and North Africa. Kola nuts were another important trade item, and the Dyula were noted as skilled craftsmen. They began to disperse and settle into towns in about the 16th century. In the mid-19th century some of these towns expanded into larger states, but they had declined by 1900.

Today the Dyula are settled in the towns and villages in the Ivory Coast, Burkina Faso (formerly Upper Volta) and parts of Mali and Ghana. Some Dyula communities have become agricultural, but most remain active in commerce, at least in the dry season.

Dyushambe (Tadzhik S.S.R.): *see* Dushanbe.

Dzalamo (people): *see* Zaramo.

Dzaudzhikau (Russian S.F.S.R.): *see* Ordzhonikidze.

Dzerzhinsk, also spelled DZERŽINSK, formerly (until 1929) RASTYAPINO, city, Gorky *oblast* (administrative region), western Russian Soviet Federated Socialist Republic, on the Oka River above its confluence with the Volga at Gorky and on the Moscow–Gorky railway. Part of the Gorky metropolitan area, Dzerzhinsk and its satellite towns stretch for 15 mi (24 km) along the river. It is one of the U.S.S.R.'s most important centres of the chemical industry, producing phosphate and nitrate fertilizers, materials for synthetic textiles, and plastics. The production of building materials, engineering, and flour milling are also carried on. Pop. (1983 est.) 269,000.

Dzerzhinsky, Feliks Edmundovich, Polish FELIKS DZIERŻYŃSKI (b. Sept. 11 [Aug. 30, old style], 1877, Vilna province, Russia—d. July 20, 1926, Moscow), Bolshevik leader, head of the first Soviet secret police organization.

Son of a Polish nobleman, Dzerzhinsky joined the Kaunas (Kovno) organization of the Lithuanian Social Democratic Party in 1895. He became a party organizer, and, although he was arrested by the Russian Imperial Police for his revolutionary activities five times between 1897 and 1908, he repeatedly escaped from exile in Siberia. Not only did he participate in the Russian Revolution of 1905 but he also became a leader of the Polish–Lithuanian Social Democratic Party and was influential in convincing his colleagues to unite with the Russian Social Democrats in 1906. Afterward, Dzerzhinsky pursued his revolutionary activities within the Russian Empire and in western Europe. Arrested for the sixth time in 1912, he remained in captivity until after the February Revolution of 1917.

Elected to the Bolshevik Party's Central Committee in July 1917, Dzerzhinsky played an active role in the October Revolution (1917) and on Dec. 20 (Dec. 7, O.S.), 1917, was named head of the new All-Russian Extraordi-

nary Commission for Combating Counterrevolution and Sabotage (Cheka), which became Soviet Russia's security police agency. The Cheka helped stabilize V.I. Lenin's dictatorship by arbitrarily executing real and alleged enemies of the Soviet state. Dzerzhinsky, who organized the first concentration camps in Russia, acquired a reputation as an incorruptible, ruthless, and fanatical communist.

During the Russo-Polish War (1919–20), when the Red Army was driving the anti-Bolshevik Polish forces westward, Dzerzhinsky was appointed to the Polish revolutionary committee that was intended to become the Bolshevik government of Poland. But after the Soviet army was forced to retreat, he again concentrated on Russian affairs. He remained head of the Cheka and commissar for internal affairs (after 1919) and became commissar for transport (1921). In 1924, after he had become a firm supporter of Joseph Stalin, Dzerzhinsky was given control of the Supreme Economic Council and was also elected a candidate of the Politburo. In 1926, during a heated debate at a Central Committee session, Dzerzhinsky collapsed and died.

Dzhalal-Abad, also spelled DŽALAL-ABAD, city, Osh *oblast* (province), Kirgiz S.S.R. It lies at an elevation of 2,300 feet (700 m) in an agricultural area. Though made a city in 1877, it remained essentially a large village. Given city status again in 1927, it now has a number of food- and light-industry undertakings, a theatre, and a museum. On nearby Mount Ayubtau is a spa with hot springs. Pop. (1987 est.) 74,000.

dzhalman: *see* Selevin's mouse.

Dzhambul, also spelled DŽAMBUL, *oblast* (province), southern Kazakh S.S.R. The *oblast* occupies an area of 55,850 square miles (144,600 square km). The southern portion of the *oblast* includes the northern slopes of the Kirgiz and Karatau mountains and, in their foothills, a narrow strip of fertile irrigated land. In the centre of the *oblast* is the sandy Muyun-Kum Desert, which is separated by the Chu River from the clay desert of Betpak-Dala in the northern sector of the *oblast*. Dzhambul has hot, dry summers and cold winters. Sugar beets, grain, and tobacco are grown along the Chu, Talas, and Assa rivers. In the drier areas cattle, sheep, and camels are raised. Phosphate production from the rich Karatau phosphorite deposits is important. The *oblast*'s industries, which produce sugar and other foods, chemicals, and construction materials, are concentrated in Dzhambul city. The population consists mainly of Kazakhs and Russians, with some Germans, Ukrainians, Uzbeks, Tatars, Dungans, and Greeks. Besides the *oblast* capital of Dzhambul, the major cities are Chu, Karatau, and Zhanatas. Pop. (1989) 1,048,000.

Dzhambul, also spelled DŽAMBUL, city, Dzhambul *oblast* (province), southern Kazakh S.S.R. It lies at the junction of the Talas River and the Turk-Sib Railway. Dzhambul is one of the oldest towns of Kazakhstan. It stands on the site of the ancient city of Taraz, which flourished as a stop along the Silk Road from Europe to China until it was destroyed by Mongol armies in the 13th century. A new town called Auliye-Ata was established on the site by the emirs of Kokand in the late 18th century. The fort and town were captured by the Russians in 1864, and in 1938 the town was renamed after the Kazakh poet Jambul Jabayev (Russian Dzhambul Dzhabayev; 1846–1945). The modern city of Dzhambul has large phosphate-processing works; a large power station; sugar, leather, and footwear factories; and a wool-washing plant. There are institutions for training teachers, food and light-industry technicians, and irrigation engineers. The city also has a museum and two theatres. Pop. (1989 prelim.) 307,000.

Dzhezkazgan, also spelled DŽEZKAZGAN, *oblast* (province), central Kazakh S.S.R. The *oblast* lies in the arid centre of Kazakhstan and occupies an area of 121,000 square miles (313,400 square km). The terrain consists mostly of the Kazakh *melkosopochnik,* which is a large area of gently sloping low hills in which there are isolated low mountains. Dzhezkazgan *oblast* has hot, dry summers and mild winters. It is quite arid and receives an average annual rainfall of only about 4 inches (100 mm). The province's irrigated agriculture produces cereals and some fodder crops, and some sheep, cattle, and horses are also raised. Mining is more important in the *oblast,* which has major deposits of copper as well as iron and manganese ores. Industries, which include food processing and the manufacture of building materials, are concentrated mainly in Dzhezkazgan city. The other main urban centre is Balkhash, on the northern shore of Lake Balkhash, which borders the *oblast* on the southeast. The population of Dzhezkazgan consists mainly of Kazakhs and Russians. Pop. (1989) 496,000.

Dzhezkazgan, also spelled DŽEZKAZGAN, city, capital (since 1973) of Dzhezkazgan *oblast* (province), Kazakh S.S.R., on a reservoir of the Kara-Kengir River. The city was created in 1938 in connection with the exploitation of the rich local copper deposits. In 1973 a large mining and metallurgical complex was constructed to the southeast to smelt the copper hitherto sent elsewhere. The city has a rail link with Karaganda. Its urban area includes the neighbouring mining town of Nikolsky. Pop. (1989 prelim.) 109,000.

Dzhirgalantu (Mongolia): *see* Hovd.

Dzhizak, city, Syrdarya *oblast* (province), eastern Uzbek S.S.R. The city is located in a small oasis irrigated by the Sanzar River, northeast of Samarkand. One of the most ancient settlements of Uzbekistan, it was situated on the trade routes to the Mediterranean near Tamerlane's Gates, the only convenient passage through the Nuratau Mountains to the Zeravshan River valley. Today the city processes cotton and other local agricultural products together with building materials. Polytechnic, medical, and teacher-training institutes are located in the city. Pop. (1989 prelim.) 102,000.

Dzhugashvili, Joseph Vissarionovich: *see* Stalin, Joseph.

dziady, in Slavic religion, all the dead ancestors of a family, the rites that are performed in their memory, and the day on which those rites are performed. *Dziady* take place three or four times a year; though the dates vary in different localities, *dziady* are generally celebrated in the winter before the beginning of Advent and in the spring on the Sunday of Doubting Thomas. A solemn funereal feast (*pominki*) is prepared and attended by the family; the *dziady* themselves are addressed and invited to join their kinsmen. The *dziady,* however, are not considered family guardians and are never asked for favours or protection.

Dzierżoniów, German REICHENBACH, city, Wałbrzych *województwo* (province), southwestern Poland, on the Piława River. The community was founded as Reichenbach in the 12th century and received town rights in the 13th. The Duke of Ziębice (Münsterberg) pledged the town to Bohemia (1335), whence it passed to the Habsburgs. In 1742 it was surrendered, with Silesia, to Prussia; it returned to Poland in 1945 and was renamed for the Polish priest Jan Dzierżoń (1811–1906).

A heavy industrial city located in Dolny Śląsk (Lower Silesia), Dzierżoniów is the major trading centre for its surrounding area, dealing in textiles (primarily cotton and wool), machinery, and electrical equipment, as well as grain and cattle and other agricultural products. Pop. (1988 est.) 37,800.

Dzungar, also spelled JUNGAR, JÜÜNGAR, DZHUNGAR, or DSONGAR, people of central Asia, so called because they formed the left wing (*dson,* "left"; *gar,* "hand") of the Mongol army. A western Mongol people whose home was the Ili River valley and Chinese Turkistan, they adopted Buddhism in the 17th century. They are for all practical purposes identical with the Oyrat (*q.v.*).

Dzungarian Basin, Wade-Giles romanization CHUN-KO-ERH P'EN-TI, Pinyin JUNGGAR PENDI, extensive basin in the Sinkiang Uighur autonomous *ch'ü* (region), China. The basin lies between the Altai Mountains, on the Sino-Mongolian border, to the north, and the P'o-lo-k'o-nu and Po-ko-ta mountains to the south; the latter run east and west immediately to the north of the Tien Shan ("Celestial Mountains"). To the west, the basin is bounded by the A-la-t'ao and T'a-erh-pa-ha-t'ai mountain ranges, which separate it from the Lake Balkhash depression in the Soviet Union. The main pass through these ranges is the so-called Dzungarian Gate (Chun-ko-erh Men), which leads to Lake Alakol and Lake Balkhash in the Soviet Union. In the far north the O-erh-ch'i-ssu River (Russian Kara Irtysh) drains into Lake Zaysan across the Soviet border. Otherwise, Dzungaria is an area of internal drainage, the rivers from the Altai draining into Chi-li Lake and those from the southern ranges into Ma-na-ssu or Ai-pi lakes in the low-lying depression immediately southeast of the Dzungarian Gate. The whole depression is between 1,650 and 3,300 feet (500 and 1,000 m) above sea level, with a general slope from northeast to southwest, where Ai-pi Lake is at an elevation of little more than 620 feet (189 m).

The area is very dry and receives only 6–12 inches (150–300 mm) of annual precipitation. It also experiences great extremes of temperature. The surrounding mountains, however, receive much heavier precipitation, and much of the northern ranges and the Altai are forested. The east-central part of the basin is a desert but is not totally barren. Surrounding it are zones of steppe (grassy plains) and semisteppe watered by seasonal watercourses that often peter out into saline marshes. There are few rivers in the basin. The O-erh-ch'i-ssu River, flowing west along the foothills of the Altai into the Soviet Union, is China's only river emptying into the Arctic Ocean.

The population mostly consists of Uighurs and various Turkic or Mongol peoples, the only native Han (Chinese) being the settlers on the southern oases and state farms and the industrial population.

Dzungarian Gate, Russian DZHUNGARSKIYE VOROTA, also spelled DŽUNGARSKIJE VOROTA, Chinese CHUN-KO-ERH MEN, mountain pass, between the Dzungarian Alatau and Pa-erh-luk'o and Ma-li ranges, that links the Balkhash-Alakol depression in the Kazakh S.S.R. with the basin of Ai-pi Lake in western China. Its width varies from about 6 miles (10 km) to 25 miles (40 km). In the cold season the southeast wind reaches hurricane force in the narrowest part of the valley. From ancient times the Dzungarian Gate was used by nomadic tribes en route from Inner Asia to the steppes of Kazakhstan, and Genghis Khan's troops passed that way at the beginning of the 13th century. The Aktogay-China railway was intended to pass through the Dzungarian Gate; but only the Soviet half was completed, reaching the station of Druzhba on the frontier.

Dzyubin, Eduard Georgiyevich, also spelled DZIUBIN: *see* Bagritsky, Eduard Georgiyevich.

E region, also called KENNELLY–HEAVISIDE LAYER, ionospheric region that extends from an altitude of 90 kilometres (60 miles) to about 160 kilometres (100 miles). As in the D region (70–90 kilometres), the ionization is primarily molecular—*i.e.*, resulting from the splitting of neutral molecules—oxygen (O_2) and nitrogen (N_2)—into electrons and positively charged molecules. Unlike that of the D region, the ionization remains at night, though it is considerably diminished. The E region was responsible for the reflections involved in Marconi's original transatlantic radio communication in 1902. The ionization density is typically 10^5 electrons per cubic centimetre during the day. Intermittent patches of stronger ionization are sometimes observed at the same general altitude.

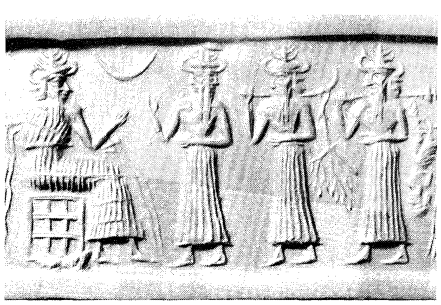
E source (biblical literature): *see* Elohist source.

E-trisomy, also called TRISOMY 18, human autosomal disorder in which the set of chromosomes known collectively as chromosome 18 is present as a triplet rather than the usual pair. The disorder produces the following characteristics: low and malformed ears, protruding eyes, receding chin, hernias, rigidly flexed fingers in which the index finger crosses the third, convex soles of the feet, generalized body rigidity, severe nervous system abnormalities, and multiple internal deficiencies. Approximately one in 3,000–4,000 live births is affected. Females are affected three times as often as males. Fifty percent of affected infants die within two months of birth, the remainder within two years.

E^1 (mountain, Nepal–Tibet): *see* Lhotse.

Ea (Akkadian), Sumerian ENKI, Mesopotamian god of water and a member of the triad of deities completed by Anu (Sumerian An) and Bel (Enlil). From a local deity worshipped in the city of Eridu, Ea evolved into a major god, Lord of Apsu (also spelled Abzu), the fresh waters beneath the earth (although Enki means literally "lord of the earth"). In the Sumerian myth, "Enki and the World Order," Enki is said to have fixed national boundaries and assigned gods their roles. According to another Sumerian myth Enki is the creator, having devised men as slaves to the gods. In his original form, as Enki, he was associated with semen and amniotic fluid, and therefore with fertility. He was commonly represented as a half-goat, half-fish creature, from which the modern astrological figure for Capricorn is derived.

Ea, the Akkadian counterpart of Enki, was the god of ritual purification: ritual cleansing waters were called "Ea's water." Ea governed the arts of sorcery and incantation. In some



Ea (seated) and attendant deities, Sumerian cylinder seal, *c.* 2300 BC; in the Pierpont Morgan Library, New York

By courtesy of the Pierpont Morgan Library, New York

stories he was also the form-giving god, and thus the patron of craftsmen and artists; he was known as the bearer of culture. In his role as advisor to the king, Ea was a wise god although not a forceful one. In Akkadian myth, as Ea's character evolves, he appears frequently as a clever mediator who could be devious and cunning. He is also significant in Akkadian mythology as the father of Marduk, the national god of Babylonia.

Eadbald (d. Jan. 20, 640), king of Kent, who succeeded his father Aethelberht in 616. He had not been influenced by the teaching of the Christian missionaries, and his first step on his accession was to marry his father's widow. After his subsequent conversion by Laurentius, archbishop of Canterbury, he built a church dedicated to the Virgin at Canterbury. He arranged a marriage between his sister Aethelberg and Edwin of Northumbria, on whose defeat and death in 633 he received his sister in the company of Paulinus and offered the latter the bishopric of Rochester.

Eadbert, also spelled EADBERHT (Anglo-Saxon king): *see* Edbert.

Eadmer (English writer): *see* Edmer.

Eadmund (Old English personal name): *see under* Edmund.

Eadred, also spelled EDRED (d. Nov. 23, 955, Frome, in modern Somerset, Eng.), king of the English from 946 to 955, who brought Northumbria permanently under English rule. Eadred was the son of the West Saxon king Edward the Elder (ruled 899–924), the half brother of King Athelstan (ruled 924–939), and the brother of King Edmund I (ruled 939–946). Upon Eadred's accession to power, the Northumbrians acknowledged his overlordship, but they soon proclaimed as their

Eadred, shown on a 10th-century silver penny; in the British Museum

Peter Clayton

king Erik Bloodax, son of the Norwegian ruler Harald I Fairhair. In revenge Eadred ravaged all of Northumbria (948). The Northumbrians submitted to Eadred, but in 949 they accepted another Norse king, Olaf Sihtricson, as their ruler. They overthrew Olaf in 952 in favour of Erik Bloodax, who in turn was expelled and killed in 954. The Northumbrians then resumed their allegiance to Eadred.

Eadred was a close friend of Dunstan, abbot of Glastonbury (later archbishop of Canterbury), and a supporter of the monastic revival inspired by Dunstan.

Eadric STREONA (d. 1017), ealdorman of the Mercians, who, though a man of ignoble birth, was advanced to the revived office of ealdorman by the English king Ethelred II, whose daughter Eadgyth Eadric married (1009).

Little is known of Eadric's origins. His appointment to the office of ealdorman was probably an attempt by Ethelred to unite south-central England under one command. He is generally considered an archtraitor in the struggle between the English and the Danes for sovereignty over England. Although there are several records of his minor betrayals and instances of bad counsel, Eadric committed his chief act of treachery in 1015, when he sided with Canute against Edmund Ironside as Ethelred, Edmund's father, lay dying. When at length peace was made, Canute restored to Eadric the earldom of Mercia; but at Christmas 1017, fearing further treachery, Canute had him slain.

Eads, James B(uchanan) (b. May 23, 1820, Lawrenceburg, Ind., U.S.—d. March 8, 1887, Nassau, Bahamas), U.S. engineer best known for his triple-arch steel bridge over the Mississippi River at St. Louis, Mo. (1874). His other projects include provision of a year-round

Eads

By courtesy of the Library of Congress, Washington, D.C.

navigation channel for New Orleans by means of jetties (1879).

Eads was named for his mother's cousin James Buchanan, a Pennsylvania congressman who later became president of the United States. The boy spent a migrant youth with little formal education, for his father's never very successful business ventures took the family to Cincinnati, Ohio, then Louisville, Ky., and finally St. Louis. James Eads educated himself by reading the library of his first employer, a St. Louis dry-goods merchant. At 18 he became purser on a Mississippi riverboat. Not long after, he began to consider means to recover by salvage the heavy losses from the frequent riverboat disasters. When he was 22, he invented a salvage boat, which he called a submarine; actually it was a surface vessel from which he could descend in a diving bell he had also designed and walk the river bottom. He recovered lead and iron pigs and other valuable freight; on one occasion he retrieved a cargo that included a large crock of butter in a good state of preservation. So successful was his equipment that in 12 years of operations on the Mississippi and its tributaries he made his fortune.

Retiring from the river to marry and settle down, Eads set himself up briefly as a glass manufacturer, but the promising enterprise, the first glass factory in the West, was ruined by the Mexican War; by 1848 he was back in the salvage business. He built three new submarines, the third of which was capable of pumping out and raising a sunken hull from the bottom. Within a few years he had 10 boats in his fleet.

As the Civil War threatened, Eads foresaw the struggle that would take place for control of the Mississippi system, and he advanced a radical idea. He proposed that ironclad steam-powered warships of shallow draft be built to operate on the rivers. The U.S. government was slow to take up his offer to build such a flotilla; when it did, he built the ships in record time, working 4,000 men on day and night shifts seven days a week. The novel craft he set afloat spearheaded Grant's offensive against Forts Henry and Donelson, the first important Union victories of the war. They continued to play a conspicuous role under Andrew Foote and David Farragut at Memphis, Island No. 10, Vicksburg, and Mobile Bay. The vessels were the first ironclads to fight in North America and the first in

the world to engage enemy warships. (The "Monitor" and "Merrimac," both ironclads that battled in the U.S. Civil War, were the first such vessels to close against each other in combat.) Immediately after the war, Eads was chosen to direct a construction project of extraordinary difficulty, the bridging of the Mississippi at St. Louis.

From his knowledge of the river and of the fabrication of iron and steel, he secured, against opposition, some of it unscrupulous, a contract for a steel triple-arch bridge over the river at St. Louis, which he began on Aug. 20, 1867. Its three spans, 502, 520, and 502 feet (152, 158, and 152 metres), respectively, consisted of triangularly braced 18-inch (46-centimetre) hollow steel tubes linked in units and set in piers based on bedrock. Since the rock lay some 100 feet (30 metres) below the river surface, reaching it posed major problems. The work of digging through the mud bottom had to be carried on under compressed air, and some of the men developed caisson disease (the bends). Following the deaths of two workers on March 19, 1870, Eads established a floating hospital, provided nourishing food for his workers, insisted on slow decompression on emerging from the caissons, and installed a lift.

The steel used in construction of the bridge was subject to similar rigorous standards; it was inspected at the works and on the site. Indeed, its supplier, the famed industrialist Andrew Carnegie, was forced to take back some batches for rerolling three times, and some were still rejected as not conforming to the specified strength of 60,000 pounds (27,000 kilograms) per square inch. Many other problems arose. To construct his first steel arches without disturbing navigation on the river, Eads used timber cantilevers to support them, with the halves of each arch held back by cables passing over the top of towers built on the piers. To join the two halves of the middle arch, Eads's deputy, Col. Henry Flad, had planned to hump the middle arch slightly to bring the two halves together; then, with the cantilevering removed, the arch would assume its normal shape. Eads, on the other hand, had prepared a wrought-iron plug fitted with threads; the last two arch ribs could be shortened by five inches each and cut with screw threads to receive the plug, which would close the distance between the ribs. Because of an unusual mid-September warm spell, which warped the bridge arches toward the north, Flad could not close the arches by the method he had chosen and, after trying to cool the steel tubes with ice packs, fell back on Eads's screw-plug connection. The first arch was closed on Sept. 17, 1873.

The Eads, or St. Louis, Bridge, the largest bridge of any type built up to that time, was recognized throughout the world as a landmark engineering achievement, with its pioneering use of structural steel, its foundations planted at record depths, and its cantilevering technique used for raising the arches. The bridge was officially opened on July 4, 1874.

Soon after, Eads's rare understanding of the Mississippi was enlisted at New Orleans to provide a year-round navigation channel for the city. Despite widespread skepticism, he successfully altered the sedimental behaviour of the river by building a series of jetties, and within five years, by 1879, he had created a practical channel for shipping. In this important work he employed a technique of carrying out the project at his own expense, simply on the basis of guarantees if successful. On the same conditions he sought to promote a ship-carrying railway across the Isthmus of Tehuantepec, in Mexico, as a more economic and viable alternative to a canal across the Isthmus of Panama. Two bills to promote the railway, however, failed in Congress.

James Buchanan Eads was the first U.S. engineer to be honoured with the Albert Medal of the Royal Society of Arts in London. He had been a consultant for Liverpool docks, as well as for installations in Toronto and in Veracruz and Tampico, Mex. Twice married, he had two daughters and three stepdaughters.

(W.H.G.A.)

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Eadweard, also spelled EADWARD (Old English personal name): *see under* Edward.

Eadwig, also spelled EDWY (d. Oct. 1, 959), king of the English from 955 to 957 and ruler of Wessex and Kent from 957 to 959. The eldest son of King Edmund I (ruled 939–946) and the nephew of King Eadred (ruled 946–955), he was probably no more than 15 years old at the time of his accession.

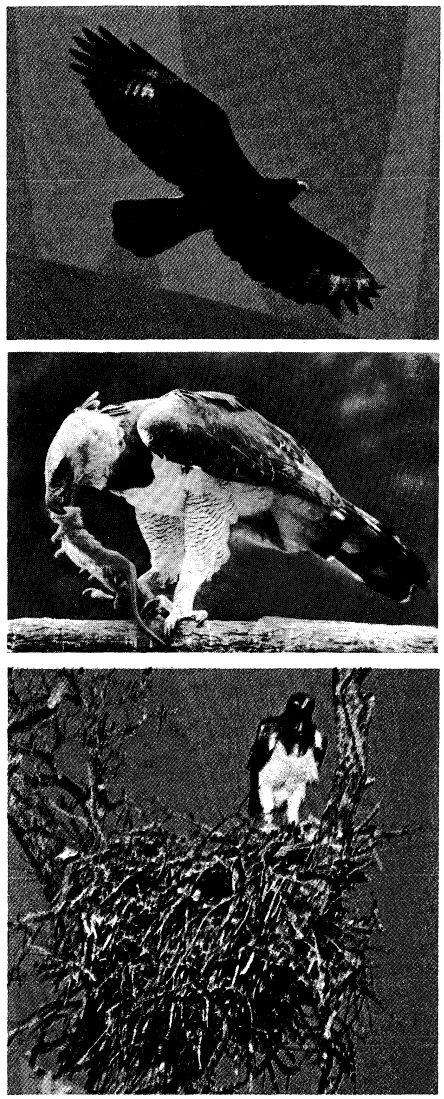
Early historical sources are biased against Eadwig. According to one writer, he hated the great monastic reformer Dunstan because he made Eadwig return to his coronation feast which he had left in order to visit Aelfgifu, whom he later married. Although Eadwig drove Dunstan into exile, he evidently did not attempt to halt the monastic revival that the churchman had inspired. In 957 the Mercians and Northumbrians revolted and proclaimed Eadwig's brother Edgar as their king. For the next two years Eadwig controlled only the region south of the Thames.

eagle, any of many large, heavy-beaked, big-footed birds of prey belonging to the family Accipitridae (order Falconiformes). In general, an eagle is any bird of prey more powerful than a buteo. An eagle may resemble a vulture in build and flight characteristics but has a fully feathered (often crested) head and strong feet equipped with great curved talons. A further difference is in foraging habits: eagles subsist mainly on live prey. They are too ponderous for effective aerial pursuit but try to surprise and overwhelm their prey on the ground. Like owls, many decapitate their kills. Because of their strength, eagles have been a symbol of war and imperial power since Babylonian times.

Eagles are monogamous. They mate for life and use the same nest each year. They tend to nest in inaccessible places, incubating a small clutch of eggs six to eight weeks. The young mature slowly, reaching adult plumage in the third or fourth year.

The harpy eagles, named after the half-bird, half-woman monsters of Greek mythology, are large, powerful, crested eagles of the jungles of South America and the South Pacific. They nest in the tops of the tallest trees and hunt macaws, monkeys, and sloths. The great harpy eagle (*Harpia harpyja*), ranging from southern Mexico to Brazil, is about one metre (3.3 feet) long and bears a crest of dark feathers on its head. Its body is black above and white below except for a black chest band. It was becoming increasingly rare in the late 20th century, particularly in Mexico and Central America. The New Guinea harpy eagle (*Harpyopsis novaeguineae*) is about 75 centimetres (30 inches) long. It is gray-brown and has a long tail and a short but full crest. Very similar in appearance and habits is the monkey-eating eagle (*Pithecophaga jefferyi*) of the Philippines. It is about 90 cm (35 in.) long, brown above and white below, with a crest of long narrow feathers. It is an endangered species.

The harrier eagles, six species of *Circaetus* (subfamily Circaetinae, serpent eagles), of Europe, Asia, and Africa, are about 60 cm (24 in.) long and have short unfeathered legs. They nest in the tops of trees and hunt snakes.



(Top) Verreaux's eagle (*Aquila verreauxi*); (centre) harpy eagle (*Harpia harpyja*) with prey; (bottom) martial eagle (*Polemaetus bellicosus*)
(Top, bottom) Walter R. Spofford, (centre) Shelly Grossman—W.C.I.

The hawk eagles (genera *Spizastur, Spizaetus, Lophaetus,* and *Hieraaetus,* subfamily Accipitrinae) are lightly built eagles that have fully feathered legs and large beaks and feet. They hunt all kinds of small animals. *Spizaetus* species (as the ornate hawk eagle, *S. ornatus,* of tropical America) have short wide wings, long rounded tails, and ornamented heads. Bonelli's eagle (*Hieraetus fasciatus*) of Mediterranean areas and parts of southern Asia, is about 60 cm (24 in.) long, dark above and light below, has a broad tailband, and usually shows a white patch on the back.

The martial eagle (*Polemaetus bellicosus*), of Africa, is heavily built, brown above with black throat and black-spotted white underparts. It has a short, barred tail and bright-yellow eyes. It is large and strong enough to kill jackals and small antelopes, but its usual food is gallinaceous birds and hyraxes.

The sea eagles (sometimes called fish, or fishing, eagles), species of *Haliaetus,* of which one of the best known is the bald eagle (*q.v.*), are very large eagles that live along rivers, big lakes, and tidewater throughout the world except South America. Some reach one metre (3.3 feet) long. All have exceptionally large high-arched beaks and bare lower legs. Undersurfaces of the toes are roughened for grasping

slippery prey. These birds eat much carrion but sometimes kill. They snatch fish from the water surface and often rob their chief competitor, the osprey. Asian species include the gray-headed, or greater, fishing eagle (*Ichthyophaga ichthyaetus*) and the lesser fishing eagle (*I. naga*).

The serpent eagles, or snake eagles, *Spilornis* (six species, subfamily Circaetinae), eat mostly snakes, including large poisonous ones. They occur in Asia. Other birds called serpent eagles, notably the long-tailed members of the genera *Dryotriorchis* (*e.g.* African serpent eagle) and *Eutriorchis* (*e.g.*, the endangered Madagascar serpent eagle) occur in Africa.

Verreaux's eagle (*Aquila verreauxi*) is an uncommon bird of eastern and southern Africa. It is black with white rump and wing patches. It reaches about 80 centimetres (31 inches) in length, and it subsists mainly on hyraxes. *See also* bateleur; golden eagle.

eagle owl (*Bubo bubo*), bird of the family Strigidae (order Strigiformes), characterized by its large size (often 70 centimetres [about 2.3 feet] long), two tufts of feathers on the head (ear tufts), and large orange eyes. The overall coloration is tawny, mottled with brown, lighter below. The eagle owl roosts and breeds within rocky niches and hollow trees. At twilight it perches on a branch while searching its territory for prey, mainly rodents, hares, rabbits, and large game birds.

The eagle owl, sometimes called the Eurasian eagle owl, inhabits Europe, Asia, and northern Africa but is only a straggler in most of Great Britain. It is a horned owl (*q.v.*), related to the great horned owl (*B. virginianus*) of America.

Several other *Bubo* species are also called eagle owls, among them the spotted eagle owl (*B. africanus*) of sub-Saharan Africa and the forest eagle owl (*B. nipalensis*) of southeast Asia.

Eagle Pass, city, seat (1856) of Maverick County, southwestern Texas, U.S., on the Rio Grande, bridged to Piedras Negras, Mex., 130 mi (210 km) southwest of San Antonio. It evolved as a garrison town laid out as El Paso de Aguila (Eagle Pass) near Camp California (on the Gold Rush Trail) and Ft. Duncan (established 1849, now restored in a city park). In the Civil War it was an outlet for Confederate goods that were blockaded elsewhere. It had special importance during the Mexican Revolution, and as Camp Eagle Pass it was under military authority until 1916. A port of entry, its economy depends on border trade, tourist traffic, farm and ranch business, and industries (notably oil and gas production). Inc. 1908. Pop. (1980) 21,407.

eagle ray, any of about two dozen species of exclusively marine rays constituting the family Myliobatidae (order Rajiiformes), occurring in the major oceans. They have the enlarged, winglike pectoral fins characteristic of the order and a poisonous spine at the base of the long, whiplike tail. Their teeth are flat, for crushing and grinding mollusks and crustaceans. Although they are bottom feeders, eagle rays frequently swim near the ocean's surface, occasionally jumping high out of the water in spectacular displays. The spotted eagle ray (*Aetobatus narinari*) has a wingspan of up to 2.1 metres (7 feet).

Eakins, Thomas (b. July 25, 1844, Philadelphia—d. June 25, 1916, Philadelphia), painter who carried the tradition of 19th-century American Realism to perhaps its highest achievement. He painted mainly portraits of his friends and scenes of outdoor sports, such as swimming and boating (*e.g.*, "Max Schmitt in a Single Scull," 1871). Because of its frank and unsentimental nature, the work generally acknowledged as his masterpiece, "The Gross Clinic" (1875), which depicts a surgical operation, was received with distaste by his contemporaries.

Thomas Eakins, detail of a self-portrait, oil on canvas, 1902; in the National Academy of Design, New York

By courtesy of the National Academy of Design, New York

Early life and artistic training. Eakins was born in Philadelphia and, except for one extended study trip abroad and a brief trip to the West, virtually his entire life was spent in that city. From his father, a writing master, Eakins inherited not only the manual dexterity and sense of precision that characterizes his art but also the love of outdoor activity and the commitment to absolute integrity that marked his personal life. He did well in school, especially in science and mathematics.

As his interest in art developed, he studied at the Pennsylvania Academy of Fine Arts. Concerned particularly with the human figure, he reinforced his study of the live model at the academy by attending lectures in anatomy at Jefferson Medical College and eventually witnessing and participating in dissections.

Eakins went to France in 1866. He enrolled at the École des Beaux-Arts and studied with the leading academic painter Jean-Léon Gérôme for over three years. Unaffected by the avant-garde painting of the Impressionists, Eakins absorbed a solid academic tradition with its emphasis on drawing. After completing his study, Eakins went to Spain late in 1869, where he was greatly influenced by the 17th-century paintings of Diego Velázquez and José de Ribera. Perhaps reacting against the rigours of his academic training, he preferred artists who used paint and brush boldly to express their sense of life, creating what he called "big work." In Spain, his student days behind him, Eakins undertook his first independent efforts at oil painting.

Early career. Eakins returned to Philadelphia in the summer of 1870. His earliest artistic subjects were his sisters and other members of his family and the family of his fiancée, Katherine Crowell. Redolent with the character of each individual in an intimate and personal domestic setting—pensive young ladies at the piano, children engrossed with toys scattered on the floor, Katherine playing with a kitten in her lap—these rich, warm portraits seem to express in colour and mood the essence of what Lewis Mumford called "the Brown Decades." Close family ties were important to Eakins, and the intimate harmony of his home life was seriously disrupted and saddened by the death first of his mother and later of Katherine Crowell.

Eakins resumed the vigorous outdoor life of his earlier years—hunting, sailing, fishing, swimming, rowing. These activities, like his family circle, provided him with subject matter for his art. A candid realist, Eakins simply painted the people and the world that he knew best, choosing his subjects from the life that he lived. Like the poetry of his aged friend Walt Whitman, who lived across the Delaware River in Camden, N.J., Eakins' art was autobiographical, "a song of himself." Eakins, in fact, often included himself as an observer in his own paintings—sculling in the background behind his friend in "Max Schmitt in a Single Scull," peering intently at a surgical operation in "The Agnew Clinic," or treading water next to his setter dog Harry and watching a group of students swimming in "The Swimming Hole." Each of the early outdoor scenes, natural and informal at first glance, was, in fact, carefully composed on a perspective grid, with each object precisely located in pictorial space. Each image is further informed by Eakins' personal knowledge of the scene depicted. Thus colour, composition, and the play of lights and darks subtly convey to the viewer a fuller understanding of and feeling for the concentrated energy of a sculler propelling his boat through the water, or the taut equilibrium of the moment when a hunter standing in his boat balances himself, sights his target, and slowly squeezes the trigger.

Eakins' masterpiece. In 1875 Eakins, who had yet to become well known, decided to paint a major picture for the Centennial Exposition to be held in Philadelphia the following year. He took as his subject a scene that had become familiar to him—Samuel Gross of Jefferson Medical College operating in his clinic before his students. Gross was a magnetic teacher and one of the country's greatest surgeons. Eakins often selected moments that reveal multiple aspects of a scene and in this picture depicts Gross as both surgeon and teacher. Gross stands in the centre of a sombre amphitheatre, starkly top-lighted by a flood of cool daylight cascading down from a skylight above; he is dressed in black street clothes. He has opened an incision in the leg of the anesthetized male patient stretched out before him. While his assistants probe the wound, the doctor turns, one hand holding a scalpel covered with blood, to tell his students what he has done and what he will do next. At the left a seated woman, perhaps the patient's mother, flings an arm across her face, shielding her eyes from the scene, her fingers clawing the air in anguish. Her emotion and the note of pain and suffering inherent in the subject contrast strikingly with the cool professionalism of Gross, whose calm features reflect assurance and determination as well as compassion. The painting objectively records a realistic drama of contemporary life, full of feeling but free of sentimentality. "The Gross Clinic" is generally agreed to be Eakins' masterpiece.

To Eakins' dismay "The Gross Clinic" was rejected for the art exhibition at the Centennial Exposition, and he had to exhibit it in a medical section. Critics and public alike responded to the painting unfavourably. While they could accept historical scenes of grisly martyrdoms or bloody massacres without qualm, "The Gross Clinic" represented blood and pain and suffering as immediate facts in Philadelphia. That was offensive and unacceptable. Viewers could not appreciate a picture that was neither entertaining nor ennobling but simply a frank statement of contemporary reality. The rejection of the painting was the first of many rebuffs Eakins was to receive from Victorian contemporaries who shared his world but not his values.

Mature period. From his earliest student days, Eakins had been primarily interested in studying and portraying the human figure. His early sculling scenes displayed the musculature of athletic men, and "The Gross Clinic" dealt directly with the subject of human anatomy. But Eakins found few subjects in contemporary Philadelphia that afforded opportunities for portraying the undraped human figure, especially females. He circumvented this by painting repeatedly a partly imaginary scene

of William Rush, a much earlier Philadelphia sculptor, carving his statue of the "Nymph with Bittern" from a naked female model in the presence of a chaperon, which provided him with a pictorial pretext for portraying a nude woman.

In the late 1870s Eakins began to teach at the Pennsylvania Academy of Fine Arts, where he became professor of drawing and painting in 1879. A popular and influential teacher, Eakins stressed anatomy and drawing from live, nude models as opposed to the study of plaster casts of antique sculpture. The fame of the Pennsylvania Academy as a centre for the best art instruction in the country spread among young artists. Yet notoriety accompanied repute, and objections were voiced increasingly from outside the academy to Eakins' unrestrained use of nude models in front of mixed classes. The suspicious were unable to accept Eakins' assurance that the relationship between artist and model was as innocent, objective, and professional as that between doctor and patient. Eakins continued to insist on the importance of teaching from nude human models and was finally forced to resign in 1886. Teaching had become a major part of his life, and this was another severe blow. He continued to teach sporadically at the newly formed Art Students League in Philadelphia and at the National Academy of Design in New York, and his personal relationships with young artists remained close. One bright moment during these difficult years occurred in 1884, when he married one of his pupils, Susan Macdowell.

As a corollary to his interest in anatomy, Eakins was fascinated with locomotion—human and animal figures in motion. A commission in 1879 to paint Fairman Rogers driving his four-in-hand coach through Fairmount Park in Philadelphia (Philadelphia Museum of Art) led him to an intensive study of horse anatomy, and he made a number of sculpted wax sketches of horses in motion. He developed a serious interest in sculpture, an aspect of his art that only became appreciated much later. His interest in locomotion led to familiarity with the experiments in sequential photography being made in California by Eadweard Muybridge. By 1884 Eakins himself was experimenting with multiple-image photography of moving athletes and animals. And in later years his interest in the human figure in motion led him to make a series of impressive paintings of boxing scenes.

Eakins' interests ranged widely—sports, anatomy, locomotion, music, sculpture, photography—in directions often reminiscent of his great French contemporary Edgar Degas but without that artist's innovative stylistic concerns. There is no evidence, however, that Eakins was aware of the work of Degas. Eakins' art does demand comparison with that of Winslow Homer, the contemporary he most admired and his principal rival claimant to the title of the greatest American artist of the 19th century. Homer, also an objective realist, was similarly interested in outdoor sports and such sporting subjects as hunting, canoeing, and fishing. He also had a similar love for and identification with a specific place—in Homer's case, Prouts Neck, Maine. Homer's art is cool, detached, impersonal, and ultimately pessimistic in its view that man is at the mercy of a deterministic universe. Eakins' art, although often sad in its reflection of the buffeting each human receives in the course of his years, still is ultimately optimistic in its humanism, in its message that man, through his individual actions—a doctor with a knife, a sculler with an oar, a hunter with a gun, a boxer with his gloved fist, a musician with his instrument, a singer with her voice, a chess player with his pieces, a scientist with his instruments—can act, do things, have an effect in this world. Despite the wide variety of his subject matter, almost all of Eakins' art is portraiture, images of real people whom he knew and loved or respected. In his representations of the physical world, Eakins combined a technical ability to depict the external aspect of things with a probing for the essence of each scene. In his portraits of individuals, he similarly combined the faithful representation of the external and anatomical realities of each person with a deeper probing into the subject's inner being and character. The people he portrays have lived, and often their experiences are etched on their faces. The wear and tear of years is not glossed over but celebrated in staring eyes, wrinkles, and slumping torsos.

Significance and influence. Although always respected for his ability, Eakins remained throughout his years something of an outcast. His contemporaries, rather than allowing themselves to be shaken by his frank statements of the human condition and his joyous appreciation of the human body, ignored him. He sold few pictures, but fortunately a small private income matched his modest needs. Unfettered by the demands of clients, Eakins was free to paint what and, more importantly, whom he wished. His art was never compromised by the need to flatter patrons or sitters, and honesty was his only policy. Good friends and faithful followers rather than fame and fortune were his lot. Not until 1916, the year of his death, was one of his paintings acquired by a museum ("Pushing for Rail," Metropolitan Museum of Art, New York City), and the first major exhibition of his work was held the following year (Metropolitan Museum of Art). But Eakins' art had its long-range effect, serving as a model and an impetus for the burst of realism in American painting during the early years of the 20th century, especially in the work of George Bellows and the group called the Ashcan School of painters. And despite the increasing dominance of abstract art during the middle years of the 20th century, a pervasive and stubborn substream of realism surfaced periodically—Regionalism, Pop art, the figurative work of artists such as George Segal and Leonard Baskin—to manifest the continuing debt of American art to the achievement of Thomas Eakins.

(J.D.Pro.)

MAJOR WORKS. All paintings in oils unless otherwise noted. "A Street Scene in Seville" (1870; Mrs. John R. Garrett, Sr. Collection); "Home Scene" (1871; Brooklyn Museum, New York); "Max Schmitt in a Single Scull" (1871; Metropolitan Museum of Art, New York City); "Katherine" (1872; Yale University Art Gallery, New Haven, Conn.); "The Pair-Oared Shell" (1872; Philadelphia Museum of Art); "The Biglin Brothers Turning the Stake" (1873; Cleveland Museum of Art); "John Biglin in a Single Scull" (watercolour, 1873; Metropolitan Museum of Art); "Sailing" (1874; Philadelphia Museum of Art); "Pushing for Rail" (1874; Metropolitan Museum of Art); "The Gross Clinic" (1875; Jefferson Medical College, Philadelphia); "Will Schuster and Blackman Going Shooting" (1876; Yale University Art Gallery); "Chess Players" (1876; Metropolitan Museum of Art); "William Rush Carving His Allegorical Figure of the Schuylkill River" (1877; Philadelphia Museum of Art); "The Fairman Rogers Four-in-Hand" (1879; Philadelphia Museum of Art); "The Crucifixion" (1880; Philadelphia Museum of Art); "The Pathetic Song" (1881; Corcoran Gallery of Art, Washington, D.C.); "The Swimming Hole" (1883; Fort Worth Art Center Museum, Fort Worth, Texas); "Lady with a Setter Dog (Mrs. Eakins)" (1885; Metropolitan Museum of Art); "Walt Whitman" (1887; Pennsylvania Academy of the Fine Arts, Philadelphia); "Letitia Wilson Jordan Bacon" (1888; Brooklyn Museum); "Miss Van Buren" (*c.* 1889; Phillips Collection, Washington, D.C.); "The Agnew Clinic" (1889; University of Pennsylvania, Philadelphia); "Professor Henry A. Rowland" (1891; Addison Gallery of American Art, Andover, Mass.); "The Concert Singer" (1892; Philadelphia Museum of Art); "Frank Hamilton Cushing" (1894–95; Thomas Gilcrease Institute of American History and Art, Tulsa, Okla.); "Taking the Count" (1898; Yale University Art Gallery); "Salutat" (1898; Addison Gallery of American Art); "Between Rounds" (1899; Philadelphia Museum of Art); "Benjamin Eakins" (1899; Philadelphia Museum of Art); "Mrs. William D. Frishmuth" (1900; Philadelphia Museum of Art); "The Thinker: Louis N. Kenton" (1900; Metropolitan Museum of Art); "Self-Portrait" (1902; National Academy of Design, New York); "Mrs. Edith Mahon" (1904; Smith College Museum of Art, Northampton, Mass.); "Monsignor Diomede Falconio" (1905; National Gallery of Art, Washington, D.C.).

BIBLIOGRAPHY. Lloyd Goodrich, *Thomas Eakins: His Life and Work* (1933), is the principal monograph on Eakins. Other books of interest on the subject are Fairfield Porter, *Thomas Eakins* (1959); and Sylvan Schendler, *Eakins* (1967). The largest collection of works by Thomas Eakins is to be found in the Philadelphia Museum of Art. There are also substantial collections at the Metropolitan Museum of Art in New York and at the Yale University Art Gallery.

Ealdred, also spelled ALDRED (d. Sept. 11, 1069, York, Eng.), Anglo-Saxon archbishop of York from 1060, played an important part in secular politics at the time of the Norman conquest and legitimized the rule of William the Conqueror (William I) by crowning him king on Christmas Day, 1066.

Ealdred became abbot of Tavistock, Devon, about 1027, and bishop of Worcester in 1046. Made archbishop of York by Pope Nicholas II, he was forced by Nicholas' successor, Alexander II, to relinquish the see of Worcester in 1062. As archbishop he did considerable ecclesiastical building in the city of York and elsewhere.

In 1054 Ealdred went to Germany to negotiate with the emperor Henry III for the return from Hungary of the heir to the English throne, Edward, son of Edmund Ironside. He probably crowned Harold II as king of the English (Jan. 6, 1066). After the Battle of Hastings (Oct. 14, 1066), Ealdred was among those who wished to elect Edgar the Aetheling as successor to the slain Harold, but he soon joined Edgar in declaring allegiance to William I. With the approval of the papacy, Ealdred crowned the new king in Westminster Abbey.

Ealing, outer borough of Greater London, midway between central London and the western periphery. Its area is 21 sq mi (55 sq km). Ealing's name probably derives from the Saxon Gillings (Illing). The borough includes Acton, which became a popular health resort in Queen Anne's reign (1702–14); notable residents have included the novelist Henry Fielding, the actor David Garrick, and the financial dynasty of the Rothschilds. Bedford Park, founded in 1875, was the forerunner of the English "garden suburb."

In the 20th century, Ealing has attracted shops and many industries that make a variety of consumer goods. The community of Southall grew in the 1950s through overseas immigration from the newly independent, largely nonwhite, countries of the "New Commonwealth." Pop. (1982 est.) 282,000.

Ealing Studios, also called ASSOCIATED TALKING PICTURES, LTD., English motion-picture studio, internationally remembered for a series of witty comedies that reflected the social conditions of post-World War II Britain. Founded in 1929 by two of England's best known producers, Basil Dean and Reginald Baker, with the financial support of the Courtauld family, manufacturers of textiles, the company opened its own distribution outlet within two years and built the studios at Ealing near London. It produced several vaudeville-style musical comedies as well as serious feature films during the 1930s. It added

information and propaganda films and short subjects for the British Ministry of Information during World War II and often infused a documentary-like realism into its films.

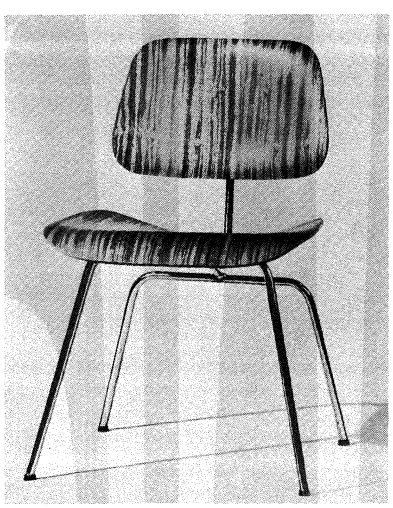
In the decade after the war, the studio became well known for its highly successful comedies, which dealt with the exploits of unconventional, antibureaucratic individuals in realistic settings. The first of these films was *Passport to Pimlico* (1949). *Kind Hearts and Coronets* (1949) made Alec Guinness an international star and linked his name with the Ealing comedies. *Whisky Galore* (1949; U.S. title *Tight Little Island*) and *The Lavender Hill Mob* (1951) are other well-known productions in the Ealing style.

In 1944 the major portion of stock in the company had been sold to the Rank Organisation, Ltd., which controlled a large portion of the British film industry. The studio ceased production in 1955, and it was sold to the British Broadcasting Corporation.

EAM-ELAS, abbreviation of Greek ETHNIKÓN APELEFTHEROTIKÓN MÉTOPON-ETHNIKÓS LAÏKÓS APELEFTHEROTIKÓS STRÁTOS, English NATIONAL LIBERATION FRONT-NATIONAL POPULAR LIBERATION ARMY, communist-sponsored resistance organization (formed September 1941) and its military wing (formed December 1942), which operated in occupied Greece during World War II. Fighting against the Germans and the Italians as well as against other guerrilla bands, particularly EDES (*q.v.*), EAM-ELAS became the most powerful guerrilla band in the country. It also established an effective administrative apparatus, through which it ruled liberated areas.

By October 1944, when the Germans evacuated Greece, EAM controlled about two-thirds of the country. It participated in conferences in September 1944 that were designed to unite the rival resistance groups and the government-in-exile in a postwar government. When the new government ordered ELAS to disarm, however, the resistance group refused, causing an outbreak of hostilities in Athens (December 1944), mainly between ELAS and the British. A peace treaty was signed (Varkiza Peace Agreement, Feb. 12, 1945), providing for the surrender of ELAS. Large-scale guerrilla war was begun by the communists in 1946, however, and lasted until 1949.

Eames, Charles; and Eames, Ray, Ray Eames *née* KAISER (respectively b. June 17, 1907, St. Louis, Mo., U.S.—d. Aug. 21, 1978, St. Louis; b. 1916, Sacramento, Calif., U.S.—d. Aug. 21, 1988, Los Angeles), American designers best-known for the beauty, comfort, elegance, and delicacy of their mass-producible furniture. They also wrote books, made motion pictures, and designed exhibitions, fabric, and industrial and consumer products.



Molded plywood chair, with rubber cushioning between component parts, by Charles Eames, 1946

By courtesy of Herman Miller Furniture Co., New York City

Charles Eames, who was also an architect, was for several years head of the experimental design department at Cranbrook Academy of Art, Bloomfield Hills, Mich. During that time (1939–41) he collaborated with the architect-designer Eero Saarinen on various design projects, one of which was a formfitting shell chair that won first place in the Organic Design Competition conducted in 1940–41 by the Museum of Modern Art, New York City. In 1940 he met and began working with Ray Kaiser, who was then studying painting with Hans Hoffman; Eames and Kaiser were married in 1941.

They moved to California, where he designed sets for motion pictures and did research in the uses of plywood, continuing the latter when, in 1943, he became director of research and development for the West Coast operations of the Evans Products Company.

In 1946 the Museum of Modern Art invited Charles Eames to be the first designer to have a "one-man" exhibit of his furniture designs (he was often given sole credit for their joint efforts). The exhibition was highly successful, and the Herman Miller Furniture Company soon began mass production of their molded plywood furniture.

The Eameses continued their design activities in California, where they became involved in architectural projects, product design, film production, and exhibits. Their house, built in 1949 in Pacific Palisades, was outstanding for its elegant use of factory-produced elements. After 1955 they became increasingly active in the making of motion pictures, chiefly of an educational nature, one excellent example of which is *Powers of Ten* (1968).

During the 1960s Eames served as design consultant for a number of major U.S. corporations. The Eameses' contributions to the International Business Machines exhibit at the New York World's Fair (1964–65) were particularly notable. A decade later, under the aegis of the same company, they designed a large American Bicentennial exhibition called "Franklin and Jefferson." The show was seen in Paris, Warsaw, and London, before appearing at the Metropolitan Museum of Art, New York City, and the Art Institute of Chicago.

After Charles's death in 1978, Ray continued to work on various design projects.

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

Eames, Emma (Hayden) (b. Aug. 13, 1865, Shanghai—d. June 13, 1952, New York City), American lyric soprano, admired for her beauty and for the technical control and dramatic expressiveness of her voice.

Eames studied with Clara Munger in Boston, then with Mathilde Marchesi in Paris. Selected by Charles Gounod to sing Juliette in his *Roméo et Juliette,* she was so successful in this debut at the Paris Opéra in 1889 that she was called on to repeat the performance many times.

In 1891, having left the Paris Opéra because of jealous intrigues, Eames appeared for the first time with the Metropolitan Opera in New York City as Juliette and remained a leading member of the company until her resignation in 1909. She was also popular in London during those years—especially as Tosca, Donna Anna and Donna Elvira (*Don Giovanni*), and Aida. In 1911 she returned from a brief retirement to perform Desdemona and Tosca with the Boston Opera, after which she made periodic concert tours, often with her husband, the American baritone Emilio Edoardo de Gogorza. She received a number of honours and awards. In 1927 her autobiography, *Some Memories and Reflections,* was published.

EAN (chemistry): *see* effective atomic number.

ear, vertebrate organ of hearing and equilibrium that detects and analyzes noises by transduction (or the conversion of sound waves into electrochemical impulses) and maintains sense of balance (equilibrium).

A brief treatment of the ear and hearing follows. For a full treatment, *see* MACROPAEDIA: Sensory Perception.

The hearing apparatus of vertebrates is surprisingly uniform, considering the range of body types and habitats of vertebrates. In the evolution from jawless fishes to mammals and birds, the ear has become progressively complex and increasingly able to discriminate sound frequencies. The basic sound-sensitive structures of the fish ear are three interconnecting, fluid-filled cavities derived from the lateral-line system. In amphibians the ear is basically like that of fishes, except that frogs have an additional cavity, the air-filled middle ear, with a membrane (the eardrum, or tympanic membrane) at the skin surface and connected to the inner ear by a small bone, the columella. In reptiles one structure is somewhat elongated (the start of a true cochlea, or inner ear), and the eardrum is withdrawn into the head. Snakes have lost the middle ear and the external opening but have retained the columella; they hear airborne sound poorly but are especially sensitive to vibrations of the ground.

The ear of birds is basically reptilian, but the cochlea is longer and more sensitive. Pitch discrimination is far more acute in birds, many of which perceive frequencies well above the range of human hearing.

The mammalian ear consists of three main parts: the outer ear, comprising a largely cartilaginous external projection called the pinna (lacking in cetaceans and phocid seals and reduced or lacking in many burrowing mammals) and the auditory canal; the middle ear, comprising the tympanic cavity, or eardrum, separated from the external ear by the tympanic membrane and containing the auditory ossicles, a chain of three tiny bones (the malleus, or hammer; the incus, or anvil; and the stapes, or stirrup); and the inner ear, or labyrinth, comprising a complex cavity in the petrous portion of the temporal bone—the bony labyrinth—and an inner membranous labyrinth, a delicate system of fluid-filled ducts and sacs (the semicircular canals, the vestibule, and the cochlea) that occupies only a small part of the available space. In hearing, sound waves in the air are directed by the pinna into the auditory canal. Vibrations of the tympanic membrane, positioned across the end of the canal, are conducted and intensified by the auditory ossicles through the tympanic cavity to the oval window, a membrane in the outer wall of the vestibule. Through the oval window, the intensified vibrations are transmitted to the fluid of the inner ear. It is in the coiled cochlea that the vibrations of this fluid are converted by the hair cells of the organ of Corti into nerve impulses that are transmitted to the brain.

The inner ear also functions, independently of hearing, as the organ of equilibrium. Acceleration in space and rotation of the body cause an inertial lag of fluid in the semicircular canals, which stimulates sensory hairs. Continued stimulation of the hairs after body rotation has stopped is experienced as dizziness. Static pressures, such as gravitational forces, are detected by hair cells in two sacs within the vestibule, permitting perception of the orientation of the head.

Each of the ear's three sections can be afflicted by a particular set of diseases. The most common cause of progressive hearing

loss in human beings is otosclerosis, a disease of the bone enclosing the inner ear that causes fixation of the base of the stirrup in the oval window; this fixation prevents the conveyance of sound vibrations to the inner ear. The cause of otosclerosis is unknown, but it can often be corrected surgically. A common inner ear disease is congenital nerve deafness, which is caused by defective hearing nerves in the cochlea that usually become evident at or soon after birth. Resulting hearing impairment is most often severe, and there is no known medical or surgical treatment for the disease. The gradual decay of the hearing nerve in the inner ear due to old age is called presbycusis.

While the ear is, strictly speaking, a vertebrate organ, invertebrates possess certain analogous structures for hearing. Many arthropods have tactile hairs that are stimulated by sound energy, in addition to other forms of energy. Certain roaches and crickets possess cercal organs (tufts of hairs supplied with nerves) that are located at the tip of the abdomen and are sensitive to a wide range of sound frequencies. Tympanal organs, found on the abdomen, thorax, or first legs of certain members of the insect orders Orthoptera (crickets), Homoptera (cicadas), and Lepidoptera (moths), consist of a membrane at the body surface or in a trachea (respiratory tubule). Changes in the tension of the tympanal membrane induced by impinging sound waves are sensed by chordotonal, or scolophore, organs, highly specialized nervous structures that record tension changes in a variety of situations in the insect body.

ear shell, any of various marine snails of the subclass Prosobranchia (class Gastropoda) that constitute the genus *Haliotis* and family Haliotidae. The characteristic planispiral shell has a broad, oblique aperture, which gives it an ear-like shape. A series of perforations through the shell follow the spiral form. The inside of the shell is always nacreous, often in iridescent greens and blues. The snails live attached to rocks by a large adherent foot. They feed on algae and are found in the shallow waters of rocky shores worldwide. The larger species are called ormer in England, abalone in the United States, paua in New Zealand, and awabi in Japan. Several of these larger species are found on the western coast of North America and include the red, green, black, and pink abalones (*Haliotis refescens*, *H. fulgens*, *H. cracherodi*, and *H. corrugata*, respectively). Over exploitation has reduced stocks in many parts of the world; there are catch limits and even total protection in some areas. The shells of *Haliotis* have been extensively used for ornamental and decorative purposes from early times.

ear squeeze, also called AEROTITIS, AEROOTITIS, BAROTITIS, or BARO-OTITIS, effects of a difference in pressure between the internal ear spaces and the external ear canal. These effects may include severe pain, inflammation, bleeding, and rupture of the eardrum membrane. Underwater divers and airplane pilots are sometimes affected.

The middle ear, the cavity behind the eardrum membrane, is connected with the nasal cavity (nasopharynx) by a thin, narrow tube known as the eustachian tube. Under normal conditions, when the external air pressure increases or decreases, air from the nose passes through the eustachian tube to equalize the pressure in the middle ear cavity; often, however, the eustachian tube becomes blocked by fluids from head colds, by small tumours, or by an excess of tonsillar tissue around the opening.

As a pilot in an unpressurized cabin ascends to higher altitudes and the external pressure decreases, air that is trapped in the middle ear expands. Usually the expanding air forces its way out of the eustachian tube so that the pressure can be equalized. If the tube is sufficiently blocked, the expanding air in the middle ear causes the eardrum membrane to bulge outward, with eventual rupturing if the pressure cannot be relieved. A pilot descending from higher altitudes has the opposite problem; as he descends, the external pressure increases. In order to equalize pressure in the middle ear cavity, air must pass from the eustachian tubes to the middle ear. It is usually harder to equalize pressures on descent than on ascent, as a vacuum is created in the middle ear that more tightly seals the eustachian tubes. The methods that are commonly employed to equalize the pressure in the ears include swallowing, yawning, chewing, elevation of the roof of the mouth, and blowing with the nose and mouth sealed. As the pressure in the ears is brought to the same level as that outside, the pain is relieved, unless damage has already been done. If the pressure within the ears is not kept the same on descent as the external pressure, the drum membranes bulge inward, bleed, and eventually break. Rupture of an eardrum membrane relieves the pain and pressure, but it may also cause dizziness, partial hearing loss, and middle ear infections. Usually if there are no serious complications, the membrane heals in three to four weeks.

Underwater divers encounter the same difficulties. The deeper they descend under water, the greater the amount of pressure upon their body. As they go down, they normally have to equalize the pressure inside their ears to the external pressure every 10 to 15 feet (3 to 4.5 metres).

Earhart, Amelia (b. July 24, 1897, Atchison, Kan., U.S.—disappeared July 2 (?), 1937, near Howland Island, central Pacific Ocean),

Amelia Earhart
Culver Pictures

one of the world's most celebrated aviators, the first woman to fly alone over the Atlantic Ocean.

Earhart worked as a military nurse in Canada during World War I and as a social worker in Denison House, Boston, after the war. She achieved fame on June 17—18, 1928, as the first woman to cross the Atlantic, although she was only a passenger. She married the publisher George P. Putnam in 1931 but continued her career under her maiden name.

Determined to justify the renown that her 1928 crossing had brought her, Earhart crossed the Atlantic alone on May 20—21, 1932. This soon led to a series of flights across the U.S. and drew her into the movement that encouraged the development of commercial aviation. She also took an active part in efforts to open aviation to women and end male domination in the new field.

In January 1935 she made a solo flight from Hawaii to California, a longer distance than from the U.S. to Europe. Earhart was the first person to fly that hazardous route successfully; all previous attempts had ended in disaster. She set out in 1937 to fly around the world, with Fred Noonan of the U.S. as her navigator, in a twin-engine Lockheed Electra. After completing more than two-thirds of the distance, her plane vanished in the central Pacific near the international dateline. Although her mysterious disappearance has since raised many questions and much speculation about the events surrounding it, the facts remain largely unknown. *Soaring Wings*, a biography written by her husband, appeared in 1939.

earl: (title of nobility): *see* count.

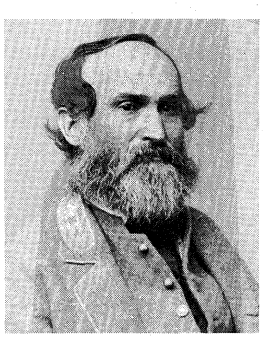
Earle, John, Earle also spelled EARLES (b. 1601?, York, Eng.—d. Nov. 17, 1665), Anglican clergyman, best known as author of *Micro-cosmographie. Or, A Peece of the World Discovered; in Essayes and Characters* (1628; enlarged 1629 and 1633).

An outstanding book of "characters," it avoids didacticism and displays genuine personalities, such as a "child," a "Good old Man," a "young raw Preacher," and a "Grave Divine." It is alive with its humour, perception, and epigrammatic brilliance. Earle's wit, learning, and tolerance were widely praised, and, though a Royalist Anglican, he tried to conciliate Nonconformists.

At the University of Oxford as student from *c.* 1616 and as fellow from 1620, he wrote occasional verse and tutored Lucius Cary (later Lord Falkland, a statesman, philosopher, and poet), to whose circle he belonged. He later tutored the future king Charles II and suffered exile during 1644–60. Meanwhile he translated into Latin the *Eikon Basilike* ("Royal Image"), an extremely popular book of meditations supposedly by Charles I and published about the time of his execution, and Richard Hooker's *Of the lawes of ecclesiasticall politie.* After the Restoration, he became bishop successively of Worcester and of Salisbury.

Early, Jubal A(nderson) (b. Nov. 3, 1816, Franklin County, Va., U.S.—d. March 2, 1894, Lynchburg, Va.), Confederate general in the American Civil War (1861–65) whose army at one time threatened Washington, D.C., but whose series of defeats during the Shenandoah Valley campaigns of late 1864 and early 1865 led to the final collapse of the South. A West Point graduate, Early served in the Second Seminole War in Florida (1835–42) and the Mexican War (1846–48). In the period leading up to the Civil War, he strongly opposed secession, but when Virginia decided to withdraw from the Union in 1861, he felt obliged to conform to the action of his state.

As an officer in the Confederate Army of Northern Virginia, he rendered conspicuous service at the First Battle of Bull Run (July 1861), near Manassas, Va., and served throughout the Virginia campaigns of 1862–63 and at Gettysburg (July 1863). The climax of his career came in the summer of 1864 when Gen. Robert E. Lee placed him in command of all Southern forces in the strategic Shenandoah Valley. His first action was to drive the Union forces under Gen. David Hunter out of the state and to move



Early
By courtesy of the Valentine Museum, Richmond, Va.

down the valley unopposed. He then crossed the Potomac River, reaching Hagerstown and Frederick in Maryland, and defeated a small Union force at the Battle of Monocacy (July

9, 1864). Two days later he led 8,000 troops past Silver Spring and brought them into sight of Washington before withdrawing.

Northern pride was wounded by Early's threat, and Gen. Ulysses S. Grant dispatched Gen. Philip Sheridan to clear the valley once and for all. Bowing to numerically superior forces, Early suffered three decisive defeats at Sheridan's hands between September 19 and October 19—at Winchester, Fishers Hill, and Toms Brook—after which the valley was laid waste. Early then carried out a well-planned attack at Cedar Creek but was forced to retreat up the valley to Waynesboro, where he experienced the final defeat (March 2, 1865) that ended Confederate resistance in that area and opened the way to Union capture of Richmond.

After the Confederate surrender (April 1865) Early went to Mexico and then Canada, where he published *A Memoir of the Last Years of the War of Independence in the Confederate States of America* (1866). In 1869 he returned to Virginia, where he practiced law and wrote historical essays.

Early American furniture, furniture made in the last half of the 17th century by American colonists. Furniture made by the earliest settlers, none of which is known to have survived, was probably crude and makeshift. The earliest known American-made furniture dates from the mid-17th century, when life in the colonies was becoming more settled. Many of these early pieces were massive in size and were based on Jacobean styles recalled from earlier days in England. In general, furniture styles followed those of England, with adaptations, after an interval of about 15 years. Instead of shaped legs or feet, American case furniture had legs and feet that were simply downward extensions of the rectangular styles. Decoration consisted of carved flower motifs or lunettes (crescent shapes) and chip carved (executed with mallet and chisel) scrolls and leaves, occasionally highlighted by painting, mainly in black, red, and yellow; but the carving was flatter, less finished, and more primitive than its English predecessors. Turned (shaped on a lathe) split balusters stained to look like ebony were also applied. Joinery was confined to simple rectangular panelling with mortise and tenon joints. Oak and pine were the commonest woods.

In view of the still-unsettled existence of the early colonists, chests assumed particular importance because of their portability. The Connecticut and Hadley chests were clearly variants, their carved leaf, flower, and vine ornament bearing a marked Dutch flavour. Important, too, in wealthier households, was the court cupboard for storing utensils and the press cupboard for storing clothes and linen. Trestle tables, which could be dismantled easily, were in everyday use; and the stretcher tables—large rectangular tables with turned baluster legs joined by stretchers—served as dining or centre tables among better furnishings. Joint stools (small rectangular stools with four turned legs joined with stretchers) were the commonest form of seating, but Brewster and Carver chairs also came into use, the most popular chairs being simplified versions of English turned chairs. Chairs with slung leather seats of the Cromwellian type were used in more comfortable homes by the late years of the century. Most early beds had simple, low turned posts and plain, low headboards.

Regional characteristics appeared at an early stage and are best represented in furniture surviving from the 17th century by the contrast between the chests from the Connecticut River valley mentioned above and the more austere varieties of the Massachusetts coastal settlements—sometimes painted but characterized particularly by severe, geometric carved lozenges and friezes of overlapping lunettes.

Early Christian art, also called PALEOCHRISTIAN ART, or PRIMITIVE CHRISTIAN ART, architecture, painting, and sculpture from the beginnings of Christianity until about the early 6th century, particularly the art of Italy and the western Mediterranean. The Christian religion was part of a general trend in the late Roman Empire toward mysticism and spirituality. As Christianity developed, its art reflected the prevailing late antique artistic climate. Except for differences in subject matter, Christian and pagan works looked much the same; in fact, it is possible to show that the same workshop sometimes produced sculpture for both Christian and non-Christian purposes.

The earliest identifiably Christian art consists of a few 2nd-century wall and ceiling paintings in the Roman catacombs, which continued to be decorated in a sketchy style derived from Roman impressionism through the 4th century. They provide an important record of some aspects of the development of Christian subject matter. The earliest Christian iconography tended to be symbolic. A simple rendering of a fish was sufficient to allude to Christ. Bread and wine invoked the Eucharist. During the 3rd and 4th centuries, in the catacomb paintings and in other manifestations, Christians began to adapt familiar pagan prototypes to new meanings. The early figural representations of Christ, for instance, most often show him as the good shepherd by directly borrowing from a classical prototype. He was also sometimes depicted in the guise of familiar gods or heroes, such as Apollo or Orpheus. Only later, when the religion itself had achieved some measure of earthly power, did he take on imperial attributes. Narratives tended at first to be typological, often suggesting parallels between the Old and New Testaments. The earliest scenes from the life of Christ to be depicted were the miracles. The Passion, particularly the Crucifixion itself, was generally avoided until the religion was well established.

The beginnings of Early Christian art date to the period when the religion was yet a modest and sometimes persecuted sect, and its flowering was possible only after 313, when the future emperor Constantine the Great adopted Christianity, paving the way for it to become the state religion. Official recognition and imperial sponsorship brought popularity, riches, and many converts from all classes of society. Suddenly the church needed to produce art and architecture on a more ambitious scale in order to accommodate and educate its new members and to reflect its new dignity and social importance.

Churches and shrines were soon being built throughout the empire, many sponsored by Constantine himself. These buildings were usually basilicas, such as Old St. Peter's in Rome, or central-plan buildings (round or polygonal), such as the shrine of the Church of the Nativity in Bethlehem. Large-scale sculpture was not popular, but relief sculpture on sarcophagi, such as that of Junius Bassus (died 359), and ivory panels and book covers continued to be produced. The walls of the churches were decorated with paintings or mosaics to instruct the faithful. The church of Sta. Maria Maggiore in Rome has an extensive mosaic program of Old and New Testament scenes that was begun in 432. Painting also illustrated liturgical books and other manuscripts.

The art of this period had its roots in the classical Roman style, but it developed into a more abstract, simplified artistic expression. Its ideal was not physical beauty but spiritual feeling. The human figures thus became types rather than individuals and often had large, staring eyes, "the windows of the soul." Symbols were frequently used, and compositions were flat and hieratic, in order to concentrate on and clearly visualize the main idea. Although the art of the period intentionally departed from earlier naturalism, it has great power and immediacy.

Early Netherlandish art, sculpture, painting, architecture, and other visual arts created in the several domains that in the late 14th and 15th centuries were under the rule of the dukes of Burgundy, coincidentally counts of Flanders. As "Burgundian" and "Flemish" describe only parts of the phenomenon, neither can posit for the whole, although Early Flemish art is a common term.

In 1363 John II of France titled his son Philip, surnamed the Bold, duke of Burgundy. By marriage to the heiress of Flanders, Philip added to his duchy, on the death of his father-in-law in 1384, the countship of Flanders. The formidable Flemish–Burgundian alliance remained intact until 1482, when Philip the Bold's great-granddaughter Mary of Burgundy died.

Philip's capital was Dijon, which he embellished with works of art. In the chapel of the Carthusian monastery, the Chartreuse de Champmol, he planned a dynastic necropolis, and until the French Revolution his tomb and those of his son and grandson could be seen there. Claus Sluter (*c.* 1340/50–1406) was his chief sculptor. Sluter, the greatest realist of his day, carved portraits of the Duke and Duchess in kneeling positions (1385–93) for the portal of the monastery, and for the garden he designed an elaborate and symbolic fountain known as the Well of Moses (1395–1404/05). Six full-length, life-size, polychromed prophets flank the central pier. Among the painters in service at Dijon were Jean Malouel, Henri Bellechose, and Melchior Broederlam (flourished 1381–*c.* 1409). Broederlam was one of the first masters to explore the use of disguised symbolism in the representation of an ultra-naturalistic world, and in the scenes that he painted on a set of altar wings for Dijon there are several levels of implied meaning.

Under the Duke's grandson and namesake, Philip the Good (reigned 1419–67), patronage of the arts continued on an even larger scale. Not the least of the new duke's projects was his library, which eventually contained about 250 illuminated manuscripts. Realizing the propaganda value of art, Philip the Good filled his long reign with lavish spectacles such as triumphal processions and elaborate state banquets. Many artists spent large portions of their careers on these "temporary" achievements. The name of Jan van Eyck (*c.* 1395–1441) appears frequently in the ducal accounts. He travelled to several foreign countries, presumably to make portrait and reconnaissance drawings and once to paint a portrait of Isabella of Portugal (1428); the Duke approved of the portrait and subsequently married the Princess.

Van Eyck perfected an oil and varnish technique that other masters in Flanders adopted, enabling the brilliant colours of their paintings to survive unchanged. Of van Eyck's works, "The Adoration of the Lamb" (finished 1432), in Ghent, and "The Marriage of Giovanni Arnolfini and Giovanna Cenami (?)" (1434), in the National Gallery, London, were the most important and are the best known. There were many other painters whose works celebrated the wealth and intellectuality of 15th-century Flanders. Van Eyck's most important contemporary was the Master of Flémalle and, in the next generation, Rogier van der Weyden (1399/1400–1464) of Brussels succeeded him in the Duke's esteem. The gentle linearity and movement, reticent sentiment, and soft colouring in the paintings of van der Weyden were to have a profound influence on the art of neighbouring countries as well as on that of Quattrocento (*q.v.*) Italy in the later 15th century.

The meticulousness with which the early Flemish painters recorded nature, their innate sense of design, and their highly compressed symbolism was continued by their followers, each of whom added his own special direction to what he had inherited. Among the masters who were active up until the end of the Burgundian–Flemish political alliance are Petrus Christus (*c.* 1420–1472/73), Dirck Bouts (*c.* 1400–75), Hugo van der Goes (*c.* 1440–82), and Hans Memling (1430/35–1494).

Earn, loch and river, Tayside region, Scotland. Loch Earn is 6.5 miles (10.5 km) from east to west with a maximum width of 0.5 miles (0.8 km). Lochearnhead is situated at its western end, and St. Fillan's village at the eastern extremity, where the river, a notable fishing stream, flows out to the River Tay, 46 miles (74 km) away. Strath Earn, the picturesque valley of the river, is an attractive and fertile region which includes the health resorts of Crieff and Bridge of Earn, and many historic ruins.

Earnshaw, Thomas (b. Feb. 4, 1749, Ashton-under-Lyne, Lancashire, Eng.—d. March 1, 1829, London), English watchmaker, the first to simplify and economize in producing chronometers so as to make them available to the general public.

Earnshaw became an apprentice at the age of 14 and later set up a shop in London. He made significant improvements in the transit clock at the Royal Observatory of Greenwich, London, and, independently of John Arnold, also of Great Britain, he developed the bimetallic compensation balance.

In developing watch mechanisms, Earnshaw also invented the cylindrical balance spring and the detached (or free) detent escapement.

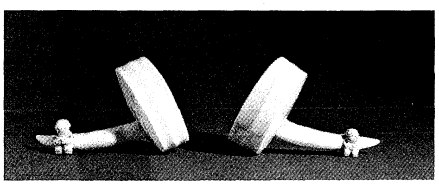
Earp, Wyatt (Berry Stapp) (b. March 19, 1848, Monmouth, Ill., U.S.—d. Jan. 13, 1929, Los Angeles), legendary frontiersman of the American West, who was an itinerant saloonkeeper, gambler, lawman, gunslinger, and confidence man. The first major biography, Stuart N. Lake's *Wyatt Earp, Frontier Marshal* (1931), written with Earp's collaboration, established the rather fictionalized portrait of a fearless lawman.

Earp and his four brothers—James C. (1841–1926), Virgil W. (1843–1906), Morgan (1851–82), and Warren B. (1855–1900)—spent their early lives in Illinois and Iowa but, toward the end of the American Civil War (1864), moved with their parents to San Bernardino, Calif. In 1868 the family moved back to Illinois, Wyatt and Virgil working on a Union Pacific Railroad crew on the way home. After the Earps moved to Lamar, Mo., Wyatt married in 1870 and was elected local constable, but upon his wife's death of typhoid, he took off, drifting from Indian Territory to various towns in Kansas. He worked as a police officer in Wichita (1875–76) and Dodge City (1876-77), went off to the gold rush in the Black Hills (1877–78), and returned to Dodge City as assistant marshal (1878–79), where he became noted as both lawman and gambler and where he befriended such gunmen as Doc Holliday and Bat Masterson.

Leaving Dodge City with his second wife, he went to New Mexico and then California, working for a time as a Wells Fargo guard, and ended up in 1878 in the Wild West town of Tombstone, Ariz., where most of the Earp family had congregated, buying real estate and businesses, and where Wyatt became a gambler and guard in the Oriental Saloon and where his brother Virgil became town marshal. By 1881 a feud had developed between the Earps and a gang led by Ike Clanton and was resolved in the celebrated gunfight at the O.K. Corral (Oct. 26, 1881), pitting the Clanton gang against three Earp brothers (Virgil, Wyatt, and Morgan) and Doc Holliday. Three of the Clanton gang were killed, but Ike and another member escaped. The townspeople then discharged Virgil Earp, on suspicion that the gunning was murder rather than crime fighting. In March 1882 Morgan Earp was killed by unknown assassins, and Wyatt, his brother Warren, and some friends subsequently killed at least two suspects. Accused of murder, Wyatt fled, moving first to Colorado, then to several boomtowns in the West, and eventually to California, where he supported himself variously by police work, gambling, mining, and real-estate deals.

earphone, small loudspeaker held or worn close to the listener's ear or within the outer ear. Common forms include the hand-held telephone receiver; the headphone (*q.v.*), in which one or two earphones are held in place by a band worn over the head; and the plug earphone, which is inserted in the outer opening of the ear. The conversion of electrical to acoustical signals is effected by any of the devices used in larger loudspeakers; the highest fidelity is provided by the so-called dynamic earphone, which ordinarily is made part of a headphone and equipped with a cushion to isolate the ears from other sound sources.

earplug, type of ear ornament usually inserted in pierced and distended earlobes and generally worn by primitive peoples. Earplugs were the direct forerunners of today's pierced earrings.



Whale's-tooth earplugs from Polynesia, 19th century; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, the Michael C. Rockefeller Memorial Collection of Primitive Art, bequest of Nelson A. Rockefeller, 1979

The Japanese Ainu have used plugs of rags; in the New World, Mayan earplugs were made of thin jade, stone, bone, shell, wood, and metal in many sizes. The Berawan people of Borneo used plugs 3¾ inches (9.5 centimetres) in diameter, and there is a Masai stone earplug that is 4½ inches (11.4 centimetres) in diameter and weighs 2 pounds, 14 ounces (1.3 kilograms).

Earraghaidheal (Scotland): *see* Argyll.

earring, a personal ornament worn pendent from the ear, usually suspended by means of a ring or hook passing through a pierced hole in the lobe of the ear or, in modern times, often by means of a screwed clip on the lobe. The impulse to decorate or to modify the appearance of the ear seems to be almost universal. In general, usage appears to call for wearing earrings in pairs, the two ornaments in all respects resembling each other; but a single earring has sometimes been worn. (The single earring was especially popular in Europe during the Renaissance and Baroque period.)

In the Orient, earrings were worn by both sexes; in the West (including ancient Israel and Egypt) as a general rule, they have been considered exclusively female ornaments. Among the Greeks and Romans earrings were worn only by women, and the wearing of them by a man is often spoken of in classical literature as a distinctly Oriental (*i.e.*, Middle Eastern) trait.

In the tombs of the Greek settlers in the Crimea (4th century BC), earrings of marvelous complexity and beauty were found. Jewels of the same class, of exquisite beauty and workmanship, were found in the sepulchres of ancient Etruria. Earrings of comparatively simple forms, but set with pearls and other stones, were the mode in Rome.

In Europe, earrings tended to go out of fashion when the wig, coiffure, or headdress obscured the ears, as in the late-17th and 18th centuries. Use of these ornaments continued to be unfashionable in Europe and the Americas during the 19th century but were revived again in the 20th, especially with the introduction of clipping devices. Simplified painless methods of piercing the ears led to the renewed popularity of pierced earrings.

Earth, the third planet in distance outward from the Sun. It is the only planetary body in the solar system that has conditions suitable for life, at least as known to modern science.

A brief treatment of the Earth follows. For full treatment, *see* the MACROPAEDIA, which considers the various aspects of the subject in several different articles. For the relationship of the Earth to other components of the solar system, *see* Solar System, The. For detailed coverage of the shape, structure, and composition of the Earth, as well as of its gravitational and magnetic fields, *see* Earth. For specific information about terrestrial surface features and the factors governing their formation, *see* Continental Landforms; Geomorphic Processes; Oceans; Plate Tectonics. For a description of the layers of air and water that envelop the Earth, *see* Atmosphere; Hydrosphere, The. For a discussion on the so-called zone of life at the Earth's surface, *see* Biosphere, The; Ecosystems.

For a description of the place of the Earth in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Two.

Basic planetary data. The mean distance of the Earth from the Sun is about 149,573,000 km (92,960,000 miles). The planet orbits the Sun at a speed of 29.8 km per second (18.5 miles per second), making one complete revolution in 365.25 days. As it revolves around the Sun, the Earth spins on its axis and rotates completely once every 23 hours 56 minutes 4 seconds.

The fifth largest planet of the solar system, the Earth has an equatorial circumference of 40,076 km (24,902 miles), an equatorial radius of 6,378 km (3,963 miles), a polar radius of 6,357 km (3,950 miles), and a mean radius of 6,371 km (3,960 miles). The planet's total surface area is roughly 509,600,000 square km (197,000,000 square miles), of which about 29 percent, or 148,000,000 square km (57,000,000 square miles), is land. The balance of the surface is covered by the oceans and smaller seas. The Earth has a mass of 5.976×10^{27} grams (or roughly 6×10^{21} metric tons) and a mean density of 5.517 grams per cubic cm (0.2 pound per cubic inch).

The Earth has a single natural satellite, the Moon. The latter orbits the planet at a mean distance of slightly more than 384,400 km (238,870 miles).

The Earth's figure and gravity. The centrifugal force of the Earth's rotation makes the planet bulge at the Equator. Because of this, the Earth has the shape of an oblate spheroid, being flatter near the poles than near the Equator. Correspondingly, one degree of latitude is longer in high latitudes than it is in low ones.

The gravitational field, or gravity, of the Earth is manifested as the force acting upon a free, unsupported body causing it to move in the general direction of the centre of the planet. The Earth's gravity is not fixed, but rather varies from place to place on the surface, with the main variation occurring with latitude. It averages approximately 983.22 cm per second per second (32.26 feet per second per second) at the poles, which is somewhat higher than at the Equator, where it is only about 973.03 cm per second per second (31.92 feet per second per second).

Atmosphere and radiation belts. The Earth's atmosphere consists of a mixture of gases, chiefly nitrogen (78 percent) and oxygen (21 percent). Argon makes up much of the remainder of the gaseous envelope, with trace amounts of water vapour, carbon dioxide, and various other gases also present. At lower altitudes, minute dust particles and water droplets occur in suspension.

The Earth is surrounded by a magnetosphere, a region of strong magnetic forces that extends upward from about 140 km (90 miles) in the upper atmosphere. In the magnetosphere, the magnetic field of the Earth traps rapidly moving charged particles (*e.g.*, electrons and high-energy protons), the majority of which appear to be emitted by the Sun during periods of intense activity. If it were not for this shielding effect, such particles would bombard the terrestrial surface and destroy life. High concentrations of the trapped particles make up two doughnut-shaped zones called the Van Allen radiation belts. These belts play a key role in several geophysical phenomena, as, for example, auroras.

Hydrosphere. The Earth is the only planet known to have liquid water. Together with ice, the liquid water constitutes the hydrosphere. Seawater makes up more than 98 percent of the total mass of the hydrosphere and covers about 71 percent of the Earth's surface. Significantly, seawater constituted the environment of the earliest terrestrial life forms. The rest of the hydrosphere consists of fresh water, occurring principally in lakes, streams (including rivers), and glaciers.

Surface features. The Earth's surface is subdivided into continental masses, of which there are seven: Europe, Asia, Africa, Australia, North America, South America, and Antarctica. These continents are surrounded by the so-called World Ocean, which is commonly broken down into three major bodies—namely, the Atlantic, Pacific, and Indian oceans. The continents and oceanic depressions may be further subdivided into major relief features, such as mountain systems, volcano chains, rift valleys, and plateaus on land, and mid-oceanic ridges, trenches, submarine canyons, and clusters of guyots (flat-topped, deeply submerged undersea mountains) on the ocean floor. Most such third- and fourth-order topographic features were formed as a result of vertical tectonic movements (*i.e.*, uplift and subsidence of the Earth's crust) and the extrusion of molten-rock material called magma. Continental landforms of smaller scale, including pediments, caves, and cliffs, have been produced by denudational processes, which involve the weathering and erosion of rocks and the accumulation of the resultant sedimentary debris.

Structure and composition. Broadly speaking, the Earth consists of two regions: a core composed largely of molten, iron-rich metallic alloy; and a solid shell of silicate minerals comprising both the mantle and crust. In continental regions, the crust is made up chiefly of granitic rock, whereas the composition of the ocean floor corresponds mainly to that of basalt and gabbro. On average, the crust extends 35 km (22 miles) downward from the surface to the underlying mantle from which it is separated by the Mohorovičić discontinuity (often simply called the Moho). The mantle, consisting of rock material in which olivines, pyroxenes, and silicate perovskite predominate, ends at a depth of approximately 2,900 km (1,800 miles). The core is thought to have a two-part structure: an outer fluid region and a solid, extremely dense inner region that measures only about 2,400 km (1,500 miles) across. The inner core is most likely composed exclusively of iron, whereas the outer core appears to include such alloying elements as sulfur or oxygen, as suggested by its lower density.

Recent studies indicate that more than 90 percent of the magnetic field at the Earth's surface originates in an electric-current system in the outer core. The magnetic field is thought to be caused by the flow of electric charges in the region's fluid molten metal. Variations in the field through geological time, as revealed by paleomagnetic research, suggest that the electrically conductive fluid in the outer core circulates. The fluid motions, responsible for surface variations, presumably also generate and maintain the currents. This process is analogous to the one that occurs in the dynamos (rotating generators) used by power stations, in which current is produced by the motion of metallic wires past each other. The streams of molten iron alloy in the Earth's outer core are the equivalent of the moving wires.

Earth current: *see* telluric current.

Earth Mother, in ancient and modern nonliterate religions, an eternally fruitful source of everything. Unlike the variety of female fertility deities called mother goddesses (*q.v.*), the Earth Mother is not a specific source of vitality who must periodically undergo sexual intercourse. She is simply the mother; there is nothing separate from her. All things come from her, return to her, and are her.

The most archaic form of the Earth Mother transcends all specificity and sexuality. She simply produces everything, inexhaustibly, from herself. She may manifest herself in any form. In other mythological systems she becomes a more limited figure. She becomes the feminine Earth, consort of the masculine sky; she is fertilized by the sky in the beginning and brings forth terrestrial creation. Even more limited reflections of the Earth Mother occur in those agricultural traditions in which she is simply the Earth and its fertility.

Earth Resources Technology Satellite: *see* ERTS.

Earth satellite, man-made object launched into a temporary or permanent orbit around the Earth. Spacecraft of this type may be either manned or unmanned, the latter being the most common.

The idea of an artificial satellite in orbital flight was first suggested by Sir Isaac Newton in his book *Philosophiae Naturalis Principia Mathematica* (1687). He pointed out that a cannonball shot at a sufficient velocity from atop a mountain in a direction parallel to the horizon would go all the way around the Earth before falling. Although the object would tend to fall toward the Earth's surface because of gravitational force, its momentum would cause it to descend along a curved path. Greater velocity would put it into a stable orbit, like that of the Moon, or direct it away from the Earth altogether. On Oct. 4, 1957, nearly three centuries after Newton had proposed his theory, the Soviet Union launched the first Earth satellite, Sputnik I. Sputnik circled the Earth every 96 minutes, and its simple radio signal was heard by scientists and radio operators across the world. The United States orbited its first satellite, Explorer 1, three months later (Jan. 31, 1958). Explorer, though much smaller than Sputnik, was instrumented to detect radiation and discovered the innermost of the two Van Allen radiation belts, a zone of electrically charged solar particles that surrounds the Earth.

Since these initial efforts, more than 5,000 Earth satellites have been orbited by at least 15 different nations. The satellites vary widely in size and design, ranging from a tiny sphere of several pounds equipped with only two radio transmitters to heavily instrumented space laboratories weighing many tons. They are equally diverse in function. Scientific satellites are chiefly used to collect data about the Earth's surface and atmosphere and to make astronomical observations. Weather satellites transmit photographs of cloud patterns and measurements of other meteorological conditions that aid in weather forecasting, while communications satellites relay telephone calls, radio and television programs, and data communications between distant parts of the world. Navigation satellites enable the crews of oceangoing vessels and airplanes to determine the position of their craft in all kinds of weather. Some satellites have distinctly military applications, such as reconnaissance and surveillance.

Satellites can be placed in any number of different orbits. The particular path selected is largely determined by the function of the spacecraft. Most weather and reconnaissance satellites, for example, are fired into a polar orbit in which the Earth's polar axis is a line on the orbital plane. Because the Earth rotates under polar-orbiting satellites, they pass over its entire surface within a given time period, providing full global coverage. Communications satellites, on the other hand, are generally placed into an equatorial orbit, which enables them to circle the most densely populated regions of the Earth from west to east. Moreover, communications satellites comprising a network or system are nearly always launched to a distance of 22,300 mi (35,890 km) above the Earth. At this altitude, the motion of a satellite becomes synchronized with the Earth's rotation, causing the craft to remain fixed over a single location. If properly positioned, three communications satellites travelling in such a synchronous orbit can relay signals between stations around the world. *See also* spacecraft.

Earth sciences, the fields of study concerned with the solid Earth, its waters, and the air that envelops it. Included in the Earth sciences are the geologic, hydrologic, and the atmospheric sciences.

A brief treatment of the Earth sciences follows. For full treatment, *see* MACROPAEDIA: Earth Sciences, The.

Each of the three major families of the Earth sciences is conventionally divided into disciplines and subdisciplines according to its particular subject matter.

Geologic sciences. In the geologic sciences, disciplines are frequently grouped under the heading of physical geology, which includes the study of minerals (mineralogy), of rocks (petrography and petrology), of structures in the solid Earth (structural geology), of sedimentary strata and their fossil content (stratigraphy and paleontology, respectively), and of landforms (geomorphology). The history of the development of these natural entities is broadly comprehended under the heading of historical geology.

Geophysics and geochemistry overlap many of the above-mentioned disciplines. Broadly speaking, geophysics is concerned with the physical properties and dynamics of the Earth in all its parts. Among the phenomena investigated by geophysicists are the Earth's fields of gravity and magnetism, the thermal properties of the Earth, the motions of fluids within and surrounding the planet, and the release of mechanical and thermal energy in earthquakes and volcanic activity. Geochemistry deals with the composition of the Earth and the chemical changes that occur in nature. Although both of these geologic sciences focus on changes affecting the Earth today, they also are concerned with determining the chain of events that led up to present conditions.

Economic geology, engineering geology, and various other so-called applied geosciences entail for the most part the practical application of the principles and techniques of geophysics and geochemistry. Also closely interlinked with the latter fields is astrogeology, a relatively new discipline that deals with other

planetary bodies of the solar system and their satellites, as well as with asteroids, meteoroids, and tektites.

The geologic sciences contribute significantly to modern society. Workers in these fields have led the exploration for accumulations of fossil fuels (*e.g.,* oil, natural gas, and coal), deposits of industrial minerals, and concentrations of geothermal energy. Geologic surface maps, gravity measurements, seismic methods, and analyses of borehole samples have all become essential in petroleum prospecting. Knowledge about the periods of Earth history and plate tectonic environments helps economic geologists to define regional metallogenetic provinces and locate ore deposits of commercial value. Global heat-flow maps based on geophysical data have proved invaluable in the search for major sources of geothermal energy.

Seismological research plays a key role in explaining the characteristics of ground motions in earthquakes. Information of this kind, which is needed to predict ground motions in future quakes, enables engineers to design earthquake-resistant buildings, bridges, and other structures. Information provided by engineering geologists about the composition and structure of bedrock is important in selecting sites for such facilities as nuclear power plants and dams.

Hydrologic sciences. The hydrologic sciences deal with the occurrence, movement, and physical and chemical properties of water (in all its forms) within the Earth's hydrosphere. The component disciplines include the study of water close to the land surface (hydrology), of seas and oceans (oceanography), of lakes and inland seas (limnology), and of glaciers and ice caps (glaciology).

The hydrologic sciences are of fundamental importance because water is essential to many of humankind's most basic activities—agriculture, industry, power generation, and recreation. They provide much of the knowledge on which the development and management of available water resources are founded, and provide a better understanding of such serious problems as groundwater pollution and acid rain (*q.v.*).

Atmospheric sciences. The atmospheric sciences focus on the structure and dynamics of the Earth's atmosphere. They have traditionally been divided into three areas: meteorology, climatology, and aeronomy. Meteorology is primarily concerned with short-term weather variations in the lower regions of the atmosphere. Climatology has to do with long-term weather conditions (those that occur over periods ranging from roughly a month to millions of years) on a global scale. Researchers in this field seek to explain why climate differs from region to region and how it is interrelated with other elements of the physical environment. Aeronomy involves studies of the atmospheric regions above the lower stratosphere, dealing with phenomena such as airglow, magnetospheric storms, auroras, and photochemical processes.

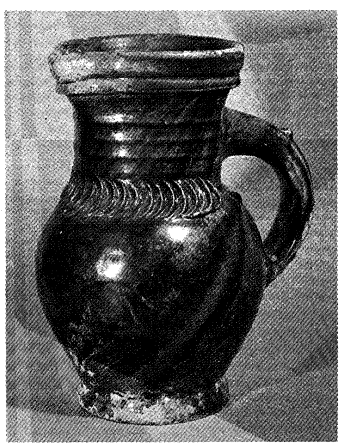
Of the varied applications of the atmospheric sciences, weather forecasting obviously has the most immediate impact. Today, weather forecasting is carried out with a worldwide network of ground-based stations and Earth-orbiting satellites specially equipped for meteorological measurements. High-speed computers are used to analyze the tremendous quantities of data so gathered to produce reasonably accurate short-range forecasts.

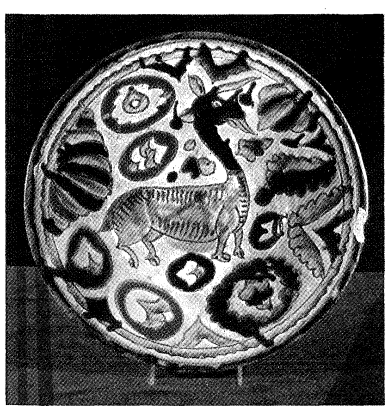
Another application that has attracted considerable interest in recent years is weather modification. Such deliberate alterations of atmospheric conditions include efforts to enchance precipitation, weaken hurricanes, and suppress hail and fog.

Earth tide, deformation of the solid Earth as it rotates within the gravitational fields of the Sun and Moon. Earth tides are similar to ocean tides. The Earth deforms because it has a certain degree of elasticity; were it perfectly rigid, there would be no Earth tides. Several tidal components mathematically can be shown to exist, but only four are large enough to be generally measurable; these are the lunar diurnal, the lunar semidiurnal, the solar diurnal, and the solar semidiurnal tides. Diurnal tides have a period of approximately 24 hours (1 day), and semidiurnal tides have a period of approximately 12 hours (½ day). The actual amplitudes of these tides in terms of vertical movement of the surface of the solid Earth are about one foot or less.

earthenware, pottery that has not been fired to the point of vitrification and is thus slightly porous and coarser than stoneware and porcelain. The body can be covered completely or decorated with slip (a liquid clay mixture applied before firing) or it can be glazed. For both practical and decorative reasons, earthenware is usually glazed. To overcome its porosity (which makes it impracticable for storing liquids in its unglazed state, for example), the fired object is covered with finely ground glass powder suspended in water and is then fired a second time. During the firing, the fine particles covering the surface fuse into an amorphous, glasslike layer, sealing the pores of the clay body. There are two main types of glazed earthenware. One is covered with a transparent lead glaze; when the earthenware body to which this glaze is applied has a cream colour, the product is called creamware. The second type, covered with an opaque white tin glaze, is variously called tin-enameled or tin-glazed earthenware, maiolica, faience, or delft.

A crude, soft earthenware, excavated at a Neolithic settlement at Çatalhüyük, on the Anatolian Plateau of Turkey, and thought to be about 9,000 years old, is the earliest known pottery. Earthenware is still widely used in the 20th century, much of the commercially produced ware being heatproof and coldproof and thus practicable for cooking and freezing as well as for serving.





Earthenware
(Top) creamware vase, Luxembourg, late 18th century, in the Victoria and Albert Museum, London; (centre) lead-glazed earthenware water pot, Paris, 15th century, in the Musée National de la Céramique, Sèvres, Fr.; (bottom) tin-glazed earthenware dish, Spain, first half of the 19th century, in the Victoria and Albert Museum, London

By courtesy of (top, bottom) the Victoria and Albert Museum, London, (centre) the Musee National de la Ceramique, Sevres; photograph, (top) EB Inc.

earthfill dam, also called EARTH DAM, or EMBANKMENT DAM, dam built up, generally, by compacting successive layers of earth, using the most impervious materials to form a core and placing more permeable substances on the upstream and downstream sides. A facing of crushed stone prevents erosion by wind or rain, and an ample spillway, usually of concrete, protects against catastrophic washout should the water overtop the dam.

Consult the INDEX *first*

earthflow, sheet or stream of soil and rock material saturated with water and flowing downslope under the pull of gravity; it represents the intermediate stage between creep and mudflow. Earthflows usually begin in a large basin on the upper part of a slope where debris and weathered material accumulate; the movement, usually set off by heavy rainfall, may be relatively slow or very fast, depending on the amount of water present, the angle of the slope, and other aspects of the terrain.

earthnut, also called PIGNUT, or HOGNUT (*Conopodium majus*), European plant of the carrot family (Apiaceae), so called because of its edible tubers. It grows in woods and fields in the British Isles and from Norway, France, Spain, and Portugal to Italy and Corsica. The slender, smooth perennial, growing 750 mm to 1 m (30 to 39 inches) high, has much-divided leaves and small, white flowers in compound umbels. The tubers, reaching 25 mm (1 inch) in diameter, are more commonly used as food on the Continent than in Britain. The peanut, or groundnut, is sometimes called earthnut.

earthquake, any abrupt disturbance within the Earth that is tectonic or volcanic in origin and that results in the generation of elastic waves. The passage of such seismic waves through the Earth often causes violent shaking at its surface.

A brief treatment of earthquakes follows. For full treatment, *see* MACROPAEDIA: Earthquakes.

The origin and distribution of most major earthquakes can be explained in terms of the plate tectonics theory. This theory postulates that the Earth's surface is made up of a number of large, rigid plates that move relative to one another and interact at their boundaries. The severest earthquakes tend to occur at con-

Major historical earthquakes

year, AD	magnitude or intensity*	deaths	affected area
365	...	50,000	Knossos, Crete (Greece)
526	...	250,000	Antioch, Syria
844	...	50,000	Damascus, Syria
847	...	50,000	Mosul, Iraq
847	...	70,000	Damascus, Syria
856	...	200,000	Qumis, Dāmghān, Iran
893	...	82,000	Caucasus, Russia (U.S.S.R.)
893	...	180,000	Daipur, India
893	...	150,000	Ardabīl, Iran
1042	...	50,000	Palmyra, Baalbek, Syria
1138	...	230,000	Ganzah, Aleppo, Syria
1201	...	1,000,000	Upper Egypt or Syria
1268	...	60,000	Cilicia, Anatolia (Turkey)
1290	6.75	100,000	China
1556	XI	830,000	Shensi province, China
1667	6.9	80,000	Shemakha, Azerbaijan (U.S.S.R.)
1668	XII	50,000	Shantung province, China
1693	XI	100,000	Sicily, Catania (Italy)
1703	...	200,000	Jeddo, Japan
1727	...	77,000	Tabrīz, Iran
1730	...	137,000	Hokkaido, Japan
1731	...	100,000	Peking, China
1737	...	300,000	Calcutta, India
1739	...	50,000	China
1755	...	60,000	Lisbon, Portugal; Spain; Morocco
1780	...	100,000	Tabrīz, Iran
1811	8.7	...	New Madrid, Mo., U.S.
1836	7.6	28,321	northern Japan
1857	8.3	...	Tejon Pass (Palmdale), Calif., U.S.
1868	...	70,000	Ecuador
1883	...	100,000	Java, Indon.
1905	8.6	19,000	Jammu and Kashmīr, India
1906	8.3	700	San Francisco, Calif., U.S.
1906	8.6	1,500	Valparaíso, Chile
1908	7.5	58,000	Calabria, Messina, Italy
1915	7.5	32,610	Abruzzi, Italy
1920	8.5	200,000	Kansu province, China
1923	8.3	140,000	Tokyo; Yokohama, Japan
1927	8.0	40,000	Nan Mountains, China
1932	7.6	70,000	Kansu province, China
1935	7.5	25,000	Quetta, India
1939	8.0	32,000	Erzincan, Turkey
1939	8.3	28,000	Chillán, Chile
1948	7.3	19,800	Ashkhabad, Turkmen S.S.R.
1950	8.7	574	Assam, India
1960	5.9	12,000	Agadir, Mor.
1960	8.5	5,700	Puerto Montt, Valdivia, Chile
1963	6.0	1,070	Skopje, Yugos.
1964	8.3	131	Prince William Sound, Alaska, U.S.
1970	7.7	10,000	southern Yunnan province, China
1970	7.8	66,794	northern Peru
1972	6.2	5,000	Managua, Nic.
1976	7.5	23,000	Guatemala City, Guat.
1976	6.5	929	northeastern Italy
1976	7.8	240,000	T'ang-shan, China
1977	7.2	1,500	Bucharest, Rom.
1978	7.4	25,000	Khorāsān, Iran
1979	7.9	600	Colombia; Ecuador
1980	7.7	4,000	El-Aṣnām (Ech-Cheliff), Alg.
1980	7.2	4,800	southern Italy
1983	7.1	1,400	eastern Turkey
1985	8.1	10,000	Mexico City, Mex.
1986	5.4	1,000	San Salvador, El Salvador
1989	7.1	67	northern California, U.S.

*Magnitudes given for pre-20th century events are generally estimations from intensity data. When no magnitude was available, the maximum intensity, written as a Roman numeral, is given.
Sources: World Data Center A for Solid Earth Geophysics, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, *Catalog of Significant Earthquakes 2000 B.C.–1979* (July 1981), *Significant Earthquakes 1900–1979*, map and table; Münchener Rückversicherungs-Gesellschaft, *World Map of Natural Hazards* (1978); Swiss Reinsurance Company, *Atlas on Seismicity and Volcanism* (1978); U.S. Department of the Interior Geological Survey, *Earthquake Information Bulletin;* Smithsonian Institution, *SEAN Bulletin*.

vergent plate boundaries where one plate descends—*i.e.,* is subducted—beneath the other. Most of these are deep-focus quakes originating more than 300 km (190 miles) below the surface and are associated with island arcs and trenches. Much seismicity also occurs near the margins where plates separate or slide past one another. Quakes at such sites tend to be of lower magnitude and are fairly shallow. In all the boundary regions described above, seismic waves are generated by the sudden fracturing of rock, which results when elastic strain accumulated during tectonic processes exceeds the strength of the rock.

Three major zones of seismicity have been identified: (1) the circum-Pacific belt, which lies along plate margins around the Pacific Ocean and includes the well-known seismically active areas of Japan, Indonesia, New Guinea, the Andes Mountains, the western part of Central America, and the San Andreas Fault region of California, (2) the trans-Asiatic belt, extending from Mediterranean Europe eastward through Asia to the Pacific, and (3) the mid-ocean ridges, which form a connected worldwide rift system.

Some earthquakes occur from time to time outside of these and various associated belts, well away from plate boundaries. These so-called intraplate earthquakes must be explained by mechanisms other than plate motions and suggest that stresses occasionally can exceed the strength of rock masses even within plates.

Some phenomena akin to earthquakes, usually relatively minor, have been triggered by human activities that disturb the equilibrium of subsurface rock layers—*e.g.,* underground nuclear testing, impounding of water behind high dams, and the pumping of liquid wastes into the Earth through deep wells.

The location of an earthquake is determined with a seismograph. This instrument records the oscillation of the ground caused by seismic waves that travel from their point of origin through the Earth or along its surface. A seismogram of a nearby earthquake is fairly simple, showing the arrival of P (or primary) waves, those that vibrate in the direction of propagation; slower traveling S (or secondary) waves, those that vibrate at right angles to the direction of propagation; and surface waves, those of extremely high amplitude that skirt along the Earth's surface. In the case of distant earthquakes, the seismogram pattern tends to be more complex because it shows various types of seismic waves that originate from one point but are then reflected or refracted within the Earth's crust before reaching the seismograph. The relation between the arrival time of these waves and the epicentral distance (*i.e.,* the distance from the point of origin) is expressed by a time–distance curve in which the arrival time is read on the vertical axis and the epicentral distance on the horizontal axis. If the arrival times of various seismic waves are read on the seismogram at a recording station and compared with standard time–distance curves, the distance of the centre of an earthquake from the station can be ascertained.

The magnitude of an earthquake is usually expressed in terms of the Richter scale, which is a logarithmic scale based on seismograph recordings of seismic-wave amplitudes. The scale is so arranged that each increase in magnitude of one unit represents a tenfold increase in earthquake size—*i.e.,* an earthquake of Richter magnitude 8 is 10,000 times as large as one of magnitude 4. Whereas the latter would be capable of causing only slight damage, the former constitutes a devastating seismic event. The magnitude of an earthquake differs from its intensity, which is the perceptible degree of shaking of the Earth's surface and the attendant damage at any given location. In general, a quake's intensity decreases with distance from its epicentre, but other factors, including surface geology (*e.g.,* hard bedrock versus sediment or loose landfill) may have a significant bearing on its effects on man-made structures.

Large earthquakes have caused some of the worst disasters in history. No other natural phenomenon is as destructive over so large an area in so short a time. A major earthquake that struck Shensi province of China in 1556, for example, is estimated to have killed nearly 830,000 people while destroying entire towns and villages. The violent motions of the surface during large quakes can wreak havoc on poorly designed or ill-constructed buildings. People are crushed and buried under the collapsing structures or are burned to death in fires that rage out of control following building failures. Destructive, too, are the landslides and mudslides that occasionally accompany an earthquake, as are tsunamis, the enormous seismic sea waves induced by a disturbance in the adjacent seabed or by a submarine landslide triggered by an earthquake.

Much research has been devoted to earthquake prediction since the mid-1960s, most

notably by seismologists in China, Japan, the Soviet Union, and the United States. Various advances notwithstanding, no method has yet been devised to predict the time, place, or magnitude of quakes with a high degree of accuracy or consistency. Seismologists have found that major earthquakes are often preceded by certain measurable physical changes in the environment around their epicentres. These so-called precursor phenomena include the degree of crustal deformation in fault zones; occurrence of dilatancy (*i.e.,* an increase in volume) of rocks; and a rise in radon concentrations in wells. Continual monitoring and close scrutiny of these and other related phenomena are expected to improve prediction capability.

earthshine, sunlight reflected from the Earth, especially that reflected to the Moon and back again. For a few days before and after New Moon, this doubly reflected earthshine is powerful enough to make the whole Moon visible.

At this time an observer on the Moon would see the Earth as a bright body, four times the diameter of the Moon as seen from Earth, almost completely illuminated by the Sun. The phases of the Earth and Moon are complementary, so that the Earth is near full when the Moon is near new, and the earthshine then is strongest.

Earthshine on the Moon
By courtesy of Yerkes Observatory, Wisconsin

earthworm, also called ANGLEWORM, any one of more than 1,800 species of terrestrial worms of the class Oligochaeta (phylum Annelida)—in particular, members of the genus *Lumbricus.* Seventeen native species and 13 introduced species (from Europe) occur in the eastern United States, *L. terrestris* being the most common. Earthworms occur in virtually all soils of the world in which the moisture and organic content are sufficient to sustain them.

An Australian species can grow as long as 3.3 metres (about 11 feet). *L. terrestris* grows to about 25 centimetres (10 inches). This species is reddish brown, but some earthworms (*e.g., Allolobophora chlorotica,* native to Great Britain) are green. The reddish tinge of *L. terrestris* results from the presence of the pigment hemoglobin in its blood.

The earthworm body is divided into ringlike segments (as many as 150 in *L. terrestris*). Some internal organs, including the excretory organs, are duplicated in each segment. Between segments 32 and 37 is the clitellum, a slightly bulged, discoloured organ that produces a cocoon for enclosing the earthworm's eggs. The body is tapered at both ends, with the tail end the blunter of the two. Earthworms cannot see or hear, but they are sensitive to both light and vibrations.

Their food consists of decaying organisms; as they eat, however, earthworms also ingest large amounts of soil, sand, and tiny pebbles. It has been estimated that an earthworm ingests and discards its own weight in food and soil every day.

Earthworm (*Lumbricus terrestris*)
John Markham

Earthworms are hermaphroditic; *i.e.,* functional reproductive organs of both sexes occur in the same individual. The eggs of one individual, however, are fertilized by the sperm of another individual. During mating two earthworms are bound together by a sticky mucus while each transfers sperm to the other. The worms separate and form cocoons; the cocoon moves forward, picking up eggs at the 14th segment; at the 9th and 10th segments it picks up the sperm deposited by the other earthworm. The cocoon slides over the head, and fertilization takes place. Within 24 hours after the worms mate, the cocoon is deposited in the soil.

Miniature earthworms usually emerge from the cocoon after two to four weeks. They become sexually mature in 60 to 90 days and attain full growth in about one year.

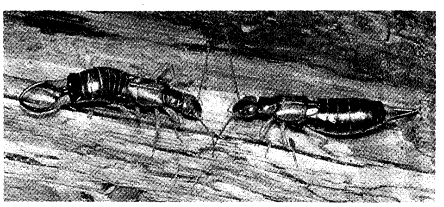
Earthworms usually remain near the soil surface, but they are known to tunnel as deep as 2 m during periods of dryness or in winter. One Asian species is known to climb trees to escape drowning after heavy rainfall.

Earthworms provide food for a large variety of birds and animals. Indirectly they provide food for man by their beneficial effects on plant growth: they aerate the soil, promote drainage, and draw organic material into their burrows where it decomposes faster, thus producing more nutritive materials for growing plants. Earthworms also serve as fish bait; hence, the name angleworm.

earwax impaction, filling of the external auditory canal with earwax, or cerumen. Normally the wax produced by skin glands in the outer ear migrates outward. If the earwax is produced too rapidly, it may become hardened and accumulate, thus plugging the outer ear canal and preventing sound passage to the tympanic (eardrum) membrane. This hearing impairment is painless. Impacted earwax is often found in infants, because the large cotton swabs used to remove the wax often push it further into the baby's tiny ear canal. The problem also exists among industrial workers because of the surrounding dirt that gets into the ears. Persons who have an abnormal number of hairs in their ears are also susceptible, because the earwax becomes enmeshed in the hairs and fails to work its way out. The symptoms usually include sudden deafness. The wax is easily removed by a physician.

earwig, any insect of the order Dermaptera (about 1,100 species), characterized by large membranous hindwings that lie hidden under short, leathery forewings. The earwig varies from 5 to 50 millimetres (0.2 to 2 inches) in length and is flat, slender, and dark coloured. It has a shiny outer covering and simple biting mouthparts, and it undergoes incomplete metamorphosis (*i.e.,* egg, nymph, and adult stages). This nocturnal insect is usually herbivorous. Several species can fire a foul-smelling liquid, formed in abdominal glands and probably protective in function, for distances up to 10 centimetres.

The earwig has a pair of horny, forceps-like tail filaments, or pincers (cerci), at the posterior end of the abdomen; those of the male are larger and of a different shape than those of the female. It has been suggested that the pincers may function in defense, in catching insects and holding them while eating, in helping to fold the hindwings under the forewings, or during courtship fights for possession of a female. When alarmed or aggressive the earwig carries the cerci over its body in a scorpion-like manner. The name earwig is derived from the Anglo-Saxon word meaning "ear creature," probably because of a widespread ancient superstition that earwigs crawl into the ears of sleeping people.



Male (left) and female earwigs
Stephen Dalton—EB Inc.

easel painting, painting executed on a portable support such as a panel or canvas, instead of on a wall. It is likely that easel paintings were known to the ancient Egyptians, and the 1st-century-AD Roman scholar Pliny the Elder refers to a large panel placed on an easel; it was not until the 13th century, however, that easel paintings became relatively common, finally superseding in popularity the mural, or wall painting.

easement, in Anglo-American property law, a right granted by one property owner to another to use a part of his land for a specific purpose.

An easement may be created expressly by a written deed of grant conveying to another the right to use for a specific purpose a certain parcel of land. An easement may also be created when one sells his land to another but reserves for himself the right to future use of a portion of that land. An easement may also be created by implication, when, for example, a term descriptive of an easement is incidentally included in a deed (such as "passageway"—a section of land to be used for passage). An easement by implication also arises when the owner of two or more adjacent parcels of land sells one lot; the buyer acquires an easement to that visible property of the seller necessary to the buyer's use and enjoyment of his lot, such as a roadway or drainage duct. When created in this manner the easement also arises as an easement of necessity.

In most of the United States and England, statutes permit the creation of an easement by prescription, which arises by virtue of a long, continuous usage of the property of another by a landowner, his ancestors, or prior owners. The length of time necessary for such continued use to ripen into an easement by prescription is specified by the applicable state statute.

When use of the easement is restricted to either one or a few individuals, it is a private easement. Use of a public easement, such as public highways or a portion of private land dedicated by a present or past owner as a public park (also known as a dedication), is not restricted.

An owner of an easement is referred to as the owner of the dominant tenement. The owner on whose land the easement exists is the owner of the servient tenement.

Easington, district, county of Durham, northeastern England, occupying an area of 55 sq mi (143 sq km) that extends north–south along the North Sea coast between the industrialized metropolitan counties of Tyne and

Wear to the north and Cleveland to the south. Easington district is a plateau 300 to 400 feet (90 to 120 m) high that descends to a narrow coastal plain having sandy and gravel beaches along the North Sea. Its thick glacial drift soils are underlain by magnesian limestone that in turn covers coal deposits. Not until the 1820s did advances in mining techniques allow the deep-lying coal reserves to be worked. Easington's coal-mining industry peaked in the early 20th century and declined thereafter; it nevertheless remains the principal employer, and the district is the only one in the county of Durham where substantial amounts of coal are still mined. Most coal now comes from long galleries extending from the mainland below the North Sea. Seaham, founded in 1828, is the district's port, shipping mostly coal.

The new town of Peterlee, the district seat, was established in central Easington in 1948. Its original purpose was to replace the typical 19th-century housing of the nearby scattered mining villages and to create recreational and service facilities for the local inhabitants. With the subsequent local decline of the coal industry, Peterlee became a centre of light industry. Dairying is the most important agricultural pursuit. Pop. (1985 est.) 97,100.

East, Edward Murray (b. Oct. 4, 1879, Du Quoin, Ill., U.S.—d. Nov. 9, 1938, Boston), American plant geneticist, botanist, agronomist, and chemist, whose experiments, along with those of others, led to the development of hybrid corn (maize). He was particularly interested in determining and controlling the protein and fat content of corn, both of which have significant influence upon that grain's value as animal feed.

Precocious as a youth, East finished high school at 15 and then worked in a machine shop for two years to earn money for college. Trained as a chemist, he developed an interest in genetics and in 1900 became an assistant to Cyril George Hopkins of the Illinois Agricultural Experiment Station, University of Illinois, Urbana, on corn-breeding experiments intended to increase fat and protein content. After receiving an M.S. degree in 1904, he worked for four years as an agronomist at the Connecticut Agricultural Experiment Station, where he continued his experiments with corn.

East's genetic investigations, with independent work by the geneticist and botanist George Harrison Shull, led to the development of hybrid corn. Commercial production of hybrid seed corn was made possible by the work of Donald F. Jones, a student of East. In 1909 East joined the faculty of Harvard University. He helped found the journal *Genetics* in 1916. Though he continued his work in genetics, his later contributions to the field were generally of a more theoretical nature. He wrote a number of books on science and international affairs.

East, Michael, East also spelled EASTE, EST, or ESTE (b. 1580?—d. 1648, Lichfield, Staffordshire, Eng.), English composer, especially known for his madrigals. (He was once thought to be a son of the music printer Thomas East, but late research suggests that they were, at most, distant relatives.)

He had some madrigals published as early as 1601 and again in 1604 and received a bachelor of music degree from Cambridge University in 1606. He had patrons in London for a time, was employed by Ely Cathedral from 1609 to 1614, and apparently, from 1618 on, lived in Lichfield, where for some time he was master of choristers for the cathedral. Over the years he published seven "sets of bookes" (1604, 1606, 1610, two in 1618, 1624, 1638) containing his madrigals, pastorals, anthems, "Neapolitanes," "fancies," various songs, and works for bass viols and treble viols. Although his compositions offer a valuable outline of the English musical tastes of the period (which were somewhat Italianate), his music tended to be unoriginal and colorless.

East, Thomas, East also spelled EASTE, EST, or ESTE (b. *c.* 1540, London—d. January 1609, London), prominent English music publisher whose collection of psalms (1592) was among the first part-music printed in score rather than as individual parts in separate books.

East was licensed as a printer in 1565 and later became an assignee in the music publishing monopoly granted by Elizabeth I to the composers William Byrd and Thomas Tallis. His first publication was Byrd's *Psalmes, Sonets and Songs of Sadnes and Pietie* (1588). In 1592 he edited *The Whole Booke of Psalmes, With Their Wonted Tunes*, harmonizations of psalm tunes by prominent musicians. His madrigal books included collections by Thomas Weelkes, John Wilbye, and Thomas Morley.

East Africa, eastern region of the continent of Africa, comprising the areas now occupied by the countries of Burundi, Kenya, Rwanda, Tanzania, Uganda, and Somalia. The more general term eastern Africa covers the area extending from The Sudan and Ethiopia in the north to the Zambezi River in the south; Mozambique is also sometimes included. *See* Eastern Africa.

Following World War I, German East Africa (Deutsch-Ostafrika) was divided into British-administered Tanganyika (amalgamated since 1964 with Zanzibar as Tanzania) and Belgian-administered Ruanda-Urundi (now Rwanda and Burundi); the small Kionga (Quionga) triangle was allocated to Portuguese East Africa (now Mozambique). Until 1920 Kenya was generally known as the East Africa Protectorate.

World War II necessitated closer cooperation between the various territories and led to the establishment in 1948 of the East Africa High Commission, which, after the British-administered territories gained independence, in turn in 1961 developed into the East African Common Services Organization (EACSO), which became the East African Community in 1967. Economic tensions led to a progressive erosion of these links, and by 1977 the community ceased to function.

East African local race, a subgroup, roughly corresponding to a breeding isolate in genetics, of the Negroid (African) geographical race, comprising the populations of East Africa and The Sudan. The physical type of the East African local race is primarily one of adaptation to a hot, dry climate; it is marked by long, thin body build, long, narrow face and nose, and moderate to heavy skin pigmentation. The Sudanese peoples are dark-skinned and extremely tall and thin (linear) in build. The other East African populations are also more or less linear in build and somewhat lighter skinned than the Sudanese. All have dark eyes and dark hair, wavy to frizzy in texture. *See also* local race; Negroid geographical race.

Karamojong tribesman, northern Kenya
George Rodger—Magnum

East African Rift Valley, also called AFRO-ARABIAN RIFT VALLEY, GREAT RIFT VALLEY, or RIFT VALLEY, part of the most extensive rift on the Earth's surface, extending from Jordan in southwestern Asia southward through Africa to Mozambique, with a total length of 4,000 miles (6,400 km) and an average width of 30 to 40 miles (48 to 64 km).

In the north the rift is occupied by the Jordan River, the Dead Sea, and the Gulf of Aqaba. It cotinues southward along the Red Sea and into the Ethiopian Danakil depression to lakes Rudolf, Naivasha, and Magadi in Kenya. The rift is less obvious through Tanzania, because the eastern rim is much eroded, but it continues southward through the Shire Valley to the coast of the Indian Ocean near Beira, Mozambique. The western branch of the rift extends from the northern end of Lake Nyasa in a great arc including the lakes Rukwa, Tanganyika (second deepest in the world at 4,710 feet [1,436 m]), Kivu, Edward, and Albert (Mobuto Sese Seko). Most of the lakes in the rift system are very deep and fjordlike, sometimes with their floors well below sea level.

The plateaus adjacent to the rift generally slope upward toward the valley and provide an average drop of from 2,000 to 3,000 feet (600 to 900 m) to the valley floor. In some places, such as the Gikuyu and Mau escarpments, the drop averages more than 9,000 feet (2,700 m). The rift is thought to have been formed in Pliocene and Pleistocene times and was accompanied by extensive volcanism along parts of its length, producing such mountains as Kilimanjaro (19,340 feet [5,895 m]) and Kenya (17,058 feet [5,199 m]).

East Anglia, traditional region of England, the easternmost, consisting of the counties of Norfolk, Suffolk, and parts of the counties of Cambridgeshire and Essex. The traditional central town is the cathedral city of Norwich, which since 1961 has been the site of the University of East Anglia and its Centre of East Anglian Studies.

The area is low and undulating and almost entirely covered with glacial deposits. The valleys are shallow, and most are occupied by rivers (notably the Wensum and the Waveney) that drain into the North Sea.

The area's regional unity depends as much on history as on physiography. It has been settled for thousands of years. Colchester, the oldest recorded town in England, was important in pre-Roman and Roman times. East Anglia was one of the kingdoms of Anglo-Saxon England, consisting of the north people (Norfolk), the south people (Suffolk), and adjacent communities. Raedwald (died between 616 and 628) was the first king of East Anglia about whom anything is known. The Sutton Hoo ship burial and the treasure that it contained, now housed in the British Museum, indicate the wealth of the East Anglian kings. During the medieval period East Anglia was known for its wool and the manufacture of woolen products, and from the 14th to the 18th century Norwich was the major weaving town in England.

The modern economy of the region is predominantly agricultural. Crops have replaced sheep as the mainstay. Barley is the major crop, and except in the extreme south it occupies more land than all the other crops combined; market gardening is also considerable in some areas. Along the coast are a number

of important fishing ports and holiday resorts. Light industry has developed in most of the towns.

East Asian arts, the music and visual and performing arts of China, Korea, and Japan. The literature of these three countries is covered in separate articles under Chinese literature, Korean literature, and Japanese literature.

A brief treatment of East Asian arts follows. For full treatment, *see* MACROPAEDIA: East Asian Arts.

Ultimately, China can be seen as the source of many of the major aspects of the Korean and Japanese arts. Despite this assertion, however, those elements of Chinese culture and arts that were not simply adopted have undergone such significant acculturation—adaptation to geography, race, and religion—that they have become distinct and recognizable national arts.

The most important of the visual arts in China is calligraphy. Its expressive qualities exemplify all that is important in the visual arts, for the artist's goal is never simply representation or realism, but rather the revelation of essence. Painting and calligraphy are considered the only true fine arts in China because they alone require no physical labour, and they have no physical function. Sculpture is considered to be a craft, as are bronze casting, carving, and the making of pottery, textiles, metalwork, and lacquer ware. Each of these crafts was heavily influenced by the aesthetics—especially the rhythmic movement of line—of the painters and calligraphers. Chinese architecture is characterized by timber buildings, and a building typically consists of a platform, a post-and-lintel frame, a roof truss, and a heavy, sloping roof.

Korean visual arts through the ages exhibit great simplicity of form, treatment, and use of decoration, as well as a concern for naturalism. Among the remarkable features of Korean art might be noted the use of stone in architecture and sculpture (particularly during the Great, or United, Silla period, 668–935) and the development of a celadon glaze that was outstanding in its quality and shading.

Japanese visual arts reflect a fascination with surface and with outward appearance. One of its principal characteristics is the concern for decorative effect. The subject matter of Japanese art often has its origins in literature, and frequently what appears to be a simple landscape is allusive. The introduction of Buddhism in the mid-6th century had a profound effect on the imagery and style of the architecture and sculpture of Japan, as it had on Korean arts. Though calligraphy and brush painting were as significant to the Japanese as they were to the Chinese, during the late Heian period (794–1185) Japanese arts emerged from the shadow of China. In an important departure from the Chinese aesthetic sense, Japanese crafts began to gain much respect and the practitioners of those crafts a hitherto unexperienced influence. Another development of note in Japanese art was the colour-print movement (Ukiyo-e) of the Tokugawa period.

East Asian music, unlike Western, or European, music, established pitch by means of an end-blown bamboo flute rather than the plucked string. Despite this difference, however, both music systems developed a pentatonic scale based on a 12-tone vocabulary. The preferred size of the Chinese musical ensemble is small, and East Asian composition emphasizes melody and rhythm over harmonics.

Early Chinese music is marked by use of wind and percussion instruments including the globular flute (*xun*), panpipe (*pai-xiao*), mouth organ (*sheng*), stone chime (*ging*), drum (*gu*), bell chime (*zhong*), and percussion idiophones (*zhu* and *wu*).

The rich variety of Chinese music today can be classified as vocal, balladic, dance, theatrical, or instrumental. Vocal music is characterized by a close fusion of melodic progression, the Chinese language, and an economic use of musical idioms; balladic music involves literary creativity fully supported by musical expressiveness; and dance music is characterized by polyrhythmic tempos and large instrumental ensembles. In the orchestral, ensemble, and solo instrumental music of China, multipart formal design dominates, and a four-stage development—consisting of an introduction (*gi*), an elucidation of the theme (*cheng*), a transition (*zhuan*), and a summing up (*he*)—is common.

The documented history of Japanese music began sometime before the 8th century. During the Heian period, the various kinds of music, imported and indigenous, were arranged in an order that remained unchanged until modern times. The general term *To-gaku* (Tang music) embraced all music from and instrumentation typical of China and south and central Asia. All Korean, northeast Asian, and Manchurian music was incorporated into *Koma-gaku.* The term *mikagura* was used for the music of the imperial Shintō rites and some song dances of the earliest times. Though it continued to develop along its own lines, Japanese music remained strongly influenced by Chinese music and, later, Western styles.

Early Korean music included many elements of Chinese court music, but aspects of indigenous music (of a ritual, shamanistic nature) were also present. Several early instruments survive, and the *kayakeum* board zither, an indigenous instrument, remains in use throughout the country.

In the related categories of East Asian dance and theatre, it is interesting to note that in the East Asian countries, music, dance, and drama are typically linked, and there is little evidence of separate evolution of form that can be seen in Western ballet and theatre. The several forms of East Asian performing arts include both masked and unmasked dances, masked dance theatre (as in Japanese nō), danced processionals, dance opera, shadow theatre, puppet theatre, and dialogue plays with music and dance.

East Aurora, village, Erie county, western New York, U.S., 12 miles (19 km) southeast of Buffalo, but, oddly enough, situated 90 miles (145 km) west of Aurora, N.Y. Settled in 1804, it was incorporated as Willink in 1849 and as East Aurora in 1874. Inspired by William Morris and his communal Kelmscott Press in England, Elbert Hubbard established the Roycroft Shops (handicrafts) and the Roycroft Press in East Aurora in 1895. There he printed *The Philistine* magazine and his "Message to Garcia." The Roycroft enterprises, which closed in 1939, became known for their excellent craftsmanship and at one time employed more than 1,000 local people. East Aurora is primarily residential. Pop. (1986 est.) 6,500.

East Australian Current, surface oceanic current, a section of the counterclockwise flow in the Tasman Sea, southwest Pacific Ocean. It is formed by water masses from the Coral Sea—equatorial water driven by monsoonal winds from January to March and eastward subtropical flow from April to December—which pass southeast between the Great Barrier and Chesterfield reefs (latitude 20° S), paralleling the east coast of Australia into the Tasman Sea. Narrowing as it approaches latitude 25° S, the current is strongest off Cape Byron, New South Wales. It weakens and begins to dissipate beyond latitude 32° S, but its remnants continue to drift southward until, off Tasmania, they swing eastward and begin to flow north as the Tasman Current. At the surface its salinity is more than 35 parts per thousand, increasing to a maximum of 35.8 at a depth of 660 feet (200 m). Reaching depths greater than 3,300 feet (1,000 m), the East Australian Current transports about 1,100,000,000 cubic feet (30,000,000 cubic m) of water per second.

East Avon (river, England): *see* Avon.

East Berlin, German OST BERLIN, eastern part of the city of Berlin (*q.v.*) that served as the capital of the German Democratic Republic (East Germany) until the reunification of the German state in 1990.

East Borneo (Indonesia): *see* Kalimantan Timur.

East Cambridgeshire, district, county of Cambridgeshire, east-central England, occupying an area of 253 square miles (655 square km) northeast of the city of Cambridge. Lying primarily within the Fens, an extensive area of reclaimed marshland, the district has a slightly elevated chalk upland (covered by unstratified glacial drift) in the southeast. The small city of Ely, the district seat, with its famous cathedral was, prior to the draining of the Fens in the 17th century, an isolated locale on an island of glacial drift amidst the marshlands. The section of the Fens around Ely is an important area for sugar-beet cultivation; cereals, onions, potatoes, fruits, and various other horticultural produce are also intensively grown. Wicker Fen, 10 miles (16 km) south of Ely, is the only substantial remnant of undisturbed marshland in the Fens. A haunting place rising several feet above the adjacent cultivated lands, Wicker Fen's 730 acres (295 hectares) are a sanctuary for rare insects, birds, and plants. The district has few woodlands and little industry. Littleport, Soham, and Haddenham are local agricultural centres in the Fens. The Stained Glass Museum in the cathedral at Ely displays panels of painted glass representing the development of the craft from the 14th century to the present. Pop. (1986 est.) 58,400.

East Cape, local government region, east-central North Island, New Zealand. With an area of 4,425 square miles (11,461 square km), it includes the easternmost promontory of North Island, the Raukumara Range, and the Waioeka, Motu, Waiapu, Waipaoa, Waimata, and other rivers. It is bounded by the Bay of Plenty local government region to the west and by the Pacific Ocean to the north and east. The cape was the first landing site of Europeans in New Zealand; the British navigator Captain James Cook in 1769 anchored in Poverty Bay near modern Gisborne. A relatively remote area, East Cape has remained a major centre of Maori settlement.

A large part of the region is above 2,000 feet (600 m) in elevation, and the limited lowland areas are composed of numerous river valleys and the narrow coastal alluvial plains. Once heavily forested, the land has been extensively deforested by farming and logging, causing serious soil erosion and floods on rivers such as the Waipaoa. The hills are used for grazing; crops are limited to the Poverty Bay flats around Gisborne, which is the only sizable town, and to the vicinity of Opotiki on the Bay of Plenty. Roads circle the coast and cross the peninsula from Gisborne (southeast) to Opotiki (northwest). Pop. (1988 est.) 53,800.

East Cape (Russian S.F.S.R.): *see* Dezhnyov, Cape.

East Caucasian languages: *see* Dagestanian languages.

East Champāran (India): *see* Purba Champāran.

East Chicago, industrial city and port, Lake county, northwestern Indiana, U.S., adjoining

Gary, Hammond, and Whiting. It is a part of the Chicago-Calumet industrialized metropolitan complex. Laid out in 1887, its industrial development was stimulated by construction of Indiana Harbor, connected with the Grand Calumet River by a 3-mile (5-kilometre) ship canal and including an extensive system of docks. Its densely concentrated industries include foundries, oil refineries, a refractory, a railway-equipment shop, and factories producing chemicals, industrial tanks, and valves. East Chicago's diverse ethnic population includes Mexican-Americans, blacks, and eastern Europeans. Inc. 1889. Pop. (1988 est.) city, 36,446.

East China Sea, Chinese (Wade-Giles) TUNG HAI, or (Pinyin) DONG HAI, arm of the Pacific Ocean and part of the China Sea (*g.v.*). It covers about 480,000 square miles (1,240,000 square km) and is bounded by the islands of Cheju (north), Kyūshū (northeast), Ryukyu (east), and Taiwan (south) and by China (west). Its Chinese name means "eastern sea."

East Cleveland, city, suburb of Cleveland, Cuyahoga county, northeastern Ohio, U.S., just southeast of Lake Erie. The site was settled in 1801 by farmers, and East Cleveland township was organized in 1805. The boundaries were reduced, and the village, which was incorporated in 1895, became a city in 1911. Suburban growth was aided by the streetcar. Primarily residential, the city has some industrial development and is the site of Nela Park, headquarters of General Electric's Lamp Division. Its Forest Hill Park was once part of the summer estate of John D. Rockefeller, the oil magnate. The Warner-Swasey Observatory of Case Western Reserve University is nearby. Pop. (1988 est.) 36,560.

East Dereham, also called DEREHAM, town ("district"), county of Norfolk, Eng., 16 miles (26 km) west-northwest of Norwich. The site of a 7th-century Christian convent, it was destroyed by invading Danes. The parish church, dating from the 12th century, contains painted Perpendicular-style ceilings, the former tomb of the church's presumed 7th-century founder, St. Withburga (in a ruined chapel), and the tomb of the 18th-century poet William Cowper. Cowper's house no longer exists, and its site is occupied by the Cowper Memorial Church. East Dereham is an agricultural centre, producing farm equipment and containing flour mills. In Swanton Morley, 3 miles (5 km) northeast of East Dereham, is a beautiful church (*c.* 1370), containing a large window commemorating the men of a nearby Royal Air Force station. Pop. (1981) 11,910.

East Detroit, city, Macomb county, Michigan, U.S., 10 miles (16 km) north-northeast of Detroit. It is primarily a residential suburb of Detroit but does have such commerce as truck and poultry farming, as well as light manufacturing. First settled in 1837, it was on the military road (now Gratiot Avenue) connecting Fort Wayne (Detroit) with Fort Gratiot (Port Huron). Equidistant between Detroit and Mount Clemens, it was incorporated as Halfway Village in 1924. It adopted its present name in 1929 when it became a city. Pop. (1988 est.) 36,022.

East Devon, district, county of Devon, southwestern England, occupying an area of 315 square miles (817 square km) in the southeastern part of the county and bordering Lyme Bay of the English Channel on the south. East Devon is a district historically known for its handmade-lace and carpet-making industries in the eastern-interior market towns of Honiton and Axminster. High-quality limestone has been quarried near the central coastal town of Beer for centuries; it was used for the finer carvings and pillars in many of Devon's medieval, Tudor, and Jacobean buildings. Modern East Devon is also known for its popular cliffside resorts, especially in the southwest at Exmouth and Sidmouth, and for its intensively cultivated fruits (particularly apples) and early-season vegetables grown on the fertile red soils of the lower Exer, Clyst, and Otter river valleys in the western part of the district. Dairying is also economically important.

Cliffs of red sandstone and white chalk some 400 feet (120 m) high along most of the seacoast, and the hilly wooded area immediately inland (especially to the east) constitute an area of outstanding beauty and are so designated by the government.

Bronze Age barrows (burial mounds) are commonplace in the hills south of Honiton and near the village of Dalwood. East of Honiton is the Loughwood Meeting House, an excellent example of a mid-17th-century English Baptist chapel with an unaltered interior. Sidmouth is the district seat. Pop. (1986 est.) 113,200.

East End, traditional area of London, lying east of a line formed by Shoreditch High Street, Houndsditch, Aldgate High Street, and Tower Bridge Approach. It extends eastward to the River Lea and lies mainly in the inner London borough of Tower Hamlets (*q.v.*). The East End began to take on an identity of its own in the 19th century. In the European Middle Ages the area was part of the great parish of Stepney. Once overcrowded and an area of much poverty, the East End has undergone considerable reconstruction following widespread air-raid damage of World War II. Points of interest include Toynbee Hall, the Whitechapel Art Gallery, and the Spitalfields Market.

East European Plain (Soviet Union): *see* Russian Plain.

East Falkland, one of the two major islands of the Falkland Islands in the South Atlantic Ocean. It is 90 miles (140 km) long and 55 miles (88 km) wide and rises to Mount Usborne (2,312 feet [705 m]). The total area is 2,550 square miles (6,605 square km), excluding adjacent small islands. The town of Stanley is on the northeast shore. Pop. (1986) 1,620.

East Flanders, Flemish OOST-VLAANDEREN, French FLANDRE ORIENTALE, *province,* northwestern Belgium, extending southward from the Netherlands border with an area of 1,151 square miles (2,981 square km). Drained by the Lys (Leie), Scheldt (Schelde), and Dender rivers, it is divided into six administrative *arrondissements* (Aalst, Dendermonde, Eeklo, Ghent, Oudenaarde, and Sint-Niklaas). It was formerly part of the old county of Flanders, other parts of which are contained in West Flanders *province,* the French *département* of Nord, and the Dutch province of Zeeland. During the French Revolutionary and Napoleonic periods, it formed part of the *départements* of Lys and Scheldt.

An area of low hills, the *province* lies in interior Flanders, rising inland from the coastal plain. The soil is mixed sand and clay in the north, more fertile alluvial clays in the south. In the northeast, to the west of the Scheldt estuary, are the fertile reclaimed polderlands of the Waasland (Pays de Waes) region. Agriculture has been practiced intensively since the European Middle Ages, much of it on a horticultural scale, for the holdings are small, particularly in the south. Ornamental plants and flowers are grown for export around Ghent; rye, potatoes, and vegetables in the north. The Waasland supports market gardening, bush fruits, and dairy and poultry farms. The more fertile south produces wheat, oats, barley, flax, hops, chicory, sugar beets, and tobacco. Fodder crops and cattle and pig raising are widespread.

A textile region since the Middle Ages, inland Flanders has also long had a flourishing industrial and commercial economy. Cotton has replaced wool and linen as the most important textile product; other textiles (jute, rayon, and nylon) are also produced. The chief centre is Ghent (the capital), which accounts for half of the country's textile production. Other textile towns include Deinze, Ronse, Oudenaarde, Geraardsbergen, Aalst, Ninove, and Dendermonde, many of which also have metallurgical, chemical, food-processing, and leather industries. Sint-Niklaas and Eeklo are busy market towns. The *province* is well served by road and rail communications. Canals link Ghent with Brugge (Bruges), Ostend, and Terneuzen (Netherlands), and the rivers carry a heavy traffic.

Flemish-speaking East Flanders is one of Europe's most densely settled areas, with a population density in excess of 1,150 persons per square mile (440 per square km). Pop. (1988 est.) 1,328,779.

Articles are alphabetized word by word, not letter by letter

East Friesland, German OSTFRIESLAND, cultural region bordering the North Sea and encompassing the coastal marshlands and East Frisian Islands (Ostfriesische Inseln) of northwestern Niedersachsen *Land* (Lower Saxony state), north-central Germany. The region has close cultural ties with West Friesland in The Netherlands and North Friesland on the west coast of the Jutland Peninsula. The Frisians, traditionally known as a Germanic seafaring and commercial people, migrated to northern Germany from the Holland coast in the 12th century AD. The use of the old Frisian language, a dialect closely related to English, is diminishing in East Friesland; it is spoken only in a few small rural pockets, among these the marshy Saterland region west of Oldenburg. East Friesland is predominantly Protestant.

The modern economy is based on cattle farming and related dairy and meat industries. Farms tend to be localized on raised mounds (Würten), where early inhabitants were forced to build for protection against flooding, or the farms are situated in linear strings (Marschhufendörfer) along dikes and canals with their fields extending at right angles in long, narrow strips. The traditional single-story Frisian house is especially adapted to cattle farming. One vast, steeply sloping roof shelters the *Diele,* a large central threshing floor, and the living quarters and stables grouped around it. The *Diele* is entered through a large gateway at the gable end of the building.

East Galloway (Scotland): *see* Kirkcudbright.

East Greenland Current, cold flow of water originating in the Arctic Ocean and flowing southward and southwestward along the east coast of Greenland. *See* Greenland Current.

East Greenland Geosyncline, a linear trough in the Earth's crust in which a fragmentary belt of rocks of late Precambrian and early and middle Paleozoic age (650 to 350 million years ago) were deposited along a portion of the eastern coast of Greenland. Deformation of the geosyncline occurred during several phases of the Caledonian orogeny (mountain-building episode) between Late Silurian and Late Devonian times (408 to 374 million years ago). The deformation resulted in folding, westward thrusting, and development of angular unconformities beneath and within Devonian sedimentary rocks and was accompanied by the intrusion of Silurian and Devonian granites.

The East Greenland Geosyncline may represent the west flank of the Caledonian Geosyncline, the remainder of which is now exposed

along the northwest coast of Norway, prior to continental rifting in Paleozoic time.

East Greenwich, town (township), seat of Kent County, central Rhode Island, U.S., on Greenwich Bay, south of Providence. It was settled and incorporated as a town in 1676, at the end of King Philip's (Indian) War, and was named for Greenwich in London. Farming, fishing, shipbuilding, pottery-making, and tanning were early industries. During the Revolutionary War, the home of William Greene, governor of Rhode Island, served as the capitol; originally built in 1680 by Samuel Gorton, Jr., it was enlarged by Greene and is preserved. The Independent Company of Kentish Guards, a volunteer militia that is still active, was formed 1774 in East Greenwich under Gen. James Mitchell Varnum, whose house (1773) is restored with period furnishings; the Guard's Armory and headquarters, built in 1842 in Greek Revival temple form, is a town landmark. Other notable buildings include the Kent County Courthouse (1750) and Windmill Cottage (pre-1800), bought by Henry Wadsworth Longfellow for his friend George Washington Greene and made the subject of a Longfellow poem. Once the textile industry was important; manufactures are now diversified and include machinery, metals, food products, printing materials, chemicals, and jewelry. Pop. (1980) 10,211.

East Grinstead, parish (town), Mid Sussex district, county of West Sussex, England, lying south of London in the wooded countryside of the Weald within easy commuting range of the metropolis. Its market charter dates back to 1121, and the town centre contains old buildings, as well as modern shops that serve an extensive residential district. The Queen Victoria Hospital (founded 1889) became after 1939 a world-renowned centre for plastic surgery. At nearby New Chapel, the first Mormon temple in Great Britain was completed in 1958. Pop. (1981 prelim.) 22,263.

East Hampshire, district, county of Hampshire, southern England, occupying an area of 199 sq mi (515 sq km). East Hampshire, a rural area of chalk uplands, is where the most westerly extensions of the North Downs, Weald, and South Downs generally merge. The terrain, at elevations of 600 to 800 ft (180 to 240 m), is undulating with interspersed scarps and valleys. The district's two principal parishes (towns), Alton and Petersfield (the district seat), have many important historical sites. Alton, in the north, is situated on the Pilgrims' Way (a prehistoric route between the English Channel and the chalk heartland of Britain) and is known for the Curtis Museum of rural implements, an old Norman tower, the house (1590) of the poet Edmund Spenser, and the Church of St. Lawrence, containing bullet marks from the English Civil War (1642–51). The novelist Jane Austen was born immediately to the southwest. Historic landmarks of Petersfield, in the southern part of the district, include a Norman church, Georgian houses, and an equestrian statue (1724) of William III (1650–1702). The Old Churcher's College (1723) has been transformed into an office block. The village of Selborne was the home of Gilbert White (1720–93), the naturalist who wrote *The Natural History and Antiquities of Selborne*, the first work on natural history to attain the status of an English classic. Agriculture (the raising of vegetables, fruits, and hops) supplemented by dairy farming is the main economic activity in the district. Brewing industries operate in Alton and Petersfield. Pop. (1982 est.) 91,600.

East Hampton, town (township), Suffolk County, southeastern New York, U.S., near the southern shore of Long Island, 100 mi (161 km) east of New York City; it includes East Hampton village. Settled in 1648 by English yeomen from Kent and first called Maidstone, the town prospered as a whaling and fishing centre. Several colonial homes have survived. Lyman Beecher, father of the orator and preacher Henry Ward Beecher and Harriet Beecher Stowe, author of *Uncle Tom's Cabin,* was pastor (1799–1810) of the town's Presbyterian church. East Hampton village is now a fashionable summer resort. Historic buildings include the birthplace (a colonial saltbox [*c.* 1660] with an old windmill [1774], now a museum) of John Howard Payne (1791–1852), who wrote "Home, Sweet Home"; Hook Mill, a windmill built in 1806; and Clinton Academy (1784), the first academy chartered by the state of New York. Inc. 1920. Pop. (1980) 14,029.

East Hartford, urban town (township), Hartford County, central Connecticut, U.S., across the Connecticut River from Hartford. The area, called Podunk by the Indians, was first settled in 1639 by John Crow. Organized as a parish in 1746 and originally part of Hartford, it was incorporated as a separate town in 1783 and experienced early industrial development (papermaking and the manufacture of gunpowder, cotton goods, hats, and watches). Its area was reduced in 1823 when Manchester was separately incorporated. It includes the villages of Hockanum and Burnside and is heavily industrialized. Pop. (1980) 52,563.

East Haven, urban town (township), New Haven County, southern Connecticut, U.S., on Long Island Sound, just east of New Haven and separated from Branford (east) by Lake Saltonstall (about 3 mi [5 km] long). Originally a part of New Haven called Iron Works Village, it was renamed East Haven in 1707 and was incorporated as a separate town in 1785. It then included the entire east shore of New Haven Harbor and was primarily an agricultural community. In the 1880s its western portion was rejoined to New Haven, leaving a narrow strip pointing inland (7 mi long and 1.5 mi wide) with some tidal marshes along a limited coastal plain. Agriculture and truck gardening remain significant activities, but some light manufacturing has developed. East Haven has several colonial houses, and its Old Stone Congregational Church (1774) was built from local red sandstone. The Branford Trolley Museum displays electric street and interurban railway cars. Pop. (1980) 25,028.

East Hertfordshire, district, county of Hertfordshire, southeastern England, occupying an area of 184 sq mi (477 sq km) at the northern edge of the Greater London Greenbelt. East Hertfordshire district is largely undulating and rural, characterized by medieval manor houses and thatched cottages. The River Lea, navigable to barge traffic from the London docks to the town of Hertford, drains the southwestern part of the district, and the River Stort forms the southeastern boundary before joining the Lea at the district's southern tip. Cereals are cultivated in the fertile northern and central parts where the soil consists of unstratified glacial drift. Farther south the less fertile heavy clays are used primarily as grazing land for dairy cows.

The first English canal, the New River aqueduct, 23 mi (40 km) long, was built in 1613 from springs southeast of the town of Ware in the southern part of the district to Stoke Newington and Hornsey in North London to augment London's water supply and is still in use, even though the Ware vicinity is no longer the source of the water. Malt breweries utilizing locally grown cereals are located in Ware, Bishop's Stortford, and Sawbridgeworth. Other industries in the district include brush making, printing, and light manufacturing. Hertford is the administrative seat for the county of Hertfordshire but shares district administration with Bishop's Stortford, Sawbridgeworth, and Ware. The Rhodes Memorial Museum (founded 1938) at Bishop's Stortford commemorates the life of Cecil (John) Rhodes, the empire builder of British South Africa. Pop. (1982 est.) 110,700.

East India Company (Dutch): *see* Vereenigde Oost-Indische Compagnie.

East India Company, also called ENGLISH EAST INDIA COMPANY, formally (1600–1708) GOVERNOR AND COMPANY OF MERCHANTS OF LONDON TRADING INTO THE EAST INDIES, or (1708–1873) UNITED COMPANY OF MERCHANTS OF ENGLAND TRADING TO THE EAST INDIES, English company formed for the exploitation of trade with the Far East and India, incorporated by royal charter on Dec. 31, 1600. Starting as a monopolistic trading body, the company became involved in politics and acted as an agent of British imperialism in India from the early 18th century to the mid-19th century.

The company was formed to share in the East Indian spice trade, then a monopoly of Spain and Portugal, which was exposed by the defeat of the Spanish Armada (1588). Until 1612 the company conducted separate voyages, separately subscribed. There were temporary joint stocks until 1657, when a permanent joint stock was raised.

The company met with opposition from the Dutch in the Dutch East Indies (now Indonesia) and the Portuguese. Although the Dutch virtually excluded company members from the East Indies after the massacre of Amboina (1623), the company's defeat of the Portuguese in India (1612) won them trading concessions from the Mughal Empire. The company settled down to a trade in cotton and silk piece goods, indigo, and saltpetre, with spices from South India. It extended its activities to the Persian Gulf, Southeast Asia, and East Asia. After the mid-18th century the cotton-goods trade declined, while tea became an important import from China. This was financed by opium exports, eventually leading to the Opium War (1839–42). The company faced opposition to its monopoly, which led to the establishment of a rival company and the fusion (1708) of the two as the United Company of Merchants of England trading to the East Indies.

The United Company was organized into a court of 24 directors who worked through committees. They were elected annually by the Court of Proprietors, or shareholders. When the company acquired control of Bengal (1757), Indian policy was for a time (1757–73) influenced by shareholders' meetings, where votes could be bought by the purchase of shares. This led to government intervention. The Regulating Act (1773) and Pitt's India Act (1784) established government control of political policy through a Board of Control responsible to Parliament. Thereafter the company gradually lost both commercial and political control. Its commercial monopoly was broken in 1813, and from 1834 it was merely a managing agency for the British government of India. It was deprived of this after the Indian Mutiny (1857), and it ceased to exist as a legal entity in 1873.

East India Company (French): *see* Indes, Compagnie des; Indes Orientales, Compagnie des.

East Indiaman, large sailing vessel of the type built from the 16th to the 19th century for the trade between Europe and southern Asia. The first were Portuguese and Dutch; English Indiamen appeared late in the 16th century and eventually came to dominate the trade. The ships varied in size from about 400 to 1,500 tons and more; often they were larger than contemporary men-of-war. They were three-masted and invariably well-armed for protection against piracy.

East Indies, most of the islands of the Malay Archipelago, extending in a wide belt along the equator for more than 3,800 miles (6,100 km) between the Asian mainland (northwest) and Australia (southeast). Borneo, Celebes, Java, New Guinea, and Sumatra are the major islands. Political units in the East Indies are Brunei, Indonesia, and Malaysia (Papua New Guinea and the Philippines are sometimes included). Historically, the term East Indies was loosely applied to either the islands of what is now the Republic of Indonesia (formerly know as the Netherlands Indies, or Dutch East Indies), or the Malay Archipelago (including the Philippines), or to the foregoing plus all of Southeast Asia and India.

The land. The East Indian islands, which separate the Indian Ocean on the south and west from the Pacific Ocean on the north and east, fall into two distinct groups—those such as Sumatra, Borneo, Java, and New Guinea, which rest wholly or in part on the continental shelves; and the islands between Bali and Borneo in the west and Aru and New Guinea in the east, which are the isolated peaks of submerged mountain ranges.

At the centre of the region is the Sunda platform, which is covered by shallow seas and termed the Sunda Shelf. The Sunda Shelf is a stable continental extension of mainland Southeast Asia. The neighbouring Sahul Shelf, of which New Guinea and related islands are a part, is similarly an extension of the Australian continent. It was around this nucleus that the rest of the region was gradually built up by the formation of successive series of folds on its outer margins. Further and more extensive mountain building occurred in Mesozoic times. Scattered at various points in the region are more than 200 volcanoes, of which some 70 in Indonesia have erupted during the last 150 years. During the last four major ice ages, when the sea level was more than 300 feet (100 m) lower than at present, the Sunda and Sahul shelves lay exposed, and across this surface flowed large rivers. Land bridges enabled animals and early humans to migrate across the region. When the ice sheets melted about 17,000 years ago, the Sunda platform was partly flooded, and the ridges and higher ground became islands and peninsulas covered by shallow seas.

The relief of the region's islands is dominated by rugged mountain backbones, which are capped in volcanic zones by numerous cones, many of which rise to well over 10,000 feet (3,000 m). In the more stable area around the Sunda Shelf, the mountain slopes are smooth in outline from long weathering; in the unstable regions, where the mountain chains are more recent, the outlines of relief are often irregular. There are wide estuaries on several islands, formed by drowning of river mouths, while along many of the shallower shores, such as in eastern Sumatra, western and southern Borneo, and southwestern New Guinea, there are vast belts of swamps. The waterlogged character of these areas has made them less suitable for human habitation than the better-drained and more fertile alluvial terrains found in east-central Java, northern Sumatra, and parts of the Lesser Sundas.

The mountainous nature of the islands, plus the generally high annual rainfall, results in many short, steep-gradient rivers with erosive power. On the islands that lie on the continental shelves, the rivers deposit eroded material in the shallow surrounding seas and rapidly build extensive floodplains and deltas. Across these lowlands develop long rivers, such as the Musi in Sumatra, the Kapuas and Barito in Borneo, and the Sepik and Fly in New Guinea. The islands that rise steeply from the deep seas between the continental shelves have little opportunity to build coastal plains and deltas in the surrounding deeps; level lowlands are limited and the rivers are usually short and steep.

Soils in the region exhibit considerable diversity. The soils of the volcanic belt and their alluvial derivatives are quite rich, such as those in central and eastern Java, some parts of Sumatra, and in various more scattered localities in Celebes. Laterite soils occur in Malaya, Borneo, and other islands of the stable Sunda Shelf, but these are agriculturally poor and sometimes virtually useless. In the larger Indonesian islands there are vast coastal swamps fringing the Sunda Shelf, where dead vegetation tends to accumulate on the surface and makes the potential fertility of these areas of little practical use.

The East Indies lie entirely within the tropics and within 10° of the equator. Because of this equatorial location, temperatures are high, averaging 80° F (27° C). The annual variation in temperatures is only a few degrees at the equator but increases away from the equator. Annual variation in temperature is modified by the maritime influence of the surrounding seas.

The variable element in the climate is rainfall, which ranges from more than 320 inches (8,130 mm) annually on exposed mountain slopes in Sumatra and Java to less than 20 inches (500 mm) in rain-shadow areas of western Celebes and the Lesser Sunda Islands. Most of the archipelago averages more than 80 inches (2,000 mm) of rainfall well distributed through the year, but the total decreases and the length of the dry season increases from central Java eastward through the Lesser Sundas. Another climatic element is the typhoon. More than 20 of these storms arise each year in the southwest Pacific from July through November and then swing westward and northward.

Throughout most of the East Indies, heavy rainfall and high temperatures result in continuous, rapid plant growth of great variety. Evergreen tropical rain forest covers areas with ample rainfall. In drier areas there is a semideciduous monsoon forest, including such trees as teak and eucalyptus. This forest has seasonal rather than continuous growth. Other forest types include coastal forests (mangrove, nipa palms, pandanus), swamp forests, and mountain forests. There are more than 150 species of palms, including the coconut, lontar, sugar, sago, and areca palms, and bamboo is found in all areas. Large areas of the natural forest have been repeatedly cleared by human agriculture and are now dominated by cogon grass (*Imperata cylindrica*).

The flora of the East Indies is among the most varied in the world. More than 30,000 species of trees, shrubs, and grasses belonging to more than 2,500 families have been recorded. This wealth of different species is the result of the heavy rainfall, long growing period, relief, variety of environments, and the position of the East Indies as a bridge between Asia and Australia. Mingling of the flora and the fauna of these two continents takes place in the islands.

While the fauna of the Malay Archipelago is very rich, there are few large animals. Elephants, tigers, rhinoceros, wild cattle, tapir, and orangutan are all part of the Asian fauna. They are unevenly distributed on the islands of the Sunda Shelf and indicate differing periods of connection between these islands. Of the Australian fauna, kangaroos are found in New Guinea and other marsupials have moved beyond the Sahul Shelf as far as Timor and Celebes. Some of the islands in between have endemic species, such as the anoa, or dwarf buffalo, and the giant monitor lizard, or "dragon," of Komodo Island near Flores in the Lesser Sundas. Insects and birds have wider distribution, and the archipelago has perhaps the richest insect and bird life of the world. Particularly notable are the large longicorn beetles, the giant butterflies, the exotic birds of paradise, argus pheasants, and myriad-coloured cockatoos.

The people. The dominant population of the East Indies appears to have entered the area from the South and Southeast Asian mainland. Among the region's original inhabitants were Negroid peoples known as Negritos. They were displaced or absorbed by migrants from Asia known as Proto-Malays beginning about 4,000 years ago. The Proto-Malays brought with them wet-rice cultivation and domestic livestock. They were followed about the 3rd century BC by Malays proper from Southeast Asia. The Malayan peoples spread over all of what is now Indonesia and the Philippines as well. On the Asian continent (except for the Malay Peninsula) they were eventually dispossessed or absorbed by incoming peoples such as the Mon-Khmer, Thai, and Burmese. The Malay racial stock of the East Indies subsequently underwent minor intermixtures with Arabs, Indians, and Chinese. The peoples of the East Indies speak various languages belonging to the Austronesian, or Malayo-Polynesian, family of languages. The cultural diversity of the modern population of the East Indies is largely the result of cultural influences emanating from Hinduism, Islām, and Buddhism.

The economy. The importance of agriculture in the region can hardly be overemphasized, as most of the people are farmers or are directly dependent on farming and secondary industries based on agriculture. The East Indies' agricultural economy is varied. Most of the farmers are sedentary peasant cultivators who grow irrigated rice but also sometimes corn (maize), yams, or cassava as their principal food crop. The region's intensely cultivated rice-growing areas are on the fertile alluvial soils of river valleys, deltas, and coastal swamps. Such cash crops as sugarcane, copra, spices, rubber, tobacco, and natural fibres are also grown by smallholders. Plantations produce valuable exports of rubber, palm oil, sisal, cinchona (quinine), and tea, as well as some coffee, tobacco, and copra. Nomadic hill cultivators raise subsistence crops of rice and corn in upland areas. The role of livestock is limited and herding is rare, except in the eastern Indonesian archipelago. The usual large animals raised are buffalo and cattle. Animal power for tilling is basic to agriculture in the region.

Forests provide valuable resources in timber and in resins, rattans, and other forest products. Timber exports are particularly important in the less developed economies of Borneo and Sumatra.

Although the region cannot be regarded as one of the world's great trading groups, it accounts for more than half of the world's natural rubber exports and about one-third of its tin exports. In Indonesia, only one-seventh of the gross domestic product comes from manufacturing, and in other countries of the region it ranges between 10 and 25 percent. Rural industries include rubber and palm oil processing, small-scale rice milling, and brick and tile works. Urban industries include large-scale rice milling, rubber remilling, tin smelting, spinning and weaving, and the manufacture of glass, soap, cigarettes, and other consumer goods.

Much of the region that is underlain by the Sunda Shelf lies within one of the world's most highly mineralized belts and is rich in tin, gold, copper, zinc, silver, lead, iron ore, manganese, chromium, cobalt, vanadium, molybdenum, and tungsten. Extensive deposits of limestone, fluorite, kaolin, gypsum, marl, silica sands, and salt also occur. The emergence of independent nations after World War II not only led to the intensification of the production of the traditional minerals but also to the production of a wide range of other minerals previously ignored, as for example, petroleum,

natural gas, iron ore, bauxite, nickel, and copper. Petroleum-producing areas extend across Brunei and eastern Borneo; bauxite and nickel are mined in Indonesia. The development of mining had a tremendous impact on the landscape and on the location and development of urban communities and communications.

History. A number of Indianized kingdoms, located mainly on Sumatra, Java, and Borneo, rose and fell during the first 15 centuries of the Christian era. Islām reached the region in the 14th and 15th centuries from the Middle East and from India, and Malacca in Malaya became both the main entrepôt for trade and also the centre for the propagation of Islām. European domination began in the 16th century. The Portuguese captured Malacca in 1511. The Portuguese were ousted by the Dutch, and the East Indies, despite British efforts to intervene, fell under Dutch control. The Portuguese were left with the marginal possession of Timor. European dominance was replaced by that of the Japanese during World War II. This period stimulated the growth of nationalism and the emergence of new nations after the war: Indonesia (1949), Malaysia (1963), Papua New Guinea (1975), and Brunei (1984).

East Java (Indonesia): *see* Jawa Timur.

East Kazakhstan (Kazakh S.S.R.): *see* Vostochno-Kazakhstan.

East Kilbride, district, Strathclyde region, southwestern Scotland, created by reorganization in 1975 from part of the former county of Lanark. The district covers an area of 110 square miles (285 square km). It includes farmland in the south devoted mainly to dairy cattle and centres on the new town of East Kilbride, designated in 1947 to house and provide industrial employment for overflow population from Glasgow. Pop. (1987 est.) 81,718.

East Kilbride, burgh, Scotland's first post-World War II planned new town. It was built around the old pastoral village of East Kilbride, in the district of East Kilbride, Strathclyde region, Scotland, to accommodate overflow population from the nearby metropolitan complex of Glasgow. The name suggests early Celtic association with St. Bride or Brigit.

Milk bottling and agricultural engineering were already important industries before East Kilbride was designated a new town in 1947. The burgh's new industries are light engineering and the manufacture of a variety of consumer goods. It also houses the National Engineering Laboratory. Pop. (1982 est.) 71,600.

East Lansing, residential and university city, Ingham county, Michigan, U.S., on the Red Cedar River. The site was a remote area east of Lansing when Michigan State University, a pioneer land-grant school, was founded there as Michigan Agricultural College in 1855. First known as College Park, the city was redesignated East Lansing by the state legislature at the time of its incorporation in 1907. It now adjoins the state capital of Lansing. Pop. (1988 est.) 48,960.

East Lindsey, district, county of Lincolnshire, east-central England. It occupies an area of 680 square miles (1,762 square km) along the North Sea in the northeastern part of the county. East Lindsey's most significant physiographic component is the chalk upland of The Wolds, about 10 miles (16 km) wide and 500 feet (150 m) high, in the north and centre of the district. To the west lies a fertile clay valley, and south of The Wolds is a section of the Fens (an extensive area of reclaimed peat and silt marshland); on the east lie the Lincoln Marshes, a flat plain interspersed with islands of fertile, unstratified glacial drift. The elevation of both the Fens and the Lincoln Marshes is only slightly above sea level, making embankments necessary along the North Sea coast to avoid flooding. Sandy shores along the seaward side have given rise to holiday resorts at Skagness and Mablethorpe.

This extremely arable district grows a variety of crops, including wheat, barley, potatoes, and vegetables. Dairy cattle are grazed, especially in the valley to the west. Louth, the district seat and a light industrial centre at the eastern edge of the uplands, is dominated by the spectacular Perpendicular Gothic spire of its Church of St. James. Horncastle, in the western valley, was formerly known for its horse fairs. The poet Alfred Tennyson spent his childhood in the village of Somersby, in the upland area of open country east of Horncastle. Pop. (1986 est.) 110,500.

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East Liverpool, city, Columbiana county, eastern Ohio, U.S. It lies along the Ohio River (there bridged to Newell and Chester, W.Va.), at a point where Ohio, Pennsylvania, and West Virginia meet. Founded in 1798 by Thomas Fawcett, an Irish Quaker, it was originally called St. Clair and then Fawcettstown. After it became a village in 1834, it was renamed for Liverpool, Eng. It is known for its porcelain and pottery industry, which was established in 1840 to exploit local clay deposits. The Tri-State Pottery Festival is held there in June. The construction of the high-lift navigation dam at Stratton, a few miles downstream, and its nearness to Great Lakes ports and highways make the city an important river terminal. A branch (1966) of Kent State University is in East Liverpool. Inc. city, 1882. Pop. (1986 est.) 15,640.

East London, Afrikaans OOS-LONDEN, port city, Cape province, South Africa. It lies at the mouth of the Buffalo River along the Indian Ocean.

Buffalo Harbour, first visited by the British in 1836 and named Port Rex, was used as a supply base during the seventh Kaffir War (1847). In the same year, Fort Glamorgan (now a prison) was built, and the site was annexed to Cape Colony as the Port of East London. It prospered after the arrival of German settlers in the late 1850s, becoming a town in 1873 and a city in 1914.

The city has beach resort facilities. Built mainly on the east bank of the river, it has wide straight streets and gardens. It is a terminus of the South African Railways servicing the Orange Free State goldfields and an entrepôt for the nearby (not internationally recognized) independent black states of Transkei and Ciskei. There is a considerable fishing industry and diversified manufactures. The East London Museum (established 1921) has a noteworthy natural history collection. Pop. (1985) 85,699.

East Lothian, district, Lothian region, eastern Scotland. Created by the reorganization of 1975, it consists of the former county of East Lothian (bordering Edinburgh) and a small portion (8 square miles [21 square km]) of the former county of Midlothian. It lies on the southern coast of the Firth of Forth and includes part of the Lammermuir Hills. The district has an area of 275 square miles (712 square km); Haddington is the seat of the district authority.

In the European Middle Ages the old Scottish county (frequently called Haddingtonshire until the 20th century) lay in the path of the English invaders and was subject to much destruction during the 14th, 15th, and 16th centuries. In this period the feudal castles of Dirleton, Tantallon, and Hailes were built. There were also nunneries at Haddington and North Berwick, friaries at Haddington, Luffness, and Dunbar, and the Holy Well at Whitekirk, a place of pilgrimage. John Knox was a native of East Lothian, and, by 1560, people had turned to the Reformed Church. The last battles fought in the county were those of Dunbar (1650) and Prestonpans (1745).

Conditions were more settled in the 18th century, and there was a further development of agriculture. The land was enclosed and drained, industries were started, and woods planted. The old settlements of group holdings gave way to centralized farms, each with a slated farmhouse, large pantiled service buildings, and a group of rubble and pantiled cottages. Mansion houses were built, and parks were walled and planted. Some new villages were established (Gifford, 1722, and Ormiston, 1732, are both of architectural interest), and Haddington and Dunbar developed as market towns.

Farming reached the height of prosperity in the 1870s. In the last years of the 19th century, golfing and holiday facilities were developed at North Berwick, Gullane, and Dunbar. Also, deep coal mines were sunk in the west of the county, notably at Prestonpans, which then became a mining town. Coal mining declined in the mid-20th century, and the last colliery closed in 1964. The district's manufacturing consists mainly of food-and-drink products and textiles, with new industries of precision engineering and electronic equipment. Pop. (1987 est.) 81,855.

East Malaysia, wing of the 13-state federation of Malaysia; it comprises the states of Sabah and Sarawak on the northern part of the island of Borneo and is separated from mainland West Malaysia on the Malay Peninsula by 400 miles (640 km) of the South China Sea. Pop. (1987 est.) 2,872,900.

East Mauch Chunk, former town in Pennsylvania, U.S., since 1954 a part of the town of Jim Thorpe (*q.v.*).

East Moline, city, Rock Island county, northwestern Illinois, U.S., on the Mississippi River. With Moline, Rock Island, and Davenport (*qq.v.*), Iowa, it forms an industrial complex known as the Quad Cities. Originally called Port Byron Junction, it was settled in 1895 and developed as a centre of manufacture of farm implements. There are large railway repair shops at Silvis, immediately east. East Moline State Hospital was established in the former village of Watertown (later annexed to East Moline). In Campbell's Island State Memorial an obelisk marks the site of a battle (1814) between troops led by Lieutenant John Campbell and Indians under Chief Black Hawk. Inc. 1907. Pop. (1988 est.) 20,328.

East Northamptonshire, district, county of Northamptonshire, south-central England, occupying an area of 197 square miles (510 square km) in the northeastern part of the county. The district is rural and agricultural in character except in the extreme south. It is covered with fertile glacial drift, and the gently rolling clay hills 200 to 300 feet (60 to 90 m) in elevation are bisected north-south for the length of the district by the River Nene. The four manufacturing towns at its southern end (Rushden, Irthlingborough, Higham Ferrers, and Raunds) grew as a result of the early development of leather-tanning and shoe-manufacturing industries, in association with such other nearby centres as Northampton. The contemporary economy of these locales, however, has become increasingly diversified and includes assorted light industries.

The two parishes (towns) of Oundle and Thrapston, farther north in the Nene Valley, serve as local market centres for adja-

cent stone-built villages in this mixed-farming area. Oundle, containing fine examples of 17th- and 18th-century town houses and 17th-century hostelries, is being preserved. Remnants of the Rockingham Forest, a former royal hunting preserve, are in the western part of the district. Thrapston is the district seat. Pop. (1985 est.) 62,800.

East Nusa Tenggara (Indonesia): *see* Nusa Tenggara Timur.

East Orange, city, Essex County, northeastern New Jersey, U.S., adjoining Newark on the northwest. Originally settled in 1666 by 30 families from New Haven, Conn., it was set off from Orange and established as a municipality in 1863. Mainly a residential suburb, it nevertheless has an industrial section, which has been called Ampere since F.B. Crocker and S.S. Wheeler began manufacturing electric motors there in the 1890s. Other manufactures include clothing, concrete and metal products, paint, and insecticides. Upsala College (Lutheran) was founded there in 1893. Inc. 1899. Pop. (1986 est.) 77,399.

East Pacific Rise, submarine mountain range on the floor of the south Pacific Ocean, generally paralleling the west coast of South America. It lies generally about 2,000 miles (3,200 km) off the coast, and its northernmost outliers extend as far north as the mouth of the Gulf of California and as far south as the continental rise of Antarctica south of New Zealand near the Antarctic Circle. The East Pacific Rise is a part of the mid-oceanic ridge system that extends into the Atlantic and Indian oceans. Its surface is generally smooth and flattish, and it drops sharply away at the sides. Its structure is largely of basic igneous crust, overlain or abutted by more or less flat-lying sediments. It rises from approximately 6,000 to 9,000 feet (1,800 to 2,700 m) above the surrounding seafloor and is extensively fractured by faults mostly occurring at intervals of roughly 200 miles (320 km).

East Point, city, Fulton County, Ga., U.S., a southwestern suburb of Atlanta. Established as the eastern terminus for the Atlanta and West Point Railroad (completed 1853), it was an important defense post for the South during the American Civil War and was the site of forts and ammunition depots. Now industrialized, it manufactures textiles, fertilizer, and metal products. Atlanta Christian College was opened there in 1937. Inc. 1887. Pop. (1986 est.) 40,310.

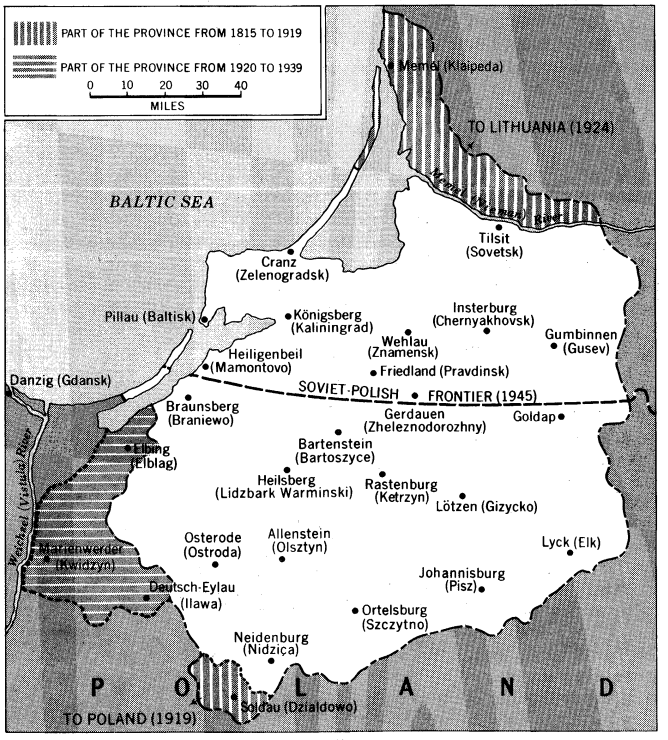
East Providence, city, Providence County, Rhode Island, U.S., on the eastern side of the Seekonk and Providence rivers, opposite Providence. Roger Williams, the founder of Rhode Island Colony, established himself on the site in 1636 but left at the request of Plymouth Colony. About 1644 it was settled by a company from Weymouth as part of the Massachusetts town (township) of Rehoboth. In 1812 the western part of Rehoboth was set off as the township of Seekonk. It was subsequently decided that western Seekonk belonged to Rhode Island, and that part was incorporated as the township of East Providence in 1862. City status was attained in 1958. Although it is primarily residential, the city has industries of its own. Chief products are chemicals, jewelry, and machinery. Storage facilities for refined-petroleum products have been built along the river. Pop. (1986 est.) 52,391.

East Prussia, German OSTPREUSSEN, former German province bounded, between World Wars I and II, north by the Baltic Sea, east by Lithuania, and south and west by Poland and the free city of Danzig (Gdańsk). After World War II its territory was divided between the Soviet Union and Poland.

The name Prussia is linguistically of Baltic origin; its ancient inhabitants, exterminated by the Knights of the Teutonic Order, called themselves Prusi. When the Knights conquered the Polish province of Pomorze in 1308, the name Prussia was extended westward to the whole territory administered by the Teutonic Order. In 1466 Poland recovered Pomorze; and, between that date and 1701 (when the elector of Brandenburg became king in Prussia), the country held directly by the crown of Poland was called Royal Prussia, to distinguish it from the land retained by the Knights as Poland's vassals, which became a secular duchy (Ducal Prussia) in 1525 and was freed from Polish suzerainty by the Treaty of Wehlau (1657). From 1815 the name East Prussia was given to the easternmost province of the kingdom of Prussia. The boundaries of this province remained unchanged until World War I. Its area was then 14,284 square miles (36,995 square km), and its population in 1910 was 2,064,175 and largely Lutheran. It had long since become a stronghold of Prussian Junkers, a military aristocracy who had vast estates there.

As a result of the Treaty of Versailles (1919), the Memel (Klaipėda) territory was taken from Germany (in 1924 it was incorporated into Lithuania); the district of Soldau (Dzialdowo) was given to Poland, while the regency of Marienwerder (Kwidzyn), which was formerly part of the province of West Prussia, joined East Prussia, now territorially separated from the rest of Germany by the Polish Corridor and Danzig.

After World War II, East Prussia was partitioned between Poland (the southern part) and the Soviet Union (the northern part), the frontier running north of Goldap, Bartenstein (Bartoszyce), and Braunsberg (Braniewo). With the exception of the Klaipėda territory, which was reincorporated into Lithuania, the northern part was incorporated into the Russian federation and colonized by Russians. Königsberg became Kaliningrad, Insterburg became Chernyakhovsk, and Tilsit became Sovetsk. In the southern part about 400,000 indigenous Poles remained, and immigrants from pre-1939 Poland replaced the Germans, who either had fled in 1944 or were evacuated after 1945.



Post-World War I and post-World War II boundary changes of the area of former East Prussia and its major towns

East Rājasthān Uplands, highlands in southeastern Rājasthān state, northwestern India, with an area of about 23,200 square miles (60,000 square km), east of the Arāvalli Range. The uplands range in height from 820 feet (250 m) in the northeast to 1,620 feet (495 m) in the southwest and form the northern part of the Central Highlands. The East Rājasthān Uplands, formed by past fluvial erosion and by geologically recent desert erosion, are bounded by the Upper Ganges Plain on the north, the Mālwa region on the south, the Madhya Bharat Pathār (plateau) on the east, and the Arāvalli Range on the west. The uplands are wide and stony, with a sandy central region. The valleys between the hill ranges are wide and stretch for many miles; flattened hilltops form small plateaus. Teak, sal (*Shorea*), and acacia trees and bamboo grow on the lower slopes of hills, and grasslands and pastures are found on the hilltops. The Banās River, rising in the eastern flank of the Arāvalli, is the main waterway in the highlands; the Kari, Kathari, and Bāngangā rivers flow eastward.

Agriculture constitutes the principal occupation of the uplands population; cereals, pulse (legumes), oilseeds, cotton, peanuts (groundnuts), sugarcane, and tobacco are grown. Most of the industries in the region are household ones.

East River, navigable tidal strait linking Upper New York Bay with Long Island Sound, New York City, U.S. It separates Manhattan Island from Brooklyn and Queens. About 16 miles (26 km) long and 600–4,000 feet (200–1200 m) wide, it connects with the Hudson via the Harlem River and Spuyten Duyvil Creek at the north end of Manhattan Island. Roosevelt (formerly Welfare), Wards, Randalls, and Rikers islands are in the East River. The Brooklyn, Manhattan, Williamsburg, Queensboro, Triborough, Bronx–Whitestone, and Throgs Neck highway bridges and the Hell Gate railroad bridge span it; vehicular, railroad, and subway tunnels pass under it. Port facilities are on southern portions of the river.

East Saint Louis, city, St. Clair county, southwestern Illinois, U.S. It lies along the Mississippi River opposite St. Louis, Mo. A ferry station was established on the site in 1797, and 20 years later a village was laid out. Originally known as Illinoistown, it was incorporated as a town in 1859, and, after absorbing adjacent East St. Louistown (laid out 1859), it was reincorporated as the city of East St. Louis. With the arrival of the first railroad (1855) and the building of the Eads Bridge (1874), the city developed as a transportation centre. Meat-packing became a major industry after the opening of the National Stock Yards (1873) in National City, which, although it has a separate government, is economically a part of East St. Louis.

By the mid-20th century the city's industrial activities included oil refining and the manufacture of chemicals, pigments, steel products, glass, and building materials. Changes in the city's racial composition in subsequent decades, however, were accompanied by a loss of industry and by economic impoverishment. Cahokia Mounds State Historic Site (containing prehistoric Indian burial grounds) is northeast. Pop. (1988 est.) 49,505.

East Saint Louis Race Riot of 1917 (July 2), bloody outbreak of violence in East St. Louis, Ill., stemming specifically from the employment of black workers in a factory holding government contracts. It was the worst of many incidents of racial antagonism in the United States during World War I that were directed especially toward black Americans newly employed in war industries. In the riot, whites turned on blacks, indiscriminately stabbing, clubbing, and hanging them and driving 6,000 from their homes; 40 blacks and 8 whites were killed.

On July 28 the National Association for the Advancement of Colored People (NAACP) staged a silent parade down Fifth Avenue in New York City, protesting the riot and other acts of violence toward black Americans. German propaganda magnified these incidents in an attempt to arouse antiwar sentiment in the American black community, and President Woodrow Wilson publicly denounced mob violence and lynchings, of which there had been 54 in 1916 and 38 in 1917.

East Scotia Basin, submarine trough of the eastern Scotia Sea, a part of the south Atlantic Ocean southeast of Argentina. Its midpoint lies about 1,300 miles (2,000 km) east of Tierra del Fuego; the basin extends about 700 miles (1,100 km) east–west and about 300 miles (500 km) north–south. It is bounded by the island of South Georgia to the north and by the South Sandwich Islands to the east. It has an average depth of 5,000 feet (1,500 m) and lies within the 2,700-mile- (4,340-kilometre-) long loop made by the Scotia Ridge that supports these islands. The Antarctic Circumpolar Current flows from west to east in the basin. The East Scotia Basin is separated from the West Scotia Basin by a minor submerged rise running between South Georgia and the South Orkney Islands. The greater part of the basin floor is covered by oozes made up of the skeletons of diatoms and foraminifera, although in some parts, manganese nodules are found.

East Siberian Sea, Russian VOSTOCHNO-SIBIRSKOYE MORE, part of the Arctic Ocean between the New Siberian Islands (west) and Wrangel Island (east). To the west it connects to the Laptev Sea by the straits of Dmitry Laptev, Eterikan, and Sannikov; to the east Long Strait connects it with the Chukchi Sea. The East Siberian Sea, with an area of 361,000 square miles (936,000 square km), is covered by ice much of the year. Its greatest depth is 510 feet (155 m), but it is as shallow as 30 to 65 feet (9 to 20 m) in the western and central parts. There are several island groups. Chief ports are Pevek, in the Chukchi Autonomous Okrug, and Ambarchik, in the Yakut Autonomous S.S.R.; navigation is limited to August and September.

East Staffordshire, district, county of Staffordshire, central England, occupying an area of 150 square miles (388 square km). East Staffordshire is essentially a gently rolling rural district. It is situated between the industrial areas of Stafford to the west, the West Midlands conurbation built on Birmingham to the south, Derby to the east, and the north Staffordshire coalfield region (centred on Stoke-on-Trent and also called The Potteries) to the north. It is drained to the east by the Trent and Dove Dale rivers.

The district is an area of mixed farming with emphasis on dairying. Its principal locality and the district seat, Burton-upon-Trent, is one of England's leading brewing centres; the Bass Museum located there illustrates the history of brewing from the 18th century and the influence of the pub on social life. The parish of Uttoxeter, 14 miles (22 km) northwest of Burton-upon-Trent, is the site of one of England's noted steeplechase courses. Pop. (1986 est.) 93,900.

East Sussex, county of southeastern England, bordering the English Channel. With an area of 693 square miles (1,795 square km), it is divided into the following districts: Brighton, Eastbourne, Hastings, and Hove, all boroughs, and Lewes (administrative centre), Rother, and Wealden.

A ridge of chalk hills, the South Downs, crosses the county along the coast, reaching the sea in a line of imposing cliffs, notably at Beachy Head. To the north of these hills, whose northern face forms an abrupt scarp line, lie the ridges of the Weald, an area of sands and clays widely covered by woodland and heath. In the southeast of the county, beyond Beachy Head, lie the reclaimed marshes of Pevensey Levels, historically an important point of entry into Britain for early invaders. A further line of cliffs lies along the coast eastward past Hastings.

In early times the chalk downs provided favoured sites for settlement; at Whitehawk Hill near Brighton are examples of Neolithic causewayed camps, and the Caburn Mount near Lewes is an Iron Age hill fort. The area provided the Romans with grain and iron ore. The South Saxons (hence the name Sussex) next dominated the area but were in turn subjugated by their Wessex neighbours. In 1066 William of Normandy (William I the Conqueror) landed at Pevensey and fought the decisive battle of Hastings a short distance inland; the town and abbey of Battle commemorate his victory. The Normans built numerous castles and abbeys; Pevensey Castle was built inside a Roman fort.

In the European Middle Ages an iron industry, based on local ore and charcoal, was developed in the Weald, but most of the county's more recent growth has been coastal, beginning with the rise to popularity in the late 18th century of Brighton as a seaside resort under royal patronage. Today Brighton and Hove, Peacehaven, Seaford, Eastbourne, Bexhill, and Hastings form an ever-lengthening line of resorts. With frequent electric-rail services to London, all these towns lie within commuting range of the capital.

The county boasts a wealth of architectural remains, including 12th- and 13th-century castles and abbeys and churches dating, in some instances, from Saxon times. Herstmonceux Castle (*c.* 1440) houses Britain's Royal Greenwich Observatory, formerly located at Greenwich. The University of Sussex was opened at Falmer near Brighton in 1961. Hops are grown in the county, but not so extensively as in the past, and cattle are raised. Pop. (1987 est.) 698,000.

East Syrian rite (liturgies): *see* Chaldean rite.

East Timor (Indonesia): *see* Timor Timur.

East–West Schism (Christianity): *see* 1054, Schism of.

East York, borough that, with the cities of North York, Toronto, Scarborough, York, and Etobicoke, constitute Metropolitan Toronto, southeastern Ontario, Canada. It has an area of 8 square miles (21 square km) and is bordered by the cities of Toronto (south and west), North York (north), and Scarborough (east). A planned industrial and residential urban complex, it was established on Jan. 1, 1967, through the amalgamation of the former East York Township (created in 1924 from York Township) and the former town of Leaside (settled by James Lea in 1819 and incorporated in 1913). The two communities were first linked in 1927 by a viaduct over the Don River. Pop. (1986) 101,085.

East Yorkshire, also called (1974–81) NORTH WOLDS, district (borough), county of Humberside, England. It extends over parts of the Yorkshire Wolds into the north of the Holderness Plain and includes the seaside resort of Bridlington and the small market town of Driffield. Its area is 403 square miles (1,044 square km).

The Wolds rise inland from Flamborough Head and reach 800 feet (300 m). Their dry chalk surface has little soil, and they are bleak and windswept. Although occupied in prehistoric times and early colonized by farmers from across the North Sea, they were sparsely settled in the later European Middle Ages and remained so until agricultural improvements undertaken in the 18th century. From this time extensive grazing of sheep for wool gave way to enclosure and advanced arable farming, based on grain and sheep (for meat).

A high proportion of labour still works on the land, with little alternative local employment except for the tourist trade on the coast, where Bridlington is the only well-equipped service centre. Pop. (1986 est.) 79,200.

Eastbourne, district (borough), county of East Sussex, England, on the English Channel coast. With an area of 18 square miles (46 square km), it lies at the eastern end of the chalk South Downs, which reach the sea in high cliffs at Beachy Head (534 feet [163 m]). The modern resort town of Eastbourne dates from the early 19th century and the coming of the railway. The town's development—in a spacious, regular layout—took place on the estates of the duke of Devonshire and others. The Wish Tower and the Redoubt are defenses dating from the Napoleonic threat of invasion. Eastbourne has grown as an attractive residential town, as well as a resort and conference centre. Pop. (1986 est.) 80,700.

Eastchester, town (township), Westchester county, southeastern New York, U.S., just east of Yonkers. Its first settlers issued their

Sarah Lawrence College dormitory, Bronxville, Eastchester, N.Y.

Milt and Joan Mann from CameraMann

own code of laws called the Eastchester Covenant (1665). Eastchester Township was organized in 1788 and derived its name from Chester, Eng., and at one time extended from Scarsdale to Goose Island in the Bronx. The town-at-large includes the unincorporated village of Eastchester and the villages of Bronxville (1898) and Tuckahoe (1903). Pop. (1986 est.) 20,197.

Easter, Latin PASCHA, Greek PASCHA, principal festival of the Christian Church Year, celebrating the Resurrection of Jesus Christ on the third day after his Crucifixion. Its origins go back to the beginnings of Christianity, and it is probably the oldest Christian observance after Sunday, which came to be regarded as the weekly celebration of the Resurrection. The English name *Easter* is of uncertain origin; the Anglo-Saxon priest Venerable Bede in the 8th century derived it from the Anglo-Saxon spring goddess Eostre.

Date of Easter. Western Christians celebrate Easter on the first Sunday after the full moon (the paschal moon) that occurs upon or next after the vernal equinox (on or about March 21). If the paschal moon, which is calculated from a system of golden numbers and epacts and does not necessarily coincide with the astronomical full moon, occurs on a Sunday, Easter day is the succeeding Sunday. Easter, therefore, can fall between March 22 and April 25. This rule was fixed after much controversy and uncertainty, which lasted in various parts of the church down to the 8th century. In the Eastern Orthodox Church, however, a slightly different calculation is followed, with the result that the Orthodox Easter, although sometimes coinciding with that of the West, can fall one, four, or five weeks later.

In the 20th century the possibility of a fixed date for Easter has been discussed and supported among some churchmen; adoption would depend on agreement being reached among the various churches. The second Sunday in April has been proposed.

Religious observances. The festival of Easter occurs on a particular Sunday, but its importance is emphasized in the worship of the church by the long preparation of Lent; by Holy Week, with its solemn services; and by the following 50 days until Pentecost (Whitsunday), a period known as Eastertide, or Paschaltide. Easter is central to the whole Christian year; not only does the entire ecclesiastical calendar of movable feasts depend upon its date but the whole liturgical year of worship is arranged around it. In the liturgical texts the emphasis is laid on its being the Christian Passover (the time of redemption).

By the time that the Christian liturgy had begun to take shape (2nd century), the Sunday Eucharist was preceded by a vigil service of Scripture readings and psalms. In this must be seen the origin of the Easter Vigil service, one of the striking celebrations of Easter in both East and West; from being a weekly observance the vigil has turned into an annual one at Easter only. As it is now constituted in the Roman Catholic missal, this vigil consists of the blessing of the new fire (a practice introduced during the early European Middle Ages); the lighting of the Paschal candle; a service of lessons, called the prophecies; followed by the blessing of the font and baptisms and then the mass of Easter. This pattern is quite primitive and, in its principal elements, can be traced back to the 3rd–4th century. In the course of time the vigil in the West (but never in the East) came to be celebrated on Saturday evening, then on Saturday afternoon, and finally, by the end of the Middle Ages, on Saturday morning. In 1951 (optionally) and 1955 (obligatorily) throughout the Roman Catholic Church, the Easter vigil was restored to the starting time of about 10:00 PM, so that the first mass of Easter begins at midnight.

The connection of baptism with Easter is of early date. During the first centuries the whole of Lent was not only a time of penance but also the period during which the catechumens (persons to be baptized) were prepared for baptism, which was given only once a year, at Easter. For the six weeks preceding Easter the catechumens were instructed in the Christian faith, and the texts of the Lenten liturgy in the Roman Catholic missal still preserve very clear indications of this practice. The catechumenate came to an end with the solemn baptisms of Easter night. This is the explanation of the present practice of the long ceremony of blessing the font on Easter night and of the great emphasis on baptism and its meaning and the many allusions to it still present in the Easter services.

Among the Eastern Orthodox and Russian Orthodox, perhaps even greater emphasis is laid on the central position of Easter not only as an annual observance of the church year but as a centrepiece in the whole worship and spiritual life of the church. The vigil service is preceded by a procession outside the church representing a fruitless search for the body of Christ. Then comes the joyful announcement, "Christ is risen," followed by the Easter Eucharist. When the procession first leaves the church, there are no lights anywhere, but on its return hundreds of candles and coloured lamps are lighted to show the splendour of Christ's Resurrection.

In the Church of England the Book of Common Prayer provides special anthems to take the place of the *Venite* (Psalms 95) at matins. Lutheran hymnbooks, which contain orders of service, use special sentences at Easter. The Book of Common Order of the Church of Scotland includes prayers for Easter, and the *Divine Worship* of the Methodists has an order of worship for Easter morning, but the use of them is not compulsory.

In the Protestant churches, Easter Sunday observances are the culminating point of a series of services held during Holy Week, beginning with Palm Sunday. It is customary for the sacrament of Holy Communion to be administered during Holy Week, but the time of its observance varies. Many denominations have established the custom of celebrating Holy Communion on Maundy Thursday (the Thursday before Easter); others administer the sacrament on Easter morning some time before the regularly established hour of worship. Many Protestant churches hold joint interdenominational Good Friday services, prepared under the auspices of the local ministerial association. These services in many communities centre on the traditional seven last "words" (or sayings) of Christ and are conducted from 12:00 noon to 3:00 PM with choirs and clergy of the participating denominations. This interdenominational pattern culminates in the Easter dawn service, which is of such interest in the United States that it commands wide television and radio coverage. The origin of the sunrise service is not known, but it would appear to be rooted in the Gospel narratives describing the Resurrection of Christ—*e.g.,* John 20, "Now on the first day of the week, Mary Magdalene came to the tomb early, while it was still dark." Mingled with this biblical warrant is an association with the spring of the year and the idea of the new birth symbolized in nature's renewal of itself out of the death of winter.

Popular customs. Around the Christian observance of Easter as the climax of the liturgical drama of Holy Week and Good Friday, folk customs have collected, many of which have been handed down from the ancient ceremonial and symbolism of European and Middle Eastern pagan spring festivals brought into relation with the resurrection theme. These customs have taken a variety of forms, in which, for example, eggs, formerly forbidden to be eaten during Lent, have been very prominent as symbols of new life and resurrection. The hare, the symbol of fertility in ancient Egypt, a symbol that was kept later in Europe, is not found in North America. Its place is taken by the Easter rabbit, the symbol of fertility and periodicity both human and lunar, accredited with laying eggs in nests prepared for it at Easter or with hiding them away for children to find.

Easter cactus (*Rhipsalidopsis gaertneri*), popular spring-flowering cactus, with flattened stems, grown for its bright-red blossoms that appear about Easter time in the Northern Hemisphere. The related *R. rosea* is the so-called dwarf Easter cactus, a diminutive plant with fragrant rose-pink flowers in abundance. A period of cool temperature (10° C; about 50° F) during winter is essential to the best flower-bud initiation.

These epiphytic cacti, native to rain forests of Brazil, where they grow perched on other plants, are often considered as the genus *Rhipsalis;* they were formerly grouped with *Schlumbergera* species, the Thanksgiving and Christmas cacti.

Easter Fracture Zone, submarine fracture zone in the Earth's surface, in the southeastern Pacific Ocean. The fracture zone is incompletely mapped but may be as long as 3,700 miles (5,900 km) extending east-southeastward from east of the Tuamotu archipelago, at latitude 20° S, longitude 131° W, to the Peru–Chile Trench at the 26° S parallel. The fracture zone is associated with several volcanic islands, including Easter Island, after which it was named. Maximum relief of the fracture zone's ridges and troughs is about 9,800 feet (3,000 m). The Peru Basin north of the lineament is about 13,000 feet (4,000 m) deep, several thousand feet deeper than the seafloor to the south.

The fracture zone intersects the East Pacific Rise, and the crest of the rise north of the fracture zone is several hundred miles west of the southern crest. Seismic activity along the fracture zone is limited to this offset, or transform fault. Seafloor spreading is believed responsible for the formation of the fracture zone, which is a scar produced by transform faulting.

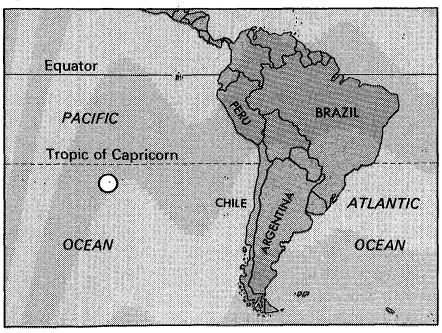
Easter Island, Spanish ISLA DE PASCUA, also called RAPA NUI, island in the eastern Pacific Ocean, 2,200 miles (3,600 km) west of Chile. It is a province that is administratively part of Chile's Valparaiso region.

A brief treatment of Easter Island follows. For full treatment, *see* MACROPAEDIA: Pacific Islands.

Easter Island has an area of 63 square miles (163 square km). The island's mixed population is predominantly of Polynesian ancestry; almost all live in the village of Hanga Roa on the sheltered western coast.

Initially inhabited about AD 400 by Polynesians from the Marquesas, the island has long been famous for the *rongorongo* hieroglyphs and remarkable monolithic stone statues in human form. They have evoked various legends and theories as to their origin. The statues, carved from tuff, a soft volcanic stone, range in height from 10 to 40 feet (3 to 12 m), some weighing more than 50 tons. The non-Polynesian vestiges on Easter Island have given rise to much speculation, but the most recent archaeological work indicates that most of the statues were erected in the Middle Period (AD 1000–1600) and that environmental degradation and fighting among the islanders (culminating in the Peruvian slave raids of 1862–63, in which about one-third of the population was carried off) brought precipitous decline to the island's fortunes. When a few of the abducted islanders were returned,

they brought smallpox and tuberculosis, and the island suffered further severe depopulation and cultural decline. With the introduction of Christianity in the later 1860s, the surviving Polynesian traditions were forgotten.



Easter Island

The first European to see Easter Island was the Dutch admiral Jakob Roggeveen, who paid it a single day's visit in 1722. In 1888 the island was annexed by Chile, which leased nearly all its territory for sheep raising. In 1954 the Chilean navy administration took over the sheep range; sheep ranching came to an end in the mid-1980s. The island is now administered by a civilian governor. Chile has declared the entire island a historic monument.

The small and hilly island is a typical oceanic high island formed by a series of separate underwater volcanic eruptions. Easter Island is mostly covered with grassland. The land is fertile and the climate subtropical, and farming is the traditional occupation. Cattle are raised, and some sweet potatoes, sugarcane, figs, bananas, gourds, taro, corn (maize), potatoes, melons, grapes, and pineapples are grown. Tourism, however, has become the mainstay of the economy. There is no natural harbour, but anchorage is found off the coasts of Hanga Roa to the west, Vinapu and Hotu Iti to the south, and Anakena to the north. There are a commercial airport, with flights from Santiago, Chile, and several small hotels on the island, but horses and four-wheel-drive vehicles are needed for local transport because of a lack of paved roads. Pop. (1989 est.) 2,095.

Easter Rising, also called EASTER REBELLION (1916), republican insurrection in Ireland against British government there, which began on Easter Monday, April 24, 1916, in Dublin. Those who took part were under the aegis of the Citizen Army, an association of Dublin workers formed to combat bad housing and labour conditions, and included some of the more extreme members of the nationalist Irish Volunteers, the Irish Republican Brotherhood (an older revolutionary society within the Volunteers), and the small Sinn Féin party.

The British had learned of the planned uprising and had already arrested the Irish nationalist Sir Roger Casement (April 21) in County Kerry for arms running for the rebels. Eoin MacNeill, the leader of the Irish Volunteers, therefore canceled mobilization orders for the insurgents, but the Citizen Army went ahead, so that only 2,000 men were involved. The Dublin General Post Office and other strategic points were seized, and a proclamation announcing the birth of the Irish republic was read aloud. For a week Dublin was paralyzed by street fighting, until bombardment and fires compelled the leader, Patrick Pearse, and his colleagues to surrender.

The execution of Pearse and 13 others changed the temper of the country. The Irish government collapsed, as the British prime minister H.H. Asquith admitted, and, from then until the establishment (Dec. 6, 1921) of the Irish Free State (an independent Ireland within the Commonwealth), the British made several attempts to govern, none of which was particularly successful. Irish Home Rule, involving a degree of autonomy, had been passed in 1914 but was suspended during World War I; nevertheless, the Easter Rising heralded the end of British power in Ireland. Eamon De Valera, because he was the senior survivor of the rising, dated much of his personal popularity with the Irish people from the time of that event.

Easter Vigil: *see* Holy Saturday.

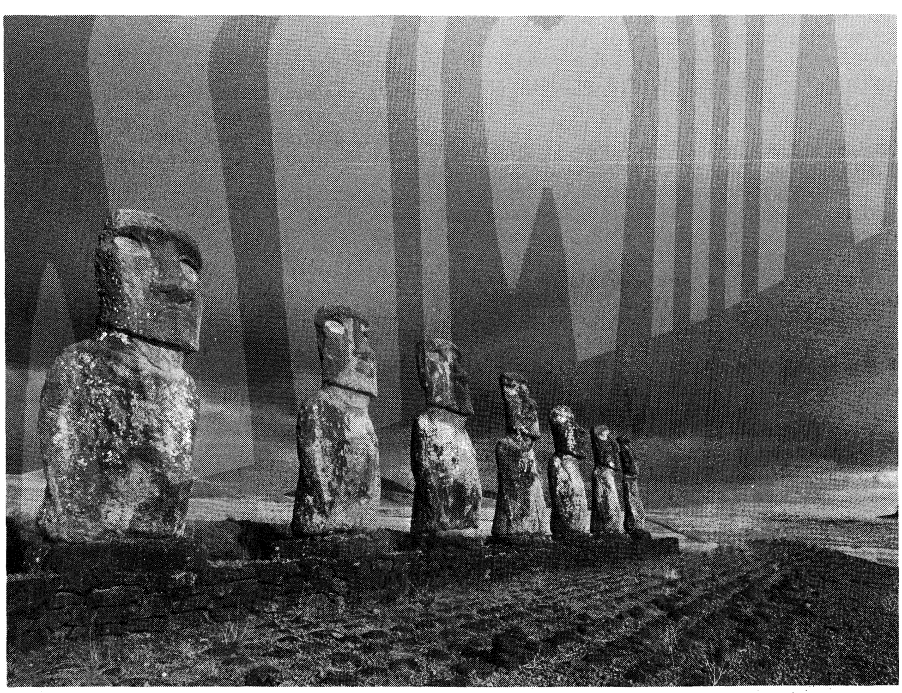
eastern Africa, region of the eastern African continent, extending southward from the Horn of Africa through the continental territories of the former British East Africa but excluding the country of Mozambique, once Portuguese East Africa. As defined by *Encyclopædia Britannica,* the region includes the modern countries of Djibouti, Ethiopia, Kenya, Somalia, Tanzania, and Uganda. Mozambique is treated in the MACROPAEDIA under southern Africa; the Indian Ocean island state of Madagascar is treated under its own name; and the other islands of the Indian Ocean, while often included in definitions of eastern Africa, are treated in the MACROPAEDIA under Indian Ocean Islands.

A brief treatment of eastern Africa follows. For full treatment, *see* MACROPAEDIA: Eastern Africa.

The six countries constituting the region occupy an area of 1,410,000 square miles (3,653,000 square km). Eastern Africa occupies several broad physiographic provinces: the northernmost portion belongs to the Ethiopian Highlands; they are terminated to the southeast by the lowlands (some below sea level) of the Afar Depression, a portion of the East African Rift System, which controls most of the major topographic features in the southerly reaches as far as Mozambique. The Horn of Africa, a major peninsular extension of the mainland into the Arabian Sea, contains the countries of Djibouti and Somalia, both predominantly lowland coastal plains; all of eastern Africa's southerly coastal areas are backed by the highlands of the Masai Steppe and the Nyasa Tableland, with the exception of Somalia's Benadir Lowland, which is relatively wide.

Culturally, eastern Africa has served as a meeting place over the centuries for a variety of peoples of African, Asian, and European extraction. Archaeological findings at the celebrated hominid sites of eastern Africa probably indicate that the area was the original site of the train of events that made proto-human hominids of 4 to 3 million years ago into the human race of today. Archaeological findings at sites of lesser antiquity in the area display Paleolithic, Neolithic, Iron Age, and Bronze Age human beings at various stages of cultural evolution.

The arrival of peoples representing most of eastern Africa's modern linguistic families was a complex process that has lasted for more than four millennia already and that in the late 20th century was further complicated by strands originating in all of the neighbouring continents as well.



Ahu Akivi statues, Easter Island

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Eastern Air Lines, Inc., major American airline, serving the northeastern and southeastern United States, with extensions to the western United States and (until 1990) the Caribbean and South America.

Founded by Harold Frederick Pitcairn (1897–1960) in 1928 as Pitcairn Aviation, Inc., the company was sold the following year and became Eastern Air Transport, one of the nearly four dozen divisions of North American Aviation, Inc. On March 29, 1938, it was incorporated as an independent company under its current name and sold for $3,500,000 to the former World War I ace Edward V. Rickenbacker and some associates. Rickenbacker, having been general manager for Eastern from January 1935, became president (1938–59). The airline flourished over the years and, in the 1970s and early '80s, acquired a number of other airlines.

By the mid-1980s Eastern began suffering financial reverses, and in 1986 the airline was taken over by Texas Air Corporation. Mismanagement continued, and in 1989 Eastern's profitable northeastern shuttle service was sold, a series of large-scale union strikes began, and the company went into bankruptcy. In 1990 Eastern's Latin American routes were all sold, and in April a U.S. federal bankruptcy court, criticizing Texas Air's treatment of Eastern, removed control from Texas Air and appointed a trustee to run Eastern Air Lines.

Eastern Austronesian languages: *see* Oceanic languages.

Eastern Chin, a phase of the Chin dynasty, ruling China from AD 317 to 420 and forming one of the Six Dynasties. *See* Chin dynasty; Six Dynasties.

Eastern Desert, Arabic AṢ-ṢAḤRĀ' ASH-SHARQĪYAH, also called ARABIAN DESERT, large desert in eastern Egypt. Comprising much of al-Baḥr al-Aḥmar *muḥāfaẓah* (governorate), the Eastern Desert extends from the Nile Delta southeastward into northeastern Sudan and from the Nile Valley eastward to the Gulf of Suez and the Red Sea. It consists of a rolling sandy highland that rises abruptly from the Nile Valley and merges some 50 to 85 miles (80 to 137 km) east of the Nile into a series of rugged volcanic, north–south-trending mountain chains (the Red Sea Hills), which rise to 6,000–6,500 feet (1,800–2,000 m) in the south. The Eastern Desert receives occasional rainfall and is extensively dissected by wadis (dry beds of seasonal streams). Most of the sedentary population lives in small fishing, mining, or petroleum-extracting communities along the Red Sea coastal plain east of the Red Sea Hills. Nomadic desert dwellers live by herding and trading. The Eastern Desert, relatively isolated from the rest of Egypt, is rich in natural resources including Egypt's major oil fields (located both onshore and offshore in the Red Sea) and deposits of phosphate, asbestos, manganese, uranium, and gold.

Eastern Highlands (India): *see* Purvachal.

Eastern Indian bronze, also called PĀLA BRONZE, any of a style of metal sculptures produced from the 9th century onward in the area of modern Bihār and West Bengal in India, extending into Bangladesh. They are sometimes referred to as Pāla bronzes, after the name of one of the reigning dynasties (Pāla and Sena, 8th–12th century AD). The principal centres of production were the great Buddhist monasteries at Nālandā (near modern Patna) and Kurkihar (near Buddh Gayā). Images were exported all over Southeast Asia, so that the style influenced Burma, Siam (modern Thailand), and Java. Its impact on the Buddhist art of Kashmir, Nepal, and Tibet also is clearly recognized.

The bronzes, strictly speaking, consisted of an alloy of eight metals and were cast by cire perdue (the lost-wax process). They represent the various divinities of later Buddhism (especially Śiva and Vishnu) and, being mainly small and portable in size, were intended for private worship. In style the metal images largely continued the Gupta tradition of Sārnāth but endowed it with a certain heavy sensuousness. They differ little stylistically from contemporary stone sculptures of the region but surpass the stone images in the precise definition of ornamental detail and in a certain elegant virtuosity.

Eastern Indian bronze Buddha, c. 9th century AD; in the Nālandā Museum, Bihār, India

P. Chandra

Eastern Indian painting, also called PĀLA PAINTING, school of painting that flourished in the 11th and 12th centuries in the area of what is modern Bihār and Bengal. Its alternative name, Pāla, derives from the name of the ruling dynasty of the period. The style is confined almost exclusively to conventional illustration on palm leaves of the life of the Buddha and Buddhist divinities, though painting on cloth and on wall surfaces must also have been known.

A Buddhist divinity, Eastern Indian painting on palm leaf, c. 12th century; in a private collection

P. Chandra

The style disappeared from eastern India after the conquest of the area by the Muslims in the late 12th century, but many of its features were preserved in Nepal. The style also influenced the art of Tibet, to a lesser extent that of Burma, and possibly even that of Ceylon (now Sri Lanka) and Java. The widespread nature of the influence is partly explainable by the travel of pilgrims who visited the great Buddhist centres of eastern India and carried back to their homes portable icons such as paintings and small bronzes.

The paintings mostly depict the numerous deities evoked by later Buddhism and were used to aid in the evocation of the deities. They had, accordingly, to conform to the same strict iconographic rules used in the production of contemporary stone and bronze icons.

The narrow leaf of the palm determined the size of the miniatures, which were approximately 2¼ by 3 inches (6 by 8 cm). The leaves were threaded together and enclosed in wooden covers, which were frequently painted. The outlines were first drawn in black or red, then filled in with flat areas of colour—red, blue, green, yellow, and touches of white. The compositions are simple and the modeling vestigial.

Eastern Orthodoxy, official name ORTHODOX CATHOLIC CHURCH, one of the three major doctrinal and jurisdictional groups of Christianity, characterized by its continuity with the apostolic church, its liturgy, and its territorial churches. Eastern Orthodoxy follows the faith and practices that were defined by the first seven ecumenical councils. Its adherents live mainly in the Balkans, the Middle East, and the Soviet Union.

A brief treatment of Eastern Orthodoxy follows. For full treatment, *see* MACROPAEDIA: Eastern Orthodoxy.

Eastern Orthodoxy is embodied in a family of autonomous churches that recognize the titular headship of the patriarch of Constantinople (the ecumenical patriarch) and are in communion with each other. Eastern Orthodoxy maintains the same seamless institutional continuity with the earliest Christian churches that Roman Catholicism does and recognizes the same sacraments. Cultural and political factors, not theological ones, caused the separation of the two communions. Culturally, the split between Western Christianity (Roman Catholicism and Protestantism) and Eastern Orthodoxy perpetuates the Roman Empire's division into a Western half, in which Latin was the dominant language, and an Eastern half, in which Greek was dominant among literate people.

From the 4th century onward these two halves drifted apart politically. The Roman Empire in the West succumbed to barbarian invasions in the 5th century. The pope, who had long enjoyed a primacy of honour in the entire church, then emerged as the heir to much of the vanished empire's authority. In the East the Roman Empire, although weakened, survived for a thousand years more as what modern historians call the Byzantine Empire. There the patriarch of the capital, Constantinople, emerged as the head of the church, but, as a subject of an all-powerful emperor, he never assumed the independent authority of a pope. A tendency for Orthodox churches to accept a subordinate role in the nation-state is a Byzantine legacy.

The earliest Christian literature was in Greek, and Christianity, even at Rome, was long predominantly Greek. The Greek tradition ceased to predominate in the 5th century, when the majority of Christians in Egypt and Syria, who until then had accepted Greek intellectual leadership, broke with the rest of the church over the decrees of the ecumenical councils of Ephesus (431) and Chalcedon (451). The Arab conquest of those provinces further weakened Eastern Christianity and made the 5th-century schisms permanent. In the meantime, Latin Christianity was spreading beyond the bounds of the old Roman Empire to win the loyalties of the peoples of the rest of western Europe. Only in the 10th century would the conversion of Russia by missionaries from Constantinople redress somewhat the balance between Eastern and Western Christianity.

The attempt to revive the Roman Empire in the West under Charlemagne in the 9th century produced the first overt tension between Rome and Constantinople, where minor differences in doctrine and ritual became an occasion of schism. The chief of these differences was the Western belief that the Holy Spirit, the third person of the Trinity, proceeds from

the Son as well as the Father, rather than, as the Greeks hold, from the Father alone. Greeks took offense when Western Christians inserted words to that effect (the *Filioque* clause) in the sacrosanct Nicene Creed and when Westerners charged them with heretically omitting them. Such differences effected a lasting schism that is dated in church history from the mutual excommunications of Pope Leo IX and Michael Cerularius, the patriarch of Constantinople, in 1054; this mutual nonrecognition persisted until 1965. The infamous Fourth Crusade, which overthrew the Byzantine emperor, sacked Constantinople, and installed a Latin patriarch submissive to the pope in 1204, created such ill-feeling in the East that later attempts at reunion were doomed.

Since that period Eastern Orthodoxy has maintained its identity and the loyalty of its people in the face of hostile Roman Catholic, Muslim, and Communist domination in all or most of its territory. From the fall of the revived Byzantine Empire to the Turks in 1453 until the Revolution of 1917, the Russian Church was the leader of world Orthodoxy. Russian missionaries to Alaska established Orthodoxy in the Americas in 1794, and immigration from eastern Europe made Eastern Orthodoxy a major factor in North American religious life. Most Orthodox in America remain organized along ethnic lines in churches that retain their European ties.

The beauty and richness of its ceremonial worship, which deliberately appeals to all the senses, is the most striking characteristic of Eastern Orthodoxy. Icons—formal paintings of Christ, the Mother of God, and the saints—play an important role in Orthodox worship. Orthodox theologians maintain that the veneration (as distinguished from worship) of icons results necessarily from Christian belief that God became man in the person of Jesus Christ, thereby divinizing human nature. The Orthodox commemorate the promulgation of the decrees of the second Council of Nicaea (787), which validated the veneration of icons, and the end of the Iconoclastic Controversy in 843 in the Feast of Orthodoxy on the First Sunday of Lent.

Monasticism and monastic spirituality have long played a vital role in Orthodoxy. All Eastern Orthodox bishops must be monks (and, hence, celibate), although married men may become priests. Monasticism has fostered Hesychasm, a distinctively Eastern form of mysticism, which employs breathing techniques and special posture, along with continual repetition of the Jesus Prayer, as aids to obtaining a vision of the so-called uncreated energies of the Godhead manifested as light. St. Gregory Palamas (fl. early 14th century), a monk of Mt. Athos, the great monastic community in northern Greece, gave Hesychasm its classic theological formulation.

The Eastern Orthodox churches have participated actively in the ecumenical movement of the 20th century. Most Orthodox churches have joined with the major Protestant churches as members of the World Council of Churches and have entered into theological discussions with many churches in order to promote understanding and unity. Relations between Eastern Orthodoxy and Roman Catholicism have, in particular, improved dramatically, especially since the removal of the anathemas of 1054. At the same time, the Orthodox have shown a determination to preserve their church's integrity and not to compromise their duty as legatees of a great tradition.

Eastern Question, diplomatic problem posed in the 19th and early 20th centuries by the disintegration of the Ottoman Empire, centring on the contest for control of former Ottoman territories. Any internal change in the Turkish domains caused tension among the European powers, each of whom feared that one of the others might take advantage of the political disarray to increase its own influence. This question arose periodically during the 19th century—*e.g.,* during the Greek War of Independence in the 1820s, in the Crimean conflict (1853–56), the Balkan crisis of 1875–78, the Bosnian crisis of 1908, and the Balkan Wars of 1912–13. The eventual distribution of the Ottoman territories was as follows: the Balkan provinces emerged in the course of the century as independent states, often under the influence of Russia or one of the other great powers; Great Britain occupied Cyprus in 1878 and Egypt in 1882 and acquired Palestine and Iraq as mandates after World War I; and France took over Syria and Lebanon in 1920. Turkey, the heart of the Ottoman state, won recognition as an independent republic in 1923.

eastern red cedar, also called PENCIL CEDAR (*Juniperus virginiana*), an evergreen ornamental and timber tree of the cypress family (Cupressaceae), native to poor or limestone soils of eastern North America. An eastern red cedar is 12 to 15 m (about 40 to 50 feet) tall and 30 to 60 cm (about 1 to 2 feet) in diameter. It has needlelike juvenile foliage and dark-green, scalelike mature leaves. The green, fleshy, rounded cones are about 0.7 cm (about ¼ inch) in diameter. Mature dark-blue cones are covered by a gray, waxy material. The fibrous bark may be reddish brown or ashy gray, and it separates into long, fringed scales. The fragrant wood is made into cabinets, fence posts, and pencils.

Eastern red cedar (*Juniperus virginiana*)
Grant Heilman—EB Inc.

Eastern rite church, also called EASTERN CATHOLIC CHURCH, any of a group of Eastern Christian churches that trace their origins to various ancient national or ethnic Christian bodies in the East but have established union (hence Eastern rite churches were in the past often called Uniates) or canonical communion with the Roman Apostolic See and, thus, with the Roman Catholic Church. In this union they accept the Roman Catholic faith, keep the seven sacraments, and recognize the pope of Rome as supreme head of the church. But they retain all other characteristics, such as liturgy, spirituality, sacred art, and especially organization, proper to themselves.

The special status of the Catholic churches of the Eastern rite was guaranteed at the time of each rite's union with Rome and was approved again by the decree of the second Vatican Council, in *De ecclesiis catholicis orientalibus,* promulgated on Nov. 21, 1964.

In the late 20th century, the number of Eastern Catholics throughout the world numbered more than 12,000,000.

History. Eastern Catholics, in contrast to Western, or Latin, Catholics, who have a history continuous from the 1st century AD, trace their origins largely to the failure of the ecclesiastical authorities at the Council of Ferrara–Florence in 1439 to unite Christians of the East and West. Stimulated by this unsuccessful beginning, however, and encouraged also by the later missionary activities of monastic orders, such as the Jesuits, Dominicans, Franciscans, and Capuchins, the proponents of the goal of the eventual reunion of Eastern and Western Christians began to achieve some elements of success.

The Brest-Litovsk Union of 1596—under which all but two Ukrainian Orthodox bishops submitted to the demand of their Polish Catholic king that they accept the primacy of the pope—in a substantial way signaled the effective advent of Eastern rite churches. Other smaller groups had united with Rome in previous centuries, but the Ukrainians who were united with Rome at this time were the largest branch of Eastern Catholics to move in that direction.

Prior to this event, Eastern Catholics were limited to Italo-Albanians in southern Italy and Sicily, a large number of Maronites (Lebanese Christians of the Syro-Antiochene rite) who became associated with Rome in the 12th century, and some Armenians in the Syria–Lebanon region who also trace their relationship with Rome to the 12th century. A number of Nestorians (followers of the 5th-century patriarch of Constantinople Nestorius, who was declared a heretic) were united with Rome in 1551, Ruthenians (an east central European people) in 1595, Romanians of Transylvania in 1698, and Melchites (Syrian Christians of the Byzantine rite) in 1724.

Political factors also played a role during the reunion process; Eastern Christians were, and are, much influenced by nationalistic loyalities in their respective regions. As these various groups of Eastern Catholics grew in number, Rome encouraged and established ecclesiastical hierarchies.

Relationship to other churches. Eastern Catholic churches correspond in kind to the more numerous Byzantine Orthodox churches and the Eastern independent, or Oriental, churches—*i.e.,* those that do not accept the decrees of the ecumenical Council of Chalcedon (451). Within this fuller context, Eastern Catholics as a group are the smallest segment within Eastern Christianity.

Furthermore, from the viewpoint of the Byzantine and non-Chalcedonian traditions, Eastern Catholics may be looked upon with suspicion, primarily because of the Latinizing influence found in their ranks. Hence the majority of Byzantine Orthodox and Eastern independent churches characterize Eastern Catholics as "Uniate" churches. The expression Uniate is taken from the Slavic *uniya,* a term coined by the opponents of the Brest-Litovsk Union. "Uniatism" implies hybridism, or the tendency for Latinization, and hence a betrayal of one's ancient and nationalistic tradition. Eastern rite churches would prefer to be considered as united churches rather than Uniate, with its negative implications.

Eastern rite churches make manifest the pluralistic composition of the Roman Catholic tradition. Permission for the various Eastern rites is a concession from Roman Catholic canon law, for a rite indicates more than liturgy; it points to an entire life-style and discipline of a church tradition. Eastern Catholic rites permit a married clergy and the immediate admission of baptized infants to the sacraments of communion (the Lord's Supper) and confirmation. In the "Decrees on the Catholic Churches of the Eastern Rite" adopted by the second Vatican Council (1962–65), the Roman pontiff reaffirmed the pledge of his predecessors to preserve the rites of the Eastern churches. "All the Eastern Rite members should know and be convinced," states the decree, "that they can and should always preserve their legitimate liturgical rite and their established way of life, and that these may not be altered except to obtain for themselves an organic improvement."

Organization. The supreme head of the Eastern rite churches is the pope. The central organ of the Holy See for them is the Congregation for the Eastern Churches. The prefect of this congregation is the pope himself, and a cardinal proprefect performs the ordinary functions of chairman. The congregation is competent for the Eastern churches in all matters (except certain specified cases) and has exclusive jurisdiction in specified countries in eastern Europe and the Middle East. The individual Catholic Eastern churches are organized differently according to their historical and ethnic situation, the number of adherents, the degree of evolution, and so on. The following organizational units are found.

Patriarchates comprise a certain number of dioceses of a single rite, under the jurisdiction of a patriarch. The patriarchs, according to the Eastern canon law, have special rights and privileges; in the general hierarchy they rank with the cardinals according to seniority (following the titular cardinal bishops of the suburban sees of Rome) and before all other bishops. In the late 20th century there were six Catholic Eastern patriarchates, as follows: one of Alexandria, for the Copts; three of Antioch, one each for the Syrians, Maronites, and Greek Melkites; one of Babylonia, for the Chaldeans; and one of Sis, or Cilicia, for the Armenians. The patriarchs of Babylonia and of Sis, or Cilicia, are properly called *katholikos.*

Major archiepiscopates are those which govern a certain number of dioceses of their rite but whose territory has not yet been erected into a patriarchate.

Metropolitanates govern ecclesiastical provinces independent of the patriarchates and major archiepiscopates and comprise a number of dioceses. One of them is the metropolis; and its archbishop, the metropolitan, is the head of the whole metropolitanate.

Eparchies correspond to the Latin dioceses. Although they are usually subject to one of the aforementioned higher organizations, a few are immediately subject to the Holy See or to a Latin metropolitan see.

Exarchies correspond to vicariates, and their bishops govern not by ordinary jurisdiction but by delegated authority.

Apostolic administrations concern territories whose administration the Holy See, for certain reasons, has assumed, entrusting them to the care of a neighbouring bishop or of a special bishop called an apostolic administrator. This kind of organization is intended to be transitory.

Ordinariates are the lowest organizational units, found either at an early stage of development, such as a mission, or in areas with a small number of faithful. Usually the head is not a bishop.

The rites. The term rite in "Eastern Catholic rites" signifies not only liturgical ceremonies but the whole discipline and organization of particular churches. In the late 20th century, there were five distinct Eastern rite traditions—the Byzantine, the Alexandrian, the Antiochene, the Chaldean, and the Armenian—each (except the last) with two or more branches.

The Byzantine rite is by far the most significant, affecting the most persons and most territories worldwide (many of the faithful are in the Americas). Its liturgy is based on the rite of St. James of Jerusalem and the churches of Antioch, as reformed by St. Basil and St. John Chrysostom. The liturgy is used by the majority of Eastern Catholics and by the Eastern Orthodox Church (which is not in union with Rome). The Byzantine branches include the Albanians, Bulgarians, Belorussians, Georgians, Greeks, Greek Catholic Melkites, Hungarians, Italo-Albanians, Romanians, Russians, Ruthenians, Slovaks, Ukrainians (or Galician Ruthenians), and Yugoslavs, Serbs, and Croatians.

The Alexandrian rite is found among the Egyptians and the Ethiopians. Its Coptic liturgy (known as the liturgy of St. Mark) is derived from the Greek liturgy of Alexandria, modified by several elements, including the Byzantine rite of St. Basil. Its two branches are the Copts (of Egypt) and the Ethiopians.

The Antiochene rite can be traced to Book 8 of the *Apostolic Constitutions* and to the liturgy of St. James of Jerusalem. Its branches include the Maronites (constituting the largest single group of Eastern Catholics in the Middle East and throughout the world), the Syrians, and the Malankarese (of India).

The Chaldean rite, though derived from the Antiochene rite, is listed as a separate and distinct rite by the Sacred Congregation for the Eastern Churches. Its branches include the Chaldeans (descended from the Nestorians) and the Syro-Malabarese (descended from the St. Thomas Christians of India).

The Armenian rite, using the liturgical language of classical Armenian, is based on the Greek liturgy of St. Basil, as modified by elements of the Antiochene rite. It consists of one group, the Armenians, found in the Middle East, Europe, Africa, the Americas, and Australasia.

Eastern Scheldt, Dutch OOSTERSCHELDE, channel extending about 30 mi (50 km) northwestward through the Delta Islands in southwestern Netherlands to the North Sea. A former estuary of the Scheldt River (as well as the Maas before completion [in 1970] of the Volkerakdam on the Volkerak Channel), the Eastern Scheldt consists of a main southeast–northwest channel between the islands of Tholen (northeast), Noord Beveland (southwest), and Schouwen and Duiveland (northwest), and the former island, now a peninsula, of Zuid Beveland. A smaller northeastern arm of the channel extends northwest of Tholen Island to the Volkerak Channel. The Eastern Scheldt is an area of shellfish (mussels, oysters, shrimp) cultivation and a wintering area for geese and other migratory birds.

During the late 1960s, construction of the Oosterscheldedam (or Eastern Scheldt Dam), originally designed as a pier dam for total closure of the channel to protect against storms and prevent silting, was begun at the mouth of the Eastern Scheldt. As work progressed on the dam, deleterious effects on the marine environment resulted, including an imbalance of the water's salt content and a decrease in the shellfish and migratory-bird populations. The design of the dam was modified, and upon completion in 1986 it was a storm surge barrier permitting the channel to be a reduced tidal saltwater area. Secondary dams include the Oesterdam in the eastern part of the Eastern Scheldt and the Philipsdam in the Volkerak Channel north of Sint Philipsland peninsula. The Oesterdam forms freshwater Lake Zoom and is connected by the Eendracht (Scheldt-Rhine Canal) north to the freshwater Volkerak Channel. The dams accommodate road travel and frontage recreation areas.

The Zeelandbrug (Zeeland Bridge), extending 16,472 ft (5,022 m) between Schouwen and Duiveland and Noord Beveland, is the longest bridge in Europe and was opened in 1965.

Eastern Seaboard, also called ATLANTIC SEABOARD, region, eastern U.S., fronting the Atlantic Ocean and extending from Maine in the north to Florida in the south. Not merely a geographic term, the Eastern Seaboard is, historically, the part of the United States that was first settled by European immigrants and from which most westward American settlement originated. In popular usage, the Eastern Seaboard connotes, in particular, the coastal settlements from Boston to Philadelphia, an area of heavy urbanization, in which are islands of great poverty and conspicuous wealth, decaying business and financial centres, numerous major educational institutions, and a high level of social and cultural sophistication.

Eastern Slovakia Region: *see* Východoslovenský kraj.

Eastern Sudanic languages, group of languages representing the most diverse of the four subbranches of the Chari-Nile branch of the Nilo-Saharan language family. The Eastern Sudanic branch is composed, according to many scholars, of the Murle-Didinga, Barea, Merarit, Ingassana, Daju, Nyangiya, Temein, Nyima, Nilotic, and Nubian language groups. These languages are spoken from southern Egypt in the north to Tanzania in the south and from Ethiopia in the east to Chad in the west. Nilotic and Nubian are the two most important of the Eastern Sudanic language groups. The term Eastern Sudanic has also been applied by some scholars to the group of languages usually called Central Sudanic. *See also* Nilotic languages; Nubian languages; Central Sudanic languages.

Eastern Townships, French LES CANTONS DE L'EST, region in southeastern Quebec, Can., between the St. Lawrence lowlands and the U.S.–Canadian border and centred on Sherbrooke. It extends from Missisquoi County in the southwest to Dorchester County in the northeast and includes these and 13 other counties. The total area of Eastern Townships is 9,120 square miles (23,620 square km), more than three-quarters of which is occupied.

The region contains parallel ranges of hills (extensions of the Appalachians), the Sutton Mountains (extensions of the Green Mountains of Vermont), the Stoke Mountains, and the Megantic Range. There are a few lakes and various rivers emptying into the St. Lawrence.

Although a few Loyalists from the United States had settled at Missisquoi Bay as early as 1784, after the U.S. War of Independence, it was not until 1791 that the region was surveyed and English land laws were imposed on Lower Canada, replacing the French system of seigneural tenure. Then, although the initial settlers were British (mostly Loyalists), a large influx of French Canadians filled the area, so that today all 15 counties have French-speaking majorities.

The diversified economy of Eastern Townships includes asbestos mining, traditionally supplying about 80 percent of the world's supply of asbestos but declining in the late 20th century because of the growing recognition of the health risks of asbestos. Agriculture includes dairy farming, sheep raising, and fruit growing. The region is also important for manufactures, especially in textiles, paper, furniture, and machinery.

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Eastern Woodlands Indian, a native of the largely wooded area stretching easterly across North America from an area just west of the Mississippi River to the Atlantic coastline. The northern boundaries of the Eastern Woodlands Indians included the Great Lakes and extended into today's Canada; southern boundaries included the areas that became Illinois and North Carolina. They spoke languages of the Iroquoian, Algonkian, and Siouan families.

A brief treatment of Eastern Woodlands Indians follows. For full treatment, *see* MACROPAEDIA: American Indians.

The Eastern Woodlands Indians were concentrated largely in open areas where natural resources were readily available and where agriculture could be practiced. Thus the majority of people inhabited the more southerly regions or the areas near seacoasts, rivers,

lakes, and other water sources. The division of labour was relatively slight, with little specialization except by sex. Women took responsibility for home and child care along with tending crops and making clothing and baskets; men hunted and fished, built houses and tools, and went to war.

In addition to the larger tribe, the social organization of life among the Eastern Woodland Indians included the band. Bands comprised the people occupying a particular area who took a name and shared common interests. A tribe consisted of several bands and was a cultural as well as a political unit. Often, tribes also contained clans, whose members might include people from other communities or other tribes. Clan affiliation carried responsibilities and demanded a lifetime commitment.

Northeastern Indian leaders were chiefs, or sachems. These positions were often inherited, although the influence that a particular chief exerted was directly related to his abilities as a leader and as an orator. Because problems were settled through councils, in which the intent was to find solutions acceptable to all, leaders had to be clever, persuasive speakers. Without unanimity no action could be taken; councils were often lengthy, continuing until the few with opposing opinions withdrew from the scene or until unanimous agreement was achieved.

Economic systems were relatively simple and related to the use of an abundance of natural resources. Some agriculture was practiced, particularly by the Iroquoian tribes, in the areas where the growing season was long enough for corn (maize) to mature, and principally included the cultivation of three crops: corn, beans, and squash. The Indians used the hoe and the digging stick but did not employ animals in this work. Other food sources were plentiful through hunting, fishing, and gathering; Indians moved to different locales as the seasons dictated.

Wigwams and longhouses were the common forms of housing, both being made of raw materials provided by the forests. Natural resources also provided the materials for canoes, snowshoes, and clothing. Clothing consisted of capes, robes, skirts, leggings, moccasins, and breechclouts for men. Jewelry and other decorations, including paint and tattoos, were common. The belief systems of this culture involved medicine societies in conjunction with a knowledge of herbal medicines, attention to a spirit world, and an emphasis on the power of dreams.

European settlement prompted the establishment of confederacies of Indian bands—confederacies that were the result, in large part, of Indian efforts to counteract the influence and aggression of the whites. The most powerful was the League of the Iroquois founded to establish peace among the Iroquois tribes. In the 17th century it began warring with other tribes, and it appears that warfare among the Indians generally increased with European influence and the establishment of trading posts. Beaver and other furs were particularly desirable commodities for which Europeans actively traded. In exchange they provided the Indians with guns and other manufactured items and introduced wampum as a form of currency.

The Europeans also introduced new diseases that decimated the tribes. (A major epidemic occurred in 1616–17 prior to the landing of the Pilgrims.) The first Indians to be heavily affected by the European influence were the coastal Algonkians. Uprisings against European encroachment, including the Pequot War in 1637 and King Philip's War from 1675–76, were not successful, and European ways were adopted as a means of survival; some Indians left the area altogether and moved west. The inland Indians, largely Iroquois, and those of the upper Great Lakes region were affected only later because of their inaccessability and the desire on the part of the Europeans to maintain good relations in the interest of trade. They remained organized and formidable until the American Revolution.

Most Indians who did not adopt the white culture were gradually eradicated or forced west and north into Canada. Some were regionally contained on reservations, and a few of these reservations remain today: Algonkian reservations are found in New England and on Long Island; six Iroquois reservations exist in New York state; and a few of the upper Great Lakes Indians still live in that area. Otherwise, the culture of the Eastern Woodlands Indians has been lost or has become so blended with that of the whites as to be largely indistinguishable.

Eastham, town (township), Barnstable County, southeastern Massachusetts, U.S., extending across the northern arm of Cape Cod. In December 1620 a shore party of "Mayflower" pilgrims landed at the Cape Cod Bay site near the entrance to Wellfleet Harbor and encountered their first Indians, the Nausets, who luckily were friendly. The meeting is commemorated by a memorial stone adjoining First Encounter Beach. In 1644, Thomas Prence (or Prince), with more than 40 other colonists from Plymouth, returned and organized a settlement known as Nauset, which was incorporated in 1651 and renamed, probably for Eastham, Eng., or for its easterly location. The town's Old Cove Burial Ground contains the graves of early Pilgrims. After the American Revolution, fishing and coastal trade flourished, but by the mid-19th century farming dominated. The town, which includes the village of North Eastham, is now a summer resort and tourist base for Nauset Beach and the Cape Cod National Seashore. Points of interest include the Old Grist Mill (1793; restored 1936), the Swift-Daley House (1741), and the Coast Guard Beach Area with Nauset Light. Pop. (1980) 3,472.

Eastlake, Charles Lock (b. March 11, 1836, Plymouth, Devon, Eng.—d. Nov. 20, 1906, London), English museologist and writer on art who gave his name to 19th-century furniture style.

The nephew of the Neoclassical painter Sir Charles Lock Eastlake, he studied architecture at the Royal Academy, London, which in 1854 awarded him a silver medal for architectural drawing. Giving up that discipline, he studied art on the Continent, after which he returned to England to write and to design. In 1856 he married Eliza Bailey (died 1911). He was secretary (1866–77) of the Royal Institute of British Architects and keeper and secretary of the National Gallery, London (1878–98). There he reorganized the classification of paintings and initiated the use of glass to protect the works from the London air.

As a writer on painting and industrial arts, Eastlake made a permanent reputation. More of a reformer of furniture style than an originator, he was a leading exponent of Jacobean and Gothic Revival, and he strongly influenced furniture and architectural tastes of the late Victorian and Edwardian eras. He was against the substitution of machine manufacture for quality workmanship. (Nevertheless, after Philadelphia's Centennial Exposition [1876], American Eastlake furniture was mass-produced.)

Eastlake's influential *Hints on Household Taste in Furniture, Upholstery and Other Details* (1868) was in its 6th edition in the U.S. by 1881 and its 4th in London by 1887. His *Lectures on Decorative Art and Art Workmanship* (1876) was followed by the progressively published series *Notes on the Principal Pictures* in such continental collections as the Brera (1883) of Milan, the Louvre (1883), and the Royal Gallery (1888) in Venice. He also wrote a series of social essays, *Our Square and Circle* (1895), under the pseudonym of Jack Easel.

Eastlake, Sir Charles Lock (b. Nov. 17, 1793, Plymouth, Devon, Eng.—d. Dec. 24, 1865, Pisa, Italy), English Neoclassical painter who helped develop England's national collection of paintings.

Eastlake studied first under the English historical painter and writer Benjamin Robert Haydon, whose genre he chose to follow, and later at the Royal Academy, London. After 1813 he travelled extensively on the Continent, remaining in Rome from 1818 to 1830. During this period he painted the Italian peasant scenes for which he became famous in England. In about 1823 he began to explore historical and classical subject matter. In 1830 he was elected to the Royal Academy.

Between 1830 and 1840 Eastlake worked devotedly on his notebooks. From 1843 to 1847 he served as keeper of the National Gallery, resigning that post amid unjust criticism. His significant study *Materials for a History of Oil Painting* was published in 1847. When in 1850 he became president of the Royal Academy and was knighted, Eastlake abandoned painting for administration; he became the arbiter of national and court taste. In 1855 he was appointed to the new directorship of the National Gallery, a position he held until his death.

Although he is not considered to be more than a conventional painter, he acquired many important works for the National Gallery and also contributed to the literature of art history.

Eastleigh, district (borough), county of Hampshire, north and east of Southampton, with an area of 31 sq mi (80 sq km). The district grew rapidly in the 19th century with the establishment of railway works. Eastleigh has become an area of contrasts, ranging from an expanding industrial annex of Southampton through residential development to a yachtsmen's playground at Hamble. Pop. (1982 est.) 94,000.

Eastmain River, French RIVIÈRE EAST-MAIN, river in Nouveau-Québec region (New Quebec), western Quebec province, Canada, rising in the Otish Mountains of central Quebec, flowing nearly due west, and discharging into James Bay. Its course of about 500 mi (800 km) is interrupted by numerous falls and rapids. Known earlier under the names of Hudson, Canuse, and Slude, the river was probably discovered in 1685 when the Hudson's Bay Company established a trading post (Eastmain) at its mouth.

Eastman, George (b. July 12, 1854, Waterville, N.Y., U.S.—d. March 14, 1932, Rochester, N.Y.), U.S. manufacturer whose introduction of the first Kodak (a coined word that became a trademark) camera helped to promote large-scale amateur photography.

After his education in the public schools of Rochester, Eastman worked briefly for an

George Eastman, 1926

By courtesy of the Library of Congress, Washington, D.C.

insurance company and a bank. In 1880 he perfected a process for making dry plates for photography and organized the Eastman Dry Plate and Film Company for their manufacture. The first Kodak, placed on the market in 1888, was a simple, hand-held box camera containing a 100-exposure roll of paper stripping film. The entire camera was sent back to the manufacturer for developing, printing, and reloading when the film was used up. In 1889 Eastman introduced transparent film and in 1892 reorganized the business as the Eastman Kodak Company. Eight years later he introduced the Brownie camera, intended for use by children. It sold for one dollar. By 1927 Eastman Kodak had a virtual monopoly of the photographic industry in the United States, and it has continued to be one of the largest American companies in its field. Eastman gave away half his fortune in 1924. His gifts, which totaled more than $75,000,000, went to such beneficiaries as the University of Rochester (of which the Eastman School of Music is a part) and the Massachusetts Institute of Technology. He was also one of the first to introduce profit sharing as an employee incentive. Eastman died by his own hand.

Eastman, Max (Forrester) (b. Jan. 12, 1883, Canandaigua, N.Y., U.S.—d. March 25, 1969, Bridgetown, Barbados), American poet, editor, and leading radical before and after World War I.

Eastman was educated at Williams College, Williamstown, Mass., graduating in 1905. He taught logic and philosophy at Columbia University for four years, and he was the founder of the first men's league for woman suffrage in 1910. Eastman edited and published *The Masses,* a radical political and literary periodical. Its editors were brought to trial twice in 1918 because of their editorial opposition to the United States' entry into World War I, but both trials ended with divided juries. He then edited and published *The Liberator,* a similar magazine, until 1922, when he traveled to Russia to study the Soviet regime. He married Eliena Krylenko, a sister of the Soviet minister of justice, but returned to the United States believing that the original purpose of the October Revolution had been subverted by a corrupt governing group. In the 1920s and 1930s he wrote several books attacking developments in the Soviet Union: *Since Lenin Died* (1925), *Artists in Uniform* (1934), *The End of Socialism in Russia* (1937), and *Stalin's Russia and the Crisis in Socialism* (1939). He also translated (1932) Leon Trotsky's history of the Russian Revolution.

From 1941 he was a roving editor for *The Reader's Digest,* writing on almost anything that interested him. His many other books included *Enjoyment of Poetry* (23 eds., 1913–48), *Enjoyment of Laughter* (1936), and two autobiographical works, *Enjoyment of Living* (1948) and *Love and Revolution: My Journey Through an Epoch* (1965).

Eastman Kodak Company, major American manufacturer of film, cameras, and photographic supplies and processing services. It also manufactures pharmaceuticals. Headquarters are in Rochester, N.Y.

The company was incorporated in 1901 as the successor to a business established in 1880 by George Eastman, a bank clerk who perfected the newly developed method of making photographic dry plates. Before 1880, photographers had to coat a plate with fresh, wet chemicals each time they wanted to take a picture. Eastman developed a machine that mechanically produced dry, precoated plates, and he set up the company that later would become Eastman Kodak to sell his plates.

Four years later, Eastman introduced roll film, and in 1888 he introduced the Kodak camera, the first camera that was simple and portable enough to be used by large numbers of amateur photographers. The camera was sold with film sealed inside and the whole unit was mailed back to Rochester for film processing and replacement. In 1900 Eastman introduced the less-expensive Brownie, a simple box camera with a removable film container, so that the whole unit no longer needed to be sent back to the plant.

In following years, the company continued to produce innovations for the amateur photographer. Kodak was the first to make home-movie equipment and an easy-to-use colour slide film, Kodachrome. In the 1960s the company introduced the Instamatic series of still and movie cameras, all of which used cartridge-loaded film. The Disc camera series, introduced in 1982, was a technologically advanced group of cameras that automatically activate the use of the flash, if necessary, in addition to adjusting the focus and advancing the film. Kodak also manufactures film, paper, plates, and equipment for professional photographers, and synthetic fibres, plastics, and industrial chemicals. In 1984 it entered the video market by introducing an 8-millimetre video-camera system and videocassette tapes.

The company also owns businesses in areas unrelated to photography, including such companies as Spin Physics, a manufacturer of magnetic recording heads; Atex Inc., which produces input and editorial systems for the graphic-arts industry; and Verbatim Corporation, which manufactures floppy-disk storage systems. In 1988 Kodak acquired Sterling Drug Inc., a large American pharmaceutical manufacturer.

Easton, town, seat of Talbot county, eastern Maryland, U.S. It is situated in the tidewater region along the eastern shore of Chesapeake Bay, near the head of Tred Avon River. Settled by Quakers in 1682, it was called Talbot Court House from 1710 until 1789, when the present name, probably a contraction of East Town, was adopted. The town is an agricultural trading centre supplemented by canning (fruits and vegetables), seafood processing, and light manufacturing (hosiery, clothing, and furniture). The Third Haven Quaker Meeting House (1682–84) was the nucleus of an early Quaker settlement and is one of the oldest frame structures for worship in the United States. Nearby are Wye Oak State Park (with its 400-year-old white oak, 104 feet [32 m] high and 32 feet (10 m) around the trunk, that is Maryland's official state tree) and the Chesapeake Bay Maritime Museum. Inc. 1906. Pop. (1984 est.) 8,336.

Easton, city, seat (1752) of Northampton county, eastern Pennsylvania, U.S. It lies at the confluence of the Lehigh and Delaware rivers (bridged to Phillipsburg, N.J.) and is part of the Lehigh Valley industrial complex that includes Allentown, Bethlehem, Wilson, and West Easton.

Easton was laid out in 1752 by William Parsons, at the request of Thomas Penn, on land obtained from the Indians in the notorious "Walking Purchase" of 1737, a treaty that enforced Indian resettlement. The town was named for the English estate (Easton-Neston) of Penn's father-in-law, the Earl of Pomfret. During the French and Indian Wars, Easton was the scene of several Indian peace councils; it served as an outpost during the American Revolution, and the Declaration of Independence was read on July 8, 1776, from the steps of the Old Courthouse (a marker in the city's "Great Square" recalls the occasion).

The surrounding area is rich in natural resources—farmland, limestone, slate, iron ore, timber, and serpentine. Factories in the locality manufacture air valves, cement, crayons, machinery, steel, textiles, paper, and transportation equipment.

Lafayette College was established (1826) in the city. The Easton home (1757) of George Taylor, signer of the Declaration of Independence, has been restored. Inc. borough, 1789; city, 1887. Pop. (1984 est.) 26,066.

Eastport, easternmost city of the United States, in Washington county, eastern Maine. It is situated on Moose Island along Passamaquoddy Bay (bridged to the mainland) of the Atlantic Ocean, 126 miles (203 km) east of Bangor. Originally settled in about 1780, it once included Lubec (*q.v.*) and was known as Moose Island but was renamed upon incorporation as a town (1798) for being the nation's most easterly port. It was captured by British troops during the War of 1812 and remained under martial law until 1818, when it was returned to the United States under the terms of the Treaty of Ghent. Eastport was the scene of considerable activity during the 1930s when the federal government began work on the Passamaquoddy Tidal Power Project to harness the exceptionally high tides (up to 27 feet [8 m]) of Passamaquoddy Bay for hydroelectric power. The project was abandoned in 1937 but was revived in the 1970s. Eastport's economy is heavily dependent on fishing. Herring, the main catch, are canned as sardines and used in making other products, such as pearl essence, fish meal, and fish oil. Deer Island, site of Pleasant Point Indian Reservation, is just to the north, while across the water to the east is Roosevelt Campobello International Park on Campobello Island. Inc. city, 1893. Pop. (1984 est.) 1,881.

Eastwood, district, Strathclyde region, southwestern Scotland, created by the reorganization of 1975 from part of the former county of Renfrew. The district encompasses an area of 45 square miles (117 square km) and lies immediately south-southwest of the City of Glasgow district. It is composed mainly of upland farming country, rising to a height of 1,230 feet (375 m) in the extreme southeast. The urbanized area in the north developed during rapid expansion of the cotton-textile industry in the early 19th century. The subsequent decline of this industry and the development of an efficient transport system have changed this area into a dormitory appendage of Glasgow. The seat of the district authority is at Paisley (*q.v.*) in Renfrew district. Pop. (1986 est.) 56,060.

Eastwood, Clint, in full CLINTON EASTWOOD, JR. (b. May 31, 1931?, San Francisco), American motion-picture actor who was one of the most popular Hollywood stars during the 1970s and early '80s.

After graduating from high school in California, Eastwood held various jobs and served in the U.S. Army before becoming a bit player in Hollywood. His lacklustre career there revived when he was cast as the second lead in the television western series *Rawhide,* which ran from 1959 to 1966. Eastwood's international stardom was established when he played The Man With No Name—a laconic, fearless, mercenary-minded gunfighter—in three popular Spanish-Italian westerns ("spaghetti westerns") directed by Sergio Leone: *A Fistful of Dollars* (1964), *For a Few Dollars More* (1965), and *The Good, the Bad, and the Ugly* (1966). With the subsequent release of these films in the United States, Eastwood began playing starring roles in a series of American adventure pictures—westerns, crime and police dramas, and war films. These films included *Coogan's Bluff* (1968), *Two Mules for Sister Sara* (1970), *The Beguiled* (1971), *Thunderbolt and Lightfoot* (1974), *Every Which Way But Loose* (1978), *Escape from Alcatraz* (1979), and *Tightrope* (1984). One of his most popular roles was as the murderously effective police inspector Harry Callahan in *Dirty Harry* (1971) and its sequels. Eastwood proved a competent director of himself in such films as *Play Misty for*

Me (1971), *The Outlaw Josey Wales* (1976), *Bronco Billy* (1980), and *Pale Rider* (1985). His film biography of jazzman Charlie Parker, entitled *Bird,* appeared in 1988.

Eastwood's style of acting was minimally expressive, and his films rarely drew much praise from critics, but he had a strong, resonant screen presence that guaranteed him success at the box office. His standard role was that of a tough, competent loner whose violent behaviour nevertheless conforms to his own understated moral principles.

Eaton, Amos (b. May 17, 1776, Chatham, N.Y.—d. May 10, 1842, Troy, N.Y., U.S.), American botanist, geologist, and lawyer who aroused widespread interest in science through his public lectures and inspired many students as a teacher and writer of textbooks.

Educated at Williams College (Williamstown, Mass.), he worked in Catskill, N.Y., as a lawyer and land agent and pursued the study of natural science. After giving a well-received series of public lectures on botany, mineralogy, and geology and publishing a book on botany (1810), he abandoned his law practice and studied at Yale. He moved to Williamstown, and his lectures there on science were so successful that he lectured in various other towns in New England. The course of lectures he gave in 1818, at the request of Governor DeWitt Clinton, before the New York State Legislature led to the establishment of a State Geological Survey (1836). He was appointed professor of natural history at the Medical School at Castleton, Vt. (1820), made geological and agricultural surveys, and in 1824 became a senior professor at the Rensselaer School (now Rensselaer Polytechnic Institute) at Troy.

Eaton, Cyrus S(tephen) (b. Dec. 27, 1883, Pugwash, Nova Scotia, Can.—d. May 9, 1979, near Cleveland, Ohio, U.S.), U.S.–Canadian industrialist and philanthropist, founder of the Republic Steel Corporation (1930).

While a student, Eaton was persuaded by John D. Rockefeller to forego joining the ministry and become a businessman instead. Starting in business in 1907, within a few years he had built several electric power plants in western Canada, and he soon diversified into other utilities, banking, and steel in the United States. He was a relentless consolidator of the many companies that at one time or another came under his control. In 1930 he amalgamated several steel companies that he owned into Republic Steel Corporation, which was the third largest steel company in the United States. Eaton lost most of his fortune in the Great Depression but subsequently made a second one with his activities in the securities industry, banking, and railroads.

Eaton became prominent in the 1950s and '60s as an advocate of nuclear disarmament and improved U.S.–Soviet relations. In 1957 he was one of the inaugurators of the Pugwash Conferences (originally held at his lodge in Nova Scotia), at which leading scientists and scholars from various countries met to exchange views and promote international understanding. At Eaton's death his fortune was estimated at about $200,000,000.

Eaton, John (b. Dec. 5, 1829, Sutton, N.H., U.S.—d. Feb. 9, 1906, Washington, D.C.), American educator, commissioner of education from 1870 to 1886, and first U.S. superintendent of public schools in Puerto Rico.

Eaton was raised on a farm and worked his way through Dartmouth College, in Hanover, N.H., graduating in 1854. He was a school principal in Cleveland and a superintendent in Toledo. He then resigned his Toledo position in 1859 to enter the Andover Theological Seminary. Ordained as a minister in 1861, at the outbreak of the American Civil War, he immediately enlisted as a chaplain and was stationed in Tennessee in 1862 when General Ulysses S. Grant ordered him to gather the flood of former slaves escaping to the Union Army into camps where they could work and learn how to be self-supporting. In 1863 he was made colonel of a black regiment and in 1865 promoted to brevet brigadier general.

Eaton's handling of the escaped slaves served as a precedent for the Freedmen's Bureau, and from March to December 1865 Eaton was assistant commissioner of the bureau. He then moved to Memphis, Tenn., where he received a two-year appointment in 1867 as state superintendent of public instruction. In 1870 President Grant appointed him commissioner of the recently created U.S. Bureau of Education. Under his administration, the bureau grew from an insignificant office in the Department of the Interior to a well-staffed, highly influential repository of educational information drawn from all over the globe. When Eaton resigned in 1886 owing to poor health, the U.S. Bureau of Education was widely regarded as a model agency.

Eaton returned to Ohio as president of Marietta College (1886–91), and he held a similar post at Sheldon Jackson College in Salt Lake City (1896–99). He left Utah to become the first U.S. superintendent of schools in Puerto Rico. He achieved several reforms on that island before his health compelled him to resign in 1900.

Eaton, Margaret, *neé* O'NEALE, byname PEGGY EATON (b. Dec. 3, 1799, Washington, D.C.—d. Nov. 8, 1879, Washington, D.C.), woman whose marriage in 1829 to a prominent Democratic politician caused the famous "Cabinet crisis" of U.S. President Andrew Jackson (in which Jackson dismissed his entire Cabinet) and led eventually to the succession of Martin Van Buren as head of the party.

Daughter of a Washington tavernkeeper, Peggy O'Neale was married to a navy purser, John B. Timberlake. Throughout the 1820s her name was linked with Tennessee Senator John H. Eaton, a close friend of Jackson. When her husband died in 1828, Eaton, with Jackson's approval, married her, and Jackson made him secretary of war. A few weeks after the wedding, rumours about her misconduct spread in Washington, and Washington hostesses, including wives of Cabinet members, snubbed her—though some observers believed that her major sin lay in her humble social origins. President Jackson was outraged when the wife of Vice President John C. Calhoun took the lead in Peggy's ostracism. Van Buren, then secretary of state and a widower, made a point of being gracious to her, and his stock rose with the president as Calhoun's fell. It was the beginning of the estrangement between Jackson and Calhoun, a break that was finalized when Jackson reorganized his Cabinet in 1831 and dropped three Calhoun supporters from it. Jackson chose Van Buren to run for vice president in 1832 and supported him for president four years later.

Peggy Eaton, *c.* 1830

By courtesy of the Library of Congress, Washington, D.C.

Eaton resigned from the Cabinet in 1831, but he and his wife enjoyed the brilliant society of Madrid when he served there as U.S. minister (1836–40). After his death (1856) Peggy Eaton married a young Italian dancing master, Antonio Buchignani, who within a few years defrauded her of her property and ran off with her granddaughter.

Eaton, Theophilus (b. *c.* 1590, Stony Stratford, Buckinghamshire, Eng.—d. Jan. 7, 1658, New Haven, Conn.), merchant who was cofounder and colonial governor of New Haven colony.

As a youth, Eaton went to London as a merchant apprentice. He began his own commercial enterprise trading with Baltic seaports, and his successes in business resulted in his election as deputy governor of the East-Land Company and also in his appointment to the court of Denmark as agent for Charles I.

When he returned to London from his residence in Copenhagen, Eaton became interested in the settlement of New England. He was one of the original patentees of the Massachusetts Bay Company. Eaton had adopted firm Puritan beliefs, and in early 1637 he joined his boyhood friend John Davenport and several Puritan followers in migrating to New England. The group arrived in Boston in June, but instead of settling in Massachusetts Bay, they established an independent colony at New Haven (Quinnipiac) in April 1638. The next year Eaton was elected governor of the colony and was reelected annually until his death.

In 1643 Eaton became an original commissioner in the New England Confederation, and 12 years later he and Davenport drew up a new legal code for New Haven colony. As governor, Eaton also became involved in various mercantile endeavours, some of which provoked tensions with the Dutch in neighbouring New Netherlands. The last years of his life, however, were devoted primarily to agricultural pursuits, along with his duties as governor.

Eaton, William (b. Feb. 23, 1764, Woodstock, Conn.—d. June 1, 1811, Brimfield, Mass., U.S.), army officer and adventurer who in 1804 led an expedition across the Libyan Desert during the so-called Tripolitan War.

After service in the U.S. Army, Eaton was appointed consul at Tunis (1798) by President John Adams. In 1803 he won President Thomas Jefferson's approval for a plan to settle U.S. maritime differences with Tripoli by removing its government and reinstating the exiled Pasha Hamet Karamanli. Eaton marched from Egypt westward, with 10 U.S. marines, a number of Arabs, and Karamanli. With the help of a U.S. naval bombardment, he took Derna (Darnah; April 27, 1805). But when the ruling pasha at Tripoli agreed to a treaty with the United States, Eaton was obliged to curtail his operation. He returned to the United States, where he remained until his death.

Eau Claire, city, seat (1856) of Eau Claire county, west-central Wisconsin, U.S. It lies at the confluence of the Eau Claire ("Clear Water," so named by 18th-century French trappers and traders) and Chippewa rivers, 90 miles (145 km) east of St. Paul, Minn. Settled in the 1840s and laid out in 1855, it developed a lumber economy. With the decline of logging in the 1890s, it turned to manufacturing (notably rubber tires) and food processing. Eau Claire is also the trading centre for a large dairying region. It is the seat of District One Technical Institute (1912) and the University of Wisconsin—Eau Claire (1916). Carson Park, a peninsula on Half Moon Lake, contains a Paul Bunyan Camp, a replica of logging days. Inc. 1872. Pop. (1987 est.) city, 54,842; (1986 est.) metropolitan area (MSA), 136,800.

eau de cologne: *see* cologne.

eavesdropping, electronic: *see* electronic eavesdropping.

EB virus: *see* Epstein–Barr virus.

Eban, Abba (Solomon), original name AUBREY SOLOMON (b. Feb. 2, 1915, Cape Town), foreign minister of Israel (1966–74) whose exceptional oratorical gifts in the service of Israel won him the widespread admiration of diplomats and increased support for his country from U.S. Jewry.

Brought up in England, Eban studied Oriental languages and classics and lectured at the University of Cambridge. In 1941, as a British army major, he served as an aide to the British minister of state in Cairo. In 1946 he worked with the Jewish Agency as a political information officer to establish a Jewish homeland in Palestine. He also served as the liaison officer with the UN Special Committee on Palestine in 1947 and as a member of the delegation to the General Assembly that played a critical role in the passage (1947) of the UN resolution to partition Palestine. When the new state of Israel was admitted to membership in the UN in 1949, Eban became its permanent representative and served in that post until 1959. From 1950 to 1959 he served concurrently as ambassador to the United States.

First elected to the Knesset (Israeli parliament) in 1959, he was minister of education and culture under Prime Minister David Ben-Gurion from 1960 to 1963 and from 1959 to 1966 was also president of the Weizmann Institute of Science. He served as deputy prime minister in 1964–65 and later was Israel's foreign minister from 1966 to 1974. As foreign

Eban
Judith Gefter

minister, he sought to strengthen relations with the United States and to bring about Israeli association with the European Economic Community. When Israel was threatened with an Arab blockade in May 1967, Eban traveled to Paris, London, and Washington to seek a peaceful solution. When diplomacy proved fruitless, Eban supported the military decisions in the Six-Day War. His eloquent defense of Israel's actions before the Security Council and again before the General Assembly of the United Nations was widely admired. He sat in the Knesset as a member of the Israel Labour Party until 1988.

His published works include *Voice of Israel* (collection of speeches, 1957), *The Tide of Nationalism* (1959), *My People* (1969), a history of the Jews, and *An Autobiography* (1977).

ebb tide, seaward flow in estuaries or tidal rivers during a tidal phase of lowering water level. The reverse flow, occurring during rising tides, is called the flood tide. *See* tide.

Ebba Ksour (Tunisia): *see* Althiburos.

Ebbinghaus, Hermann (b. Jan. 24, 1850, Barmen, Rhenish Prussia [Germany]—d. Feb. 26, 1909, Halle, Ger.), German psychologist who pioneered in the development of experimental methods for the measurement of rote learning and memory.

Ebbinghaus received his Ph.D. degree from the University of Bonn in 1873. Shortly thereafter he became assistant professor at the Friedrich-Wilhelm University, Berlin, a post he held until 1894, when he was appointed professor at the University of Breslau.

Using himself as a subject for observation, Ebbinghaus devised 2,300 three-letter nonsense syllables for measuring the formation of mental associations. This learning invention, along with the stringent control factors he developed and his meticulous treatment of data, brought him to the conclusion that memory is orderly. His findings, including the well-known "forgetting curve" that relates forgetting to the passage of time, were reported in *Über das Gedächtnis* (1885; *Memory*).

After completing his work on memory, Ebbinghaus turned to research on colour vision and in 1890, with the physicist Arthur König, founded the periodical *Zeitschrift für Psychologie und Physiologie der Sinnesorgane* ("Journal of the Psychology and Physiology of the Sense Organs"). In conjunction with a study of the mental capacities of Breslau schoolchildren (1897), he created a word-completion test. That same year the first part of another work on which his reputation rests, *Grundzüge der Psychologie* (1902; "Principles of Psychology"), was published. In 1905 he left Breslau for the University of Halle, where he wrote a still more popular work, *Abriss der Psychologie* (1908; "Summary of Psychology"). Ebbinghaus' research showed that, contrary to prevailing beliefs, scientific methods could be applied to the study of the higher thought processes.

Ebbo OF REIMS, Ebbo also spelled EBO (b. *c.* 775—d. March 20, 851, Hildesheim, Saxony [Germany]), archbishop whose pioneering missions to the North helped prepare the ground for the Christianization of Denmark and who exercised significant influence on contemporary arts.

Born a royal serf, Ebbo was educated and ordained a priest in the Carolingian court, where he became a close friend of Charlemagne's son and successor, Louis I the Pious, who made him director of the imperial library at Aachen, and then counselor. In 816 Louis appointed Ebbo archbishop of Reims, where he commissioned (*c.* 817–834) the famous Ebbo gospel book, or *Evangeliarium* of Ebbo, and promoted the arts, including the building of the cathedral. Appointed apostolic legate (822) by Pope St. Paschal I, he led into Denmark a Frankish mission (822–823) that was temporarily successful. He returned to the North twice, making converts and founding a monastery in Holstein, but the evangelization of the Danes was finally accomplished later under St. Ansgar.

By 833 Ebbo, with other leading prelates, joined the emperor's opponents who, led by his son Lothair I, accused Louis of having destroyed Frankish unity. Ebbo headed those bishops who endorsed Louis's deposition and imprisonment. For supporting Lothair, Ebbo received handsome benefices. Upon Lothair's downfall and Louis's restoration (Easter 834), Ebbo took refuge near Paris. A year later he was seized, and he was later imprisoned in the abbey of Fulda.

On Louis's death, in 840, Lothair reclaimed his rights to succession and unlawfully reinstated Ebbo. On June 25, 841, however, Lothair was defeated in battle by his brothers Charles II the Bald and Louis the German; thereafter, the Frankish empire was jointly ruled by all three kings. Banished by Charles, Ebbo fled to Rome, where he pleaded his case to Pope Sergius II, who reduced him to the laity. Discarded by Lothair, he was eventually protected by Louis, who between 845 and 847 made him archbishop of Hildesheim.

Ebbw Vale, Welsh GLYNEBWY, industrial town, seat of Blaenau Gwent district, Gwent county, Wales. It first developed as a coal-mining centre. Iron has been processed there since the late 18th century, using local coal, ore, and limestone; steel production was initiated later. The 20th-century coastward migration of steelmaking in South Wales was temporarily prevented from affecting Ebbw Vale when, in 1935, the British government subsidized the reconstruction of the town's steelworks to provide jobs in an economically depressed area; but the problems of the British steel industry in the 1970s led to the closing of the works in 1978. The town continues to be important as a shopping centre. Pop. (1981) 24,444.

Ebedjesus OF NISIBIS (theologian): *see* Abhdisho bar Berikha.

Ebenales, ebony order of flowering plants, belonging to the class called dicotyledon (characterized by two seed leaves). It comprises five families, as many as 145 genera, and about 1,700 species of trees and shrubs, distributed chiefly in the tropics. Only three of the families—Ebenaceae (ebony), Sapotaceae (sapodilla), and Styracaceae (storax)—are of economic importance.

A brief treatment of Ebenales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

The overwhelming majority of the Ebenales grow in hot, humid forests of the tropics. Only a few members, such as the common persimmon (*Diospyros virginiana*) of the eastern United States and the Asian date plum (*D. lotus*), thrive in fairly dry soils. The order is distinguished, in part, by its woodiness, simple leaves, attachment of stamens (pollen-producing organs) to the petals, and the production of only a few ovules within each chamber of the ovary.

The ebony family, Ebenaceae, consists of trees and shrubs that shed their leaves in autumn and develop heartwood that often is black, red, or green in colour. Its six genera and approximately 450 species are native to the tropics of both hemispheres, with extensions into warm temperate regions.

The large Macassar ebony tree (*Diospyros ebenum*) of India and the East Indies yields the most commercially valuable ebony wood. Its black heartwood, streaked with brown, contains fibres filled with a hard gum that makes it heavy enough to sink in water. This close-grained wood is difficult to work but assumes a beautiful metallic sheen when polished; it is used primarily for flutes, black piano keys, wood inlays, knife handles, cabinets, and sculpture.

Several persimmons produce prized fruits. These include Japanese persimmon (*D. kaki*), grown in the Orient, the Mediterranean region, and the warmer parts of the southern United States; the black sapote (*D. digyna,* formerly *D. ebanaster*), with its dark brown, highly palatable fruits; and *D. virginiana,* a seedy persimmon native to the United States.

The sticky, milky latex of plants of the Sapotaceae (sapodilla) family differentiates it from other families in the Ebenales. Of its approximate 126 genera and more than 600 species, several representatives are of economic importance, including *Pouteria,* the white balata; *Manilkara,* the red balata; *M. bidentata,* known as bulletwood and possessing purple heartwood; and other timber trees. The sapodilla (*M. zapota*), native to southern Mexico, produces a luscious, fragrant fruit. Its trunk also yields chicle, a gum that serves as the base for many chewing gums. The tree is now cultivated in India, Hawaii, and parts of Africa.

Edible oils are extracted from many seeds of the sapodilla family, including those of *Buty-*

rospermum paradoxum, grown on the savannas of the Sudan and the Nile River regions, and those of *Argania spinosa,* the Morocco ironwood. Certain species of *Payena,* found in Thailand and nearby regions, are tapped for latex, which is processed into gutta-percha, a nonelastic, rubber-like substance.

The storax family, Styracaceae, is identified by star-shaped hairs on leaves and by fleshy fruits that develop an internal stony layer (drupe). This is in contrast to the fully fleshed fruits (berries) of the other families. Trees and shrubs of its 10 genera and 150 species generally are smaller than those of the ebony and sapodilla families. Three genera native to China furnish species grown for ornament. The Malayan *Styrax benzoin* produces the resin benzoin, used as a base in perfumes, as a soothing medicine, and as an antiseptic.

Inflorescences in the Ebenales vary from small clusters (and even solitary flowers) in the ebony and sapodilla families to branched types (panicles and cymes) in the more primitive Styracaceae and Symplocaceae. An idealized flower of this order consists of four whorls. Sepals, petals, and stamens each number four or five. Sepals and petals of a whorl are joined laterally to form, respectively, an urn- or bell-shaped calyx and corolla.

The pistil consists of two to five carpels differentiated into a basal ovary, a single style, and stigma lobes corresponding in number to the chambers in the ovary. No more than two ovules are borne centrally in each chamber.

In the ebony family functional stamens and pistils seldom are developed in the same flower. Male flowers produce pollen, but the pistil is undeveloped; conversely, the female flower has a fully developed pistil, but contains abortive stamens. The flowers are borne on separate trees, but in each case a few perfect flowers develop, possessing both male and female units, thereby assuring that isolated plants may bear fruit. Following pollination and fertilization, the ovule becomes the seed and the ovary the fleshy fruit. Sepals and petals often appear in two series in the Sapotaceae and may number up to 12. Flower parts in both the Symplocaceae and the Lissocarpaceae arise from the top of the ovary, unlike the flower parts in the other families.

Ebensee, town, *Bundesland* Oberösterreich (federal province of Upper Austria), central Austria, where the Traun River enters one of the lakes (the Traunsee) in the Salzkammergut region, south of Gmunden. First mentioned in 1450, the town has saltworks dating from 1607. Overlooked by the Feuerkogel (5,241 ft [1,598 m]) of the Höllengebirge massif, it is a summer and health resort, has chemical industries (soda, ammonia), and makes concrete and plywood. Pop. (1981) 9,005.

Eberhard (d. 939, Andernach, Ger.), duke of Franconia from 918.

The brother of Conrad I, duke of Franconia and German king (911–918), Eberhard in 915 supported his brother's ineffectual action against the rebellious duke of Saxony, Henry the Fowler. On Conrad's death Henry became king as Henry I, probably at Conrad's wish. Eberhard renounced all claim to the kingship but in exchange became almost completely independent in Franconia. Henry's son Otto I (king from 936) attempted to exercise more authority over his dukes, and in 938 Eberhard rebelled; he was defeated and fined. He allied himself with Henry of Bavaria (the King's brother) and Giselbert of Lorraine, and in 939 launched a new rebellion. His forces were surprised by those of King Otto, and Eberhard was killed in the battle.

Eberhard VI, byname BEARDED EBERHARD, German EBERHARD IM BART (b. Dec. 11, 1445, Urach, Ger.—d. Feb. 24, 1496, Tübingen), count, later 1st duke of Württemberg,

Eberhard VI, stained-glass window from the studio of Peter Hemmel von Andlau, 1477; in the collegiate church at Tübingen, Ger.
Landesbildstelle Wurttemburg, Stuttgart, Ger.

administrative and ecclesiastic reformer who laid the foundations for Württemberg's role in German history.

Eberhard expanded his territories and in 1482 established primogeniture and settled the succession to his holdings. The towns of Stuttgart and Tübingen received charters, and Eberhard reformed convents and monasteries. Interested in Renaissance learning as a result of his travels to the Holy Land and Italy and of his having an Italian wife, he founded a university at Tübingen. He was a leading member of the pro-Habsburg Swabian League and was created duke at the Reichstag (Diet) of Worms (1495), where the emperor Maximilian I recognized his rulings on primogeniture and territorial indivisibility.

Eberhard, Johann August (b. Aug. 31, 1739, Halberstadt, Brandenburg—d. Jan. 6, 1809, Halle), German philosopher and lexicographer who defended the views of Leibniz against those of Immanuel Kant and compiled a dictionary of the German language that remained in use for a century.

After studying theology at Halle University, Eberhard became a Lutheran preacher in 1763 at Halberstadt. In 1774 he was a pastor at Charlottenburg but gradually became estranged from orthodox Lutheranism through the influence of the German-Jewish thinker Moses Mendelssohn and the German writer C.F. Nicolai, an opponent of Kant. Consequently, in his *Neue Apologie des Socrates* (1772–78; "A New Apology for Socrates") and in his *Allgemeine Theorie des Denkens und Empfindens* (1776; "General Theory of Thinking and Feeling"), he advocated the free examination of religious doctrine and epistemological Rationalism in the manner of Leibniz and the German thinker Christian Wolff. Kant's critical philosophy appeared to him superfluous in view of what Leibniz and Wolff had already achieved.

In 1778 Eberhard was named professor of theology at Halle by King Frederick II of Prussia. Eight years later he became a member of the Berlin Academy and in 1805 was appointed a privy counsellor. His German dictionary, 6 vol. (1795–1802) was reissued in an abridged form as *Synonymisches Handwörterbuch der deutschen Sprache* (1802; "Dictionary of Synonyms in the German Language") and was republished in its 17th edition in 1910 with English, French, Italian, and Russian equivalents.

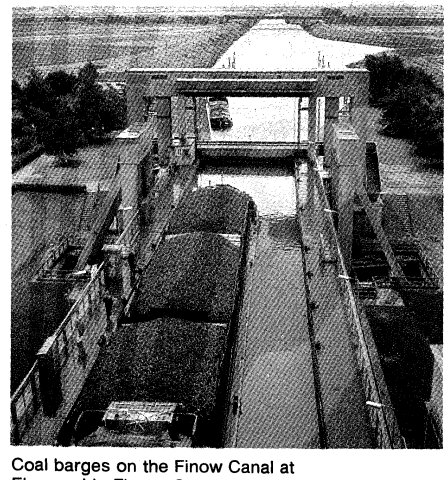
Opposed to abstract philosophical speculation, Eberhard preferred empirical studies in fields including aesthetics and ethics. Among his later works are *Theorie der schönen Künste und Wissenschaften* (1783; "Theory of the Fine Arts and Sciences"); *Allgemeine Geschichte der Philosophie* (1788; "General History of Philosophy"); and *Handbuch der Aesthetik* (1803–05).

Eberhart, Richard (b. April 5, 1904, Austin, Minn., U.S.), poet and teacher, a founder of the Poet's Theatre, Cambridge, Mass. (1951).

Educated at Dartmouth College, Cambridge, and Harvard, Eberhart published his first book of poems, *A Bravery of Earth,* in 1930. In the 1930s he also became tutor to the son of King Prajadhipok of Siam (now Thailand) and afterward taught at several U.S. universities, particularly at Dartmouth (1956–70). He was consultant in poetry at the Library of Congress (1959–61). In 1962 he was co-winner, with John Hall Wheelock, of the Bollingen Prize in Poetry. *Collected Poems, 1930–1976* was published in 1976. *Of Poetry and Poets* (1979) is one of his books of criticism.

Ebers papyrus, Egyptian compilation of medical texts dated approximately 1550 BC, one of the oldest known medical works. The scroll contains 700 magical formulas and folk remedies meant to cure afflictions ranging from crocodile bite to toenail pain and to rid the house of such pests as flies, rats, and scorpions. It also includes a surprisingly accurate description of the circulatory system, noting the existence of blood vessels throughout the body and the heart's function as centre of the blood supply. The Ebers papyrus was acquired by George Maurice Ebers, German Egyptologist and novelist, in 1873.

Eberswalde-Finow, city, Brandenburg *Land* (state), northeastern Germany, in the Thorn-Eberswalder glacial valley, about 40 miles (60 km) northeast of Berlin. Occupation of the site from the early Bronze Age is attested by the discovery at Finow in 1913 of a gold hoard dating from about the 11th to 10th century BC. The margraves of Brandenburg selected a fortified Slavic site in 1261 for the building of a castle, about which Eberswalde



Coal barges on the Finow Canal at Eberswalde-Finow, Ger.
© Caio Garrubba—Madeline Grimoldi

grew. Market rights were granted sometime before 1276 and city rights just prior to 1300.

From 1400 to 1876, the city (including annexations of nearby villages) was known as Neustadt Eberswalde.

Location at a natural ford of the Finow, together with nearby forests, bog-iron deposits, and water power, made the city an early centre for trade, woodworking, milling, and metalworking (the first iron forge dates from 1440). The Finow was canalized (1602–20), improving navigation, and although the city was sacked during the Thirty Years' War (1618–48), development continued with the construction of the Finow Canal in the 17th century. Traditional industries were given new impetus in the mid-18th century by the settlement of Thuringian cutlers and by the rise in the 19th century of what is still Europe's largest marine and industrial crane factory. The Oder-Havel Canal (completed 1914) passes just north of the city; modern industries include rolling mills, gravel and brick industries based on glacial deposits, and chemicals.

Cultural resources of the city include a forest research institute (1830) with a botanical garden, a medical school, and a local museum. Pop. (1983 est.) 53,381.

Ebert, Friedrich (b. Feb. 4, 1871, Heidelberg, Ger.—d. Feb. 28, 1925, Berlin), leader of the Social Democratic movement in Germany and a moderate Socialist, who was a leader in bringing about the Weimar constitution that attempted to unite Germany after its defeat in

Ebert, *c.* 1924
Archiv fur Kunst und Geschichte, West Berlin

World War I. He was president of the Weimar Republic from 1919 to 1925.

Ebert was the son of a master tailor. He learned the saddler's trade and travelled through Germany as a journeyman saddler. He soon became a Social Democrat and trade unionist, representing so-called revisionist—gradualist, liberal—"trade-union" Socialism, without, however, displaying a deep interest in the ideological struggles of Marxism. His attention was always directed toward practical improvement in the living conditions of the German working class and, above all, its social and moral betterment.

In 1905 Ebert became secretary general of the German Social Democratic Party (SPD). The party had steadily increased in membership and electoral support and had accumulated physical assets and property. He updated party administration, introducing typewriters and filing systems that the party had lacked until that time due to its fear of house searches.

Ebert succeeded August Bebel as party chairman in 1913. Under his leadership, the Social Democratic movement gained increasing influence in German national politics. It was Ebert, in particular, who on Aug. 3, 1914, prevailed upon German Social Democrats to support the war appropriations. The action of the German Social Democratic Party did not differ from that of the other Socialist parties of Europe, in which nationalist feelings remained stronger than internationalist convictions. To its own detriment, Ebert's party gave the "Fatherland" its unconditional support without requiring that Germany adopt a genuine peace policy. In consequence, it lacked the power to force the government to adopt a policy through which Germany might have escaped the crushing defeat that was to destroy the empire and also eventually Ebert's postwar policy.

Ebert could not hold the entire party to his course for long. In March 1917 a left-wing faction left the party to become the Independent Social Democratic Party of Germany (USPD), strenuously rejecting war appropriations and Germany's war policy. Another group split from the SPD to form the Communist Party of Germany (KPD). The leftists who had withdrawn from the SPD sought a social revolution, while Friedrich Ebert and his party wanted to establish a German parliamentary democracy. Even in the midst of the war, the Catholic Centre Party, the Democratic Party (previously the Progressive Party), and the Social Democrats had formed the so-called Black–Red–Gold (Weimar) coalition, named after the colours of the flag of the liberal revolution of 1848.

With Ebert's active cooperation, a new government, headed by Prince Max of Baden and consisting of the three parties of the Black–Red–Gold coalition, was organized in October 1918 through a sweeping constitutional reform that in essential respects foreshadowed the Weimar Constitution. Thus, Germany would not have needed a revolution to achieve parliamentary democratic reform, and Ebert did everything he could to prevent such a revolution from occurring. "I hate the revolution like sin," he later said to Chancellor Max of Baden. But the revolution of November 1918 was not made by Germans to bring about the advent of the republic, democracy, or even Socialism. For nearly all Germans, the revolution had only one aim: peace. Rightly or wrongly, the German people believed that Emperor William II would not secure peace for Germany.

The revolution, winning its race with peace, came three days before the armistice. It triumphed in Berlin on November 9, and on the same day Prince Max of Baden, acting on his own authority, asked Friedrich Ebert to replace him as chancellor. Ebert, who still hoped to establish a regency for the Emperor, actually held office as chancellor for one day. On November 10 he yielded to the *fait accompli* of the revolution and set up an entirely Socialist government, with representatives from the SPD and USPD. Calling itself the Council of People's Representatives, the government derived its authority from the Workers and Soldiers Council, which claimed to speak for Germany and the German Republic but in truth had been elected rather arbitrarily by the factories and regiments of Berlin alone. Ebert was determined to place the power of the Council of People's Representatives and the Workers and Soldiers Council in the hands of a freely elected German parliament as soon as possible. He wished to see a liberal coalition government rather than a Socialist regime in power.

The elections of January 1919 gave the Black–Red–Gold coalition a majority of 85 percent. The republic's first government, under Ebert's fellow party member Philipp Scheidemann, was based on this tripartite coalition, and the new German constitution, the Weimar Constitution, so called after the town in which it was drawn up, was the work of the coalition. By the votes of the three parties forming the coalition, Ebert was elected the first president of the republic.

Ebert and Hugo Preuss, a professor of constitutional law whom he had charged with the task of drafting the constitution, wished to alter the organic structure of the *Reich.* But the old German states (the *Länder,* or territories) successfully resisted the "unitary state" (*Einheitsstaat*) of Ebert and Preuss. Prussia in particular continued to exist as a state. The groups and forces that had until then been the pillars of the old Germany also remained intact, for the first years of the Weimar Republic were taken up by the bloody civil war which the government, under Ebert's presidency, waged against the leftist Socialists and Communists, who had been Ebert's former comrades. The republic exhausted itself in the civil war against Communism and lacked the strength to carry out the basic changes in the *Reich* that might have placed the republic on a lasting foundation. The workers did not want to make an armed defense of the democratic republic. So Ebert and his friend Gustav Noske, the defense minister, had recourse to volunteer groups, the *Freikorps,* which were principally composed of officers of the old army, and suppressed the Communist uprising out of hatred of Communism rather than love of the republic. The old officer corps formed the backbone of the Reichswehr, the republic's army. Together with the officer class and the old officialdom, the Junkers—the landed gentry east of the Elbe River—with their great estates and influence in social and political life, also survived the revolution.

With the elections to the republic's first parliament on June 6, 1920, the Black–Red–Gold coalition lost its majority and was never to regain it. The Social Democratic Party thereby lost its commanding position in the *Reich,* and the political constellation on which Ebert's leadership had been based dissolved. The electoral defeat was a direct result of the Treaty of Versailles. At that time many Germans, including Ebert, were convinced that the peace of Versailles aimed at the destruction of Germany. The resulting loss of confidence in the Black–Red–Gold coalition was the death blow of the Weimar Republic, although in fact the country's strength and stability had remained untouched.

Nevertheless, the first consequence of the Treaty of Versailles was a coup d'état against the republic, the Kapp Putsch, by radical nationalists, a part of the Reichswehr, and the *Freikorps,* which were to be disbanded under the provisions of the peace treaty. The coup of March 13, 1920, led by Wolfgang Kapp, a provincial bureaucrat who planned a restoration of the monarchy, collapsed after a few days, but Ebert's dream of a reconciliation between the army and the Social Democrats was shattered.

Soon thereafter, the government was confronted by a near-fatal crisis. When, in January 1923, Germany was declared in default of coal deliveries under the reparations provisions of the Treaty of Versailles, France, wishing to settle the reparations question decisively, occupied the Ruhr territory. Ebert, like nearly all Germans, supported national resistance and the general strike in the Ruhr, which was directed toward ending foreign military control. But Germany suffered as a result of the strike, in which eventually millions became idle. Inflation assumed staggering proportions, and the country experienced its most severe social and political crisis. Adolf Hitler nearly succeeded in seizing power in Bavaria. Chancellor Wilhelm Cuno, an independent, appointed on the eve of the Ruhr struggle as a man whom Ebert particularly trusted, was helpless in the face of the crisis. Gustav Stresemann, of the right-of-centre People's Party, who succeeded Cuno, brought the crisis under control. Ebert initially appointed him only with hesitation and treated him with reserve but finally gave him his full support. He bitterly rebuked his own party when, protesting Stresemann's move to a more rightist position, it dropped out of the governing coalition and thus brought about the Chancellor's res-

ignation in November 1923. In point of fact, Ebert's party had thereby eliminated itself from active participation in German national politics for many years to come.

The unity of the *Reich* was preserved. Inflation was ended through monetary reform, and a means for resolving the reparations question was partially resolved in an American proposal providing for their reduction. The evacuation of the Ruhr district was in sight. Yet much of the German right persisted in its defamation of Friedrich Ebert. The judgment of a German court, which ruled that Ebert had committed high treason, at least in the legal sense, during the war by his support of a munition workers' strike, contributed to his early death. (M.Fre.)

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Ebetsu, city, Hokkaido, Japan, on the lower Ishikari-gawa (Ishikari River). It originated as a colonial farm village settled by 10 families from Honshu in the early Meiji era (1868–1912). It is a satellite city of Sapporo with a well-planned residential area and industries, including food processing, metal, pottery, and paper manufacturing. Important factors of its industrial growth are abundant water and a hydroelectric power plant on the Ishikari-gawa, the largest power plant in Hokkaido. Pop. (1980) 86,349.

Ebionite (Hebrew *evyonium,* "poor men"), a member of an early Christian ascetic sect that retained and exaggerated the Jewish emphasis in Christianity. Explicit mention of the Ebionites is first found in the works of Irenaeus (*c.* 185), and they were known to still exist in the 4th century. They evidently left Palestine and settled in Transjordan and Syria and were later known to be in Asia Minor, Egypt, and Rome.

According to Irenaeus, the Ebionites believed in one God, the Creator, taught that Jesus (the son of Joseph and Mary) was the Messiah, used only the Gospel According to Matthew, rejected Paul as an apostate from the Jewish Law, and venerated Jerusalem as the house of God. Later writers stated that the sect was founded by a certain Ebion and that the Ebionites believed Jesus became the Messiah because he obeyed the Jewish Law. They denied the preexistence of the Logos (Word), although some of them finally accepted the virgin birth of Jesus. By the 3rd or 4th century, they described Jesus as the "Son of Man" and the true "prophet" mentioned in Deut. 18:15. They were removing what they regarded as interpolations from the Old Testament in order to uphold their teachings, which included vegetarianism, holy poverty, and frequent ritual washings. They rejected sacrifices and the Jewish Temple.

Most of the features of Ebionite doctrine were anticipated in the teachings of the earlier Qumrān sect, as revealed in the Dead Sea Scrolls. Evidently, the Ebionite movement arose after the destruction of the Jewish Temple in Jerusalem in AD 70 and for a time had some association with Jewish Christianity. When they rejected Paul, however, the Ebionites were not following the example of the Christian Church in Jerusalem. Finally, they found even the Gospel According to Matthew unsatisfactory, and they developed their own literature, including the gospels of the Ebionites and of the Nazarenes.

Ebira (people): *see* Igbira.

Ebisu, in Japanese mythology, one of the Shichi-fuku-jin (Seven Gods of Luck); the patron of fishermen and tradesmen. He is depicted as a fat, bearded, smiling fisherman often carrying a rod in one hand and a *tai* (sea bream—*i.e.,* a red snapper—symbolic of good luck) in the other. He is a popular Shintō deity, and his image is frequently seen in shops and places of commerce.

Ebisu, detail of a painting by Hokurei, 1851; in the Museum für Völkerkunde, Vienna

By courtesy of the Museum fur Volkerkunde, Vienna

In some Shintō shrines Ebisu is identified with Hiru-ko (usually translated Leech Child), the misconceived firstborn son of the creator couple Izanami and Izanagi, who considered him inadequate and set him adrift in a reed boat. Ebisu is also sometimes associated with Koto-shiro-nushi (Sign-Master), a son of the mythological hero Ōkuninushi and associated with happiness because of the role he once played as a pacifier in a conflict between earthly and heavenly deities. *See also* Shichi-fuku-jin.

Ebla, modern TALL MARDĪKH, also spelled TELL MARDIKH, ancient city 33 miles (53 kilometres) southwest of Aleppo in northwestern Syria. During the height of its power (*c.* 2600–2240 BC) Ebla dominated northern Syria, Lebanon, and parts of northern Mesopotamia (modern Iraq) and enjoyed trade and diplomatic relations with states as far away as Egypt, Iran, and Sumer.

Excavation of the tell (mound) now known to be the site of Ebla started in 1964 with a team of archaeologists from the University of Rome led by Paolo Matthiae. In 1975 Matthiae's team found Ebla's archives, dating to the 3rd millennium BC. Discovered virtually intact in the order in which they had once been stored on their now collapsed shelves were some 15,000 tablets and fragments, offering a rich source of information about Ebla.

Part of Ebla's prosperity stemmed from its agricultural hinterland, situated in the rich plain of northern Syria, where barley, wheat, olives, figs, grapes, pomegranates, and flax were grown and cattle, sheep, goats, and pigs were raised. Beyond, Ebla controlled a group of 17 city-states, probably located in what is now Lebanon and southeastern Turkey, areas richly endowed with silver and timber. The city proper was a manufacturing and distribution centre. Linen and wool, including damask cloth, were the main products. Metalworking, including the smelting and alloying of gold, silver, copper, tin, and lead, was the second most important activity. Woodworking and the production of olive oil, wine, and beer were also important.

Trade was the third support of Ebla's economy. Cloth, manufactured goods, and olive oil were its main exports; imports included gold, silver, copper, tin, precious stones, and sheep. Because of its geographical location, Ebla grew rich on transit trade. Materials from Iran, Anatolia, and Cyprus were transshipped to states as distant as Sumer and Egypt. The Egyptian trade passed through Byblos.

Diplomacy and limited warfare supported Ebla's commercial activities. Emar, a city strategically located at the confluence of the Euphrates and Galikh rivers, was tied to Ebla by dynastic marriage. Khammazi was Ebla's commercial and diplomatic ally in Iran. Commercial treaties were drawn up with other cities. Mari, on the Euphrates to the southeast, was Ebla's great commercial rival. Twice, an Eblaite army marched against it, and for a time Ebla ruled Mari through a military governor.

Nonhereditary kings governed Ebla for limited terms, and a council of elders shared in decision making. The manufacture of cloth was under the queen's charge. Fourteen governors appointed by the king ruled Ebla's departments, two of them in the city proper.

The religion of Ebla was polytheistic and primarily Canaanite. Dabir was the city's patron god, but Dagon, Sipish, Hadad, Balatu, and Astarte were also worshipped. The language of Ebla was a hitherto unknown Canaanite dialect, most closely akin to the Northwest Semitic languages. The script of the tablets, however, is Sumerian cuneiform, with closest similarity to tablets from Adab and Abū Salābīkh (modern Iraq). Texts reveal that Sumerian teachers came to Ebla, and the presence of a "Canal of Ebla" near Adab attests that Eblaites went to Sumer as well. Vocabularies, syllabaries, gazetteers, and student exercises that have been recovered show that Ebla was a major educational centre. The completeness of Ebla's texts, which at points duplicate fragmentary texts from Sumer, greatly enhances the modern study of Sumerian.

The prosperity of Ebla caught the attention of the Akkadian dynasty (*c.* 2350–2195 BC). Although Sargon of Akkad's claim to have conquered Ebla was cast in doubt by the discoveries in the excavations, the fire that destroyed the city was probably the result of an attack by Sargon's grandson Naram-Sin (*c.* 2240 BC). Following a 250-year period of impoverishment, an Amorite group sacked Ebla and established its own dynasty. The Amorites rebuilt the palace and a temple, and a statue representing one of their kings was excavated in the ruins. Only limited prosperity returned to the city, and a decorated bone sceptre of the pharaoh Ḥtp-ib-Re (reigned *c.* 1765 BC) indicates renewed relations with Egypt. Ebla's final destruction occurred in the great upheavals that engulfed the Middle East *c.* 1650–1600 BC, but many crafts and traditions that originated in the city lived on in Syrian culture.

Articles are alphabetized word by word, not letter by letter

Eblaite language, archaic Semitic language, probably the most ancient to survive in substantial form, dating from the third quarter of the 3rd millennium BC. As a Northern Central Semitic language, Eblaite is affiliated with the Hamito-Semitic family of languages.

Archaeological excavations in the mid-1970s in Tall Mardīkh, near Aleppo in Syria, yielded substantial written documentation of Eblaite in the form of cuneiform tablets and fragments of tablets that constituted the state archives of Ebla. The writing of the archives is classic Mesopotamian cuneiform using many Sumerian logograms. Linguistically, Eblaite is part of the Northern Central Semitic group of languages, which includes Amorite, and is thus distinct from Northern Peripheral Semitic languages such as Old Akkadian.

The information that the archives give about the political and cultural activities of Ebla, still in the early stages of investigation, nevertheless shows that Eblaite was the cultural and administrative idiom of the chancellery of one of the most highly developed Northwest Semitic areas. Beyond serving as a local language, Eblaite was probably the dominant educated language of the stable population throughout the region until the destruction of Ebla by Naram-Sin *c.* 2240 BC. The language demonstrates that the geographical influence of Ebla was considerable, extending north to the Hittite region and perhaps as far south as Egypt.

In addition to revealing the culture of Ebla, the discovery of the Eblaite tablets has aided comparative studies of Semitic languages—including Hebrew—and has also aided modern studies of the unrelated Sumerian language.

Ebner-Eschenbach, Marie, Freifrau von (baroness of), *née* DUBSKY (b. Sept. 13, 1830, Zdislavič, Moravia [now in Czechoslovakia]—d. March 12, 1916, Vienna), Austrian novelist known for sensitive portrayals of Austrian life among both the poor and the aristocratic.

Her first literary venture was the drama *Maria Stuart in Schottland* (1860), but she found her true sphere in narrative. In *Die Prinzessin von Banalien* (1872), *Božena* (1876), and her masterpiece, *Das Gemeindekind* (1887; *The Child of the Parish,* 1893), she graphically depicted the surroundings of her Moravian home and showed a true sympathy for the poor and their problems and an unsentimental understanding of children. *Lotti, die Uhrmacherin* (1879), *Zwei Comtessen* (1885), and *Unsühnbar* (1890) described with equal insight the life of the Austrian aristocracy.

She married the Austrian captain, later field marshal, Moritz, Freiherr von Ebner-Eschenbach, in 1848, and lived first at Vienna, then at Klosterbruck. In 1863 she returned to Vienna, where she remained until her death.

Ebo OF REIMS: *see* Ebbo of Reims.

Eboli, town, Salerno province, Campania region, southern Italy, east of the city of Salerno. The higher and older section of the town dominates the Piana (plain) del Sele. Historic monuments include a castle of the Colonna family and the small Romanesque basilica of S. Pietro alli Marmi (1150). Eboli is an agricultural centre, known principally for olive oil and dairy produce.

"Christ stopped at Eboli," reportedly a local saying, refers to the miserable and backward physical and social conditions in the area to the south of Eboli; it was used as the title of a book of reminiscences by the 20th-century writer Carlo Levi. Pop. (1984 est.) mun., 32,299.

Ebolowa, town, southwestern Cameroon, west central Africa. It lies 70 miles (112 km) south-southwest of Yaoundé, at the intersection of roads to Kribi (west), Yaoundé (northeast), and Gabon (south). It is a centre of the cocoa trade, and an agricultural school operates experimental plantations for African food staples, cacao, and elaeis palms near the town. Local sawmills prepare timber for export to Kribi. Ivory is also important. The town has a hospital, a museum, and an airport. Pop. (1981 est.) 22,222.

ebony, wood of several species of trees of the genus *Diospyros* (family Ebenaceae), widely distributed in the tropics. The best is very heavy, almost black, and derived from heartwood only. Because of its colour, durability, hardness, and ability to take a high polish, ebony is used for cabinetwork and inlaying, piano keys, knife handles, and turned articles. It was employed by the ancient kings of India for sceptres and images and, because of its supposed antagonism to poison, for drinking cups. Herodotus states that the Ethiopians every three years sent a tribute of 200 logs of ebony to Persia.

The best Indian and Ceylon ebony is furnished by *Diospyros ebenum,* which grows in abundance throughout the flat country west of Trincomalee, in Sri Lanka (Ceylon). The tree is distinguished by the width of its trunk and its jet-black, charred-looking bark, beneath which the wood is pure white until the heart is reached. The heartwood excels in fineness and intensity of its dark colour. Although the centre of the tree alone is used, reduced logs 1 to 3 feet (30 cm to almost 1 m) in diameter can be obtained. Much East Indian ebony is from the Coromandel ebony, *D. melanoxylon. D. montana* of India yields a yellowish-gray, soft but durable wood. *D. quaesita* is the tree from which is obtained the wood known in Sri Lanka as Calamander. Its closeness of grain, great hardness, and fine hazel-brown colour, mottled and striped with black, render it valuable for veneering and furniture making.

D. dendo, native to Angola, is a valuable timber tree with very black and hard heartwood known as black ebony, or as billetwood, Gabon, Lagos, Calabar, or Niger ebony. Jamaica, or American ebony, and the green ebony of commerce is produced by *Brya ebenus,* a leguminous tree or shrub; the heartwood is rich dark brown, very heavy, exceedingly hard, and capable of receiving a high polish.

Ebony, American monthly magazine edited for a black middle-class audience, generally considered the finest black magazine in the country and the first to attain mass circulation. Its popularity extends beyond the middle class it addresses.

Ebony was founded in 1945 by John H. Johnson of Chicago, who while editing his high school paper settled on a publishing career. Having successfully started a pocket-sized magazine, *Negro Digest,* in 1942, Johnson borrowed money to launch *Ebony* as a news and photo magazine patterned much after *Life* but aimed at a black readership. *Ebony* was a success with its readers from the start, but persuading national advertisers to buy space in it for such products as cigarettes and general consumer goods posed problems, which the magazine gradually overcame. By 1967 its circulation had surpassed 1,000,000, and the magazine had begun to shift its editorial focus from emphasizing black stars in entertainment and sports to emphasizing achievement in a variety of fields.

Ebot (city, ancient Egypt): *see* Abydos.

Éboué, (Adolphe-) Félix (-Sylvestre) (b. Dec. 26, 1884, Cayenne, French Guiana—d. May 17, 1944, Cairo), black colonial administrator who reached the highest level of the French colonial administrative system and played a crucial role in the adherence of French Equatorial Africa to Charles de Gaulle's Free France in 1940. Though his own career was a symbol of successful assimilation to French culture and career patterns, he assiduously studied the languages and cultures of the Africans with whom he worked, and as an administrator, he advocated respect for the authority of chiefs and for traditional customs.

Éboué graduated from the École Coloniale ("Colonial School") in 1908. He was sent to Oubangui-Chari (now the Central African Republic), where he spent most of his career. He believed in forced labour (for economic progress) but was genuinely friendly with chiefs and (later) with African civil servants. His attitude toward Africans was benevolent but paternalistic.

During an extended leave in the early 1920s, Éboué broadened his contacts with leaders in France, including Blaise Diagne, the first African deputy to the French National Assembly. Although he eventually reached the rank of administrator in chief in 1930, his promotions were slow—not because of his colour, he believed, but because of the low status of Africa and its administrators in the French colonial empire.

In 1932 Éboué was appointed secretary general and later acting governor of Martinique, and finally (1936) he was made a full governor in Guadeloupe, where he introduced many reforms associated with the Popular Front government in France. But he also made enemies there who probably influenced his transfer in July 1938 to Chad, one of the poorest countries in Africa. There he became the key figure in rallying to General de Gaulle that strategically located colony as well as all of French Equatorial Africa. In return, de Gaulle named him governor-general over the entire federation and further honoured him in 1944 by holding the Brazzaville Conference (to discuss postwar colonial reforms) in his capital. A few months later Éboué died while on leave in Cairo, and in 1949 he became the only black to be buried in France's Panthéon of heroes in Paris. A definitive biography is Brian Weinstein's *Éboué* (1972).

Ebro River, Spanish RIO EBRO, Latin IBERUS, or HIBERUS, river, the longest in Spain, rising in springs at Fontibre near Reinosa in the Cantabrian Mountains (Cordillera Cantábrica) and flowing for 565 miles (910 km) to its delta on the Mediterranean coast, midway between Barcelona and Valencia. The Ebro has the greatest discharge of any Spanish river but is navigable upstream only to small boats for 15 miles from its delta to Tortosa. Although its drainage basin is the largest in Spain, at 33,000 square miles (85,500 square km), the land is arid, poor, and sparsely populated. Irrigation, intensified from the 1950s onward, is limited to the main floodplains in the middle reaches of the Ebro between Tudela and Zaragoza (site of the Imperial Canal system, begun in the 16th century) and to the interfluves on the north central plain around Caspe. The modern systems of irrigation canals between the Bárdenas project and the Monegros and Cinca valleys are impressive. The upper part of the basin, the Rioja Alta, around Logroño, gives its name to the Rioja wine produced there.

The Ebro receives water from more than 200 tributaries, the largest of which have been utilized for hydroelectric power and irrigation. A system of 35 major dams produces a significant percent of Spain's hydroelectric power, chiefly in the upper La Noguera valleys. Extensive lignite deposits in the southeastern, or lower, part of the basin are used to produce thermal electric power.

Ebroïn, French EVROUIN (d. 680/683), Neustrian mayor of the palace for some 20-odd years, from 656. After his Merovingian puppet king, Chlotar III, died in 673, Ebroïn took it upon himself to appoint Chlotar's brother, Theodoric III, as successor. Irate at the lack of consultation, the magnates rebelled, calling upon a third brother, King Childeric II of Austrasia; Childeric assumed control in Neustria and also Burgundy and imprisoned Ebroïn in the monastery of Luxeuil in Burgundy. On the assassination of Childeric in 675, Ebroïn escaped, succeeded by duplicity in luring the new mayor of the palace to his death, and eventually restored Theodoric III. Shortly afterward he accused his rival in Burgundy, St. Leodegar (or Léger), bishop of Autun, of complicity in Childeric's murder; the bishop's tongue and lips were cut off before he was finally executed.

In his last years Ebroïn campaigned successfully against the Austrasians, defeating their mayor of the palace, Pepin II, at Lucofao, near Laon, in 680. His cruelty and oppression

were such, however, that he was assassinated by a Frankish nobleman. His death marked the end of Neustrian predominance in Frankish affairs.

ebullism, formation of bubbles in the bodily fluids because of an extreme reduction in the surrounding pressure. Aircraft pilots are susceptible to ebullism when they venture into the upper atmosphere; the higher the pilot goes, the lower the surrounding pressure becomes.

In the atmospheric pressure at sea level (760 mm of mercury), water boils at 212° F (100° C). When the pressure on a liquid is reduced, the boiling temperature of that liquid also decreases. At the altitude of 61,000 feet (or at 47 mm of pressure) the temperature required to boil water is only 98° F (36.7° C). A person's normal body temperature is also about 98° F, which means that liquids and tissues containing water in the body begin to vaporize at this pressure. To prevent ebullism, pilots wear pressurized suits or live in pressurized cabins.

The symptoms include bubbles in the membranes of the mouth and eyes, swelling of the skin, and bubbles in the blood. Circulation and respiration may be impaired or stopped. The brain tissue can be starved of oxygen because of blockage of arteries, and the lungs may show signs of swelling and hemorrhage. Death will result unless recompression is rapid enough to reduce the bubbles before tissue damage occurs.

Eburon glacial stage, division of Pleistocene time in northern Europe (the Pleistocene epoch began about 1,600,000 years ago and ended about 10,000 years ago). The Eburon glacial stage preceded the Waal interglacial stage and followed the Tegelen (Tiglian) interglacial stage, which were both periods of warmer climates. The Eburon glacial stage is represented by sediments that contain fossil fauna and flora that are adapted to cold climatic conditions.

Eça de Queirós, José Maria de, Queirós also spelled QUEIROZ (b. Nov. 25, 1845, Póvoa do Varzim, Port.—d. Aug. 16, 1900, Paris, Fr.), novelist committed to social reform who introduced naturalism and realism to Portugal. He is often considered to be the greatest Portuguese novelist and is certainly the leading 19th-century Portuguese novelist.

The illegitimate son of a prominent magistrate, Eça de Queirós received his degree in law in 1866 from the University of Coimbra and then settled in Lisbon. There his father helped the young man make a start in the legal profession. Eça de Queirós' real interest lay in literature, however, and soon his short stories—ironic, fantastic, macabre, and often gratuitously shocking—and essays on a wide variety of subjects began to appear in the *Gazeta de Portugal.*

By 1871 he had become closely associated with a group of rebellious Portuguese intellectuals committed to social and artistic reform and known as the Generation of '70. Eça de Queirós denounced contemporary Portuguese literature as unoriginal and hypocritical.

He served as consul, first in Havana (1872–74), then in England—in Newcastle upon Tyne (1874–79) and in Bristol (1879–88). During this time he wrote the novels for which he is best remembered, attempting to bring about social reform in Portugal through literature by exposing what he held to be the evils and the absurdities of the traditional social order. His first novel, *O Crime do Padre Amaro* (1875; *The Sin of Father Amaro*), describes the destructive effects of celibacy on a priest of weak character and the dangers of fanaticism in a provincial Portuguese town. A biting satire on the romantic ideal of passion and its tragic consequences appears in his next novel, *O Primo Basílio* (1878; *Cousin Bazilio*).

Caustic satire characterizes the novel that is generally considered Eça de Queirós' masterpiece, *Os Maias* (1888; *The Maias*), a detailed depiction of upper middle-class and aristocratic Portuguese society. Its theme is the degeneration of a traditional family whose last offspring are led into a series of tangled sexual relationships by the actions of their parents, who are symbols of the decadence of Portuguese society.

His last novels are sentimental, unlike his earlier work. *A Cidade e as Serras* (1901; *The City and the Mountains*) extols the beauty of the Portuguese countryside and the joys of rural life. Eça de Queirós was appointed consul in Paris in 1888, where he served until his death.

Écarté, card game in the Euchre family, usually played for a stake with nonplayers making side bets. The game was highly popular in France and England in the 19th century but thereafter declined.

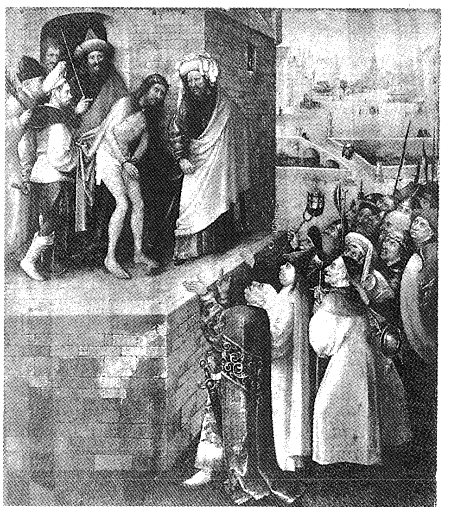
The play is by two hands, though more players frequently participate by betting with or against either player. A pack of 32 cards is used, the cards of each suit ranking K (high), Q, J, A, 10, 9, 8, 7. Each player receives five cards, and the 11th card is turned for trump. Either player may "stand," whereupon the original hands are played out. If neither player stands, each discards his unwanted cards and receives enough new cards to restore his hand to five. Again each player has the opportunity to stand—and so on, until one decides to play. If neither player stands and the pack is exhausted, the hand must be played. The card turned for trump is never changed during the deal. Either player holding the king of trumps may score one point by showing it before the opening lead. Play is largely mechanical, since the second player must win each trick if he can by playing a higher trump or higher card of the suit led. The object is to win three or four tricks, scoring one point, or all five tricks (vole), scoring two points. If the original hands are played and the one who stood fails to take at least three tricks, his opponent scores two points. Game is five points.

Ecbatana, ancient city on the site of which stands the modern city of Hamadān (*q.v.*), Iran. Ecbatana was the capital of Media and was subsequently the summer residence of the Achaemenian kings and one of the residences of the Parthian kings. According to ancient Greek writers, the city was founded in about 678 BC by the semilegendary Deioces, who was the first king of the Medes. The Greek historian Herodotus described the city in the 5th century BC as being surrounded by seven concentric walls. Ecbatana was captured from the Median ruler Astyages by the Persian king Cyrus the Great in 550 BC, and it was taken from the last Achaemenian ruler by Alexander the Great in 330 BC. The site of the ancient city lies partly within the modern city of Hamadān and has never been excavated.

Eccard, Johannes (b. 1553, Mühlhausen, Thuringia [Germany]—d. autumn 1611, Berlin, Brandenburg), German composer known for his setting of the year's cycle of Lutheran chorales.

After serving the banker Jacob Fugger in Augsburg (1577–78), Eccard joined the Königsberg chapel of Prince Georg Friedrich of Preussen-Ansbach in 1579, becoming kapellmeister in 1604. From 1608 until his death in 1611, he was kapellmeister to the electors of Brandenburg. Eccard wrote in a narrow range of forms, his songs and early Masses recalling Orlando di Lasso. He favoured short sacred pieces, vocal and instrumental, and these works of his culminated in a cycle of chorale settings, *Geistliche Lieder auf den Choral,* for five voices (1597). These represent a fusion of choral song and polyphonic motet and avoid the stark economy advocated by some Lutheran extremists.

Ecce Homo (Latin: "Behold the Man"), theme prevalent in western Christian art of the 15th to 17th century, so called after the words of Pontius Pilate to the Jews who demanded the crucifixion of Jesus (John 19:5). Paintings on this theme generally conform to one of two types: devotional images of the head or half-figure of Jesus, or narrative depictions of the judgment hall scene. In either type, the scourged and mocked Christ is shown wearing a crown of thorns and purple robe placed on him by the Roman soldiers. In many examples, his wrists are tied and a rope is knotted around his neck. Scourge marks are frequently emphasized, and his face expresses



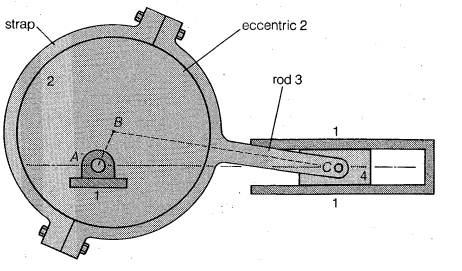
"Ecce Homo," oil painting by Hiëronymus Bosch; in the Städelsches Kunstinstitut, Frankfurt am Main

By courtesy of the Stadelsches Kunstinstitut, Frankfurt am Main; photograph, Joachim Blauel, Munich

compassion toward his accusers. In the narrative versions, two guards are often shown supporting the suffering figure while Pontius Pilate, the Roman governor of Judea, gestures toward Christ, illustrating his words.

Eccelino III da Romano (Italian noble): *see* Ezzelino III da Romano.

eccentric-and-rod mechanism, arrangement of mechanical parts used to obtain a reciprocating straight-line motion from a rotating shaft; it serves the same purpose as a slider-crank mechanism and is particularly useful when the required stroke of the reciprocating motion is small in comparison with the dimensions of the driving shaft. In the figure, the eccentric disk 2 is fixed off centre to the rotating shaft at *A* and has an eccentricity *AB*. The strap and rod 3 consist of two pieces clamped together in a sliding fit in a groove on the periphery of the disk. The rod is connected to the piston 4 within a housing 1. As the eccentric rotates with the shaft, it slides inside the strap, and the piston 4 moves on a straight path of length 2*AB*. *AB* is equivalent to the crankshaft and *BC* is equivalent to the connecting rod of



Eccentric-and-rod mechanism

a slider-crank mechanism. Because an eccentric can be attached anywhere along a shaft it is unnecessary to form any part of the shaft into a crank. Eccentrics are seldom used to transmit large forces because friction loss would be high; they are commonly used to drive the valve gears of engines.

Ecchellensis, Abraham: *see* Ibrāhīm al-Ḥāqilanī.

Eccles, Sir John Carew (b. Jan. 27, 1903, Melbourne), Australian research physiologist, who in 1963 received (with Alan Hodgkin and Andrew Huxley) the 1963 Nobel Prize for Physiology or Medicine for his discovery of the chemical means by which impulses are communicated or repressed by nerve cells.

Working at the Australian National University, Canberra (1951–66), Eccles showed that the excitement of a nerve cell by an impulse causes one kind of synapse to release into the neighbouring cell a substance (probably acetylcholine) that expands the pores in nerve membranes. The expanded pores then allow free passage of sodium ions into the neighbouring nerve cell and reverse the polarity of electric charge. This wave of electric charge, which constitutes the nerve impulse, is conducted from one cell to another. In the same way he found that an excited nerve cell induces another type of synapse to release into the neighbouring cell a substance that promotes outward passage of positively charged potassium ions across the membrane, reinforcing the existing polarity and inhibiting the transmission of an impulse.

Eccles' work, based largely on the findings of Hodgkin and Huxley, had a profound influence on the medical treatment of nervous diseases and research on kidney, heart, and brain function. Among his books are *Reflex Activity*

Sir John Eccles
Archiv fur Kunst und Geschichte, West Berlin

of the Spinal Cord (1932), *The Physiology of Nerve Cells* (1957), *The Inhibitory Pathways of the Central Nervous System* (1969), *The Understanding of the Brain* (1973), and *The Human Psyche* (1980).

Eccles, William Henry (b. Aug. 23, 1875, Barrow-in-Furness, Lancashire, Eng.—d. April 29, 1966, Oxford), British physicist who pioneered in the development of radio communication.

He received his doctorate from the Royal College of Science, London, in 1901, and then taught at South Western Polytechnic, London (1902–16), and, succeeding Silvanus Thompson, at City and Guilds Technical College, London (1916–26).

Eccles was an early proponent of Heaviside's theory that an upper layer of the atmosphere reflects radio waves, and he suggested in 1912 that solar radiation accounted for the differences in wave propagation during the day and night. He experimented with detectors and amplifiers for radio reception and studied atmospheric disturbances of radio reception.

His writings include *Handbook of Wireless Telegraphy* (1915) and *Continuous Wave Wireless Telegraphy* (1921).

Ecclesia, Greek EKKLĒSIA ("gathering of those summoned"), in ancient Greece, assembly of citizens in a city-state. Its roots lay in the Homeric agora, the meeting of the people. The Athenian Ecclesia, for which exists the most detailed record, was already functioning in Draco's day (*c.* 621 BC). In the course of Solon's codification of the law (*c.* 594 BC), the Ecclesia became coterminous with the body of male citizens 18 years of age or over and had final control over policy, including the right to hear appeals in the *hēliaia* (public court), take part in the election of archons (chief magistrates), and confer special privileges on individuals. In the Athens of the 5th and 4th centuries BC, the *prytaneis,* a committee of the Boule (council), summoned the Ecclesia both for regular meetings, held four times in each 10th of the year, and for special sessions. Aside from confirmation of magistrates, consideration of ways and means and similar fixed procedures, the agenda was fixed by the *prytaneis.* Since motions had to originate in the Boule, the Ecclesia could not initiate new business. After discussion open to all members, a vote was taken, usually by show of hands, a simple majority determining the result in most cases. Assemblies of this sort existed in most Greek city-states, continuing to function throughout the Hellenistic and Roman periods, though under the Roman Empire their powers gradually atrophied.

Ecclesiastes, Hebrew QOHELET (Preacher), an Old Testament book of wisdom literature that belongs to the third section of the biblical canon, known as the Ketuvim (Writings). In the Hebrew Bible, Ecclesiastes stands between the Song of Solomon and Lamentations and with them belongs to the Megillot, five scrolls that are read at various festivals of the Jewish religious year. The common Christian English translations follow the Septuagint in placing Ecclesiastes between Proverbs and the Song of Solomon, an order reflecting the old tradition that Solomon wrote all three.

The actual author of Ecclesiastes is unknown, but the superscription (1:1) attributes the book to *qohelet* (commonly translated "preacher," Greek *ekklēsiastēs*), who is identified as "the son of David, king in Jerusalem." Though these words can only refer to Solomon (fl. mid-10th century BC), the frequency of Aramaic forms and the book's rationalistic contents date it sometime about the second half of the 3rd century BC.

The book reflects the ideas of one who questioned the doctrine of retributive justice associated with wisdom theology. His observations on life convinced him that "the race is not to the swift, nor the battle to the strong, nor bread to the wise, nor riches to the intelligent, nor favor to the men of skill; but time and chance happen to them all" (9:11). Man's fate, the author maintains, does not depend on righteous or wicked conduct but is an inscrutable mystery that remains hidden in God (9:1). All attempts to penetrate this mystery and thereby gain the wisdom necessary to secure one's fate are "vanity," or futile. In the face of such uncertainty, the author's counsel is to enjoy the good things that God provides while one has them to enjoy.

ecclesiastical court, tribunal set up by religious authorities to deal with disputes among clerics or with spiritual matters involving either clerics or laymen. Although such courts are found today among the Jews (*see* bet din) and among the Muslims (Sharī'ah) as well as the various Christian sects, their functions have become limited strictly to religious issues and to governance of church property. During earlier periods in history, the ecclesiastical courts often had a degree of temporal jurisdiction, and in the Middle Ages the courts of the Roman Catholic Church rivalled the temporal courts in power.

The range of spiritual matters dealt with often extended into the secular area. The ecclesiastical courts had jurisdiction over sacramental matters that included anything having to do with marriage, such as separation and legitimacy. They also had exclusive jurisdiction over cases involving wills; in England, the ecclesiastical courts, which became Anglican in the 16th century, had complete jurisdiction in matters of succession to personal property until the 16th century and then, in competition with the courts of chancery, until 1857. The courts also claimed jurisdiction over clergy accused of most types of crimes.

The wide power of the church courts caused great controversy during the Middle Ages because many persons were able to claim that they were under the protection of the church and, therefore, were permitted to seek refuge in the church courts. These claimants included crusaders, students, widows, orphans, and, in some areas of the law, anyone who could read.

Church courts had jurisdiction over all disputes concerning discipline or administration of the church, property claimed by the clergy or ecclesiastical corporate bodies, tithes and benefices, questions touching on oaths and vows, and heresy. Wherever heretics were so strongly entrenched that it was thought necessary to repress them, the special ecclesiastical court of the Inquisition (*q.v.*) was employed, and lay rulers were obliged under pain of excommunication to carry out the most severe sentences.

Although bishops originally sat in the lower courts, they were soon replaced in most cases by archdeacons who sat as the bishops' agents. The archdeacons were assisted by special prosecutors and clerks and were replaced themselves by men learned in canon and Roman law. Appeals went to the archbishop and ultimately through papal legates to Rome.

In many areas where royal justice was insufficient, church courts assumed jurisdiction. By the 14th century, as the administration of royal justice increased, controversy between the two powers also heightened. The secular authorities found ways to diminish the powers of the ecclesiastical courts. One was through appeal by writ of error in the secular courts. Then, in more subtle ways, ecclesiastical jurisdiction was limited to spiritual matters. The civil contract of marriage was separated from the sacrament. Other contracts and wills were brought into the secular sphere. By the 16th century on the Continent, the ecclesiastical courts had largely ceased to have any secular functions. Nonetheless, vestiges remained. In parts of Germany, for example, marriage and divorce remained within the jurisdiction of the ecclesiastical courts until the German Civil Code came into force in 1900.

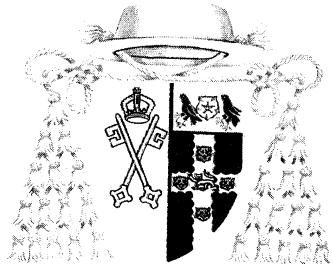
In England today the ecclesiastical courts exercise jurisdiction in civil cases concerning church buildings and in criminal cases in which clergymen are accused of ecclesiastical crimes.

ecclesiastical heraldry, arms associated with the church's administrative and collegiate bodies. Abbeys, priories, and dioceses have their own arms, and high ecclesiastics have always impaled these with their personal arms.

Originally, in most realms, the church assumed arms *motu proprio.* This is still the normal practice, not only in countries such as the United States or France, where there is no heraldic jurisdiction, but also in England. In the Roman Catholic Church a special commission maintains armorial jurisdiction; the arms of the Church of England and of Angli-

can dioceses overseas are the subject of grants of the English kings of arms.

Anglican bishops in England place over their shield a mitre; but the bishop of Durham,



Arms of Cardinal Wolsey

as a bishop palatinate (bishop of a county whose lord had royal powers), has the mitre in a ducal coronet (a coronet decorated with three strawberry leaves), and behind his shield is a sword and crosier in saltire (diagonally crossed). Archbishops have two crosiers in saltire behind the shield.

According to international Roman Catholic usage, a cardinal bears over his arms a red hat with 15 red tassels on each side and behind his shield an archbishop's cross (*i.e.,* a cross with two horizontal limbs) and the pallium (vestment worn as a symbol of full episcopal authority). A Western patriarch has a green hat with 15 green tassels on each side and behind the shield an archbishop's cross. The arms of an Eastern patriarch are more like those of an Anglican bishop insofar as they are surmounted by a mitre. Behind the shield there are in saltire the episcopal crosier and patriarchal baton on one side and the patriarchal cross and doctoral baton on the other. An Eastern archbishop has the same additaments as a Western patriarch but with ten green tassels; a bishop has six green tassels with an episcopal cross behind the shield. A prince-bishop has the shield surmounted by a mitre and a bishop's cross and crosier in saltire, in addition to a red state mantle with ermine surmounted by a prince's crown.

An abbot *nullius* ("of no diocese"; *i.e.,* exempt from episcopal jurisdiction) has over the shield a green hat with six green tassels on each side, a mitre over the shield and a gold cross with a white veil, usually ornamented. An ordinary abbot has a black hat with six black tassels on each side and a gold crosier with a veil behind the shield; a mitre may be used instead of the crosier. A prelate *di fiocchetto* has a purple hat with ten red tassels on each side, while a protonotary apostolic (one of seven members of the College of Protonotaries Apostolic of the Roman Curia) has the same with six red tassels on each side. A domestic prelate has a purple hat with six purple tassels on each side and a privy chamberlain a black hat also with six purple tassels on each side. A canon has a black hat with three black tassels on each side, a rector a black hat with two black tassels on each side, and a simple priest a black hat and one black tassel on each side. (This last is allowed in Scotland to a parish minister of the Church of Scotland, to a rector of the Episcopal Church, or to a Roman Catholic priest.)

Moderators of the general assembly of the Presbyterian Church are entitled to a black ecclesiastical hat with ten blue tassels on each side, and moderators of synods and of presbyteries to a hat with six and three tassels respectively on each side. The clergy of her majesty's Chapel Royal have red tassels and chaplains of a royal castle, blue. The Presbyterian dean of the Chapel Royal of Scotland (who is also abbot of Crossraguel and Dundrennan and dean of the Order of the Thistle) has a green pastoral staff behind his shield. This is also correct for the moderator.

Ecclesiasticus, also called the WISDOM OF JESUS THE SON OF SIRACH, deuterocanonical biblical work (accepted in the Roman Catholic canon but noncanonical for Jews and Protestants), an outstanding example of the wisdom genre of religious literature that was popular in the early Hellenistic period of Judaism (3rd century BC to 3rd century AD). This book appeared in the Septuagint, the Greek translation of the Hebrew Bible, though it was later rejected as apocryphal by Jews. Like other major wisdom books (Proverbs, Ecclesiastes, Job, and Wisdom of Solomon), Ecclesiasticus contains practical and moral rules and exhortations, frequently arranged according to subject matter—*e.g.,* hypocrisy, generosity, filial respect. Wisdom, personified as Sophia, or Lady Wisdom, delivers an extended discourse on her eternal relationship with God (chapter 24) and is identified with the Mosaic Law.

The text is the only apocryphal work whose author is known. It was written in Hebrew in Palestine around 180–175 BC by Ben Sira, who was probably a scribe well-versed in Jewish law and custom.

Ben Sira's grandson, whose name is unknown, carried the book to Alexandria and translated it into Greek shortly after 132 BC for Greek-speaking Jews. The translation was probably intended to encourage adherence to ancestral beliefs and customs and to defend Jewish religious doctrines by showing the essential agreement between Judaism and Hellenistic philosophical truths. The concept of "wisdom" as an active emanation from God, for example, closely approximates the Stoic concept of the universal logos.

The book is extant in a Greek text and in Hebrew texts, some of which was discovered in 1896–97 in the *geniza* ("repository") of the Ezra Synagogue in Cairo and among the Dead Sea Scrolls (*q.v.*).

eccyclema, Greek EKKYKLĒMA, also called EXOSTRA, in classical Greek theatre, stage mechanism consisting of a low platform that rolled on wheels or revolved on an axis and could be pushed onstage to reveal an interior or some offstage scene such as a tableau. It was introduced to the Attic stage in the 5th century to provide directors a means for clarifying the action. Because violence was prohibited from the Greek stage, it is thought by some that murdered bodies may have been displayed on the device.

The eccyclema was used mainly in tragedy but was occasionally employed in comedy. In the *Acharnians* by Aristophanes, for example, a character representing the playwright Euripides is reluctant to leave his house until Dicaeopolis, who wants to borrow a costume, brings him the "scene shifter" to wheel him onstage surrounded by costumes. After violence was no longer proscribed onstage, the eccyclema still served as a scene-shifting device, eventually giving rise to modern turntables and other revolving stage mechanisms.

ecdysiotropic hormone: *see* thoracotropic hormone.

Ecevit, Bülent (b. May 28, 1925, Constantinople [now Istanbul], Tur.), Turkish poet, journalist, and politician, who served as prime minister of Turkey in 1974, 1977, and 1978–80.

Ecevit was educated in Istanbul and became an embassy official in London (1946–50). Ecevit returned to Ankara as a writer and journalist with the newspapers *Halkçi* and *Ulus,* the official organ of the Republican People's Party (RPP), which his father had represented in Parliament.

Ecevit was elected to Parliament as an RPP member for Ankara (1957, 1961) and Zonguldak (1965, 1969) and joined the party council in 1959. During his service as minister of labour (1961–65), he made the strike a legal weapon for labour, for the first time in Turkish history. In 1966 Ecevit became secretary-general of the RPP under İsmet İnönü, whose cooperation with the country's military government he opposed. Ecevit became chairman of the RPP in 1972 and prime minister in January 1974.

As head of government, Ecevit declared an amnesty for all political prisoners and authorized (July 20, 1974) Turkey's military intervention in Cyprus after the Greek-led coup on that island. His request for a vote of confidence from the Parliament in September 1974 failed, and, after a severe political crisis, tenuous power passed to Süleyman Demirel of the Justice Party. After further crises in 1977, during which Ecevit briefly formed a government (June 21–July 3), he was again prime minister in January 1978. Acute economic and social difficulties, however, led to the fall of his government in October 1979.

Among Ecevit's literary works are a Turkish translation (1941) of Rabindranath Tagore's song poems, *Gītāñjalī,* and a translation (1963) of T.S. Eliot's play *The Cocktail Party.* His political writings include *Ortanin solu* (1966; "Left of Centre"), *Bu düzen değişmelidir* (1968; "The System Must Change"), *Atatürk ve devrimcilik* (1970; "Atatürk and Revolution"), *Demokratik Sol* (1974; "Democratic Left"), and *Işçi-Köylü Elele* (1976; "Workers and Peasants Together").

Ecgfrith, also spelled EGFRITH (d. May 20, 685, near modern Forfar, Angus, Scot.), Anglo-Saxon king of the Northumbrians from 670 who ultimately lost his wars against the Mercians on the south and the Picts on the north.

Ecgfrith was the son of King Oswiu and nephew of St. Oswald. By 674 he defeated a south English coalition under Mercian leadership and annexed the region of Lindsey. In 678, however, Ecgfrith was defeated near the River Trent by King Aethelred of Mercia. During an invasion of Pictish territory, he was killed at a place called Nechtanesmere (Duin Nechtain), and his army was destroyed.

Echegaray y Eizaguirre, José (b. April 19, 1832, Madrid, Spain—d. Sept. 4, 1916, Madrid), mathematician, statesman, and the leading Spanish dramatist of the last quarter of the 19th century. Along with the Provençal poet Frédéric Mistral, he was awarded the Nobel Prize for Literature in 1904.

A professor of mathematics in his early life, he entered government service in 1868, holding various positions. He was named minister of finance in 1874 and played a major role in developing the Banco de España.

His first play, *El libro talonario* ("The Checkbook"), was not produced until 1874, when he was 42; but he had a prolific career, producing an average of two plays a year for the rest of his life. His early work is almost wholly Romantic, but, under the influence of Henrik Ibsen and others, he turned to thesis drama in his later work. He often displayed his thesis by use of a satiric reversal; in *O locura o santidad* (1877; *Madman or Saint*), he showed that honesty is condemned as madness by society. In all his plays his manner is melodramatic. Though forgotten now, he achieved tremendous popularity in his day because of his fertile imagination, which he almost invariably used to compensate for his lack of dramatic force. His use of skillfully contrived stage effects, although disastrous in much of his own work, did much to revolutionize the scope of the Spanish theatre.

Echeveria, genus of about 100 species of succulent plants, in the stonecrop family (Crassulaceae), native from Texas to Argentina. Many are popularly called hen-and-chickens because of the way new plantlets, or offsets, develop

in a cluster around the parent plant. The usually broad fleshy leaves have waxy, velvety, or powdery surfaces and are often iridescent and sometimes red-edged when in bright sunlight. Echeverias are popular with collectors of succulent plants for their compact, symmetrical leaf rosettes and for the prominent stalked inflorescence (flower cluster), which usually rises high above the leaves.

The smaller species, such as the wax rosette (*E.* × *gilva*), the pearl echeveria, also called Mexican snowball (*E. elegans*), and the plush plant (*E. pulvinata*), are handsome as small pot plants or in dish gardens along with other succulent species. Larger echeverias, such as *E. gibbiflora, E. coccinea,* and copper roses (*E. multicaulis*), are common in Mexican and southwestern American gardens.

Echeverría Álvarez, Luis (b. Jan. 17, 1922, Mexico City), president of Mexico from 1970 to 1976.

Echeverría became the private secretary of the president of the ruling Institutional Revolutionary Party (PRI) in 1940 and received a law degree from the National Autonomous University of Mexico in 1945. He rose rapidly in political circles and held several important posts in government and the PRI prior to being appointed secretary of the interior in 1964 by President Gustavo Díaz Ordaz. He was severely criticized for his harsh handling of the 1968 student demonstrations that culminated in the "Tlatelolco massacre," in which more than 300 demonstrators were killed or wounded and thousands arrested.

After becoming president, Echeverría moved sharply to the left. He released most of the prisoners arrested in 1968, redistributed millions of acres among the landless peasantry, expanded social security, housing, and transportation programs, and poured huge sums of money into public works. Reversing an earlier stand, he introduced a national family planning program to reduce population growth. His administration was plagued by runaway inflation, high unemployment, and illiteracy, and his leftist economic proposals alienated business interests, causing reduced domestic investment. A declining balance of trade forced the devaluation of the peso by 50 percent in 1976, producing insecurity and antagonism among Echeverría's middle-class supporters. In foreign policy, Echeverría opened diplomatic relations with China and supported Latin American solidarity. He served as ambassador to Australia and New Zealand from 1977 to 1980 under his successor, President José López Portillo.

Echidna (Greek: "Snake"), monster of Greek mythology, half-woman, half-serpent. Her parents were either the sea deities Phorcys and Ceto or Chrysaor, the monstrous son of Medusa, and Callirrhoë, the daughter of Oceanus. Among Echidna's progeny, by the 100-headed Typhoeus, were the dragons of the Hesperides and of the Golden Fleece, the Hydra, the goatlike Chimera, and the infernal hounds Orthus and Cerberus. The Sphinx and the Nemean lion, both sired by Orthus, were also among her offspring.

echidna, also called SPINY ANTEATER, either of two species of egg-laying mammals constituting the family Tachyglossidae, order Monotremata. These stocky, virtually tailless, brownish-furred animals have strong-clawed feet and, on the upper part of the body, spines as well as hair. The spines vary in colour from white and yellow to black. Echidnas of the genus *Zaglossus,* the several forms of which are usually considered races of *Z. bruijni* of New Guinea, are 45 to 78 cm (18 to 31 inches) long and rather piglike, with short, wide-set spines. The other species, *Tachyglossus aculeatus,* found in many habitats across Australia and Tasmania (the latter population sometimes considered a separate species, *T. setosus*), is 35 to 53 cm (14 to 21 inches) long and has spines like a hedgehog's. *Z. bruijni,* which is valued for its meat, is declining in numbers as a combined result of forest clearance and unrestricted hunting.

Echidna (*Tachyglossus aculeatus*)
By courtesy of the New York Zoological Society

To frustrate enemies, an echidna may roll into a ball and dig straight down in loose soil, or it may wedge itself tightly into a crack. Males have spurs on the hindlegs, presumably for combat. Both genera have a narrow, sensitive snout (longer and decurved in *Zaglossus*), a small mouth, and an extensible sticky tongue for feeding on termites and ants. An echidna can fast for a month.

The female lays a single egg, which is transferred into a pouch she developed in the breeding season. Incubation takes about 10 days. The young receives milk, exuded from the nippleless mammary openings, for about seven weeks; then the mother hides its young in a nest of leaves. An echidna may live from 30 to 50 years in captivity.

echinococcosis, also called ECHINOCOCCAL DISEASE, HYDATIDOSIS, or HYDATID DISEASE, formation of cysts, or hydatids, at the site of infestation by the larval form of *Echinococcus granulosus,* a tapeworm common in sheep, cattle, camels, dogs, and many other mammals. The disease can develop in humans upon ingestion of the eggs, which may be present in the tissues of infected animals or on food contaminated by their excreta. The emergent larvae become enveloped in a cyst, most commonly in the liver, that may grow for 5 to 20 years without being detected. Surgical excision of the cyst is the only effective treatment, but in many cases the disease recurs because the contents of the cyst may escape during the operation.

echinoderm, any of a variety of invertebrate marine animals belonging to the phylum Echinodermata, characterized by a hard, spiny covering or skin.

A brief treatment of echinoderms follows. For full treatment, *see* MACROPAEDIA: Echinoderms.

More than 21 classes have been identified, but only about 6,000 species of six classes are known to still exist. The six are: Crinoidea (feather stars and sea lilies), Asteroidea (starfishes), Ophiuroidea (brittle stars and basket stars), Echinoidea (sea urchins, cake urchins, and heart urchins), Concentricycloidea (sea daisies), and Holothurioidea (sea cucumbers). Echinoderms are widely distributed in all the oceans, occurring in marine environments ranging from the intertidal zone to the deepest oceanic trenches.

The most apparent characteristics of echinoderms are the calcite skeleton and the five-rayed, or pentamerous, radial symmetry of the adult body form. The skeletal structure may be a test, a hollow structure formed of solid plates, as found in sea urchins, or it may be composed of many separate smooth or spiny ossicles held together by muscles or ligaments, which is the case in the starfishes.

Most echinoderms have numerous small appendages, called tube feet, that are contained in grooves on the animals' tentacles. Movement of the tube feet is controlled by a hydraulic, or water-vascular, system. Water is taken in and passes into five major canals that channel it into branches that carry it to the tube feet. Local muscle action in contracting or releasing the canals functions to extend or retract the tube feet. The tube feet themselves may be variously modified to serve in locomotion, respiration, tunneling, sensory perception, feeding, and grasping.

Reproduction among echinoderms is either sexual or asexual. In sexual reproduction, eggs are fertilized in the water by sperm and either pass through a larval stage before transforming into juvenile echinoderms or develop directly into juveniles. One kind of indirect development involves fission of the body and regeneration of the missing parts. Starfishes, for example, can regrow an entire organism from one arm if a small portion of the central disk remains attached.

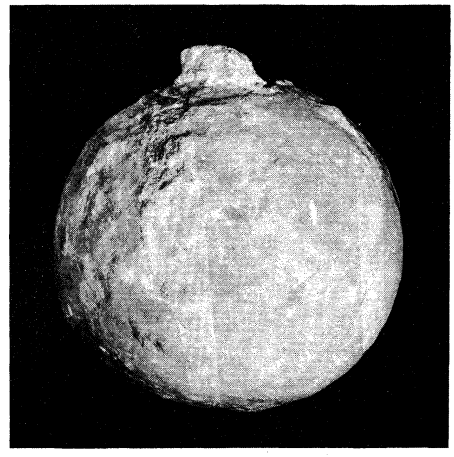
Most echinoderms feed on microscopic detritus or suspended matter (either alive or dead), but many urchins and starfishes graze on plant life. Some starfishes are carnivores and eat mainly mollusks. A few of the echinoderm species are economically important. Some sea urchin roes and the warty sea cucumbers of the genus *Holothuria* are used for food in certain countries (*see* bêche-de-mer). Various species of starfishes, such as *Asterias vulgaris* and *A. forbesi,* that prey on clams and oysters are pests in commercial shellfish beds.

echinoid, any marine invertebrate belonging to the class Echinoidea (phylum Echinodermata). They have a hollow test (internal skeleton) of limy plates. Tube feet, modified for various functions, reach the body surface through pores in the test; all species bear spines and pedicellariae (pincerlike organs).

The body of regular (radially symmetrical) echinoids is globular, and the anus is located opposite the mouth on the underside of the body. In irregular (bilaterally symmetrical) echinoids the body is flattened, the mouth may be off-centre, and the anus may be on the same body surface as the mouth.

The 900 living species of echinoids have their centre of distribution in the Indo-Malayan region. The many extinct species are important Paleozoic and Mesozoic index fossils. For more information on echinoid species and groups, *see* cake urchin; heart urchin; sea urchin.

Echinosphaerites, genus of cystoids, an extinct group related to the sea lily and starfish,

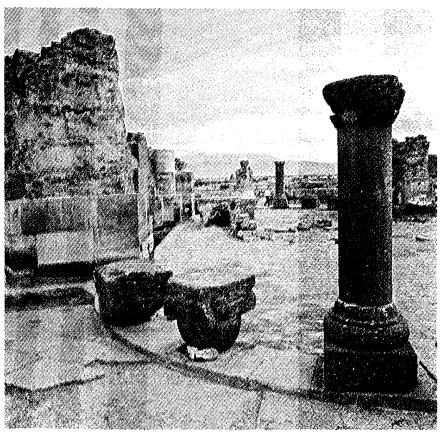


Echinosphaerites, from the Ordovician Period
By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

found as fossils in Ordovician marine rocks (between 430,000,000 and 500,000,000 years old). It is a useful guide, or index, fossil for Ordovician rocks and time.

echiurid (aquatic invertebrate): *see* spoonworm.

Echmiadzin, also spelled EČMIADZIN, formerly (until 1945) VAGARSHAPAT, city, Armenian Soviet Socialist Republic. It lies on the plain of the Araks River, 12 miles (20 km) west of Yerevan. Echmiadzin is the seat of the supreme catholicos, or primate, of the Armenian Catholic Church.



Ruins of a 4th-century church at Echmiadzin
Bjorn Bolstad—Photo Researchers/EB Inc.

Originating in the 7th century BC as the town of Vardkesavan, it was renamed Vagarshapat about AD 140, when the Parthian king Vologases III made it his capital. Upon the conversion of Armenia to Christianity in about AD 300, Vagarshapat became the residence of the Armenian patriarch. In 344 the town ceased to be the Armenian capital, and in 453 the patriarchal seat was removed elsewhere, but in 1441 the catholicos Kirakos brought back the seat to Echmiadzin, which has since remained the home of the "catholicos of all Armenians."

The monastery, founded in the 6th century AD and called Echmiadzin since the 10th century, consists of a complex of buildings surrounded by a brick wall 30 feet (10 m) high; it includes a modern college and seminary. The present cathedral, on the site of the original church, goes back to the 7th century but was considerably restored after 1441. In the cathedral treasury is the sacred hand (relic) of St. Gregory the Illuminator.

The city itself is the centre of a rich region of orchards and vineyards and manufactures plastics, wine, and canned food. Pop. (1974 est.) 37,000.

Echo, in Greek mythology, a mountain nymph, or Oread. In Ovid's *Metamorphoses* she offended the goddess Hera by keeping her talking, thus preventing her from spying on an amour of her husband, Zeus; in punishment, Echo was deprived of speech, except for the power to repeat the last words of another. A hopeless love for Narcissus, who fell in love with his own image, made her fade away to a voice only.

According to the Greek writer Longus, Echo rejected the advances of the god Pan; he thereupon drove the shepherds mad, and they tore her to pieces. Gaea (Earth) buried her limbs but allowed her to retain the power of song.

Echo, series of U.S. communications satellites launched during the early 1960s. The first passive communications satellite placed in Earth orbit was Echo 1, launched on Aug. 12, 1960. It consisted of an aluminum-coated plastic balloon that was inflated after launching to a diameter of 100 feet (30 m). The satellite reflected radio signals from one ground station to another for two-way voice transmissions. Echo 2, launched Jan. 25, 1964, consisted of a larger balloon of plastic and aluminum foil. The Echo 2 project constituted the first space venture involving U.S.–Soviet cooperation. A radio signal transmitted from the Jodrell Bank Observatory, near Manchester, Eng., was reflected off Echo 2 and received at the Zimenki Observatory, near Gorki, U.S.S.R.

echo ranging: *see* echolocation.

echo sounder: *see* depth finder.

echocardiography, diagnostic technique that uses high-frequency sound waves to produce an image of the internal structures of the heart. A piezoelectric transducer placed on the surface of the chest converts electrical impulses into a narrow ultrasonic beam that penetrates body tissues but is reflected off surfaces where a change in tissue density occurs. The reflected sound waves are detected by a receiver also placed on the chest, transformed back into electrical impulses, and projected on the screen of a cathode-ray oscilloscope. Echoes from varied depths produce an image of the walls and valves of the heart and of their motions. Such information can aid in diagnosing valve disease, congenital heart defects, and other cardiac abnormalities.

echoencephalography, method for detecting abnormalities within the cranial cavity, based on the reflection of high-frequency sound pulses delivered to the head through a probe held firmly to the scalp. The reflected pulses from the skin, brain ventricle, skull, and other head structures are recorded and amplified with a cathode-ray oscilloscope, giving a measure of the distance between the probe and the reflecting surfaces. The method is rapid, painless, and harmless; it is a good screening test for mass lesions causing brain shift and is well adapted for emergency examination of patients with brain hemorrhage. *See also* brain scanning.

echolocation, a form of orientation and sensory perception in which a pulse of sound emitted by an animal is reflected from objects and surfaces in the environment and the reflected pulse is analyzed by the animal for purposes of orientation, obstacle avoidance, food procurement, and social interactions.

Echolocation is known to be employed by most bats (all members of the suborder Microchiroptera and one genus, *Rousettus,* of the Megachiroptera); most, if not all, toothed whales and porpoises (Odontoceti), but apparently no baleen whales; a few shrews; and two kinds of birds, the oilbird (*Steatornis caripensis*), of northern South America, and certain cave swiftlets (*Collocalia*) of Southeast Asia.

Echolocation pulses consist of short bursts of sound at frequencies varying from about 7,000 hertz in birds to at least 200,000 hertz in whales. Bats utilize frequencies from about 30,000 to about 120,000 hertz. The pulses are repeated at varying rates (often in a single individual, depending upon the situation) beginning at about one per second. The rate may reach several hundred per second (*e.g.,* in a bat close to its target).

ēchos, plural ĒCHOI, melody type associated with early Byzantine liturgical chant. The eight *ēchoi* (hence, the collective *oktōēchos*) of the Byzantine system were probably derived from Syrian music, and the concept of *ēchos* is also found in Armenian, Russian, and Coptic chant. Tradition gives credit to St. John of Damascus (d. 749) for the invention of the eight Byzantine *ēchoi,* but the *oktōēchos* is mentioned already in an early 6th-century Syrian source.

The *ēchoi* are not scales but groups of melodic formulas that can be combined to form entire melodies. In a collection of Greek *kanōnes* (hymns), each melody is classified according to the *ēchos* from which formulas were selected for its composition. Like the eight modes of Gregorian chant, the *ēchoi* are grouped in four pairs. *Oktōēchos* is also used to refer to a collection of liturgical songs, arranged according to the *ēchos* to which each text is set.

Echternach, town, eastern Luxembourg. Echternach lies along the Sûre River, at the German border, northeast of Luxembourg city. A vacation resort for Trier (Trèves) in Roman times, it developed around a Benedictine abbey founded in 698 by St. Willibrord. The tomb of the saint is in St. Willibrord's Church (11th and 13th centuries), and his relics are the object of a famous pilgrimage and dancing procession every Whit-Tuesday. Other landmarks in Echternach are the 13th-century parish church of Saints Peter and Paul and the town hall (12th and 15th centuries), with a late Gothic colonnade (1520–30). A busy summer resort and excursion centre, Echternach has mineral springs and is also an agricultural market and food-processing centre. Plastics are manufactured. Pop. (1981) 4,159.

Echuca–Moama, twin communities on opposite sides of the Victoria–New South Wales border, Australia. The name Echuca is derived from an Aboriginal term meaning "meeting of the waters," from the city's location at the junction of the Murray and Campaspe rivers. Founded (1847) as a ferrying point, it developed as Victoria's second largest inland river port in the 1850s, handling wool, wheat, and timber. Echuca became a borough in 1865, but it lost its port functions in the 1870s and declined as railroads took over traffic. In 1972, however, work began on restoring the old port facilities as a museum and tourist attraction. Revived by the Goulburn River irrigation project, Echuca now serves (with the adjacent town of Moama across the Murray) a large district that produces livestock, fruits, vegetables, tobacco, cotton, and timber. Secondary industries include sawmilling and flour milling and butter, cordial, and ball-bearing manufacture. Rice mills are supplied from the Wakool–Tullakool area of New South Wales. Echuca was, until 1975, a rail junction and remains an intersection point for several highways. It was declared a city in 1965. Pop. (1986) 10,333.

Ecija, city, Sevilla *provincia,* in the *comunidad autónoma* ("autonomous community") of Andalusia, southwestern Spain. It lies along the Genil River east of Seville. The city contains the Gothic Church of Santiago (15th century) and that of Santa Cruz on the site of a pre-Moorish cathedral, of which fragments survive. Originally named Astygi, the city was called Colonia Augusta Firma by the Romans and Estadja by the Moors. During the 16th and 17th centuries, it shared Seville's prosperity from the West Indian trade. Local products include soap, textiles, vegetable oil, and chocolate. Cereals, olives, and cotton are grown in the surrounding district, which is also known for horse breeding. Because of excessive summer heat, it is also called La Sartén ("The Frying Pan"). Pop. (1981) 34,619.

Eck, Johann, original name JOHANN MAIER (b. Nov. 13, 1486, Egg, Swabia [now in Germany]—d. Feb. 10, 1543, Ingolstadt, Bavaria [now in Germany]), German theologian who was Martin Luther's principal Roman Catholic opponent.

Early in his career Maier adopted the name of his home village, Egg (or Eck), as his surname. He studied at the universities of Heidelberg, Tübingen, Cologne, and Freiburg im Breisgau. He was ordained to the priesthood in 1508 and became a doctor of theology in 1510. In that year he began a lifelong career as professor of theology at the University of Ingolstadt. Eck's early treatises attracted attention, among them one of the first theses (1514) attacking the medieval prohibition against charging interest on money.

Eck was friendly with Martin Luther until the appearance in 1517 of the latter's Ninety-five Theses, which Eck assailed as heretical in a tract published in 1518. In the celebrated Leipzig disputation of 1519, Eck debated with Luther and the latter's disciple, Andreas Karlstadt, on such topics as papal primacy and the infallibility of church councils. In 1520 Eck visited Rome, where he helped compose the papal bull *Exsurge Domine* (June 1520), in which Pope Leo X condemned 41 of Luther's theses and threatened the latter with excommunication. Leo X then commissioned Eck to publish and enforce the new papal bull throughout Germany.

Eck went on to write extensively in defense of papal authority and traditional doctrine. Traveling throughout Europe, he organized Roman Catholic opposition to German Protestantism, and he drafted the Catholic refutation (1530) of the Lutheran creed contained in the Augsburg Confession. He was the main Catholic polemicist in public debates with the Reformers John Oecolampadius in Baden (1526) and Philipp Melanchthon in Worms (1541).

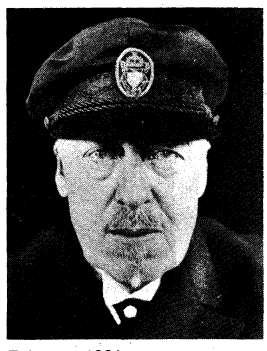
Eck was a prolific writer in Latin, and his many works in that language are notable as learned defenses of the Roman Catholic faith. His treatise entitled *Enchiridion Against the Lutherans* (1525) was a summary of contested Catholic beliefs, Protestant objections to them, and answers to these difficulties. The *Enchiridion* proved to be the most popular of Eck's works and went through 91 editions in various languages up to 1600, making it the best-known Catholic polemical handbook of the century. Eck's German-language translation of the Bible (1537), which he produced for Roman Catholics' use, was largely unsuccessful, however.

Eckener, Hugo (b. Aug. 10, 1868, Flensburg, Prussia [now in Germany]—d. Aug. 14, 1954, Friedrichshafen, W.Ger.), German aeronautical engineer and commander of the first lighter-than-air aircraft to fly around the world.

As a member of the firm operated by Ferdinand, Graf von Zeppelin, Eckener was instrumental in developing the rigid airships of the early 1900s. During World War I, Eckener trained airship pilots and directed the construction of 88 Zeppelins for the German navy.

Returning to commercial construction in November 1918, after Zeppelin's death, Eckener succeeded in popularizing airship travel. He commanded the ZR-3 in its flight across the Atlantic in 1924. The ZR-3 (later named *Los Angeles*) had been built for the United States as a war reparations payment. Eckener also commanded the *Graf Zeppelin* on its epic around-the-world flight in 1929 and on its polar-exploration flight in 1931.

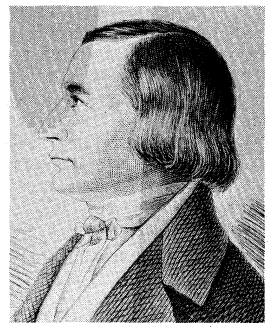
Eckener was popular internationally but not within Adolf Hitler's government, which had relieved him of airship command prior to May 6, 1937, when the *Hindenburg,* successor to the *Graf Zeppelin,* burned at Lakehurst, N.J., with heavy loss of life—a tragedy that ended international passenger airship flights. In 1938 Eckener was sent to the United States in an unsuccessful attempt to buy helium for German dirigibles, which had been using the dangerous hydrogen. He spent his last years as head of a machine factory.



Eckener, 1931

By courtesy of the Staatsbibliothek Preussischer Kulturbesitz Bildarchiv, Berlin

Eckermann, Johann Peter (b. Sept. 21, 1792, Winsen, Hanover [now in Germany]—d. Dec. 3, 1854, Weimar, Prussia [now in Germany]), German writer, chiefly remembered as the assistant and close associate of the aging Goethe; his *Gespräche mit Goethe in den letzten Jahren seines Lebens, 1823–32,* 3 vol. (1836–48; "Conversations with Goethe in the Last Years of His Life"), is comparable in importance with James Boswell's *Life of Johnson.*



Eckermann, engraving after a drawing by Karl Eckermann, 1854

Bavaria-Verlag

Reared in great poverty, Eckermann served in the northern German War of Liberation (1813–14) against Napoleon and became a clerk in the war department at Hanover, later studying for a year at Göttingen. At an early age Goethe became his idol. He published a book of poems in 1821 and in 1823 attracted Goethe's attention by sending him the manuscript of his *Beiträge zur Poesie mit besonderer Hinweisung auf Goethe* ("Helps Toward Understanding Poetry with Special Instructions on Goethe"), which contained sensitive appreciations of Goethe's work. Goethe invited Eckermann to Weimar, and he there gave up his own ambition of becoming an original poet to become Goethe's unpaid literary assistant. He also acted as tutor to the son of the grand duke of Saxe-Weimar-Eisenach and, in 1838, acquired an appointment at the Weimar court and the position of librarian.

Eckermann's most important work has been translated into every European language. The first English translation, *Conversations with Goethe* (1839), was made by the American feminist leader Margaret Fuller. Based on notes taken with Goethe's permission, Eckermann's *Conversations* are not mere records of interviews but an artistically selective arrangement of information on Goethe's life and thought. Eckermann also acted as Goethe's literary executor and published his posthumous works (1832–33) and, with F.W. Riemer, prepared the first complete edition of Goethe's works.

Eckert, J(ohn) Presper, Jr. (b. April 9, 1919, Philadelphia, Pa., U.S.), American engineer and coinventor of the first working all-electronic digital computer, the prototype for most computers in use today.

During World War II, Eckert, at 24 years old, and John W. Mauchly, a professor of electrical engineering, made several valuable improvements in computing equipment. Realizing, however, that a new approach was needed for massive computation problems, the two won a contract from the government to build a digital computer. They completed the machine (derived from a design by John V. Atanasoff) in 1946, calling it ENIAC (Electronic Numerical Integrator and Calculator). In primitive form, ENIAC contained virtually all the circuitry used in present-day high-speed digital computers. It was used by the U.S. Army for military calculations.

In 1948 Eckert and Mauchly established a computer-manufacturing firm; a year later, they announced BINAC (Binary Automatic Computer), which stored information on magnetic tape rather than on punch cards. Designed to handle business data, UNIVAC I (Universal Automatic Computer), Eckert and Mauchly's third model, found many uses in commerce and may be said to have started the computer boom. Between 1948 and 1966 Eckert received 85 patents, mostly for electronic inventions.

Eckert remained in executive positions as the Eckert-Mauchly Computer Corporation was acquired by Remington Rand, Inc., in 1950 and that firm was, in turn, merged into the Sperry Rand Corporation in 1955.

Eckhart, MEISTER (German: Master Eckhart), original name JOHANNES ECKHART, also called ECKHART VON HOCHHEIM, Eckhart also spelled ECKEHART (b. *c.* 1260, Hochheim, Franconia [now in Germany]—d. perhaps 1327 or 1328, Avignon, Fr.), Dominican theologian and writer who was the greatest German speculative mystic. In the transcripts of his sermons in German and Latin, he charts the course of union between the individual soul and God.

Johannes Eckhart was born about 1260 at Hochheim. He entered the Dominican Order when he was 15 and studied in Cologne, perhaps under the Scholastic philosopher Albert the Great. The intellectual background there was influenced by the great Dominican theologian Thomas Aquinas, who had just died. In his mid-30s, Eckhart was nominated vicar (the main Dominican official) of Thuringia. Before and after this assignment he taught theology at Saint-Jacques's priory in Paris. It was also in Paris that he received his master's degree (1302) so that always after he was called Meister Eckhart.

Eckhart wrote four works in German (usually called "treatises"). At about the age of 40 he wrote the *Talks of Instruction,* on self-denial, the nobility of will and intellect, and the obedience to God. At the same period, he faced the Franciscans in some famous disputations on theological issues. In 1303, he became provincial (leader) of the Dominicans in Saxony and, three years later, vicar of Bohemia. His main activity, especially from 1314, was preaching to the contemplative nuns established throughout the Rhine River valley. He resided in Strassburg as a prior.

The best-attested German work of this middle part of his life is the *Book of Divine Consolation* dedicated to the Queen of Hungary. The other two treatises were *The Nobleman* and *On Detachment.* The teachings of the mature Eckhart describe four stages of the union between the soul and God: dissimilarity, similarity, identity, breakthrough. At the outset, God is all, the creature is nothing; at the ultimate stage, "the soul is above God." The driving power of this process is detachment.

1. Dissimilarity: "All creatures are pure nothingness. I do not say they are small or petty: they are pure nothingness." Whereas God inherently possesses being, creatures do not possess being but receive it derivatively. Outside God, there is pure nothingness. "The being (of things) is God." The "noble man" moves among things in detachment, knowing that they are nothing in themselves and yet aware that they are full of God—their being.

2. Similarity: Man thus detached from the singular (individual things) and attached to the universal (Being) discovers himself to be

an image of God. Divine resemblance, an assimilation, then emerges: the Son, image of the Father, engenders himself within the detached soul. As an image, "thou must be in Him and for Him, and not in thee and for thee."

3. Identity: Eckhart's numerous statements on identity between God and the soul can be easily misunderstood. He never has substantial identity in mind, but God's operation and man's becoming are considered as one. God is no longer outside man, but he is perfectly interiorized. Hence such statements: "The being and the nature of God are mine; Jesus enters the castle of the soul; the spark in the soul is beyond time and space; the soul's light is uncreated and cannot be created, it takes possession of God with no mediation; the core of the soul and the core of God are one."

4. Breakthrough: To Meister Eckhart, identity with God is still not enough; to abandon all things without abandoning God is still not abandoning anything. Man must live "without why." He must seek nothing, not even God. Such a thought leads man into the desert, anterior to God. For Meister Eckhart, God exists as "God" only when the creature invokes him. Eckhart calls "Godhead" the origin of all things that is beyond God (God conceived as Creator). "God and the Godhead are as distinct as heaven and earth." The soul is no longer the Son. The soul is now the Father: it engenders God as a divine person. "If I were not, God would not be God." Detachment thus reaches its conclusion in the breakthrough beyond God. If properly understood, this idea is genuinely Christian: it retraces, for the believer, the way of the Cross of Christ.

These teachings are to be found in his Latin works too. But the Latin *Sermons, Commentaries on the Bible,* and *Fragments* are more Scholastic and do not reveal the originality of his thought. Nevertheless, Eckhart enjoyed much respect even among scholars. In his 60th year he was called to a professorship at Cologne. Heinrich von Virneburg—a Franciscan, unfavourable to Dominicans, anyway—was the archbishop there, and it was before his court that the now immensely popular Meister Eckhart was first formally charged with heresy. To a list of errors, he replied by publishing a Latin *Defense* and then asked to be transferred to the pope's court in Avignon. When ordered to justify a new series of propositions drawn from his writings, he declared: "I may err but I am not a heretic, for the first has to do with the mind and the second with the will!" Before judges who had no comparable mystical experience of their own, Eckhart referred to his inner certainty: "What I have taught is the naked truth." The bull of Pope John XXII, dated March 27, 1329, condemns 28 propositions extracted from the two lists. Since it speaks of Meister Eckhart as already dead, it is inferred that Eckhart died some time before, perhaps in 1327 or 1328. It also says that Eckhart had retracted the errors as charged.

Although Eckhart's philosophy amalgamates Greek, Neoplatonic, Arabic, and Scholastic elements, it is unique. His doctrine, sometimes abstruse, always arises from one simple, personal mystical experience to which he gives a number of names. By doing so, he was also an innovator of the German language, contributing many abstract terms. Today there is a great interest in Eckhart among some Marxist theorists and Zen Buddhists. (R.Sch.)

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Eckhel, Joseph Hilarius (b. Jan. 13, 1737, Enzersfeld, Austria—d. May 16, 1798, Vienna), Austrian numismatist whose classification of coins by region, chronology, and type became the model and standard for later systems.

Eckhel was educated at the Jesuit *Gymnasium* in Vienna, where he had entered the Jesuit order at age 14. He taught grammar at various collegiate schools, but because of poor health he gave up teaching to devote himself to his early interest in numismatics. In 1772 he was sent to Italy, where he had access to important coin collections in Bologna, Rome, and Florence. From 1775 he was professor of antiquities and numismatics at the University of Vienna and curator of the Austrian imperial collection of coins. His great work, through which he founded the science of numismatics, was *Doctrina numorum veterum,* 8 vol. (1792–98; "Knowledge of Ancient Coins").

Eckhof, (Hans) Konrad (Dieterich): *see* Ekhof, (Hans) Konrad (Dieterich).

Eckmühl, Louis-Nicolas Davout, prince d': *see* Davout, Louis-Nicolas.

Eckstine, Billy, original name WILLIAM CLARENCE ECKSTEIN (b. July 8, 1914, Pittsburgh, Pa., U.S.), American singer and bandleader who achieved great personal success while fostering the careers of a number of younger jazz musicians.

Eckstine left Howard University after winning an amateur contest in 1933 and began singing in nightclubs and with dance bands. From 1939 to 1943 he sang with Earl Hines's band, and at his urging Hines hired such newcomers as Sarah Vaughan, Dizzy Gillespie, and Charlie Parker. In 1944 Eckstine formed his own band, which in its three-year existence gave strong impetus to the new bebop style in featuring the talents of Gillespie, Parker, Miles Davis, Fats Navarro, Gene Ammons, Tadd Dameron, Art Blakey, and others. From 1947 on Eckstine was a successful popular singer; among his recordings were "Caravan," "Prisoner of Love," "You Go to My Head," and "That Old Black Magic."

eclampsia: *see* preeclampsia and eclampsia.

eclecticism (from Greek *eklektikos,* "selective"), in philosophy and theology, the practice of selecting doctrines from different systems of thought without adopting the whole parent system for each doctrine. It is distinct from syncretism—the attempt to reconcile or combine systems—inasmuch as it leaves the contradictions between them unresolved. In the sphere of abstract thought, eclecticism is open to the objection that insofar as each system is supposed to be a whole of which its various doctrines are integral parts, the arbitrary juxtaposition of doctrines from different systems risks a fundamental incoherence. In practical affairs, however, the eclectic spirit has much to commend it.

A philosopher, no less than a statesman, may be eclectic not on principle but because he perceives the intrinsic merit of doctrines that happen to have been advanced by opposite parties. This tendency is naturally most apt to manifest itself when established systems are losing their novelty or revealing their defects as changes of historical circumstance or scientific knowledge occur. From the beginning of the 2nd century BC, for instance, a number of philosophers professing to be attached to long-established schools—the Greek Academy, the Peripatetics, or the Stoics—were ready to adopt views from other schools; and Roman philosophers, in particular, to whom all Greek philosophies were enlightening, often avoided rigid partisan commitments, which even the Greeks themselves were abandoning. (Cicero was the eclectic par excellence.) It is clearly pointless to group the numerous ancient eclectics together as if they formed an Eclectic school. In 19th-century France, however, Victor Cousin, a proponent of Scottish metaphysics, adopted the name *éclectisme* as a designation for his own philosophical system.

Articles are alphabetized word by word, not letter by letter

eclipse, in astronomy, complete or partial obscuring of a celestial body by another. An eclipse occurs when three celestial objects become aligned.

A brief treatment of eclipses follows. For full treatment, *see* MACROPAEDIA: Eclipse, Occultation, and Transit.

The many eclipse phenomena known to astronomers are of two distinctly different types. In the first, the eclipsing body comes between an observer and the eclipsed object; the latter appears to the observer totally or partly covered by the eclipsing object. Eclipses of the Sun, occultations of stars by the Moon, transits of Venus or Mercury across the Sun's disk, and eclipses of binary stars are of this kind. Eclipses of the second type affect only planets or natural satellites that are not self-luminous. In this case, the eclipsing body intervenes between the Sun and the eclipsed object. The latter remains in view of the observer, but its illumination by the Sun is interrupted, and it becomes darkened by entering into the shadow of the eclipsing object. Examples of this kind of eclipse phenomenon are eclipses of the Moon and eclipses of the satellites of Jupiter.

Solar and lunar eclipses have long been of interest, because they are readily observable to the unaided eye and offer an impressive spectacle. Primitive peoples were struck with fear by the falling darkness during a total solar eclipse or by the strange sight of the eclipsed Moon. Accounts of such eclipses are found among the oldest records of history, and the successful prediction of eclipses constitutes one of the earliest achievements of the scientific investigation of nature.

Solar eclipses. A solar eclipse occurs when the Moon, revolving in its orbit around the Earth, moves across the disk of the Sun so that the shadow of the Moon sweeps over the face of the Earth. No sunlight penetrates the umbra, the inner part of the shadow. To observers on the Earth within the umbra, the disk of the Sun will appear completely covered by that of the Moon. Such a solar eclipse is said to be total. Because the umbra is narrow at its intersection with the Earth, a total eclipse can be observed only within a very narrow area—the zone of totality. Furthermore, because of the relative motion of the bodies, the conical shadow moves rapidly over the terrestrial surface; the totality of the solar eclipse thus lasts only a short time (less than eight minutes at any one place on the Earth). To observers located within the penumbra, the outer portion of the Moon's shadow, the disk of the Moon will appear to be projected against the Sun so as to overlap it in part. This gives rise to a partial solar eclipse. Because the Earth revolves around the Sun in an elliptical orbit, the distance of the Sun changes slightly during the course of a year. Similarly, the apparent size of the lunar disk changes to some degree during a month because of the elliptical shape of the Moon's orbit. If an eclipse occurs when the Sun is closest to the Earth and the Moon is farthest away, the Moon will not completely cover the Sun, thereby leaving the rim of the

latter all around it. This form of eclipse is known as an annular eclipse.

Eclipses of the Sun occur two to four times a year. In rare instances, more may occur, as in 1935, when there were five solar eclipses.

Partial solar eclipses yield little information of astronomical interest. Total eclipses, on the other hand, have contributed much knowledge about the nature of the chromosphere and corona, the thin external layers of the Sun that are usually lost in the brilliant glare from the shining solar surface (the photosphere). At total eclipse the Moon acts as a screen outside the Earth's atmosphere, cutting off the direct rays from the photosphere. The brillance of the sky is decreased greatly, and the fainter appendages of the Sun become visible. The astronomical value of eclipse observation has decreased in recent years, largely as a result of the invention of the coronagraph. This instrument obscures the photosphere artificially and thereby makes it possible for investigators to conduct studies of the solar chromosphere and corona without waiting for eclipses to occur.

Lunar eclipses. A lunar eclipse occurs when the Moon travels through the shadow of the Earth and loses its bright illumination by the Sun. It can occur only at the time of the full Moon (*i.e.,* when the Moon is directly opposite the Sun), because the Earth's shadow is directed away from the Sun. A lunar eclipse can be seen from any place on the Earth where the Moon is above the horizon. Such an eclipse can be total, partial, or penumbral, depending on the Moon's position. If the Moon passes through the centre of the Earth's umbra, a total lunar eclipse occurs. Totality may extend up to 100 minutes, with the entire eclipse lasting about 3½ hours. A partial lunar eclipse is observable when only a part of the Moon passes through the umbra. The penumbral variety occurs when the Moon moves solely through the outer part of the shadow. Lunar eclipses generally occur twice a year. In some years, however, there may be none, whereas in others, one or possibly three may take place.

Lunar eclipses are of limited value for astronomical research. They have enabled scientists to study the reactions of materials on the Moon's surface to the sudden removal of solar radiation. The results of this research have led to a better understanding of the structure and heat conductivity of lunar soil.

Other eclipse phenomena. From the Earth, the Moon appears against a background of distant stars. As the Moon moves eastward across the constellations, it occasionally passes in front of one of the brighter stars or a planet, causing an occultation. At the moment when the eastern limb of the Moon reaches a star, the latter suddenly disappears (immersion). In about an hour or less, the Moon will have passed over the star and the star will reappear at the western limb (emersion). Accurately timed observations of occultations are used to study the orbital motion of the Moon. Measurements of the time required for a star to disappear also provide information about the diameters of the stars.

The two planets Mercury and Venus, which are closer to the Sun than is the Earth, occasionally pass between the Earth and the Sun. At such a time, either of these planets appears as a small, dark circular disk projected on the brilliant disk of the Sun, crossing it slowly. Transits of Venus have been of considerable importance for accurately determining the solar parallax.

Eclipsing binaries are double-star systems consisting of two stellar bodies that revolve around one another in an orbit whose plane nearly passes through the solar system. Thus, one star passes periodically in front of or behind the other as seen from the Earth, and two eclipses take place during each revolution. From the way in which the light from the binary system varies, it is possible to calculate the orbit and relative sizes of the two components.

eclipsing variable star, pair of stars revolving about their common centre of mass in an orbit whose plane passes through or very near the Earth. An observer on the Earth thus sees one member of the binary pass periodically over the face of the other and diminish its light through an eclipse. The star Algol was the first recognized as an eclipsing binary, by John Goodricke, in 1782. Several thousand are now known. By comparing the observed duration of the eclipse to the period of the orbit, as determined spectroscopically, astronomers can find the diameters of the stars relative to the size of their orbits, and from this they can calculate the densities of the stars. *See also* variable star; binary star.

ecliptic, in astronomy, the great circle that is the apparent path of the Sun among the constellations in the course of a year; from another viewpoint, the projection on the celestial sphere of the orbit of the Earth around the Sun. The constellations of the zodiac are arranged along the ecliptic. The ecliptic is inclined about 23½° to the plane of the celestial equator; the two points of intersection of the ecliptic and the plane mark the vernal and autumnal equinoxes.

In the ecliptic system of astronomical coordinates, celestial longitude is measured in degrees east from the vernal equinox along the ecliptic. Celestial latitude is measured in degrees north (positive) or south (negative) from the ecliptic to the ecliptic poles. Each ecliptic pole is 23½° from the corresponding celestial pole.

Ecloga (from Greek *eklogē,* "selection"), compilation of Byzantine law issued in 726 by Emperor Leo III the Isaurian in his name and that of his son Constantine. It is the most important Byzantine legal work following the 6th-century Code of Justinian.

Leo issued the law code in Greek instead of the traditional Latin, so that it could be understood by more people and utilized by judges as a practical legal manual. Though the Ecloga continued to be based on Roman law, Leo revised it in the spirit of "greater humanity" and on the basis of Christian principles.

In civil law the rights of women and children were enhanced at the expense of those of the father, whose power was sharply curtailed. In criminal law the application of capital punishment was restricted to cases involving treason, desertion from the military, and certain types of homicide, heresy, and slander. The code eliminated the death penalty for many crimes previously considered capital offenses, often substituting mutilation. Equal punishment was prescribed for individuals of all social classes. In an attempt to eliminate bribery and favouritism, the code provided salaries for officials in judicial service and forbade the acceptance of gifts.

The Ecloga had a strong influence on later Byzantine legislation as well as on the development of law in the Slavic countries beyond the Byzantine frontiers.

eclogite, any member of a small group of igneous and metamorphic rocks whose composition is similar to that of basalt. Eclogites consist primarily of green pyroxene (omphacite) and red garnet (pyrope), with small amounts of various other stable minerals—*e.g.,* olivine and diopside. They are formed when volcanic or metamorphic rocks rich in such mafic minerals are subjected to extremely high pressures and moderate to relatively high temperatures. Laboratory experiments have revealed that eclogites will crystallize from basaltic magma under very high pressure conditions common to the deeper portions of the Earth's upper mantle, the mantle constituting the layer that lies between the crust and core and that comprises about two-thirds of the planet's bulk. Many investigators believe that eclogite is representative of numerous parts of the upper mantle. In the crust eclogites generally occur as xenoliths (*i.e.,* foreign inclusions) in igneous rocks and as isolated blocks measuring as much as 100 m (328 feet) across in metamorphic rocks. Interestingly, eclogites somewhat resemble chondritic meteorites in composition (*see* chondrite).

eclogue, a short pastoral poem, usually in dialogue, on the subject of rural life and the society of shepherds, depicting rural life as free from the complexity and corruption of more civilized life. The eclogue first appeared in the *Idylls* of the Greek poet Theocritus (*c.* 310–250 BC), generally recognized as the inventor of pastoral poetry. The Roman poet Virgil (70–19 BC) adopted the form for his 10 *Eclogues,* or *Bucolics.*

The eclogue, along with other pastoral forms, was revived during the Renaissance by the Italians Dante, Petrarch, Boccaccio, and Battista Spagnoli (Mantuanas), whose neo-Latin *Eclogues* (1498) were read and imitated for more than a century.

Edmund Spenser's series of 12 eclogues, *The Shepheardes Calender* (1579), is considered the first outstanding pastoral poem in English. By the 17th century less formal eclogues were written by such poets as Richard Lovelace, Robert Herrick, and Andrew Marvell. Marvell's "Nymph Complaining for the Death of her Fawn" (1681) climaxed the eclogue tradition of combining rural freshness with learned imitation. In the 18th century English poets began to use the eclogue for ironic verse on nonpastoral subjects, such as Jonathan Swift's "A Town Eclogue. 1710. Scene, The Royal Exchange."

The poets of the Romantic period rebelled against the artificiality of the older pastoral, and the eclogue fell from favour. The form has occasionally been revived for special purposes by modern poets, as in Louis MacNeice's ironic eclogues in his *Collected Poems, 1925–1948* (1949). *See also* idyll.

Eco, Umberto (b. Jan. 5, 1932, Alessandria, Italy), Italian literary critic, novelist, and semiotician (student of signs and symbols).

After receiving a Ph.D. from the University of Turin (1954), Eco worked as a cultural editor for Italian Radio-Television and also lectured at the University of Turin (1956–64). He then taught in Florence and Milan and finally, in 1971, assumed a professorial post at the University of Bologna. His initial studies and researches were in aesthetics, his principal work in this area being *Opera aperta* (1962; rev. ed. 1972, 1976; *The Open Work*), which suggests that in much modern music, Symbolist verse, and literature of controlled disorder (Franz Kafka, James Joyce) the messages are fundamentally ambiguous and invite the audience to participate more actively in the interpretive and creative process. From this work he went on to explore other areas of communication and semiotics in such volumes as *A Theory of Semiotics* (1976) and *Semiotics and the Philosophy of Language* (1984), both written in English. Many of his prolific writings in criticism, history, and communication have been translated into various foreign languages.

His fantasy novel *Il nome della rosa* (1981; *The Name of the Rose*)—in story, a murder mystery set in a 14th-century Italian monastery but, in essence, a questioning of "truth" from theological, philosophical, scholarly, and historical perspectives—became an international best-seller. A film version, directed by Jean-Jacques Annaud, appeared in 1986.

École des Beaux-Arts: *see* Beaux-Arts, École des.

École Polytechnique (French: "Polytechnic School"), engineering school located originally in Paris but, since 1976, in Palaiseau, Fr., and directed by the Ministry of Defense. It was established in 1794 by the National Convention as the École Centrale des Travaux Publics ("Central School of Public Works") under the leadership of Lazare Carnot and Gaspard Monge. It took its present name in 1795 and absorbed the state artillery school in 1802. Originally under the direction of the Ministry of the Interior, it was transformed into a military school by Napoleon (1804). In the past, most graduates became technical officers in the military forces; today most go into government service or business. There are faculties of mathematics, mechanical engineering, physics, chemistry, economics, and humanities and social sciences.

École Spéciale Militaire de Saint-Cyr: *see* Saint-Cyr.

ecology, also called BIOECOLOGY, BIONOMICS, or ENVIRONMENTAL BIOLOGY, study of the relationships between organisms and their environment.

A brief treatment of ecology follows. For full treatment, *see* MACROPAEDIA: Biological Sciences, The.

Ecological studies may focus on the relationships between individual organisms and the physical and chemical features of their environment (physiological ecology). Ordinarily, the tolerance of an organism to a range of factors (*e.g.,* salinity or temperature) is measured in the laboratory. Attempts are then made to relate these results to the distribution of the organism in natural conditions. An ecologist may study the behaviour of individuals. Among the characteristics studied would be the food-gathering techniques of individuals, the survival adaptations against predation, and mating. This area is often referred to as behavioral ecology. An equivalent study of plants would measure the response of the form of the plant to environmental change.

Population ecology is the study of the processes that affect the distribution and abundance of animal and plant populations. The first step is to describe the population. In order to do this, the birth rate, death rate, and rates of immigration and emigration are measured. Fluctuations in the numbers of a particular species, proportions of various species in a population, and predator–prey relationships are all factors that influence population.

An essential component of population ecology is the study of population genetics (ecological genetics), which deals with the behaviour of genes in natural populations. Among areas studied are the change of gene frequencies in nature, the operation of natural selection on genetic characteristics, and the occurrence of polymorphism in species. These problems are studied in theoretical model systems, in the laboratory, and in field populations.

Community ecology is the study of the organization and functioning of communities, which are assemblages of interacting populations of the species living within a particular area or habitat. Ecologists study the ranges of species and why some occupy a larger niche than others, the stability of communities and what factors affect it, the influence of a particular component (*e.g.,* carnivores) within a community, the nutrient cycle, and the influence of climate, as well as many other variables. Sophisticated techniques are available for the description and classification of the different associations of species that compose a community. These techniques are especially well-developed for plant communities (phytosociology). Studies show that the structure of communities can change with time, often in a directional way, known as succession. A community can be viewed as a complex machine that processes energy and nutrients. To study this machine, it is necessary to describe the food web and trace the flow of energy and nutrients through it, from the primary producers (green plants) through the herbivores, carnivores, and decomposers. One of the principles of community ecology is that the more diverse the community and the more complex the food web, the greater stability for the community.

A further important area of ecology is paleoecology—the study of the ecology of fossil organisms. The theory and techniques used in studying present-day organisms are applied to populations and communities of the past.

Ecologists frequently concentrate on particular taxonomic groups, so that there are fields of plant ecology or, more narrowly, insect ecology or the ecology of large mammals. Alternatively, ecologists may study particular environments—*e.g.,* the seashore or tropical rain forest. In applied ecology, basic ecological principles are applied to the management of populations of crops and animals, so that yields can be increased and the impact of pests reduced. Applied ecologists also study the effect of humans on their environment and on the survival of other species. Theoretical ecologists provide simulations of particular practical problems (*e.g.,* the effects of fishing on fish populations) and develop models of general ecological relevance.

econometrics, the statistical and mathematical analysis of economic relationships. Such information is used by governments to set economic policy, as well as by private business to make decisions on prices, inventory, and production.

Early econometric studies attempted to quantify the relationship between the price of a commodity and the amount sold. In theory, demand by individual consumers of particular goods and services depends on their incomes and on the relative prices of items that they intend to buy. Changes in prices and income are expected to have fairly predictable effects on the quantities sold.

Early econometricians used market statistics compiled over time to study the relationship between changes in price and demand. Others used family-budget statistics broken down by income level to estimate relationships between income and expenditure. Such studies show which commodities are elastic in demand (*i.e.,* have sales relatively responsive to changes in their prices) and which are inelastic (have sales less responsive to price changes).

On the producer side, econometric analysis examines production functions, cost functions, and supply functions. The production function is a mathematical expression of the technical relationship between the output of a firm and its various inputs (or factors of production). The earliest statistical analyses of the production function tested the theory that labour and capital are reimbursed according to their marginal productivities—*i.e.,* the amounts added to production by the "last" man hired or the "last" unit of capital employed. Later work implies that the wage rate, adjusted for price changes, is related to labour productivity.

Work in the field of cost functions originally tested the theory that marginal cost—the addition to total cost resulting from an increment in output—first declines as production expands but ultimately begins to rise. Econometric studies, however, indicate that marginal cost often remains more or less constant.

Work in estimating supply functions has been confined mostly to agriculture. Here the problem is to distinguish the effects of exogenous factors, such as temperature, rainfall, and pestilence, from those of endogenous factors, such as changes in prices and inputs.

Observations in many societies over many generations indicate that a small proportion of the population receives most of the income. Attempts have been made to describe this statistical regularity in mathematical terms as well as to explain why the distribution of income is so consistent. Distributional measures are frequently important in analyzing the effect of income inequality on aggregate demand.

After the mid-1930s the development of national income accounting and of macroeconomic theory opened the way for macroeconomic model building, involving attempts to describe an entire economy in mathematical and statistical terms.

A model developed by L.R. Klein and A.S. Goldberger in the United States after World War II was the forerunner of a large family of macroeconometric models. It was constructed on an annual basis and has been elaborated upon in a form known as the Michigan model. A later generation of models, based on quarterly data, permits the analysis of short-term movements of the economy and also permits the better estimation of the lags between different variables.

A model jointly constructed by the U.S. Federal Reserve Board, the Massachusetts Institute of Technology, and the University of Pennsylvania is specially designed to handle the entire monetary sector. It has a large number of financial equations with a detailed lag structure and supplementary equations to show the main directions of monetary influence on the economy.

Similar models have been developed in a number of advanced industrial countries, and many models have been constructed for developing economies as well.

A major purpose in the development of macro models has been to improve economic forecasting and the analysis of public policy. Models have also been applied to the analysis of economic fluctuations and economic growth.

Economic and Social Council (ECOSOC), one of the principal organs of the United Nations, responsible for the direction and coordination of the economic, social, humanitarian, and cultural activities carried out by the specialized agencies of the UN. The council was established by the UN charter, which was amended in 1965 to increase the membership of the council (which is elected by the UN General Assembly) from 18 to 27. In 1974 membership was further increased to 54.

Economic Community of West African States (ECOWAS), African organization established by the Treaty of Lagos in May 1975 to promote economic trade, cooperation, and self-reliance. The organization seeks to harmonize agricultural policies and to facilitate the free movement of peoples, services, and capital between members. The original 15 members were Benin, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo, and Upper Volta (now Burkina Faso). Cape Verde joined in 1977.

ECOWAS contains four specialized commissions: (1) trading, customs, immigration, and monetary payments; (2) industry, agriculture, and natural resources; (3) transportation, telecommunications, and energy; (4) social and cultural affairs.

Economic Co-operation and Development, Organisation for (OECD), international organization founded in 1961 to stimulate economic progress and world trade. Members in the 1980s included Australia, Austria, Belgium, Canada, Denmark, Finland, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland,

Turkey, the United Kingdom, and the United States.

The convention establishing the OECD was signed on Dec. 14, 1960, by 18 European countries, the United States, and Canada and went into effect on Sept. 30, 1961. It represented an extension of the Organisation for European Economic Co-operation (OEEC), set up in 1948 to coordinate efforts in restoring Europe's economy under the Marshall Plan. One of the fundamental purposes of the OECD is to achieve the highest possible economic growth and employment and a rising standard of living in member countries; at the same time it emphasizes maintaining financial stability. The organization has attempted to reach this goal by liberalizing international trade and the movement of capital between countries. A further major goal is the coordination of economic aid to developing countries.

Lacking the power to enforce its decisions, the OECD was essentially a consultative assembly which pursued its program through moral suasion, conferences, seminars, and numerous publications. Its staff, based in Paris, came to more than 1,000 persons. Although the rule of unanimity inhibited its impact, the OECD was considered to have had a significant influence as an advisory body. Maintaining contact with many governmental and international agencies, such as the International Monetary Fund and the General Agreement on Tariffs and Trade, the organization became a clearinghouse for a vast amount of economic data. It published over 10,000 pages annually on a variety of subjects. The range of its interests may be indicated by its published works on general statistics, agriculture, scientific research, capital markets, tax structures, energy resources, lumber, air pollution, educational development, and development assistance. Its bimonthly magazine, *The OECD Observer,* constituted a useful source of information on economic and related social matters. Annual evaluations of individual member countries' economies were also issued.

economic development, the process whereby simple, low-income national economies are transformed into modern industrial economies. Although the term is sometimes used as a synonym for economic growth, generally it is employed to describe a change in a country's economy involving qualitative as well as quantitative improvements. The theory of economic development—how primitive and poor economies can evolve into sophisticated and relatively prosperous ones—is of critical importance to underdeveloped countries, and it is usually in this context that the issues of economic development are discussed.

A brief treatment of economic development follows. For full treatment, *see* MACROPAEDIA: Economic Growth and Planning.

As is the case with many concepts in economics, there is no clear-cut agreement on what constitutes underdevelopment. In broad terms, however, it is generally accepted that the level of national per capita income is a good indicator of a country's prosperity and, therefore, of the level of its economic development. There are, however, very significant differences among developing countries that make it difficult to draw broad general conclusions about the reasons for their underdevelopment and the most effective methods of transforming their economies.

Some generalizations, nevertheless, are necessary to illustrate basic principles. As a rule, theories of economic development assume that existing differences in income levels between the developed and underdeveloped nations are not primarily the result of conditions outside man's control (*e.g.,* natural resources, climate, etc.). It follows from this that all countries have the potential to attain developed status. The task, then, of development economics is to determine how this potential can best be realized. This, in turn, involves the study of the principal causes and symptoms of underdevelopment. Despite the wide differences among developing countries, they share a number of characteristics. In most underdeveloped countries, primary (agricultural or extractive) production accounts for a very large proportion of national income, and, not infrequently, a disproportionate share is taken by one or two products. The level and range of secondary industrial activities tend to be very low and marked by poor technological development. Most of these countries have large quantities of surplus labour, considerable unemployment or underemployment, and fairly high rates of population growth. Another common feature is inadequate infrastructure—poor road and transportation networks, lack of sufficient irrigation, etc. Equally important are the underdevelopment of human resources in terms of skills and education and the weakness of economic and financial institutions.

Development policies followed by developed and underdeveloped nations alike since World War II have largely concentrated on changing these conditions by injecting missing elements into the economies in question. The most visible manifestation of this approach was the building of whole new industrial sectors in the belief that this would not only reduce underdeveloped countries' dependence on a limited number of primary products but would also raise their technological resources and incomes. Since domestic capital resources were generally inadequate for such large industrialization programs, large amounts of foreign funds were introduced in the form of either foreign investment or governmental loans or grants. As a result, many developing countries have seen considerable industrial development since the 1950s. Large sums of domestic and foreign capital were also injected into infrastructural development, and considerable attention was devoted to programs designed to increase the number and quality of skilled and trained personnel. At the same time, developed countries came under considerable pressure to take steps to make the world trading system more helpful to developing countries; such steps included measures to lessen fluctuations in the prices of a number of primary commodities and to provide preferential treatment for exports of manufactured goods from the newly established industries of developing economies.

Although there is little doubt that these policies have assisted economic growth, the overall results are generally regarded as disappointing. The initial emphasis on industrialization often led to the development of sophisticated manufacturing plants that could not be operated efficiently for lack of trained personnel or a sufficiently large and reliable domestic or export market. Furthermore, because such industries are capital- rather than labour-intensive, they did not have a significant employment-creating effect. Another consequence was that, by diverting resources into large-scale industrial projects (and also into such prestige infrastructural developments as superhighways and large airports), the more traditional areas of the economy, on which a large majority of the people depended, were starved for funds and saw little development. Crash programs in education not infrequently resulted in large numbers of highly qualified persons whom the economy could not absorb at an appropriate level. Another serious and continuing problem has been the failure to reduce high rates of population growth.

In sum, although the non-oil-exporting developing countries recorded reasonably good growth in national income during the 1970s, rapid population growth reduced growth in per capital income to a very modest level. At the same time, many developing countries continued to face serious structural imbalances in their economies accompanied by high unemployment, balance of payment deficits, and a growing level of foreign indebtedness. It is now generally accepted that the attempt to reproduce the structure of developed economies in underdeveloped countries by means of large capital investment programs is not the most efficient means of achieving development. In fact, there is a growing consensus that rather less ambitious plans (in both size and technological content) aimed at exploiting the specific resources and natural advantages enjoyed by developing countries can lead to a faster and socially much less disruptive economic development.

economic forecasting, the prediction of future economic activity and developments. Forecasting of this nature has grown rapidly since the 1930s, largely in response to the increasing unpredictability of the economic situation, a greater involvement of governments in economic affairs, which requires the preparation of economic plans and projections, and rapid improvement in the quality and coverage of economic statistics and forecasting techniques. There is a vast array of forecasts available, ranging from short-term predictions for specific economic variables (such as interest rates) or of demand for individual products (such as steel or automobiles) to medium- and long-term forecasts of the economy as a whole. Despite their lack of certainty, such forecasts are widely used in business, government, and private affairs to help in formulating policies, strategies, legislation, and long-term plans.

A brief treatment of economic forecasting follows. For full treatment, *see* MACROPAEDIA: Economic Growth and Planning.

A useful distinction can be made between macro- and micro-economic forecasts. Macroeconomic forecasts are designed to predict the future course of the entire economy or of specific broad economic variables, whereas microeconomic forecasting is designed to project the likely development of particular economic sectors such as one industry, commodity, or firm. The best known and most widely used form of macroeconomic forecast is that of national income or gross national product (GNP). This predicts, in numerical terms, the major components of a country's economic activity—private consumption, government expenditure, private and public investment, and the balance of exports and imports. All countries devote significant resources to this type of forecasting, typically on a one- to five-year basis. These forecasts are used for a number of different purposes. Governments use them to determine future economic strategy and to predict other variables of the economy such as the likely level of inflation, industrial output, employment, etc. Based on such a forecast, the effects of various proposed government actions (a cut in taxation or an increase in government expenditure, for example) can be tested before official policy is finalized.

Macroeconomic forecasts are also used outside government as a basis for producing more detailed projections of the main components of the economy and in the preparation of microeconomic forecasts. By studying the overall forecast of private consumption, for example, a retailer might, by referring to established patterns of spending, predict the amount that is likely to be spent on foodstuffs and nonfood products and then, working in the microeconomic forecasting area, attempt to determine future expenditures in specific product categories. Similarly, an automobile manufacturer will attempt to predict demand for his product by looking at the predicted level of and trends in disposable incomes and consumption and predictions of interest and exchange rates. He will also forecast production costs from the trend of wage increases and inflation. In gen-

eral, most microeconomic forecasting starts with some forecast or assumption about the economy as a whole that is then modified or analyzed into its components in light of special factors and considerations applicable to a particular product, industry, or other concern.

Forecasts range from one month to 10 years or more. However, largely owing to the economic shocks of the last 20 years (*e.g.*, the quadrupling of oil prices in 1972), there has been a trend away from highly numerical long-term forecasts in favour of indications of the broad direction of economic developments, based on both statistical evidence and more or less subjective judgments on such basic aspects of the economy as population growth, technological progress, and social changes. A set of long-term forecasts may be made to indicate the likely outcomes of several different but equally plausible assumptions in a technique often called scenario building.

The techniques of economic forecasting have developed rapidly in recent decades. This in part reflects the growing understanding of the ways in which numerous economic variables affect each other. Equally important reasons are the better availability of good statistics and the development of computer methods for processing large amounts of data. Computer capacity has made possible the practical development of mathematical models of the economy through which it is possible to explore the relationships between the key determinants of the economic system with a speed and to a degree of detail that were not possible before. Most governments and large forecasting organizations use computers in this technique known as econometric forecasting.

economic geology, scientific discipline concerned with the distribution of mineral deposits, the economic considerations involved in their recovery, and an assessment of the reserves available.

A brief treatment of economic geology follows. For full treatment, *see* MACROPAEDIA: Earth Sciences, The.

Economic geology deals with metal ores, fossil fuels (*e.g.*, petroleum, natural gas, and coal), and other materials of commercial value, such as salt, gypsum, and building stone. It applies the principles and methods of various other fields of the geologic sciences, most notably geophysics, structural geology, and stratigraphy (*qq.v.*). Its chief objective is to guide the exploration for mineral resources and help determine which deposits are economically worthwhile to mine. Specialists in economic geology often assist in the extraction of the mineral commodities as well.

economic growth, the process by which a nation's wealth increases over time. Although the term is often used in discussions of short-term economic performance, in the context of economic theory it generally refers to an increase in wealth over an extended period. The term is also generally applied to developed economies. Increases in wealth in underdeveloped economies are discussed in the article economic development (*q.v.*).

A brief treatment of economic growth follows. For full treatment, *see* MACROPAEDIA: Economic Growth and Planning.

There are two main difficulties in discussing economic growth. The first is that, although there is considerable agreement on the main ingredients and conditions of growth, there are major differences among economists as to how these ingredients interact. The second problem is that there is no consensus on what precisely constitutes economic growth. Although the real rate of growth in a country's total output of goods and services (measured by gross national product, adjusted for inflation) is the most widely used yardstick, there are those who argue that national income per capita, consumption per capita, or some other measure is the most appropriate.

Economists and economic historians have long attempted to understand the process of economic growth and the reasons for marked differences in the growth rates of different countries. The aim has been to develop economic models to indicate the best ways of maximizing economic growth. As early as the 18th century Adam Smith attempted to define how and why the economy works, placing considerable emphasis on the role of labour and the operation of unrestricted market forces. More recently economists have developed different theories. W.W. Rostow argued that the process can be divided into stages—the traditional (largely agricultural) stage; a transitional stage, in which the human and technological conditions for a rapid advance are established; the take-off stage of rapid growth; and a mature stage marked by large-scale production and mass consumption. Other analysts have attempted to explain growth in terms of a nation's development from primary (agricultural) through secondary (manufacturing) to tertiary (service) production. A number of theories concentrate on the effects of changes in one or another of the major inputs of productive economies: labour, capital, technological change, and entrepreneurship.

There is nevertheless a large degree of consensus on the main conditions of economic growth. These can conveniently be divided into internal and external conditions. The basic internal condition is the quality and extent of natural resources. These include mineral resources, sources of fuel, the fertility of land, waterways, etc. It is generally agreed that, especially in the early stages of development, natural resources exert a major influence on the rate of economic growth. Even more important are human resources: the size of the labour force as a proportion of total population; the quality of the labour force, which is dependent on the level of education as well as inherent qualities of the people (health, energy, inventiveness, etc.); the intensity of labour, determined by the number of hours worked, the way in which work is organized, and the pressures and incentives exerted by the particular political and economic system.

Closely related to the value of natural and human resources is the extent of capital resources and technological development. A labour force that is equipped with modern, highly productive machinery will produce more per unit of raw materials and time than one that operates with inefficient machinery. Similarly, a labour force that is engaged in the production of high-technology products will produce more added value (the amount by which the cost of raw materials is exceeded by the final selling price) than one engaged in simple processing industries. For this reason, most economists agree that the higher the rate of capital and technological investment, the higher the rate of economic growth. There is considerable empirical evidence that suggests that countries that devote a comparatively high proportion of their resources to investment, as opposed to consumption, tend to have relatively high long-term economic growth rates. Finally, another important internal condition of economic progress is stability of the government. Everything else being equal, a country with political stability will tend to grow faster, as it will attract more investment from both internal and external sources.

There are also a number of key external conditions of national economic progress. The most important of these is the level of world economic activity. This determines the level of world trade, and, since most countries export a substantial proportion of their output, the strength of world trade is a key determinant of the strength of demand for domestic production activities. Closely allied to this are the terms of trade, which measure the value and therefore the price of one country's export goods in terms of the value of its imported products. Thus, if the price of a country's export products exhibits a long-term decline in terms of the cost of its imported goods, its capacity to import is reduced. This can have an adverse effect on the supply of investment goods or raw materials, which will tend to inhibit economic growth.

Historically, commodity-producing countries have faced weakening terms of trade, the effect of which is to retard their economic progress and technological development. The effects of a weakening in the terms of trade, however, can be overcome by an inflow of foreign loans and investment that can enable a country to acquire import goods for domestic development that could not be acquired otherwise. The import of foreign investment is also beneficial in that it can make up for the lack of domestic technological expertise.

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economic indicator, statistic used, along with other indicators, in an attempt to determine the state of general economic activity, especially in the future. A "leading indicator" is one of a statistical series that fairly reliably turn up or down before the general economy does. Common leading indicators are building permits (suggesting the future volume of new construction), common stock prices, business inventories, consumer installment debt, unemployment claims, and corporate profits. Other types of indicators normally move in line with the overall economy ("coincident indicator") or change direction after the economy does ("lagging indicator"). Many types of sales are examples of coincident indicators because they peak or bottom out as the economy does. Lagging indicators are useless for prediction; the value of construction completed, for example, is outdated, for the main economic effects of the construction occurred earlier when the plans were made and construction actually carried on.

economic planning, the process by which key economic decisions are made or influenced by central governments. It contrasts with the laissez-faire approach that, in its purest form, eschews any attempt to guide the economy, relying instead on market forces to determine the speed, direction, and nature of economic evolution.

A brief treatment of economic planning follows. For full treatment, *see* MACROPAEDIA: Economic Growth and Planning.

Economic planning was first attempted in the Soviet Union in the 1920s when, in order to achieve rapid industrialization of a chiefly agricultural and highly disorganized economy, the new Communist regime instituted a rigorously controlled "command" economy. About the same time, planning gained considerable appeal in non-Communist countries as a way of responding to the economic difficulties of the period between the two world wars. Later, during World War II, most governments were forced to introduce strict control of their economies, and by the 1950s the idea that governments should take a significant role in planning and influencing economic activities was widely accepted. Today most countries engage in some form of planning activity.

Currently, the extent and nature of economic planning in any country tends to be closely related to the political complexion of the government in question. At one extreme is the detailed and rigid planning practiced by some Communist countries (notably China, the Soviet Union, and, until recently, most eastern European countries). This involves public ownership of most means of production and the central allocation of resources determined

in the light of the government's economic, political, and social objectives. It requires central determination of what is produced, the level of individual prices, the level of wages, the level of investment, foreign trade, and all other variables of the economy. It also requires enormously detailed control of the activities of individual enterprises and a vast and expensive central planning bureaucracy.

The theoretical justification for this approach to economic planning is that, since market forces are indifferent to social values and can be manipulated by owners of wealth, they cannot be relied on to bring about socially and politically desirable objectives. Furthermore, it is argued, because they cannot guarantee full employment, they are not even capable of ensuring the efficient use of available resources. Against this it is argued that, by eliminating competition, command planning destroys the incentive to effort and enterprise, thereby leading to inefficiency. It is also argued that, despite a vast army of planners, it is not actually possible to control or even identify the myriad activities that make up the economy and that the inevitable results are slow and erratic economic growth, shortages, and structural imbalances necessitating dramatic and wasteful readjustments from time to time.

Certainly the economic achievements of the most rigidly planned economies have been generally disappointing, resulting in growing dissatisfaction with the inflexibilities of such systems. Partly as a result of this, in the 1950s some Communist countries began to experiment with a less rigid and comprehensive variant of the original concept. The process started in Poland in 1956 and, despite strong Soviet pressure against reform, it continued throughout the 1960s and 1970s in most of Eastern Europe; eventually, to a very much lesser extent, it manifested itself in the U.S.S.R. itself. It has been taken furthest in Hungary, where, although the bulk of the factors of production continue to be in public ownership, there is now a fair degree of private enterprise in the supply of consumer goods, services, and foodstuffs. At the same time, the management of publicly owned enterprises is given a degree of freedom over production and pricing decisions, and incentives are provided in the form of profit-related bonuses. This kind of planning has proved relatively successful, although it is often criticized in Marxist circles as representing an unacceptable dilution of the role of the state and of the Communist Party.

At the opposite end of the spectrum are the mixed economies of the Western democracies. Although the extent of planning and government control varies from country to country, the capitalist framework and a sizable private sector are retained in virtually all cases. Furthermore, except for detailed control over one or two key publicly owned sectors, most Western governments tend to influence their economies by regulating such broad economic factors as the money supply, government expenditure, interest rates, etc. The essence of the system is that most production and pricing decisions are made by private business within a broad overall framework, which is set up by the government. The result is a greater degree of enterprise and the absence of a large and expensive planning bureaucracy.

The detailed characteristics of economic planning in the West vary widely. The United States has traditionally been less amenable to governmental planning than western Europe, and France has tended to put greater emphasis on government control of the economy than other developed non-Communist countries. Against this general background, the position of a given country also tends to vary over time; Great Britain's Labour government of the 1960s adopted a strongly interventionist and planning-oriented approach, but the main objective of the Conservative government from 1976 was to reduce the state's role in the economy. One area where most governments follow relatively interventionist policies is regional planning, the basic objective of which is to lessen regional imbalances of wealth, economic infrastructure, income, and employment. The principal means employed are tax incentives, grants, preferential loans, preferential purchasing policies, and other financial incentives.

Developing countries have also adopted the theory and practice of economic planning. Although most of them tend to prepare medium-term (five- or six-year) economic development plans, there is no common approach to such planning. While most developing nations have placed substantial sectors of their economies under government ownership or influence, in only a very few countries is there an attempt to practice detailed command planning. Generally, the basic aim of developing countries' economic planning is to mobilize sufficient funds for the development of their infrastructure and selected areas of industry and to exercise a degree of influence over those sectors of the economy (often the output of primary commodities) from which a very large proportion of the country's income flows. Economic planning in developing countries has not been an unqualified success. Not infrequently the plans are either little more than uncoordinated lists of targets, often chosen on political grounds, or overly ambitious outlines of goals determined a priori rather than on a realistic assessment of the available resources. In some cases excessive dependence on price-volatile primary commodities makes long-term planning extremely difficult, while some countries lack the administrative resources and political stability needed to implement their planning objectives.

economic stabilizer, any of the institutions and practices in an economy that serve to reduce fluctuations in the business cycle through offsetting effects on the amounts of income available for spending (disposable income). The most important automatic stabilizers include the progressive income tax, unemployment compensation and other transfer payment programs, farm price supports, and family and corporate saving.

Income tax collections, for example, decline automatically with gross taxable income during a recession; the effect is even stronger under a progressive tax system in which tax rates go down or up as the individual's income falls or rises.

Unemployment insurance benefits and other public-assistance payments, which rise automatically as unemployment increases during recessions, help to maintain purchasing power. Farm price supports similarly help maintain farm income when farm product prices are falling. The reluctance of families to reduce their living standards also acts to maintain consumer demand during recessions, provided they are able to draw upon savings. Corporations also tend to maintain their ordinary dividend payments out of savings.

Some stabilizers are considerably more effective on the downswing than on the upswing. There is little evidence, for example, that consumers hesitate to increase spending in good times. Also, government payments that increase in time of recession do not always decline after economic recovery.

economic system, set of principles and techniques by which the ownership and allocation of economic resources are decided and organized by society. There are two main types of modern economic system, the private- or free-enterprise economy and the centrally controlled and planned economy. Neither of these is to be found in practice in its pure form; in reality, all economic systems contain varying degrees of each.

A brief treatment of economic systems follows. For full treatment, *see* MACROPAEDIA: Economic Systems.

The basis of the private-enterprise system is the belief that when each member is allowed to pursue his rational self-interest the maximum common good will be generated. In effect, the greatest common good is simply a sum of its constituent parts, and anything that interferes with the pursuit of individual rational self-interest will reduce that sum. The mechanism that assures that the pursuit of myriad private goals will produce public good is the market, which impersonally sets prices for both the factors of production—land, labour, and capital—and the products of industry. With the factors of production in private hands, the proportions in which these factors are combined to produce different goods and services are determined through the price mechanism. If something is supplied in quantities greater than are required, the price will fall or production will be reduced, or both results will occur. If there is unsatisfied demand for any product, the price will rise and, with profits in prospect, production will be stimulated.

The central-planning approach is based on the observations that the private-enterprise system accepts patterns of unequal wealth and income distribution and that, moreover, because of technological and other developments, some producers attain a size and importance that destroy the competitive conditions required for the operation of the market mechanism. The answer, for proponents of central planning, is public ownership of the means of production and the central determination and control of what is produced. In this way, inequalities of wealth and income are to be reduced or eliminated and economic activities organized according to agreed upon social and political objectives.

Most of the developed Western economies are described as private-enterprise systems, while the Communist countries are regarded as having centrally planned and controlled economies. (Developing countries have no established pattern; in many the rival philosophies coexist, often uneasily, with each other.) Most developed Western systems, however, recognize the criticisms of the pure market economy and accept the need for a degree of state involvement. In many of these countries there is a degree of state ownership of economic enterprises, mainly in public utilities and some basic industries. In addition, all governments take an active hand in influencing the nature and tempo of economic growth by controlling such key economic variables as the money supply, interest rates, and government expenditure and borrowing. In most cases, government action in these areas reflects a judgment relating to political, social, or economic objectives, but it is radically different from the prescriptions of the central-planning doctrine in stemming from the belief that freedom of enterprise is the most efficient way of maximizing economic growth. Although the extent of state involvement varies from country to country and may change with successive governments, Western countries agree that private enterprise is to be preferred on both philosophical and practical grounds.

Centrally controlled economies begin with the assumption that state determination of economic goals and detailed state control of economic activities are desirable as matters of principle. In centrally controlled economies, state ownership of the means of production is the rule. The way in which resources are allocated to investment or the output of goods and services is decided and organized in accordance with a detailed economic plan that attempts to ensure, by administrative direction rather than incentive, that all parts of the economy and every enterprise perform

according to a complex set of officially determined interlocking objectives. In practice, this has proved to be impossible. Despite a vast planning and controlling bureaucracy, the fulfillment of each of thousands of objectives cannot be guaranteed, yet such is the rigidity of the system that failure in one aspect will compromise the integrity of the entire plan. Since the Stalinist era, therefore, communist countries have experimented with limited degrees of individual enterprise and decision making to overcome the inflexibility of the system without compromising state control over the basic aims of economic development.

After the relaxation of Soviet control over eastern Europe in 1989, the eastern European nations retreated from the rigid controls of central planning and adopted the economic model that had been pioneered by Hungary in the late 1960s. In that country most of the means of production were still owned by the state, but within some fairly wide limits individual enterprises were able to determine their own production schedules and pricing policies and were rewarded on the basis of the profits. In the 1990s the eastern European countries went even further in their reliance on private enterprise and the price mechanisms of the free market, and even the Soviet Union showed an increased willingness to tolerate private enterprise in its economy. (*See also* economic planning.)

economic warfare, the use by a government of economic, as distinguished from military, measures in international conflict. Such measures include various export and import controls, trade agreements with neutral nations, shipping controls, blacklisting, the blocking of enemy exports, and preemption or preclusive buying. Economic warfare may also be defined broadly to include all measures undertaken to increase the economic power of a country at the expense of other countries.

Economic warfare among belligerents began with blockade and the interception of contraband. During World War II economic warfare was broadened to include bringing pressure to bear upon neutral countries from which the enemy obtained its supplies.

Economic warfare continued after World War II as part of Cold War tactics to deny potential enemies goods that might contribute to their war-making ability. One of the primary measures during this period was the embargo, sometimes total and sometimes restricted to strategic goods. During the 1950s the United States and other countries maintained an embargo against the Soviet Union and eastern Europe on a large list of broadly defined strategic goods.

Economic warfare may also include measures by one nation to ensure the economic dependence of another and thereby obtain political power over it. These measures may include monopolizing the supply of certain goods or guaranteeing a market for the weaker country's exports.

Economic warfare is likely to be more effective in the short run, because, over time, the enemy country has a chance to pursue alternatives. The enemy may even benefit, as in the case of an embargoed country that develops its own substitutes for embargoed goods and thereby strengthens its independence.

economics: *see under* descriptive word (*e.g.,* agricultural economics; labour economics; Austrian school of economics), except as below.

economics, the social science concerned with production, distribution, and consumption of wealth.

A brief treatment of the discipline of economics follows. For full treatment, *see* MACROPAEDIA: Social Sciences. The subject of economics is treated in a number of articles in the MACROPAEDIA. For a discussion on relevant topics concerning private enterprise, *see* Banks and Banking; Economic Systems; Marketing and Merchandising; Markets; Money. For articles dealing with the social and political implications of economic problems, *see* Birth Control; Cities; Conservation of Natural Resources; Modernization and Industrialization; Slavery; Social Differentiation; Social Welfare. For articles on certain phases of business activity, *see* Accounting; Business Law; Business Organization; Insurance. For articles dealing with broad areas of economic theory, *see* Economic Systems; Industrial Engineering and Production Management; Land Reform and Tenure. For articles concerned with statistical interpretations of economic conditions, *see* Economic Growth and Planning; Population. For articles dealing with the relationship of government to business, *see* Government Finance; Taxation. For articles on the economics of labour, *see* Work and Employment. For agricultural economics, *see* Farming and Agricultural Technology. For articles involving problems of international economics, *see* Economic Systems; International Trade; War, The Theory and Conduct of. For various ideological viewpoints of economic systems, *see* Marxism, Marx and; Smith, Adam.

For a description of the place of economics in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Five, Division III.

Major divisions of economics include microeconomics, which deals with the behaviour of individual consumers, companies, traders, and farmers, and macroeconomics, which focuses on aggregates such as the level of income in an economy, the volume of total employment, and the flow of investment. Another branch, development economics, investigates the history and changes of economic activity and organization over a period of time, as well as their relation to other activities and institutions. Within these three major divisions there are specialized areas of study that attempt to answer questions on a broad spectrum of human economic activity, including public finance, money supply and banking, international trade, labour, industrial organization, and agriculture. The areas of investigation in economics overlap with other social sciences, particularly political science, but economics is primarily concerned with relations between buyer and seller.

Economist, The, weekly magazine of news and opinion published in London and generally regarded as one of the world's preeminent journals of its kind. Despite its name, it gives excellent and wide-ranging coverage of general news and particularly of international political developments and prospects bearing on the world's economy. It was founded in 1843.

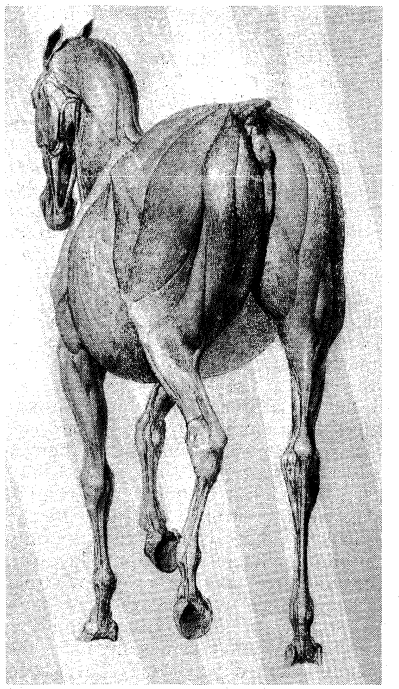
The magazine's articles are directed primarily toward business executives and investors, but it is widely read by others, including Cabinet members of most governments. Its writing is consistently lucid, and its editorial position is moderately to the left. It features articles on political and economic developments in other countries and in the world at large nearly as frequently as it does those in the United Kingdom.

economy, law of (logic): *see* Ockham's razor.

écorché (French: "flayed," or "skinned"), anatomical figure depicting an animal or human with the skin removed to show the location and interplay of the muscles.

From roughly the 15th century, Western artists began to concern themselves with accurate representation of the body—and, in particular, the working of muscles. Often artists witnessed (and sometimes performed) dissections on cadavers to determine the position and function of anatomical structures, and they made three-dimensional écorché models. These models became an essential part of most artists' studio equipment. Many drawings were made of such models—those of Leonardo da Vinci are especially well known—and some were reproduced in textbooks devoted to art or anatomy. Andreas Vesalius published his masterpiece, *De humani corporis fabrica,* and a similar work for artists that he called *Epitome* in 1543.

One of the most remarkable series are George Stubbs's engravings for *The Anatomy of the Horse* (1766), the original pencil drawings for which are in the Royal Academy of Arts in London. An écorché statue by Jean-Antoine Houdon (1741–1828) was much copied for use in art studios.



"A Skinned Horse," pencil-drawn écorché by George Stubbs; in the Royal Academy of Arts, London

By courtesy of the Royal Academy of Arts, London

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Ecorse, city, Wayne county, Michigan, U.S., one of several contiguous southwest suburbs of Detroit known as downriver communities, on the Detroit River. Settled about 1815 on the site of an Indian camp and burial ground, it was called Grandport and developed with the growth of the Ford Motor Company in nearby Dearborn. Its name was derived from the French Rivière aux Écorses ("tree-bark river"), a small stream along which Indians made their canoes. A steel-making plant was built there in 1930; auto parts and tools are also produced. Inc. village, 1903; city, 1941. Pop. (1986 est.) 13,050.

ecosphere, the sum of the Earth's ecological systems (ecosystems), all living organisms interacting with the physical environment. It is almost equivalent to the term biosphere (*q.v.*), with the further implication of a conscious ecological management of the Earth's resources.

ecossaise, variety of contredanse that was popular in the late 18th and early 19th centuries in France and England. It was danced

in quick $\frac{2}{4}$ time by a double line of couples, men facing women; the couples progressed to the head of the line as the figures of the dance were executed. The vogue of the ecossaise inspired musical compositions for piano bearing this name by Franz Schubert and Frédéric Chopin as well as by Ludwig van Beethoven, who also wrote ecossaises for military band and for small orchestra.

ecosystem, the complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space.

A brief treatment of ecosystems follows. For full treatment, *see* MACROPAEDIA: Biosphere.

The principles underlying the study of ecosystems are based on the view that all the elements of a life-supporting environment of any size, whether natural or man-made, are parts of an integral network in which each element interacts directly or indirectly with all others and affects the function of the whole. All ecosystems are contained within the largest of them, the ecosphere, which encompasses the entire physical Earth (geosphere) and all of its biological components (biosphere).

An ecosystem can be categorized into its abiotic constituents, including minerals, climate, soil, water, sunlight, and all other nonliving elements, and its biotic constituents, consisting of all its living members. Linking these constituents together are two major forces: the flow of energy through the ecosystem, and the cycling of nutrients within the ecosystem.

The fundamental source of energy in almost all ecosystems is radiant energy from the sun. The energy of sunlight is used by the ecosystem's autotrophic, or self-sustaining, organisms. Consisting largely of green vegetation, these organisms are capable of photosynthesis—*i.e.,* they can use the energy of sunlight to convert carbon dioxide and water into simple, energy-rich carbohydrates. The autotrophs use the energy stored within the simple carbohydrates to produce the more complex organic compounds, such as proteins, lipids, and starches, that maintain the organisms' life processes. The autotrophic segment of the ecosystem is commonly referred to as the producer level.

Organic matter generated by autotrophs directly or indirectly sustains heterotrophic organisms. Heterotrophs are the consumers of the ecosystem; they cannot make their own food. They use, rearrange, and ultimately decompose the complex organic materials built up by the autotrophs. All animals and fungi are heterotrophs, as are most bacteria and many other microorganisms.

Together, the autotrophs and heterotrophs form various trophic (feeding) levels in the ecosystem: the producer level, composed of those organisms that make their own food; the primary-consumer level, composed of those organisms that feed on producers; the secondary-consumer level, composed of those organisms that feed on primary consumers; and so on. The movement of organic matter and energy from the producer level through various consumer levels makes up a food chain. For example, a typical food chain in a grassland might be grass (producer) → mouse (primary consumer) → snake (secondary consumer) → hawk (tertiary consumer). Actually, in many cases the food chains of the ecosystem overlap and interconnect, forming what ecologists call a food web. The final link in all food chains is made up of decomposers, those heterotrophs that break down dead organisms and organic wastes. A food chain in which the primary consumer feeds on living plants is called a grazing pathway; that in which the primary consumer feeds on dead plant matter is known as a detritus pathway. Both pathways are important in accounting for the energy budget of the ecosystem.

As energy moves through the ecosystem, much of it is lost at each trophic level. For example, only about 10 percent of the energy stored in grass is incorporated into the body of a mouse that eats the grass. The remaining 90 percent is stored in compounds that cannot be broken down by the mouse or is lost as heat during the mouse's metabolic processes. Energy losses of similar magnitude occur at every level of the food chain; consequently, few food chains extend beyond five members (from producer through decomposer), because the energy available at higher trophic levels is too small to support further consumers.

The flow of energy through the ecosystem drives the movement of nutrients within the ecosystem. Nutrients are chemical elements and compounds necessary to living organisms. Unlike energy, which is continuously lost from the ecosystem, nutrients are cycled through the ecosystem, oscillating between the biotic and abiotic components in what are called biogeochemical cycles. Major biogeochemical cycles include the water cycle, carbon cycle, oxygen cycle, nitrogen cycle, phosphorus cycle, sulfur cycle, and calcium cycle. Decomposers play a key role in many of these cycles, returning nutrients to the soil, water, or air, where they can again be used by the biotic constituents of the ecosystem.

The orderly replacement of one ecosystem by another is a process known as ecosystem development, or ecological succession. Succession occurs when a sterile area, such as barren rock or a lava flow, is first colonized by living things or when an existing ecosystem is disrupted, as when a forest is destroyed by a fire. The succession of ecosystems generally occurs in two phases. The early, or growth, phase is characterized by ecosystems that have few species and short food chains. These ecosystems are relatively unstable but highly productive, in the sense that they build up organic matter faster than they break it down. The ecosystems of the later, or mature, phase are more complex, more diversified, and more stable. The final, or climax, ecosystem is characterized by a great diversity of species, complex food webs, and high stability. The major energy flow has shifted from production to maintenance.

Human interference in the development of ecosystems is widespread. Farming, for example, is the deliberate maintenance of an immature ecosystem—one that is highly productive but relatively unstable. Sound management of ecosystems for optimal food production should seek a compromise between the characteristics of young and mature ecosystems, and should consider factors that affect the interaction of natural cycles. Short-term production can be maximized by adding energy to the ecosystem in the form of cultivation and fertilization. Such efforts, however, can hinder efficient energy use in the long run by producing an imbalance of nutrients, an increase in pollutants, or a heightened susceptibility to plant diseases as a consequence of intensive inbreeding of crops.

Although an awareness of the interdependence between human society and its environment was already prominent in ancient philosophy and religion, the formulation of the basic principles of systems ecology as a scientific discipline began in the late 19th century. During the second half of the 20th century, the study of ecosystems has become increasingly sophisticated and is now instrumental in the assessment and control of the effects of agricultural development and industrialization on the environment. On farms, for instance, it has shown that optimal long-term production of pasturage requires a moderate grazing schedule in order to ensure a steady renewal of the moisture and nutrient content of the soil and has emphasized the need for multiple-use strategies in the cultivation of arable lands. Systems ecology has been concerned with the consequences of accumulated insecticides and has provided a way of monitoring the climatic effects of atmospheric dust and carbon dioxide released by the burning of fossil fuels (*e.g.,* coal, oil, and natural gas). It has helped to determine regional population capacities and has furthered the development of recycling techniques that may become essential in humanity's future interaction with the environment.

ecotone, a transition area of vegetation between two different plant communities, such as forest and grassland. It has some of the characteristics of each bordering community and often contains species not found in the overlapping communities. An ecotone may exist along a broad belt or in a small pocket, such as a forest clearing, where two local communities blend together. The influence of the two bordering communities on each other is known as the edge effect. An ecotonal area often has a higher density of organisms of one species and a greater number of species than are found in either flanking community. Some organisms need a transitional area for activities such as courtship, nesting, or foraging for food.

Écrins National Park, nature reserve located in the *départements* of Hautes-Alpes and Isère, southeastern France. The park, which was created in 1973, occupies 226,694 acres (91,740 hectares) and is the second largest national park in France. It encompasses the Alpine peaks of Barre des Écrins (13,457 feet [4,102 m]), La Meije (13,067 feet [3,983 m]), Ailefroide, and Pelvoux, as well as numerous lakes, cirques, and gorges. Forests of larch cover the park. Rarer plants include lady's slipper orchids, orange lilies, and martagon lilies. Mountain hares and foxes, marmots, and chamois are common, while ibex, reintroduced in 1977 and 1978, are rare. Birds are typically Alpine and include golden eagles, capercaillies, rock partridges, and ptarmigans. More than 438,000 acres (177,000 hectares) bordering the park have been designated as a peripheral, or buffer, zone and are being developed in order to accommodate visitors to the park.

ECSC: *see* European Coal and Steel Community.

ecstasy (Greek: *ekstasis,* "to stand outside of or transcend [oneself]"), in mysticism, the experience of an inner vision of God or of one's relation to or union with the divine. Various methods have been used to achieve ecstasy, which is a primary goal in most forms of religious mysticism. The most typical consists of four stages: (1) purgation (of bodily desire); (2) purification (of the will); (3) illumination (of the mind); and (4) unification (of one's being or will with the divine). Other methods are: dancing (as used by the Mawlawīyah, or whirling dervishes, a Muslim Ṣūfī sect); the use of sedatives and stimulants (as utilized in some Hellenistic mystery religions); and the use of certain drugs, such as peyote, mescaline, hashish, LSD, and similar products (in certain Islāmic sects and modern experimental religious groups). Most mystics, both in the East and in the West, frown on the use of drugs because no permanent change in the personality (in the mystical sense) has been known to occur.

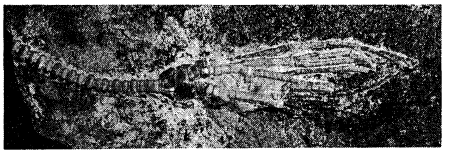
In certain ancient Israelite prophetic groups, music was used to achieve the ecstatic state, in which the participants, in their accompanying dancing, were believed to have been seized by the hand of Yahweh, the God of Israel, as in the case of Saul, the 11th-century-BC king of Israel. The Pythia (priestess) of the Greek oracle at Delphi often went into an ecstatic state during which she uttered sounds revealed to her by the python (the snake, the symbol of

resurrection), after drinking water from a certain spring. Her "words" were then interpreted by a priest to help a suppliant find a way to avoid calamities, especially death. In primitive religions, ecstasy was a technique highly developed by shamans, religious personages with healing and psychic-transformation powers, in their "soul," or "spirit," flights.

The goal of ecstasy and its effects, however, are best known from the writings and activities of the mystics of the world's great religions.

ECT: *see* shock therapy.

Ectenocrinus, extinct genus of primitive crinoids, or sea lilies, found as fossils in marine rocks, especially limestones, of Ordovician age (between 505 and 438 million years old). *Ectenocrinus,* a relatively small form, was probably ancestral to more advanced crinoids.



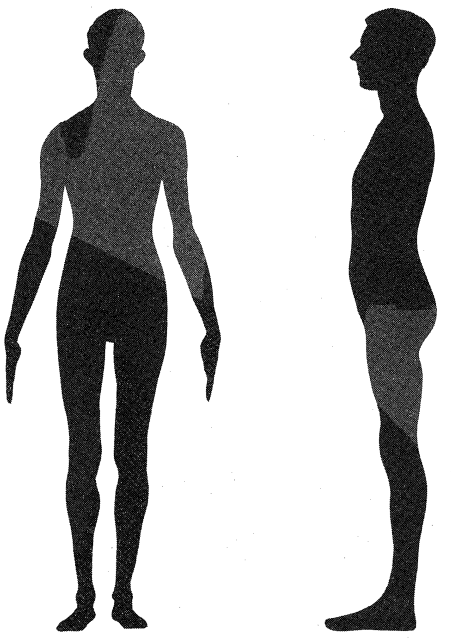
Ectenocrinus, from the Ordovician period

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

ecthyma, contagious (animal disease): *see* sore mouth.

ectoderm, the outermost of the three germ layers, or masses of cells (lying outside the mesoderm and endoderm), which appears early in the development of an animal embryo. In vertebrates, ectoderm subsequently gives rise to hair, skin, nails or hooves, and the lens of the eye; the epithelia (surface, or lining, tissues) of sense organs, the nasal cavity, the sinuses, the mouth (including tooth enamel), and the anal canal; and nervous tissue, including the pituitary body and chromaffin tissue (clumps of endocrine cells). In adult cnidarians and ctenophores, the body-covering tissue, or epidermis, is occasionally called ectoderm. *See also* endoderm; mesoderm.

ectomorph, a human physical type (somatotype) tending toward linearity, as determined by the physique classification system developed by the American psychologist W.H. Sheldon. Although classification by the Sheldon system is not absolute, a person is classed as an ectomorph if ectomorphy predominates over endomorphy and mesomorphy in his body build. The extreme ectomorph has a thin face with high forehead and receding chin; narrow chest and abdomen; a narrow heart; rather long, thin arms and legs; little body fat and little muscle; but a large skin surface and a large nervous system. If well fed he does not gain weight easily, and if he becomes fat he is still considered an ectomorph, only overweight. *Compare* endomorph; mesomorph.



Extreme ectomorph

ectopic pregnancy, also called EXTRAUTERINE PREGNANCY, condition in which the fertilized ovum (egg) has become imbedded outside the uterine cavity. The site of implantation is usually designated—*e.g.,* tubal, abdominal, or ovarian ectopic pregnancy.

Tubal ectopic pregnancy is not uncommon, occurring about once in 250 to 300 pregnancies and more frequently in blacks than Caucasians. It may be brought about by anything that interferes with the propulsion of the fertilized ovum from the fallopian tube toward the uterine cavity—*e.g.,* inflammation of the fallopian tube, developmental malformation of the sacs within its canal, or kinking of the tube. If transport to the uterus is sufficiently delayed, the ovum becomes too large for easy passage and becomes imbedded in the wall of the fallopian tubule. Tubal ectopic pregnancy in early stages is similar in some respects to normal pregnancy; implantation of the ovum in the tubal wall is much like that which occurs in the uterus. Also, as pregnancy begins to develop, placental tissue, like that of intrauterine gestation, develops. Eventually, however, the placenta removes itself from the tubal wall, and the fetus is discharged as a whole mass or in smaller fragments if it disintegrates. The symptoms of tubal ectopic pregnancy in early stages are so minor that they might be ignored by the patient. Depending upon the part of the tube in which the ovum has become implanted, the tubal pregnancy can abort, through tubal rupture, any time from 6 to 18 weeks after cessation of menstrual periods (on occasion there will be no history of missed periods). Once the fetus begins to disintegrate or is discharged, bleeding will follow. Pain is associated at some time with nearly every tubal pregnancy. During the final stages of separation and expulsion in a tubal pregnancy, the patient experiences pain and bleeding. Surgical exploration of the abdomen and removal of the affected tube and replacement of lost blood are often essential to prevent death.

Ovarian ectopic pregnancy is a relatively rare condition in which the ovum is fertilized before its discharge from the follicle. Symptoms, termination, and treatment are similar to those of tubal pregnancy, but gestation may progress slightly further before rupture and bleeding occur.

Abdominal ectopic pregnancy occurs when the placenta is attached to some part of the peritoneal cavity other than the uterus or tube. While a few of these pregnancies are a result of implantation in the abdominal lining, most are the result of expulsion of a tubal pregnancy. The condition can be suspected in the first three months of pregnancy if pain and bleeding are experienced. Abdominal pregnancy can reach term. Prompt surgical removal of the fetus is necessary, because an unrecognized and untreated abdominal pregnancy can result in infection or calcification leading to the formation of a lithopedion (calcified dead fetus) and death of the mother.

ectoplasm, in occultism, a mysterious, usually light-coloured, viscous substance that is said to exude from the body of a spiritualist medium in trance and may then take the shape of a face, a hand, or a complete body. It reportedly resembles cheesecloth or a membrane and is normally visible only in the darkened atmosphere of a séance (*q.v.*). Ectoplasm is thus said to be the substance involved in the materialization of spiritual bodies, and the levitation of material objects is commonly explained by the gradual buildup of columns of ectoplasm underneath the objects. At the end of a séance the ectoplasm disappears, allegedly by returning to the medium's body.

ectoproct (aquatic invertebrate): *see* moss animal.

ectothermy: *see* cold-bloodedness.

ectropion, sagging of the lower eyelid away from the eyeball. The condition sometimes is present in elderly persons as a result of relaxation of the lid's supporting structures. With the sagging of the lid, the opening into the channel that carries tears from the eye into the nasal cavity is also moved away from the eyeball; as a result, tears fail to drain properly, and chronic conjunctivitis—inflammation of the mucous membrane lining the lids and covering part of the eyeball—may develop. *Compare* entropion.

Ecuador, officially REPUBLIC OF ECUADOR, Spanish REPÚBLICA DEL ECUADOR, South America's fourth smallest country, lying astride the equator on the continent's Pacific coast. It covers an area (including the Galápagos Islands) of 103,930 square miles (269,178 square km). The capital is Quito. Extending about 450 miles (725 km) from north to south and 400 miles (640 km) from east to west, Ecuador is bordered by Colombia on the north and Peru on the east and south. The population in 1990 was estimated at 10,782,000.

Ecuador

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

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. Ecuador comprises a coastal lowland (mostly below 1,000 feet [300 m]) along the Pacific and a mountainous highland (the Andes) separating it from the Ecuadorian portion of the tropical Amazon River basin. The Andes Mountains rise dramatically from the west with peaks in two mostly continuous north–south chains reaching elevations of between 16,000 and more than 20,000 feet (4,900 and 6,100 m). Separating the ranges are 6,500- to 9,500-foot- (2,000- to 2,900-metre-) high intermontane valleys. Another lower-lying, more easterly range runs parallel to the main Andes at the edge of the Amazon River basin. Ecuador's highest peak (an extinct volcano in the central part of the country) is Chimborazo, at 20,702 feet (6,310 m); the world's highest active volcano, Cotopaxi, at 19,347 feet (5,897 m), is nearby. The country lies in a very active earthquake zone. Nearly one-third of Ecuador's runoff is carried by two

river basins, the Guayas River in the western-coastal region and the Napo-Aguarico in the Amazon River basin to the east.

The cold Humboldt (Peru) Current induces aridity along Ecuador's coast, particularly in the south. In the highland valleys springlike temperatures often prevail year-round; Quito, located in one of these valleys in the north-central region, averages 59° F (15° C) each month of the year. The Amazon basin east of the Andes generally has a wet tropical climate. The perpetual snow line of the Andes begins at about 16,400 feet (5,000 m). Almost half of the country is forested, mostly tropical rain forests in the eastern lowlands. About one-fifth of total land area is rangeland. Wildlife is dominated by tropical species typical of South America, including the endangered jaguar and ocelot.

Throughout the 1970s and the '80s Ecuador developed its burgeoning fossil-fuel industry, both in the Pacific coastal (natural gas) and in the Amazonian (oil) regions.

The people. Ecuador's population is ethnically mixed, with Indians (mostly Quechua) comprising about 50 percent of the population and mestizos comprising about 40 percent. Most Indians live in the Andean intermontane valleys. The Jívaro, who form the main Indian group in the Amazon basin, consist of small tribes or family units. They are being assimilated into Ecuadorian society. Caucasians, comprising less than one-tenth of the population, are largely descended from Spaniards who arrived in Ecuador between the 16th and early 19th century. Blacks make up a small percentage of the population and principally live along the northern coast; their ancestors were brought from Africa as slaves during the colonial era. Mulattos also constitute a small portion of the population and generally live in the coastal region.

Spanish, which is the official language, is spoken by most of the population. Some Indians, however, speak only a Quechuan language. The nation is overwhelmingly Roman Catholic.

Ecuador has relatively high birth and death rates. Infant mortality is also high; the Ministry of Health has given priority to maternal and child health programs. Ecuador has a very youthful population, two-fifths of it under 15 years of age. Half of the nation's population lives in urban areas.

The economy. Ecuador has a developing mixed state and private-enterprise economy. The gross national product (GNP) is not increasing as rapidly as the population. The GNP originates primarily from trade, followed by manufacturing and agriculture.

Although only about one-tenth of the country's total land area is arable, agriculture employs about one-third of the labour force. Principal cash crops include bananas, of which Ecuador is one of the world's largest producers, and sugarcane, cacao, and coffee. Important among local food crops are corn (maize), rice, potatoes, oranges, and cassava. Range and pasture are found for the most part in the intermontane valleys; the principal livestock are pigs, beef and dairy cattle, and sheep. Lumbering in general remains underdeveloped, but Ecuador is the world's leading producer of balsa wood.

Ecuador's marine fishery ranks high in Latin America in total catch, mostly thread herring, although shrimp raised on coastal fish farms constitute a major source of export revenue. Tuna are also caught.

The mining sector employs less than 1 percent of the labour force; its importance in the GNP is largely because of petroleum and natural-gas production, along with copper mining at Chaucha in the south-central mountains.

The manufacturing sector employs about one-tenth of the labour force. The principal manufactures are food products (including raw and brown sugar), refined petroleum products, textiles and clothing, base metals, beverages (including liquors), cement, and pharmaceuticals.

The government owns some mineral, petroleum, and fishing enterprises, all hydroelectric-power facilities, and all railroads.

Only about one-sixth of Ecuador's road network is paved; there are four major seaports and international airports at Quito and Guayaquil. The rail system has declined, and service has become slow and antiquated.

Ecuador's exports in the 1980s consisted primarily of crude petroleum, as well as shrimp, bananas, coffee, and cacao. The principal importers of Ecuadorian products were the United States, Germany, Singapore, Panama, and Peru. Ecuador's principal imports were industrial raw materials and machinery, transport equipment, and consumer goods. The principal sources for imports were the United States, followed by Japan, Venezuela, and Germany.

Government and social conditions. Ecuador's constitution of 1979 provides for a representative democracy with executive power vested in a president elected to a single four-year term. Legislative authority is exercised by the unicameral National Chamber of Representatives (also called National Congress), whose members are elected for either two or four years. The country has numerous political parties, and it is unusual for any single political organization to win a majority in Congress. A coalition is usually required to control the government. The judicial system is headed by a Supreme Court of Justice usually elected by the Congress.

Ecuador's social-welfare system covers all public and private employees. Health conditions in many parts of the country are poor. Many rural people continue to rely on traditional healers and midwives for all medical care. Life expectancy is 60 years for men and 64 years for women.

Education is free and compulsory at the primary level for all children ages 6 to 14. All state schools are nondenominational, but there are nondenominational and religious private schools which also receive state funds. The largest universities in the country are the Central University of Ecuador, which was established in Quito in 1586, and the University of Guayaquil, founded in 1867. The news media in Ecuador are relatively free from government interference.

History. Pre-Spanish Ecuador was inhabited by a number of diverse Indian peoples who were, for the most part, sedentary agriculturists. A kingdom established by the Caras with a capital at Quito fell to the Incas some time after 1450. After the death of the conquering Inca emperor, war over inheritance of the kingdom between two of his sons weakened the Incas on the eve of the arrival of the Spaniards (1526). From Ecuador the Spaniards marched into Inca-dominated Peru in 1532, then turned to the conquest of Ecuador in 1534 with a march on the Inca seat of Quito led by Sebastián de Belalcázar. The Indians destroyed the city and retired. On its ruins, Belalcázar founded Villa de San Francisco de Quito in late 1534. The new town thrived, becoming a cultural and artistic centre.

The Spaniards established a colony of large estates worked by Indians. The social system was hierarchical and slow to change. Under the Spaniards Ecuador was a part of the Viceroyalty of Peru (almost continuously) until 1740, when it became a part of the Viceroyalty of New Granada.

A creole middle class beginning to emerge found Spanish colonial policies discriminatory and agitated for change, declaring independence in 1809. They and a successor movement were suppressed and their leaders executed, but eventually Antonio José de Sucre routed the Spanish at the battle of Pichincha, near Quito, and Ecuador was freed of Spain as part of the republic of Gran Colombia. In 1830 Ecuador promulgated its own constitution and became a sovereign state.

For decades, the rivalry and antagonism between conservative and aristocratic Quito in the interior and the liberal and bourgeois Guayaquil on the coast dominated the political scene, encouraging instability and leading to frequent changes of government and constitution. Reaction set in with the autocratic and cleric-dominated government of Gabriel García Moreno (1860–75), which brought economic and educational progress but which aroused dissatisfaction among liberal elements. A succession of governments, each as authoritarian as the last, went on into the early decades of the 20th century. Economic hardship and social unrest prompted the military to take a strong role in the political process. Peru invaded Ecuador in 1941 and was able to seize a large tract of Ecuadorian territory in the disputed Amazonian area.

Postwar Ecuador enjoyed long periods of constitutional government and relatively free elections, but the leadership of José María Velasco Ibarra, who was elected president no fewer than five times between 1944 and 1972 but completed only one term, was so erratic and unpredictable that little progress in social and economic affairs was ever made. A new constitution was adopted in 1979.

Petroleum profits brought a boom to Ecuador's economy in the 1970s but increased inflation significantly. A long-standing border dispute with Peru flared up again in 1981. Through the 1980s Ecuador's economy suffered from depressed oil prices, a high inflation rate, and complications from earthquake and rainstorm damage.

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

écuage (feudal law): *see* scutage.

Ecumenical Patriarchate of Constantinople, honorary primacy of the Eastern Orthodox autocephalous, or ecclesiastically independent, churches; it is also known as the "ecumenical patriarchate," or "Roman" patriarchate (Turkish: *Rum patriarkhanesi*).

According to a legend of the late 4th century, the bishopric of Byzantium was founded by St. Andrew, and his disciple Stachys became the first bishop (AD 38–54). Soon after Constantine the Great transferred the capital of the Roman Empire from Rome to Byzantium (330), renamed Constantinople and New Rome, its bishopric was elevated to an archbishopric. The metropolitan of Heraclea Perinthus, to whom Byzantium had formerly been subject, now came under the jurisdiction of Constantinople. In 381 the first Council of Constantinople recognized that the bishop of Constantinople, "being now the New Rome," had rights equal to those of the bishop of Rome. The Council of Chalcedon (451) ratified this and assigned to his jurisdiction a large area in the Balkans and Asia Minor. In the 6th century the official title of the bishop became "archbishop of Constantinople, New Rome, and ecumenical patriarch." The successful territorial conquests of the Muslims begun in the 7th century helped augment the spiritual power of the ecumenical patriarchate; Eastern patriarchs of conquered sees were often forced into exile in the capital, where their successors over a long period were selected by the ecumenical patriarch.

From Constantinople, Byzantine Orthodox Christianity spread to most of Eastern Europe, *i.e.,* Bulgaria, Serbia, Romania, and Russia. As a leader of Eastern Christianity, the patriarch of Constantinople represented a clear chal-

lenge to the universalist claims of Rome. In 867 Patriarch Photius accused Pope Nicholas I of usurpation in Bulgaria, but a reconciliation took place with Nicholas' successor, John VIII, in 879–880. Another confrontation between the two churches occurred in 1054, and not until 1964 did the ecumenical patriarch (then Athenagoras I) and the pope (Paul VI) embrace.

After the capture of Constantinople by the Latins in the Fourth Crusade (1204), the ecumenical patriarchate was transferred to Nicaea (1206), but Emperor Michael VIII Paleologus restored it to Constantinople when he retook the city in 1261. When the city fell to the Turks in 1453, becoming the capital of the Muslim Ottoman Empire, the Ottoman government recognized the ecumenical patriarch Gennadius II as the ethnarch of the conquered Orthodox peoples, with increased authority over the territories of the Eastern patriarchates and over the Balkan countries, as well as farther afield.

This power began a long decline when Jeremias II declared the patriarchate of Moscow autocephalous (1593); national churches in Greece (1833), Romania (1865), Serbia (1879), Bulgaria (1870), and Albania (1937) became in their turn autocephalous. The number of dioceses subject to Constantinople was further reduced in 1922, when about 1,500,000 Greek inhabitants of Asia Minor and Thrace were driven across the Aegean by the Turks, leaving few Christians in Asia Minor.

The territory directly subject to the patriarch and his synod in Turkey is confined to the archdiocese of Constantinople itself, with four suburban dioceses of Chalcedon, Terkos, Büyükada, and the islands of İmroz Adası and Bozca Ada. In Greece the patriarch still has nominal jurisdiction over the monastic state of Mt. Athos, the monastery of St. John the Evangelist on Pátmos, several dioceses in northern Greece, four bishoprics in the Dodecanese, and the autonomous church of Crete. Greek archbishoprics and metropolitanates of Europe, North and South America, Australia and New Zealand, as well as the autonomous church of Finland, are also dependent on the patriarch of Constantinople.

Since 1586 the patriarchate has been located in the Phanar, the northern section of Istanbul (formerly Constantinople), having lost both its cathedral of Hagia Sophia and its historic quarter to the Muslims. The small church of St. George serves as the cathedral for the patriarch, who must be a native Turkish citizen elected by the synod of metropolitans. The Turkish government considers the patriarchate as serving the religious needs of Greeks in Istanbul only. Tension between Greece and Turkey over Cyprus has made the position of the patriarchate in Turkey uneasy.

ecumenism, the movement or tendency toward worldwide Christian unity or cooperation. The term, of recent origin, emphasizes what is viewed as the universality of the Christian churches.

A brief treatment of ecumenism follows. For full treatment, *see* MACROPAEDIA: Christianity.

The word ecumenism is derived from the Greek words *oikoumenē* ("the inhabited world") and *oikos* ("house") and can be traced from the commands, promises, and prayers of Jesus. After the International Missionary Conference held at Edinburgh in 1910, Protestants began to use the term ecumenism to describe the gathering of missionary, evangelistic, service, and unitive forces. During and after the second Vatican Council (1962–65), Roman Catholics used ecumenism to refer to the renewal of the whole life of the church, undertaken to make it more responsive to "separated churches" and to the needs of the world.

The ecumenical movement seeks to recover the apostolic sense of the early church for unity in diversity, and it confronts the frustrations, difficulties, and ironies of the modern pluralistic world. It is a lively reassessment of the historical sources and destiny of what followers perceive to be the one, holy, catholic, and apostolic church of Jesus Christ.

The possibility of an ecumenical approach, in the modern sense, to Christianity increased, somewhat ironically, in the 17th and 18th centuries, when English dissenting sects and Pietist groups on the Continent began to promote evangelistic, revivalistic, and missionary endeavour. This, along with the simultaneous effect of Enlightenment thought, broke down many of the traditional foundations that supported separate church structures. Other breakdowns in the traditional understandings of church unity led to new possibilities for experimentation in the 19th century. The separation of church and state in the United States signalled the need for civility and respect for religious rights in a land of many religions. The sending of missionaries at the beginning of the 19th century revealed the possibilities of cooperation across denominational lines at home and brought to light the scandal of competition and conflict among Christian denominations abroad.

Early 20th-century ecumenism derived impetus from the convergence of three movements: international missionary conferences (Protestant), beginning with the Edinburgh Conference (1910) and taking shape as an institution in the International Missionary Council (1921); the Faith and Order Conferences (on church doctrine and polity), commencing in the conference at Lausanne (1927); and the Life and Work Conferences (on social and practical problems), beginning with the Stockholm Conference (1925). In 1937 at the Oxford Conference of Life and Work, proposals were drawn up to unite with Faith and Order. The World Council of Churches, a consultative and conciliar agent of ecumenism, working with national, denominational, regional, and confessional bodies, was inaugurated in Amsterdam in 1948. The International Missionary Council joined the World Council of Churches in 1961.

Protest movements against the developments that led to and continued in the World Council of Churches have produced an ecumenical convergence of their own. Most participants in this convergence prefer to be called "evangelical." In the United States the National Association of Evangelicals was formed in 1943, in large part to counter the Federal Council of Churches, which began in 1908 and reorganized as the National Council of Churches in 1950. Evangelicals have many organizations that operate on an international level to channel specific cooperative energies.

In 1961 Pope John XXIII established the Secretariat for the Promotion of Christian Unity, and the Orthodox churches created the Pan-Orthodox Conference. Dialogues among the Roman Catholic, Orthodox, Pentecostal, and Protestant churches have brought general consensus on such issues as baptism, the Eucharist, and the nature of ministry.

eczema: *see* dermatitis.

Edam, *dorp* (village) in Edam-Volendam *gemeente* (municipality), Noord-Holland *provincie* (province), northwestern Netherlands, on the IJsselmeer (Lake IJssel). Named for the dam built on the Ye, which joined the Purmer Lake (now polder) to the Zuiderzee, it became an important harbour, fishing port, and shipbuilding centre and was chartered in 1357, when a dock was built on the Zuiderzee. The harbour silted up and industrial and commercial activity waned after the construction in 1567 of a sluice in the dock to prevent flooding. The harbour has been sealed off as part of an inland lake preparatory to the drainage of the Markerwaard Polder (*see* IJsselmeer Polders).

Edam is dominated by St. Nicholas Church, rebuilt after a fire in 1602. Other landmarks

Drawbridge in Edam, Neth.
Shostal Associates

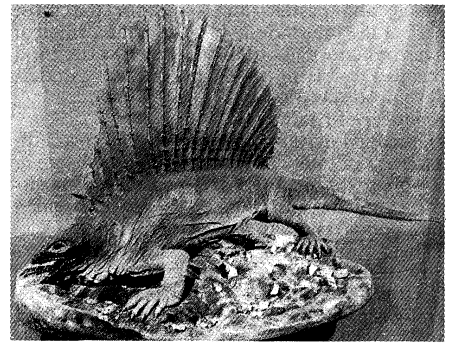
are the town hall (1737) and the tower of the former Church of Our Lady, which has one of the oldest carillons in The Netherlands (1561). The town museum (established 1895) is in an 18th-century sea captain's house with an unusual floating cellar. The Nieuwenkamp Museum has etchings and art treasures from Bali.

The town is famous for its red-coated Edam cheese; light manufactures include earthenware, textiles, packing materials, tools, and door and window furnishings. Pop. (1982 est.) including Volendam, 23,520.

Edam, semisoft cow's-milk cheese of Holland, usually molded in 2 to 4 pound (0.9 to 1.8 kilogram) spheres and coated in red paraffin; Edam is also produced in red-coated rectangular loaves. Originally the rind was brushed with vermilion to distinguish it from other Dutch cheeses, a purpose now served by the red paraffin.

The smooth-textured interior of Edam is a rich yellow-gold, with a mild but savoury flavour that makes it popular as a snack cheese. Like Gouda, it is one of Europe's oldest commercial cheeses, widely exported and imitated. True Edam bears the mark of "Holland" on its rind. Aging generally lasts for two months but may extend to a year. Prolonged aging imparts a much stronger flavour and a harder, somewhat flaky consistency.

Edaphosaurus, extinct genus of primitive and highly distinctive early reptiles found as fossils in Late Pennsylvanian to Early Permian deposits of Europe and North America



Edaphosaurus boanerges found in Texas, Early Permian age, reconstruction built on the original skeleton
By courtesy of the Royal Ontario Museum, Toronto, Canada

(the Pennsylvanian Period ended 280,000,000 years ago and was followed by the Permian Period). *Edaphosaurus* was a large herbivore more than 3.5 metres (11 feet) long, with a short, low skull and conical and rather blunt teeth. The head was very small in comparison to the massive, barrel-like body. Perhaps the most distinctive feature of *Edaphosaurus* was a large dorsal sail that was formed by elongated dorsal vertebral arches probably connected by a membrane and that had bony knobs or crossbars along its length. It is not unlikely that the sail in *Edaphosaurus* functioned as a sort of temperature-regulating device. It is possible that the sail also may have served as a storehouse for phosphates needed in cellular energy exchanges and easily mobilized from the bony processes that make up the sail structure. The sail also may have been in part a defensive structure, giving the animal a larger and more imposing appearance to frighten away predators. It is thought that the growth, development, and maintenance of the sail placed a great strain upon the resources of the animal, however.

Edbert, also spelled EADBERT, or EADBERHT (d. 768), in Anglo-Saxon England, king of Northumbrians from 737 to 758, a strong king whose reign was regarded by the contemporary scholar and churchman Alcuin as the kingdom's golden age.

Edbert succeeded to the throne on the abdication of his cousin Ceolwulf. In 750 he took the region of Kyle from the Britons of Strathclyde. In 756, with Pictish help, he forced terms on the defenders of Alcluith (Dumbarton), the capital of Strathclyde, but shortly thereafter he was defeated by the Britons.

Edbert abdicated in 758 and became a cleric at the cathedral of York, where his brother Egbert was the first archbishop. His son Oswulf, who succeeded him, was assassinated within the year, and the throne passed to a nobleman named Aethelwald (or Ethelwald) Moll. Edbert's grandson Aelfwald (or Elfwald) reigned from 779 to 788.

Under King Edbert and his brother, who was bishop from 732 and archbishop from 735, the church in Northumbria was strong, and York became a notable centre of learning.

EDC: *see* European Defense Community.

Edda, body of ancient Icelandic literature contained in two 13th-century books commonly distinguished as the *Prose,* or *Younger, Edda* and the *Poetic,* or *Elder, Edda.* It is the fullest and most detailed source for modern knowledge of Germanic mythology.

The Prose Edda. The *Prose Edda* was written by the Icelandic chieftain, poet, and historian Snorri Sturluson, probably in 1222–23. It is a textbook on poetics intended to instruct young poets in the difficult metres of the early Icelandic skalds (court poets) and to provide for a Christian age an understanding of the mythological subjects treated or alluded to in early poetry. It consists of a prologue and three parts. Two of the sections—*Skáldskaparmál,* dealing with the elaborate, riddle-like kennings and circumlocutions of the skalds, and *Háttatal,* giving examples of 102 metres known to Snorri—are of interest chiefly to specialists in ancient Norse and Germanic literature. The remaining section, *Gylfaginning* ("The Beguiling of Gylfi"), is of interest to the general reader. Cast in the form of a dialogue, it describes the visit of Gylfi, a king of the Swedes, to Asgard, the citadel of the gods. In answer to his questions, the gods tell Gylfi the Norse myths about the beginning of the world, the adventures of the gods, and the fate in store for all in the Ragnarök (Doom [or Twilight] of the Gods). The tales are told with dramatic artistry, humour, and charm.

The Poetic Edda. The *Poetic Edda* is a later manuscript dating from the second half of the 13th century, but containing older materials (hence its alternative title, the *Elder Edda*). It is a collection of mythological and heroic poems of unknown authorship, composed over a long period (AD 800–1100). They are usually dramatic dialogues in a terse, simple, archaic style that is in decided contrast to the artful poetry of the skalds.

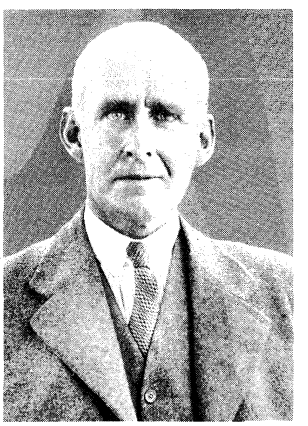
The mythological cycle is introduced by *Völuspá* ("Sibyl's Prophecy"), a sweeping cosmogonic myth that reviews in flashing scenes the history of the gods, men, and dwarfs, from the birth of the world to the death of the gods and the world's destruction.

It is followed by *Hávamál* ("Words of the High One"), a group of disconnected, fragmentary, didactic poems that sum up the wisdom of the wizard-warrior god, Odin. The precepts are cynical and generally amoral, evidently dating from an age of lawlessness and treachery. The latter part contains the strange myth of how Odin acquired the magical power of the runes (alphabetical characters) by hanging himself from a tree and suffering hunger and thirst for nine nights. The poem ends with a list of magic charms.

One of the finest mythological poems is the humorous *Thrymskvida* ("Lay of Thrym"), which tells how the giant Thrym steals the hammer of the thunder god Thor and demands the goddess Freyja in marriage for its return. Thor himself journeys to Thrym, disguised as a bride, and the humour derives from the "bride's" astonishing manners at the wedding feast, where she eats an ox and eight salmon, and drinks three vessels of mead.

The second half of the *Poetic Edda* contains lays about the Germanic heroes. Except for the *Völundarkvida* ("Lay of Völundr"; *i.e.,* Wayland the Smith) these are connected with the hero Sigurd (Siegfried), recounting his youth, his marriage to Gudrun, his death, and the tragic fate of the Burgundians (Nibelungs). These lays are the oldest surviving poetic forms of the Germanic legend of deceit, slaughter, and revenge that forms the core of the great medieval German epic *Nibelungenlied.* Unlike the *Nibelungenlied,* which stands on the threshold of romance, the austere Eddaic poems dwell on cruel and violent deeds with a grim stoicism that is unrelieved by any civilizing influences.

Eddington, Sir Arthur Stanley (b. Dec. 28, 1882, Kendal, Westmorland, Eng.—d. Nov. 22, 1944, Cambridge, Cambridgeshire), English astronomer, physicist, and mathematician who did his greatest work in astrophysics, investigating the motion, internal structure, and evolution of stars. He also was the first expositor of the theory of relativity in the English language.



Eddington

By courtesy of the University of Chicago; photograph, Yerkes Observatory, Williams Bay, Wis.

Early life. Eddington was the son of the headmaster of Stramongate School, an old Quaker foundation in Kendal near Lake Windermere in the northwest of England. His father, a gifted and highly educated man, died of typhoid in 1884. The widow took her daughter and small son to Weston-super-Mare in Somerset, where young Eddington grew up and received his schooling. He entered Owens College, Manchester, in October 1898, and Trinity College, Cambridge, in October 1902. There he won every mathematical honour, as well as Senior Wrangler (1904), Smith's prize, and a Trinity College fellowship (1907). In 1913 he received the Plumian Professorship of Astronomy at Cambridge and in 1914 became also the director of its observatory.

From 1906 to 1913 Eddington was chief assistant at the Royal Observatory at Greenwich, where he gained practical experience in the use of astronomical instruments. He made observations on the island of Malta to establish its longitude, led an eclipse expedition to Brazil, and investigated the distribution and motions of the stars. He broke new ground with a paper on the dynamics of a globular stellar system. In *Stellar Movements and the Structure of the Universe* (1914) he summarized his mathematically elegant investigations, putting forward the thesis that the spiral nebulae, cloudy structures seen in the telescope, were galaxies like the Milky Way.

During World War I he declared himself a pacifist. This arose out of his strongly held Quaker beliefs. His religious faith also found expression in his popular writings on the philosophy of science. In *Science and the Unseen World* (1929) he declared that the world's meaning could not be discovered from science but must be sought through apprehension of spiritual reality. He expressed this belief in other philosophical books: *The Nature of the Physical World* (1928), *New Pathways of Science* (1935), and *The Philosophy of Physical Science* (1939).

During these years he carried on important studies in astrophysics and relativity, in addition to teaching and lecturing. In 1919 he led an expedition to Príncipe Island (West Africa) that provided the first confirmation of Einstein's theory that gravity will bend the path of light when it passes near a massive star. During the total eclipse of the sun, it was found that the positions of stars seen just beyond the eclipsed solar disk were, as the general theory of relativity had predicted, slightly displaced away from the centre of the solar disk. Eddington was the first expositor of relativity in the English language. His *Report on the Relativity Theory of Gravitation* (1918), written for the Physical Society, followed by *Space, Time and Gravitation* (1920) and his great treatise *The Mathematical Theory of Relativity* (1923)—the latter considered by Einstein the finest presentation of the subject in any language—made Eddington a leader in the field of relativity physics. His own contribution was chiefly a brilliant modification of affine (non-Euclidean) geometry, leading to a geometry of the cosmos. Later, when the Belgian astronomer Georges Lemaître produced the hypothesis of the expanding universe, Eddington pursued the subject in his own researches; these were placed before the general reader in his little book *The Expanding Universe* (1933). Another book, *Relativity Theory of Protons and Electrons* (1936), dealt with quantum theory. He gave many popular lectures on relativity, leading the English physicist Sir Joseph John Thomson to remark that Eddington had persuaded multitudes of people that they understood what relativity meant.

Philosophy of science. His philosophical ideas led him to believe that through a unification of quantum theory and general relativity it would be possible to calculate the values of universal constants, notably the fine-structure constant, the ratio of the mass of the proton to that of the electron, and the

number of atoms in the universe. This was an attempt, never completed, at a vast synthesis of the known facts of the physical universe; it was published posthumously as *Fundamental Theory* (1946), edited by Sir Edmund Taylor Whittaker, a book that is incomprehensible to most readers and perplexing in many places to all but which represents a continuing challenge to some.

Eddington received many honours, including honorary degrees from 12 universities. He was president of the Royal Astronomical Society (1921–23), the Physical Society (1930–32), the Mathematical Association (1932), and the International Astronomical Union (1938–44). He was knighted in 1930 and received the Order of Merit in 1938. Meetings of the Royal Astronomical Society were often enlivened by dramatic clashes between Eddington and Sir James Hopwood Jeans or Edward Arthur Milne over the validity of scientific assumptions and mathematical procedures. Eddington was an enthusiastic participant in most forms of athletics, confining himself in later years to cycling, swimming, and golf.

Eddington's greatest contributions were in the field of astrophysics, where he did pioneer work on stellar structure and radiation pressure, subatomic sources of stellar energy, stellar diameters, the dynamics of pulsating stars, the relation between stellar mass and luminosity, white dwarf stars, diffuse matter in interstellar space, and so-called forbidden spectral lines. His work in astrophysics is represented by the classic *Internal Constitution of the Stars* (1925) and in the public lectures published as *Stars and Atoms* (1927). In his well-written popular books he also set forth his scientific epistemology, which he called "selective subjectivism" and "structuralism"—*i.e.*, the interplay of physical observations and geometry. He believed that a great part of physics simply reflected the interpretation that the scientist imposes on his data. The better part of his philosophy, however, was not his metaphysics but his "structure" logic. His theoretical work in physics had a stimulating effect on the thought and research of others, and many lines of scientific investigation were opened as a result of his work. (A.V.D.)

BIBLIOGRAPHY. A biography by A. Vibert Douglas, *The Life of Arthur Stanley Eddington* (1956), contains a list of his books and scientific papers. A popular discussion of Eddington's work is contained in J.R. Newman, *Science and Sensibility*, vol. 1 (1961). His place in the history of physics is described in Edmund T. Whittaker, *From Euclid to Eddington: A Study of Conceptions of the External World* (1949). For his philosophical ideas, see Herbert Dingle, *The Sources of Eddington's Philosophy* (1954).

eddo (tropical plant): *see* taro.

eddy, fluid current the flow direction of which differs from that of the general flow; the motion of the whole fluid is the net result of the movements of the eddies that comprise it. Eddies can transfer much larger amounts of energy and dissolved matter within the fluid than can molecular diffusion in nonturbulent flow because eddies actually mix together large masses of fluid. Flow that is composed largely of eddies is called turbulent; eddies generally become more numerous as the fluid flow velocity increases. Energy is constantly transferred from large to small eddies until it is dissipated.

In the lee of an obstacle, eddies form only when the flow around the obstacle reaches a critical velocity; they represent a flow of fluid into the space behind the obstacle, and this inflow begins only when the general flow is fast enough to produce a lowered pressure there.

In the atmosphere, small eddies occur in the daytime when surface air is warmed by contact with the ground and rises. On a larger scale, the huge high- and low-pressure centres that move over the Earth may be considered eddies because they are anomalous to the general circulation. These include tropical hurricanes and typhoons and the less intense cyclones and anticyclones of the mid-latitude westerly wind belts; the Rossby waves in the upper levels of the westerlies also are eddies. The mid-latitude cyclones, anticyclones, and Rossby waves, by transferring angular momentum (the measure of intensity of rotational motion) from the easterly to the westerly wind belts, play an important role in maintaining the global atmospheric circulation.

In the oceans, eddies result from many causes, including wind blowing over the water's surface and upwelling along coasts.

Consult the INDEX *first*

Eddy, Mary Baker (b. July 16, 1821, Bow, near Concord, N.H., U.S.—d. Dec. 3, 1910, Chestnut Hill, Mass.), founder of the religious faith known as Christian Science.

A daughter of Mark and Abigail Baker, Congregationalist descendants of old New England families, she had limited formal education

Mary Baker Eddy

By courtesy of the Library of Congress, Washington, D.C.

because of illness, but she read and studied at home and began to write both prose and poetry at an early age. In 1843 she married George W. Glover, who died before the birth of their son, George. Because of her ill health, the boy was reared primarily by others and had little contact with his mother.

Suffering almost constantly from a spinal malady, she was preoccupied with questions of health. She experimented with homeopathy and in 1853 married Daniel Patterson, a dentist who shared this interest. Before their marriage ended in divorce in 1873, Mrs. Patterson sought out and was healed by Phineas P. Quimby of Portland, Maine, who performed remarkable cures without medication. She thought he had rediscovered the healing method of Jesus, and she lectured and wrote of it in regional periodicals. Despite subsequent official statements of her church denying any influence of Quimby, some scholars have considered him an important source of her views.

Soon after Quimby died her illness recurred, and in 1866 she suffered a severe fall and called her own case hopeless. She was healed that year, however, after reading in the New Testament, which she marked as the point of her discovery of Christian Science. Separated from her husband, she spent several lonely years in writing and evolving her system, discussing it with some and teaching it to Hiram S. Crafts, Richard Kennedy, and others who subsequently became successful healers. In 1875 she published *Science and Health*, revised before her death as *Science and Health with Key to the Scriptures*. Regarded by her followers as divinely inspired, this work and the Bible formed the Scripture of the new faith. She soon held public meetings in Lynn, Roxbury, and Boston, Mass., and in 1877 married one of her followers, Asa G. Eddy (died 1882).

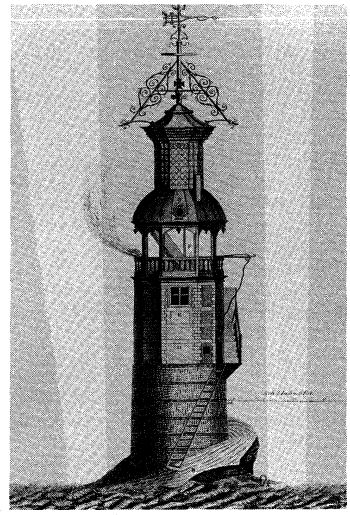
Steps were taken to organize the First Church of Christ, Scientist, in Boston in 1879, and two years later Mrs. Eddy founded the Massachusetts Metaphysical College, where she taught until it closed in 1889. Meetings in Boston moved in 1895 from rented halls to the newly dedicated Mother Church and then to its larger "extension," still a Boston landmark, in 1906. Branch churches, following organizational directives issued by Mrs. Eddy and collected in the *Church Manual*, were started in other cities; their members often belonged also to the Mother Church in Boston.

A self-perpetuating board of directors, set up by Mrs. Eddy, operated as the ruling authority according to the *Manual*, which is considered inspired and may not be amended. In 1883 she founded the monthly *Christian Science Journal*, in 1898 the weekly *Christian Science Sentinel*, and in 1908 *The Christian Science Monitor*, which has achieved a reputation as one of the leading daily newspapers in the United States. Other machinery created by Mrs. Eddy, such as the boards of education and of lectureship and the committee on publication, continue to promote Christian Science. Among her major works are *Miscellaneous Writings* (1896); *Retrospection and Introspection* (1892); *Unity of Good* (1887); and *Rudimental Divine Science* (1908). Officially approved biographies are Sibyl Wilbur's *Life of Mary Baker Eddy* (1908) and Lyman P. Powell's *Mary Baker Eddy* (1930).

BIBLIOGRAPHY. Edwin F. Dakin, *Mrs. Eddy* (1929, reissued 1968), and Charles S. Braden, *Christian Science Today* (1958).

eddy current, in electricity, motion of electric charge induced entirely within a conducting material by a varying electric or magnetic field or by electromagnetic waves. Eddy currents induced in a power transformer core represent lost power and are undesirable; eddy currents used to produce heat for cooking or for a metallurgical furnace represent useful applications of the phenomenon.

Eddystone Lighthouse, lighthouse celebrated in folk ballads and seamen's lore, standing on the Eddystone Rocks, 14 miles off Plymouth, Eng., in the English Channel. The



Eddystone Lighthouse, off Plymouth, Eng., designed by Henry Winstanley, completed 1699; engraving by Henry Roberts, 1761

Douglas B. Hague

first lighthouse (1696–99), built of timber, was swept away with its designer, Henry Winstanley, by the great storm of 1703. The second, of oak and iron, designed by John Rudyerd (1708), was destroyed by fire in 1755. John Smeaton built (1756–59) the third Eddystone Lighthouse entirely of interlocking stone, on a plan that revolutionized the construction of such towers. It stood until replaced in 1882 by the present structure, which stands 133 feet (40 m) above water and was designed by Sir James N. Douglass.

Ede, *gemeente* (commune), Gelderland *provincie,* central Netherlands. It lies on the western edge of the wooded-heath Veluwe region. Founded in the 8th century by the Saxons, it is a garrison town with a 15th-century church, the Doesburger Mill (1507), and an open-air theatre. Nearby Hoge Veluwe National Park has St. Hubertus Castle and the Kröller-Müller State Museum. The latter institution has an outstanding collection of paintings by the Dutch artist Vincent van Gogh. Ede's industries include metallurgy, the manufacture of rayon and pianos, and dairy food processing. Pop. (1987 est.) 90,186.

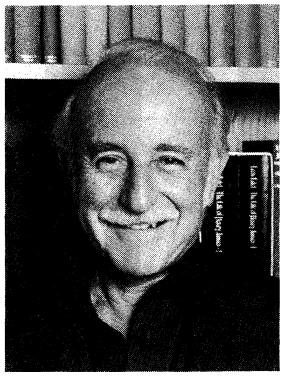
Ede, town, Oyo state, southwestern Nigeria. It lies along the Oshun River at a point on the railroad from Lagos, 112 miles (180 km) southwest, and at the intersection of roads from Oshogbo, Ogbomosho, and Ife. One of the older towns of the Yoruba people, it is traditionally said to have been founded in about 1500 by Timi Agbale, a hunter and warlord sent by Alafin (King) Kori of Old Oyo (Katunga), capital of the Oyo empire, to establish a settlement to protect the Oyo caravan route to Benin (127 miles [204 km] southeast). Ede is a local trading centre for cotton, palm produce, yams, corn (maize), cassava, pumpkins, okra, and kola nuts, and it has been a major exporting point for cocoa and palm oil and kernels since the construction of the railway from Lagos in 1906. Ede is also the site of a teacher-training college. Pop. (1989 est.) 257,700.

Edéa, town, western Cameroon, at the head of steamboat navigation of the lower Sanaga River. Aluminum from Fria in Guinea is the basis of the town's aluminum industry, which produces aluminum ingots, sheet metal, and household products. A school, a hospital, and living quarters are provided for staff and workers in the factory complex. Power for the plant and for other industries comes from Edéa's dam on the Sanaga.

There are stone quarries, palm-oil mills, and cocoa and rubber plantations in the vicinity. Edéa is connected by rail and road to Douala (northwest) and Yaoundé (east) and by road to Kribi (south). Pop. (1987 est.) 40,792.

Edel, (Joseph) Leon (b. Sept. 9, 1907, Pittsburgh, Pa., U.S.), American literary critic and biographer, notably of Henry James.

Edel grew up in Saskatchewan, Can., and graduated from McGill University (B.A., 1927; M.A., 1928). He received a doctorate of letters from the University of Paris (1932). During the Great Depression he held a variety of jobs and then served in the U.S. Army from 1943 to 1947. He taught English at New York University (1950–72; thereafter professor emeritus) and at the University of Hawaii from 1972 to 1978.



Edel, 1982
©1985 Thomas Victor

Edel edited James's *Complete Tales,* 12 vol. (1963–65), and wrote the definitive biography of James in five volumes (1953–72). He also edited James's *Complete Plays* (1949) and James's letters, 4 vol. (1974–84). His other books include *Willa Cather: A Critical Biography* (1953), written with E.K. Brown; *The Psychological Novel, 1900–1950* (1955; rev. ed. *The Modern Psychological Novel,* 1964); and *Literary Biography* (1957; reprinted 1973). He also wrote a psychological portrait of the Bloomsbury group, *Bloomsbury: A House of Lions* (1979), and a book about writing biographies, *Writing Lives* (1984).

Edelinck, Gerard (b. Oct. 20, 1640, Antwerp, Spanish Netherlands [now in Belgium]—d. April 2, 1707, Paris, Fr.), Flemish copperplate engraver during the best period of French portrait engraving.

Edelinck learned the rudiments of the art in his native town and went to Paris in 1665. On the recommendation of the painter Charles Le Brun, he was appointed teacher at the academy established at the Gobelins to train workers in tapestry. In his engravings Edelinck excelled in rendering light and shade, colour, and the texture of surfaces. He was the first to execute prints in the lozenge shape. Among his more than 300 works are a "Holy Family" after Raphael, "Penitent Magdalene" and "Alexander at the Tent of Darius" after Le Brun, and "Combat of Four Knights" after Leonardo da Vinci. He engraved numerous portraits, including a few of Louis XIV.

His two brothers, Jean and Gaspar-François, and his son Nicolas were also engravers.

Edelman, Gerald Maurice (b. July 1, 1929, New York, N.Y., U.S.), American biochemist whose contributions in elucidating the chemical structure of antibodies won him (with Rodney Porter) the Nobel Prize for Medicine or Physiology in 1972.

Edelman studied at the University of Pennsylvania Medical School (M.D., 1954). After two years in the Army Medical Corps in Paris, he went to the Rockefeller University in New York City, earning his Ph.D. in 1960 and then joining the faculty. Working at Rockefeller, Edelman and his research team succeeded (1969) in constructing a precise model of an entire antibody molecule, which was found to be a four-chain structure consisting of more than 1,300 amino acids. Edelman and his team were then able to identify the precise locations on the molecule where antigenic binding occurs.

Edelman became a full professor at Rockefeller University in 1966. His subsequent research focused on morphogenesis—*i.e.,* the formation and differentiation of tissues and organs—and in 1975 he and his colleagues discovered the proteins called cell-adhesion molecules, which act to attach individual cells to one another to make tissues. As director of the Neurosciences Institute at Rockefeller University from 1981, Edelman tried to construct a general theory of neural development and brain function, which he discussed in his book *Neural Darwinism: The Theory of Neuronal Group Selection* (1987).

edelweiss (*Leontopodium alpinum*), perennial plant of the family Asteraceae, native to alpine areas of Europe and South America. It has 2 to 10 yellow flower heads in a dense cluster, and below these flower heads 6 to 9 lance-shaped, woolly, white leaves are arranged in the form of a star. An edelweiss plant is about 5 to 30 cm (2 to 12 inches) tall.

Edelweiss (*Leontopodium alpinum*)
Siegfried Eigstler—Shostal/EB Inc.

There are a number of varieties, most of them ornamentals.

edema, also spelled OEDEMA, plural EDEMAS, or EDEMATA, in medicine, an abnormal accumulation of watery fluid in the intercellular spaces of connective tissue. Edematous tissues are swollen and, when punctured, secrete a thin incoagulable fluid. This fluid is essentially an ultrafiltrate of serum but also contains small amounts of protein. Minor differences in composition are found in various diseases with which edema is associated. Generalized edema (also called dropsy, or hydrops) may involve the cavities of the body as well as the tissues with the excessive accumulation of fluid.

Edema is most frequently a symptom of disease rather than a disease in itself, and it may have a number of causes, most of which can be traced back to gross variations in the physiological mechanisms that normally maintain a constant water balance in the cells, tissues, and blood. Among the causes may be diseases of the kidneys, heart, veins, or lymphatic system; malnutrition; or allergic reactions. The treatment of edema generally consists of correcting the underlying cause, such as improving kidney or heart function. Edema may be a purely local condition (*e.g.,* hives), or it may be a general one (*e.g.,* nephrotic edema). A swelling of the limbs, face, or some other region of the body is sometimes referred to as anasarca.

The term dropsy is somewhat archaic, and edema has come to be the preferred term.

Eden, district, county of Cumbria, northwestern England, occupying an area of 833 square miles (2,158 square km) in the eastern part of the county. Eden is a mountainous district with the Cumbrian Mountains in the west, the Pennines in the east, and other high moorlands in the south, all rising to elevations of 2,000 to 3,000 feet (600 to 900 m) above sea level. The Cumbrians in the district make up the northeastern part of the Lake District National Park, a scenic lake-filled resort area. The Pennines to the east are a westward trending series of steep-scarped, bleak hills. The narrow valley of the River Eden that originates in the southern part of the district is the only relatively low-lying and fertile part of the district. Sheep (particularly the Swaledale and Blackface breeds) graze wide expanses of the uplands. Dairy and some beef cattle are raised in the Eden valley, where oats and fodder crops are also grown. The vicinity of the parish (town) of Alston in the Pennines was a major lead-mining area until the early 19th century.

Cairns and stone circles in the moorlands and Roman, Viking, and Anglo-Saxon antiquities in the valley are evidence of varied historical occupation and settlement. The agri-

cultural centres of Penrith, the district seat, and Appleby experienced recurrent devastation during the medieval Scots-English border warfare. Pop. (1982 est.) 43,400.

Eden, (Robert) Anthony, 1ST EARL OF AVON, also called (until 1961) SIR ANTHONY EDEN (b. June 12, 1897, Windlestone, Durham, Eng.—d. Jan. 14, 1977, Alvedision, Wiltshire), British foreign secretary in 1935–38, 1940–45, and 1951–55 and prime minister from 1955 to 1957.

After combat service in World War I, Eden studied Oriental languages (Arabic and Persian) at Christ Church, Oxford. Elected to the House of Commons in 1923, he was appointed undersecretary of state for foreign affairs in 1931, lord privy seal (with special responsibility for international relations) in 1934, and minister for League of Nations affairs (a Cabinet office created for him) in June 1935. He became foreign secretary in December 1935 but resigned in February 1938 to protest Prime Minister Neville Chamberlain's appeasement of Nazi Germany and Fascist Italy.

On the outbreak of World War II in September 1939, Eden reentered Chamberlain's government as dominions secretary. When Churchill became prime minister on May 10, 1940, Eden was named secretary of state for war, but from Dec. 23, 1940, until the defeat of the Conservatives in July 1945, he served once more as foreign secretary. On Oct. 27, 1951, after Churchill and the Conservative Party had been returned to power, Eden again became foreign secretary and also was designated deputy prime minister. In 1954 he helped to settle the Anglo-Iranian oil dispute, to resolve the quarrel between Italy

Eden, photograph by Yousuf Karsh
© Karsh—Woodfin Camp and Associates

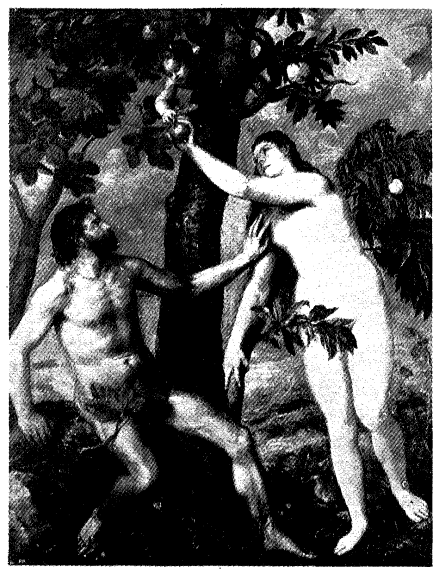
and Yugoslavia over Trieste, to stop the Indochina War, and to establish the Southeast Asia Treaty Organization (SEATO).

In 1953 he became seriously ill, and, although he underwent several operations, he never fully regained his health. Succeeding Churchill as prime minister on April 6, 1955, he attempted to relax international tension by welcoming to Great Britain the Soviet leaders N.S. Khrushchev and N.A. Bulganin. His fall began on July 26, 1956, when Gamal Abdel Nasser, head of the Egyptian state, nationalized the Suez Canal Company, in which the British government had been a principal stockholder since 1875. This action led to an Anglo-French attack on Egypt on November 5, one week after an attack on Egypt by Israel.

British public opinion was more favourable to Eden's show of force than the Labour and Liberal parties had expected; his supporters regretted, however, that he did not fulfill his intention of occupying the key positions of Port Said, Ismailia, and Suez. By December 22, partly through U.S. pressure, British and French forces had been supplanted by UN emergency units, but the canal was left in Egyptian hands rather than subjected to international control. The next month, on Jan. 9, 1957, Eden resigned, giving ill health as his reason. In 1961 he was created earl of Avon.

Eden's memoirs were issued in three volumes, *Full Circle* (1960), *Facing the Dictators* (1962), and *The Reckoning* (1965).

Eden, Garden of, in the Old Testament Book of Genesis, biblical earthly paradise inhabited by the first created man and woman, Adam and Eve, prior to their expulsion for disobeying the commandments of God. It is also called in Genesis the Garden of Yahweh,



Adam and Eve in the Garden of Eden, oil painting by Titian, c. 1550; in the Prado, Madrid
SCALA—Art Resource/EB Inc.

the God of Israel, and, in Ezekiel, the Garden of God. The term Eden probably is derived from the Akkadian word *edinu,* which was borrowed from the Sumerian *eden,* meaning "plain."

According to the Genesis story of the creation and fall of man, out of Eden, east of Israel rivers flowed to the four corners of the world. Similar stories in Sumerian records indicate that an earthly paradise theme belonged to the mythology of the ancient Near East.

The story of the Garden of Eden is a theological use of mythological themes to explain man's progression from a state of innocence and bliss to the present human condition of knowledge of sin, misery, and death.

Eden, George: *see* Auckland, George Eden, earl of.

Edén, Nils (b. Aug. 25, 1871, Piteå, Swed.—d. June 16, 1945, Stockholm), historian and politician who led what is generally regarded as the first parliamentary government in Swedish history.

A historian of early modern Sweden and a professor at the University of Uppsala (1903–20), Edén was elected to the Riksdag (parliament) in 1908 and quickly rose to prominence in the Liberal coalition party of Karl Staaff. Serving before and during World War I on the important defense and constitution committees, he became chairman of his party on Staaff's death in 1915.

The royal request that Edén form a government in 1917 after the Liberal and Social Democratic election victory is considered the first clear acknowledgment of the principle of parliamentary government in Swedish history. As head of the coalition government, he brought about better trade relations with the Allied powers and procured a constitutional amendment providing for woman suffrage and universal suffrage in local and lower chamber parliamentary elections. Leaving office in 1920, he served as governor of Stockholm province (1920–38) and returned to historical research. His scholarly writings include *1809 års revolution* (1911; "The Revolution of 1809") and *Den svenska riksdagen under femhundra år* (1935; "The Swedish Riksdag for 500 Years").

Eden, River, river in northern England. It rises in the fells (uplands) that connect the Lake District with the highlands of the Pennines and flows 90 mi (145 km) northwestward to its estuary in the Solway Firth, an Irish Sea inlet. From Kirkby Stephen, where its narrow, steep-sided upper valley opens out into the lowland vale, it flows in a meandering course among moraine hummocks (mounds of glacial debris) past Appleby, which is sited on a river peninsula. It receives short, swift right-bank tributaries from the great escarpment of the Pennines and longer left-bank ones from the Lake District and its flanking limestone hills. Its main tributary, the Eamont, entering near Penrith, collects drainage from the heart of the Lake District, including the discharge from Ullswater. Above Carlisle it receives the Irthing, which collects the drainage from the fells lying north and south of the Tyne gap near the Northumberland border. Carlisle commands the lowest bridge from a defensive site on the south bank, flanked by left-bank tributaries, the Petteril and Caldew. Even below Carlisle the Eden is not navigable. It discharges by shifting channels through tidal flats into Solway Firth.

Eden, Vale of, belt of low-lying land in the county of Cumbria, England, separating the northern Pennines from the Lake District massif. The River Eden drains the vale into the Solway Firth. Geologically, the Vale of Eden is developed upon Permian (250,000,000-year-old) and younger (Keuper and Bunter) marls and sandstones; it is a rich agricultural area. Both cattle and arable farming are of importance.

Edenbridge, parish, Sevenoaks district, county of Kent, England, south of London near the Surrey border, on the River Eden. It was enlarged after 1970 to accommodate overspill population from London, and light industries have been introduced. Nearby Hever Castle is a moated mansion of the 15th and 16th centuries, associated with the family of Anne Boleyn, second wife of Henry VIII; another notable mansion, Chiddingstone Castle, is also located in the area. Pop. (1971) 7,674.

Edenian Stage, time division of the Ordovician Period of North America (the Ordovician began about 500,000,000 years ago and lasted about 70,000,000 years). The Edenian Stage is the lowermost stage of the Upper Ordovician Cincinnatian Series of rocks; the Edenian is based on exposures of clay-rich limestones and shales that contain a distinctive fossil fauna. In the Appalachian region, the Edenian is represented by a part of the widespread Martinsburg Shale. Widespread limestones of the North American Arctic are now known, on the basis of paleontological studies, to be of Edenian age.

edentate, a member of the mammalian order Edentata, which includes all the armadillos, true anteaters, and tree sloths. All these animals are members of the suborder Xenarthra, which also contains the extinct ground sloths and glyptodonts (turtle armadillos). The other suborder, Palaeanodonta, consists of two families of extinct armadillo-like forms. The edentates have been restricted to the Western Hemisphere during their entire evolutionary history; 31 living species are known, most of them in South America.

A brief treatment of edentates follows. For full treatment, *see* MACROPAEDIA: Mammals.

Although the name Edentata means without teeth, only the true anteaters (Myrmecophagidae) are totally toothless. Armadillos (Dasypodidae) and tree sloths (Bradypodidae)

possess peglike teeth that lack enamel; some armadillos have as many as 100 of these teeth. The tree sloths have continuously growing teeth covered with a hard cement that protects them against excessive wear from their highly abrasive herbivorous diet.

Tree sloths have a shaggy yellow-to-brown fur, which in the wild has a greenish tint from the algae that inhabit it. Their long limbs and long, curved claws are adapted to support the animals while hanging upside down from branches; on the ground they are virtually helpless, but they are excellent swimmers.

Anteaters range in size from the 37-centimetre (15-inch), 325-gram (12-ounce) silky anteater (*Cyclopes didactylus*) to the 2-metre (6-foot), 25-kilogram (55-pound) giant anteater (*Myrmecophaga tridactyla*). The two arboreal anteaters, the silky and the tamandua (*Tamandua tetradactyla*), have prehensile tails. All three anteaters have elongated heads and sharp, sturdy claws. Enlarged salivary glands secrete a sticky saliva that coats the long, extrusible tongue. Silky anteaters are usually a soft golden colour; tamanduas are tan to brown, with black markings on the chest. The giant anteater is gray with a white-edged black stripe along each side. The shaggy hair is especially long and straight on the large, plumed tail.

Armadillos range in size from the tiny pink fairy armadillo (*Chlamyphorus truncatus*), which is only 16 cm long and weighs about 100 g, to the giant armadillo (*Priodontes giganteus*), a 25-kg animal that can reach 1.5 m in length. The major characteristic of armadillos is their dorsal carapace, a shield composed of several bony plates separated by movable bands. Contrary to popular belief, most species cannot roll up into a completely shielded ball; only the three-plated armadillo (*Tolypeutes tricinctus*) can do this. Some species, such as the nine-banded armadillo (*Dasypus novemcinctus*), can close up quite well, but others merely lower themselves to the ground and use the carapace as a protective shield.

The tree sloths are the only living herbivorous edentates; the two-toed sloth (*Choloepus didactylus*) eats fruits, stems, and leaves from a variety of plants, but the three-toed sloth (*Bradypus tridactylus*) has a diet restricted to the leaves of the cecropia tree. Tree sloths are found from southeastern Honduras to northern Brazil. They are solitary creatures and depend mostly on their camouflaged coloration and lack of motion for protection from predators. A cornered sloth, however, can bite savagely and use its long claws to good advantage.

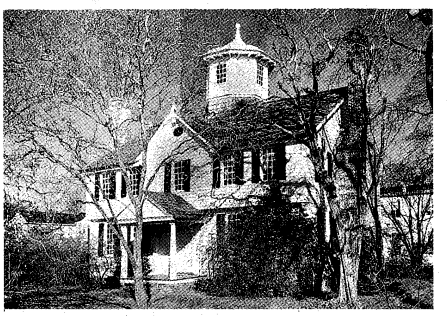
Anteaters find their prey by the sense of smell. The long, sharp claws are used to rip apart ant nests and termite mounds, and the sticky tongue is highly effective in lapping up the insects. All three species can use their daggerlike foreclaws for self-defense. Myrmecophagids are found from Argentina northward into Mexico.

Armadillos are the most omnivorous members of the order, eating small reptiles and amphibians, insects and other invertebrates, carrion, and some vegetation. They have an acute sense of smell, and some can locate insects that are hidden as deep as 12 cm underground. In addition to rolling up for protection, many armadillos dive into their burrows when threatened; some species can wedge themselves firmly into the burrow, flexing the bony carapace and digging in with the claws. Armadillos are exceptionally good diggers and occasionally will try to burrow speedily into the ground when in danger. The nine-banded armadillo is the only living edentate found north of Mexico; it ranges north into Kansas, and introduced populations have established strong footholds in Florida and other southeastern states. Other armadillo species are found throughout most Central and South American habitats as far south as Argentina.

Edentate reproduction is varied. The shortest gestation period, 65 days, occurs in the hairy armadillo (*Chaetophractus villosus*) and the longest, 263 days, in the two-toed sloth. *Dasypus* exhibits both of the distinctive reproductive phenomena found in various representatives of this order: polyembryony, with 2–12 identical embryos developing from one fertilized ovum (*Dasypus* almost always bears quadruplets), and delayed implantation, with the early embryo floating freely in the uterus for as long as several months before implanting in the uterine wall and continuing its development. *Dasypus* breeds between June and September, but implantation does not occur until November, and the young are always born in early spring. Young armadillos have a leathery carapace that hardens with age, and they are able to walk shortly after birth. Young tree sloths are born with their eyes and ears open. They cling to the mother and suckle until five months of age and are on their own at nine months. Young anteaters also ride on the mother.

The North American paleanodont edentates lived from the late Paleocene into the Oligocene (about 55,000,000 to 35,000,000 years ago). In the Southern Hemisphere the first Xenarthra also appeared during the Paleocene. This suborder underwent a large adaptive radiation. Several families of sloths appeared and died out, as did two lines of armadillo-like creatures, including the glyptodonts (Glyptodontidae). Two of the largest edentates lived in South America during the Pleistocene Era (some 500,000 years ago). These were the ground sloth *Megatherium americanum*, which was 6 m long, and the glyptodont *Doedicurus clavicaudatus*, which reached 4 m long and stood 1.5 m high.

Edenton, town, seat of Chowan County, northeastern North Carolina, U.S., on Albemarle Sound. Settled *c.* 1660, it was incorporated in 1722 and named for Charles Eden, the first royal governor, and served as the unofficial capital of the colony until *c.* 1760; Edenton's busy port exported plantation products, lumber, and fish. Joseph Hewes, a signer of the Declaration of Independence, lived there; his house and many other colonial structures are preserved, including the Cupola and Iredell houses, St. Paul's Episcopal Church, and the Chowan County courthouse. A bronze teapot marker commemorates the anti-British Edenton Tea Party (Oct. 25, 1774) staged by women of the town. The town's basic agricultural economy (peanuts [groundnuts], truck crops, and livestock) is supplemented by light manufacturing, fishing, and boating. Pop. (1982 est.) 5,305.



The Cupola House in Edenton, N.C.
Milt and Joan Mann from CameraMann

Ederle, Gertrude (Caroline) (b. Oct. 23, 1906, New York City), first woman to swim the English Channel and one of the best known U.S. sports personages of the 1920s. On Aug. 6, 1926, she swam the 35 miles (56 kilometres) from Cap Gris-Nez, Fr., to Dover, Kent, Eng., in 14 hr 31 min, breaking the men's record by 1 hr 59 min.

Gertrude Ederle was a leading exponent of the eight-beat crawl (eight kicks for each full arm stroke), and in the early 1920s she set world and U.S. women's freestyle records for distances from 100 to 880 yards. In the Olympic Games of 1924 in Paris, she won a gold medal as a member of the U.S. women's 400-metre relay team. After her channel triumph, in which her hearing was permanently impaired, she became a swimming instructor and a fashion designer.

EDES, abbreviation of Greek ELLÍNIKOS DÍMOKRATIKOS ETHNIKÓS STRÁTOS, English GREEK DEMOCRATIC NATIONAL ARMY, nationalist guerrilla force that, bolstered by British support, constituted the only serious challenge to EAM-ELAS (*q.v.*) control of the resistance movement in occupied Greece during World War II. Led by Gen. Napoleon Zervas, EDES was originally liberal and antimonarchist; but it moved steadily to the political right. It cooperated with ELAS for a time in operations against the Germans and Italians, but, between October 1943 and February 1944, the two guerrilla groups fought each other. The British hoped to build EDES into a force strong enough to rival EAM-ELAS, but it was incapable of extending its influence far beyond Epirus. During the fighting between ELAS and the British, which began in December 1944, the EDES army was destroyed by ELAS in four days.

Edes, Benjamin (b. Oct. 14, 1732, Charlestown, Mass.—d. Dec. 11, 1803, Boston), founder and co-owner with John Gill of the anti-British New England newspaper the *Boston Gazette and Country Journal.* As editor and publisher of the *Gazette*, Edes made the paper a leading voice favouring American independence.

Edes was 23 and had received only a modest education when he joined with a young Boston printer, John Gill, to found the *Gazette* as a patriots' voice in 1755. It was an immediate success. It is said that the rebellious colonists who took part in the Boston Tea Party (1773) assembled at Edes' home and then donned their Indian costumes and paint at the plant of the *Gazette.*

From mid-1774 to April 1775 Edes was circulating some 2,000 copies of the *Gazette* a week, more than any other colonial paper. British authorities offered a bounty for his arrest, intending to execute him for *Gazette* stories about alleged British atrocities. To avoid arrest Edes, in April 1775, moved his press out of Boston, resuming publication later in Watertown.

As British–colonial relations worsened, Edes began to carry articles by such famous proponents of independence as Samuel and John Adams and John Hancock. Edes published the paper until 1798, but it lost popularity after the Revolutionary War. Edes died in poverty.

Edessa, Modern Greek ÉDHESSA, chief city, *nomós* (department) of Pélla, Macedonia, Greece, on a steep bluff above the valley of the Loudhiás Potamós (river). A swift, fragmented stream flowing through the town was known as the Skirtos ("leaper") in ancient times and since the Middle Ages as the Vódhas (Slavic *voda,* "water") and now as the Edhessaíos Potamós. Its waterfalls have been threatened by the building of a hydroelectric power station at Agra, 2 mi (3 km) east of the town. A prominent trading and agricultural centre, it also manufactures carpets and textiles and is the seat of the metropolitan bishop of Edessa and Pella (Pélla).

The assumption that Edessa was the location of Aigai, the first capital of ancient Macedon, was seriously challenged by the discovery in 1977 of royal tombs of Macedonian leaders at Verghina, southeast of Véroia, including

one identified as that of Philip II. In Roman times Edessa was a stop on the Via Egnatia connecting the Adriatic Sea with the Aegean Sea; and a Roman or Byzantine bridge span of that highway survives in the town. Fought over by the Bulgarians, Byzantines, and Serbs, Edessa was taken by the Turks in the 15th century. In 1912 it passed to Greece. Pop. (1981) 16,054.

Edessa (Turkey): *see* Urfa.

Edfu (Egypt): *see* Idfū.

Edgar (b. 943/944—d. July 8, 975), king of the Mercians and Northumbrians from 957 who became king of the West Saxons, or Wessex, in 959 and is reckoned as king of all England from that year. He was efficient and tolerant of local customs, and his reign was peaceful. He was most important as a patron of the English monastic revival.

Edgar, detail from the New Minster Charter, 966; in the British Library (Vesp. MS. A viii)
By courtesy of the trustees of the British Library

The younger son of Edmund I, king of the English, Edgar was made king of the Mercians and Northumbrians in place of Eadwig, his brother, who was deposed. On Eadwig's death (Oct. 1, 959), Edgar succeeded to the West Saxon throne. His ecclesiastical policy was also that of the archbishop of Canterbury, St. Dunstan, who insisted on strict observance of the Benedictine Rule. The king supported Archbishop Oswald of York and Bishop Aethelwold of Winchester in founding abbeys. Edgar's laws were the first in England to prescribe penalties for nonpayment of tithes and Peter's pence, the annual contribution made by Roman Catholics for support of the Holy See.

Edgar (b. *c.* 1075—d. Jan. 8, 1107, Edinburgh, Scot.), king of Scots from 1097, eldest surviving son of Malcolm III Canmore and Queen Margaret (granddaughter of King Edmund II of England) and thus the first king of the Scots to unite Celtic and Anglo-Saxon blood.

As vassal to King William II Rufus of England, he was placed on the Scottish throne to succeed the Celtic, anti-English Donald Bane, his uncle, who was deposed. In 1098 Edgar ceded the Hebrides to Magnus III, king of Norway, who had been raiding the islands. Edgar was a generous benefactor of the church; a contemporary historian (St. Aelred of Rievaulx) called him the equal of Edward the Confessor in personal merit. He died unmarried and was succeeded by his brother Alexander I.

Edgar THE AETHELING (b. Hungary—d. *c.* 1125), Anglo-Saxon prince, who, at the age of about 15, was proposed as king of England after the death of Harold II in the Battle of Hastings (Oct. 14, 1066) but instead served the first two Norman kings, William I, Harold's conqueror, and William II. His title of aetheling (an Anglo-Saxon prince, especially the heir apparent) indicates he was a prince of the royal family; he was a grandson of King Edmund II Ironside.

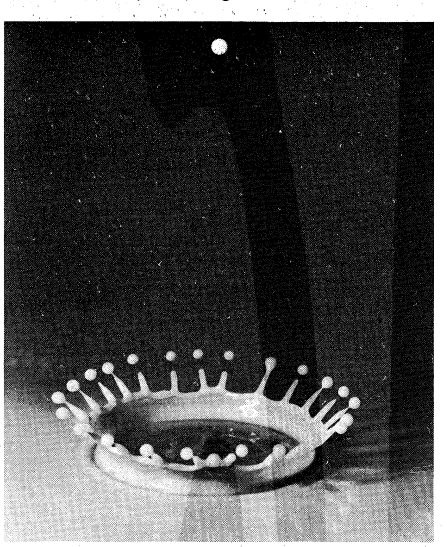
After the Norman Conquest, Edgar submitted to William I, although the new king was occupied until 1069 in crushing rebellions in favour of the aetheling. Edgar lived in Scotland (1068–72) with his brother-in-law, King Malcolm III Canmore, and then went into exile when William and Malcolm came to terms. In 1074 he submitted to William again, and in 1086 he led a Norman force sent by William to conquer Apulia, in southern Italy.

Under William II Rufus, Edgar was deprived of his Norman lands in 1091, giving Malcolm an excuse for raiding the north of England. Edgar then mediated between the two kings. In 1097, acting on William's orders, he overthrew Malcolm's brother and successor, Donald Bane, a foe of the Normans, and installed Malcolm's son Edgar on the throne of Scotland. About 1102 he went on a crusade to the Holy Land. He sided with Robert Curthose, Duke of Normandy, against Henry I in the struggle for the English crown. Edgar was captured by Henry in the Battle of Tinchebrai (Sept. 28, 1106), was released, and spent the rest of his life in obscurity.

Edgartown, town, Dukes county, southeastern Massachusetts, U.S. It lies between Nantucket and Vineyard sounds, on the eastern tip of Martha's Vineyard Island. The oldest settlement on the island, Edgartown dates from 1642 and was incorporated in 1671 and named for Edgar, son of James II of England. At first the town was called Nunnepog (Indian for "fresh pond"). In the 18th century Edgartown was the prosperous home port of many whaling vessels. Houses built by successful whalers and merchants line the town streets. On Cooke Street are some of the oldest houses in the area, including the Thomas Cooke house (1766), now headquarters of the Duke County Historical Society. Edgartown depends greatly on summer tourists for revenue and has excellent beaches and provisions for water sports. Nearby is Martha's Vineyard State Forest. Pop. (1986 est.) 2,990.

Edgerton, Harold E(ugene) (b. April 6, 1903, Fremont, Neb., U.S.—d. Jan. 4, 1990, Cambridge, Mass.), American electrical engineer and photographer, noted for developing techniques of high-speed photography and applying them to various scientific uses.

Edgerton earned a bachelor's degree in electrical engineering from the University of Nebraska in 1925 and received master's (1927) and doctoral (1931) degrees in the same field from the Massachusetts Institute of Technology (MIT). He taught at MIT from 1928, becoming a full professor there in 1948.



Falling drop of milk photographed by Edgerton using a strobe light for illumination, *c.* 1938
Harold E. Edgerton

As a graduate student, Edgerton in 1926 began to experiment with flash tubes. He developed a tube using xenon gas that could produce high-intensity bursts of light as little as 1/1,000,000 of a second in duration. Edgerton's tube is still the basic flash device used in still photography. The xenon flash could also emit repeated bursts of light at regular and very brief intervals and was thus an ideal stroboscope. With his new flash Edgerton was able to photographically record the action of such things as drops of milk falling into a saucer, a tennis racket hitting a ball, and bullets impacting against a steel plate or traveling at speeds of up to 15,000 miles per hour (24,100 kilometres per hour). The resulting images often possessed artistic beauty in addition to their value to industry and science.

Edgerton explored many uses for his new photographic equipment. During World War II he constructed stroboscopic units to photograph the night operations of enemy troops. After the war he and his associates photographed U.S. nuclear test explosions. Later he devised methods and equipment to photograph sea life at unprecedented depths.

Edgeworth, Francis Ysidro, original name YSIDRO FRANCIS EDGEWORTH (b. Feb. 8, 1845, Edgeworthstown, County Longford, Ire.—d. Feb. 13, 1926, Oxford, Oxfordshire, Eng.), Irish economist and statistician who applied mathematics to those fields, developing new concepts.

Edgeworth was educated at Trinity College in Dublin and Balliol College, Oxford, graduating in 1869. In 1877 he qualified as a barrister. He lectured at King's College, London, from 1880, becoming professor of political economy in 1888. From 1891 to 1922 he was Drummond Professor of economics at Oxford. He played an important role as editor of the *Economic Journal* (1891–1926).

Edgeworth was an economist of formidable mathematical attainments with, however, a rather obscure style of writing. He originally hoped to use mathematics to illuminate ethical questions; and his first work, *New and Old Methods of Ethics* (1877), drew on mathematical techniques, especially the calculus of variations, which possibly deterred otherwise interested readers. His most famous work is *Mathematical Psychics* (1881), which presented his ideas on the generalized utility function, the indifference curve, and the contract curve, all of which have become standard devices of economic theory.

Edgeworth contributed to the pure theory of international trade and to taxation and monopoly theory. He also made important contributions to the theory of index numbers and to statistical theory, in particular to probability, advocating the use of data of past experience as the basis for estimating future probabilities.

Edgeworth, Maria (b. Jan. 1, 1767, Blackbourton, Oxfordshire, Eng.—d. May 22, 1849, Edgeworthstown, Ire.), Anglo-Irish writer, known for her children's stories and for her novels of Irish life.

She lived in England until 1782, when the family went to Edgeworthstown, northwest of Dublin, where Maria, then 15 and the eldest daughter, assisted her father in managing his estate. In this way she acquired the knowledge of rural economy and of the Irish peasantry that was to be the backbone of her novels. Domestic life at Edgeworthstown was busy and happy. Encouraged by her father, Maria began her writing in the common sitting room, where the 21 other children in the family provided material and audience for her stories. She published them in 1796 as *The Parent's Assistant.* Even the intrusive moralizing, attributed to her father's editing, does not

Maria Edgeworth, detail of an engraving by Alonzo Chappel, 1873

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

wholly suppress their vitality, and the children who appear in them, especially the impetuous Rosamond, are the first real children in English literature since Shakespeare.

Her first novel, *Castle Rackrent* (1800), written without her father's interference, reveals her gift for social observation, character sketch, and authentic dialogue and is free from lengthy lecturing. Sir Walter Scott acknowledged his debt to Edgeworth in writing *Waverley.* Her next work, *Belinda* (1801), a society novel unfortunately marred by her father's insistence on a happy ending, was particularly admired by Jane Austen.

Edgeworth never married. She had a wide acquaintance in literary and scientific circles. Between 1809 and 1812 she published her *Tales of Fashionable Life* in six volumes. They include one of her best novels, *The Absentee,* which focused attention on a great contemporary abuse: absentee English landowning.

Before her father's death in 1817 she published three more novels, two of them, *Patronage* (1814) and *Ormond* (1817), of considerable power. After 1817 she wrote less. She completed her father's *Memoirs* (1820) and devoted herself to the estate. She enjoyed a European reputation and exchanged cordial visits with Scott. Her last years were saddened by the Irish famine of 1846, during which she worked for the relief of stricken peasants.

The feminist movement of the 1960s led to the reprinting of her *Moral Tales for Young People,* 5 vol. (1801) and *Letters for Literary Ladies* (1795) in the 1970s. Her novels continued to be regularly reprinted in the 20th century. A selection of her letters, *Maria Edgeworth in France and Switzerland,* edited by Christina Colvin, was published in 1979.

Edgeworth, Richard Lovell (b. May 31, 1744, Bath, Somerset, Eng.—d. June 13, 1817, Edgeworthstown, County Longford, Ire.), Anglo-Irish inventor and educationalist who had a dominant influence on the novels of his daughter Maria Edgeworth.

Richard Edgeworth, engraving by A. Cardon, 1812

BBC Hulton Picture Library

An estate owner in Ireland, Edgeworth did much to improve the conditions of his tenantry by land reclamation and road-improvement schemes. In 1798, when the French landed an expeditionary force in Ireland, he organized a troop of yeomanry to fight them. In 1802 he took his family to Paris and was received in scientific and literary circles. In 1806 he joined a commission of inquiry into Irish education, and from 1807 he worked on his autobiography.

Edgeworth's remarkable powers of mechanical invention are attested by his attempt at telegraphic communication, possibly the first, the creation of various sailing carriages, a velocipede (cycle), a "perambulator" (land-measuring machine), a turnip cutter, a one-wheeled chaise, and a phaeton (a four-wheeled open carriage). *Practical Education,* written in collaboration with his daughter, was inspired by the French-Swiss moralist Jean-Jacques Rousseau and by one of Edgeworth's wives, Honora. The book argued that children should be given a strong motive to learn and that the pace should be adjusted to the child's age and ability. Edgeworth discouraged learning by rote, arguing that while some things require sustained effort, others can be learned through play; children should thus be given toys that stimulate them to productive activity.

Four times married, Edgeworth had 22 children.

Êdhessa (Greece): *see* Edessa.

Ediacara fauna, assemblage of relatively advanced multicellular Precambrian animals found as fossils in the Pound Quartzite of the Ediacara Hills, north of Adelaide, South Australia (the Precambrian began about 4,600,000,000 years ago and ended 570,000,000 years ago). The discovery of the Ediacara fauna provided a glimpse into the early development of multicellular organisms and demonstrated that a far more complex level of evolution had been achieved in the Precambrian than had previously been thought. Similarly, the assemblage demonstrates that a complex, interacting biologic community existed during at least part of the Precambrian. The complexity of the organisms and of the community implies a still-longer history of development and evolution.

More than 600 specimens have been collected, including soft corals, jellyfishes, various sorts of worms, and forms of unknown affinities.

Edib Adıvar, Halide, also called (1901–10) HALIDE SALIH, original name HALIDE EDIB (b. 1883, Istanbul—d. Jan. 9, 1964, Istanbul), novelist and pioneer in the emancipation of women in Turkey.

Educated by private tutors and at the American College for Girls in Istanbul, she became actively engaged in Turkish literary, political, and social movements. She divorced her first husband in 1910 because she rejected his taking a second wife (she married again in 1917, to a Turkish politician, Adnau Adıvar).

An ardent patriot, she wrote *Yeni Turan* (1912; "The New Turan"), on the nationalistic Pan-Turkish movement. She also played a major role in the Türk Ocağı (Turkish Hearth) clubs started in 1912 that were designed to raise Turkish educational standards and encourage social and economic progress. This program included public lectures attended by men and women together, a great social innovation. During this period Halide Edib published her famous novel *Handan* ("Family"), about the problems of an educated woman.

After educational work in the Ottoman province of Syria, during World War I, she and her husband joined the Turkish nationalists and played a vital role in the Turkish War of Liberation in Anatolia. Her most famous novel, *Ateşten gömlek* (1922; *The Daughter of Smyrna*), is the story of a young woman who works for the liberation of her country and of the two men who love her. From 1925 to 1938 Halide Edib traveled extensively, lecturing in Paris, London, the United States, and India. On her return to Istanbul in 1939, she became professor of English literature at Istanbul University and later a member of Parliament (1950–54).

Among her other important novels are *Zeyno'nun Oğlu* (1926; "Zeyno's Son") and *Sinekli Bakkal* (1936, originally written in English as *The Clown and His Daughter,* 1935). Other important works in English are *The Turkish Ordeal* (1928), *Conflict of East and West in Turkey* (1935, 1963), and *Turkey Faces West* (1930), in which she examines the ideological conflicts facing the young Turkish Republic. She also wrote two volumes of memoirs (1926).

Edinburg, city, seat of Hidalgo County, extreme southern Texas, U.S., in the Lower Rio Grande Valley, 55 miles (89 km) west-northwest of Brownsville. With McAllen and Pharr it forms a metropolitan complex. Old Edinburgh (no longer existing) was founded by John Young of Scotland near the site of Hidalgo and in 1852 became the county seat. In 1908, by referendum, the seat was moved to nearby Chapin (established in 1907), which in 1911 was renamed Edinburg to commemorate the earlier town (the *h* was dropped). Edinburg developed as a cotton-ginning centre and a packing and shipping point for the valley's citrus fruits and vegetables. Oil and natural gas fields are in the vicinity. The city operates one of the nation's most scattered school districts, embracing about 945 square miles (2,450 square km) of groves and farmland and ranchland. It is the site of Pan American University (1927) and the Tropical Texas Center for Mental Health and Mental Retardation (1967). Inc. city, 1919. Pop. (1980) city, 24,075; (1985 est.) metropolitan area (MSA), 352,200.

Edinburgh, Scottish Gaelic DUNEIDEANN, city, district of the Lothian region, and capital of Scotland. It is located in southeastern Scotland near the southern shores of the Firth of Forth, an arm of the North Sea that thrusts westward into the Scottish lowlands. The original burgh, now known as the Old Town, arose in the 12th century with Edinburgh Castle as its focus. The city is the centre of Scottish culture, education, and national identity.

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

Edinburgh is situated in a rough valley punctuated by upthrusting crags and is dominated by the basalt cliffs of Castle Rock. The Georgian-style New Town arose in the late 18th and 19th centuries, made possible in part by the draining of the North Loch (lake), which stood at the base of Castle Rock. The city has expanded also to the south of the Old Town, beyond the Meadows, which occupy the site of the drained South Loch. The climate is commonly rainy or cloudy, with mild seasonal variation.

Edinburgh is of secondary industrial importance among northern European cities; its main industries are the processing of food, beverages, and tobacco; engineering, including ship repair and marine engineering; electronics and the manufacture of electrical goods; the manufacture of paper; and printing and publishing. It is Scotland's centre of medicine, law, banking, insurance, and tourism. Edinburgh's port of Leith handles imports of grain, foodstuffs, and wood products; exports include coal, whisky, iron, and steel. Granton, Edinburgh's other port town, is the home of the Firth of Forth fishing fleet.

The medieval town of Edinburgh was built on the eastern part of Castle Rock below the

castle walls. The tiny chapel of St. Margaret, on the rock's highest point, is the oldest surviving building, dating from the 12th century but possibly incorporating some 11th-century construction. The castle's cliff-hanging ramparts are mainly of 18th-century origin. Palace Yard, or Crown Square, occupies much of the summit of Castle Rock. Two east–west roads form the main axes of the city: the Royal Mile, which descends Castle Hill and links the castle with the Palace of Holyroodhouse; and Princes Street, along which stretch the Princes Street Gardens.

Edinburgh's institutions of higher education include the University of Edinburgh (1583), known for its schools of medicine and law; Heriot-Watt University; the Edinburgh College of Art; and the New College of the Church of Scotland. The National Library, National Gallery, the Scottish National Zoological Park, and the Royal Scottish Museum also are located in Edinburgh. The city was the birthplace of Sir Walter Scott and of the *Encyclopædia Britannica* (first edition begun in 1768). Edinburgh's annual international festival of the arts includes a panoply of theatre, dance, music, and visual arts presentations.

Local, regional, and national bus services are extensive, and the growing number of private motor vehicles has contributed to urban congestion. Edinburgh is served by Britrail, the national system; its Waverley railway station is the second largest in Britain. The city's ports of Leith and Granton are located 2 and 3 miles (3 and 5 km), respectively, to the north, and its international airport is 5 miles (8 km) west at Turnhouse. Area city, 101 square miles (262 square km). Pop. (1981) 420,169.

Edinburgh, City of, district, Lothian region, eastern Scotland. Created by the reorganization of 1975, it is the former county of the city of Edinburgh, together with portions of the former counties of Midlothian and West Lothian. The district has an area of 102 square miles (265 square km) and covers the city of Edinburgh, its port of Leith lying on the southern shore of the Firth of Forth, and its airport at Turnhouse. Pop. (1987 est.) 438,-721.

Edinburgh, Prince Philip, duke of: *see* Philip, duke of Edinburgh.

Edinburgh, University of, coeducational, privately controlled institution of higher education at Edinburgh, one of the most noted of Scotland's universities. It was founded in 1583 as "the Town's College" under Presbyterian auspices by the Edinburgh town council under a charter granted in 1582 by King James VI, who later became King James I of England. In 1621 an act of the Scottish Parliament accorded all the rights and privileges of Scotland's three older universities to the Town's College, after which it gradually assumed the name of the University of Edinburgh. The university remained under the control of the Edinburgh town council until 1858, when it received autonomy under the Universities Act.

The university initially consisted of a liberal arts college and a school of divinity. Schools of medicine and law were established in the early 18th century, and faculties of music, science, arts, social sciences, and veterinary medicine were subsequently added.

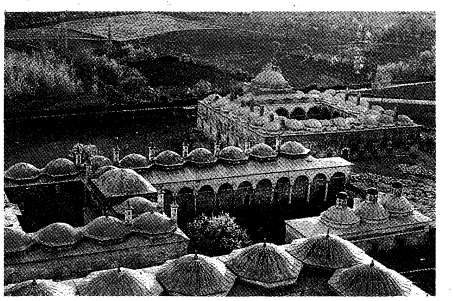
Although its faculty of divinity has always been of singular importance to the university, its school of medicine is also renowned. The English naturalist Charles Darwin studied medicine there. The University of Edinburgh has produced a long line of eminent cultural figures, including the novelist Sir Walter Scott, the philosopher and historian James Mill, the essayist and historian Thomas Carlyle, the novelist Robert Louis Stevenson, and the inventor Alexander Graham Bell.

Edinburgh Review, The, or The Critical Journal, Scottish magazine that was published from 1802 to 1929, and which contributed to the development of the modern periodical and to modern standards of literary criticism. *The Edinburgh Review* was founded by Francis Jeffrey, Sydney Smith, and Henry Brougham as a quarterly publication, with Jeffrey as its first and longtime editor. It was intended as an outlet for liberal views in Edinburgh. The magazine soon earned wide esteem for its political and literary criticism, and by 1818 it had attained a circulation of 13,500. Its contributors included the novelist Sir Walter Scott, the essayist William Hazlitt, the historian Thomas Babington Macaulay, the educator Thomas Arnold, and the legal historian Sir James Stephen. *The Edinburgh Review*'s prestige and authority among British periodicals during the 19th century were matched only by that of *The Quarterly Review.*

Edingen (Belgium): *see* Enghien.

Edirne, formerly ADRIANOPLE, or HADRIANOPLE, city, extreme western Turkey. It lies at the junction of the Tunca and Maritsa (Turkish: Meriç) rivers near the borders of Greece and Bulgaria. The largest and oldest part of the town occupies a meander of the Tunca around the ruins of an ancient citadel. Edirne's site and turbulent history were determined by its strategic position on the main route from Asia Minor to the Balkans.

Originally called Uskudama and probably first settled by Thracian tribes, the town was rebuilt and enlarged in about AD 125 by the Roman emperor Hadrian, who renamed it Hadrianopolis. In 378 the city was the site of the Battle of Adrianople, in which the Goths dealt Rome a crushing defeat. Besieged by the Avars in 586, the city was captured by the Bulgars in the 10th century and was ransacked twice by crusaders until it fell to the Ottomans in 1362. It then served as the forward base



Bayezid Cami (mosque), Edirne, Tur.
Roland Michaud from Rapho/Photo Researchers—EB Inc.

for Ottoman expansion into Europe. It served as the capital of the Ottoman Empire from 1413 until 1458 and flourished as an administrative, commercial, and cultural centre. Its decline came with foreign occupations and devastation in wars. Occupied by the Russians in 1829 and 1878, it was taken by the Bulgarians during the First Balkan War in 1913. Retaken by the Turks that same year, it was captured by the Greeks in 1920 during the Turkish War of Independence and was finally restored to Turkey in 1922.

The centre of the city has several beautiful mosques. The Selimiye Cami (Mosque of Selim) is a masterpiece of the celebrated Ottoman court architect Sinan. Built between 1569 and 1575, the mosque lies on the summit of rising ground and dominates the skyline. The mosque's main structure comprises a succession of 18 small domes dominated by a huge central dome resting on 8 columns with 3-balconied minarets on 4 sides. The mosque forms an architectural whole, with adjacent complementary buildings, school, library, and theological college, now housing archaeological and ethnographic museums. The Bayezid Cami (Mosque of Bayezid), built by Sultan Bayezid II in 1488, has a great dome supported by four walls and an elegant marble niche pointing toward Mecca. Bedesten is a restored 15th-century covered bazaar.

Edirne lies along the London-to-Istanbul railway. Major roads connect it with central Europe and Istanbul. Known for its *peynir* (white cheese), the city also produces cotton and woolens, soap, and leather goods. The surrounding agricultural area produces wheat, rice, rye, and fruits. Pop. (1985) 86,909.

Edirne, Treaty of, also called TREATY OF ADRIANOPLE (Sept. 14, 1829), pact concluding the Russo-Turkish War of 1828–29, signed at Edirne (ancient Adrianople), Tur.; it strengthened the Russian position in eastern Europe and weakened that of the Ottoman Empire. The treaty foreshadowed the Ottoman Empire's future dependence on the European balance of power and also presaged the eventual dismemberment of its Balkan possessions.

Russia, victorious on the Balkan and Caucasus fronts, preferred a weakened Ottoman Empire to one that was dismembered by other powers. The treaty allowed Russia to annex the islands controlling the mouth of the Danube River and the Caucasus coastal strip of the Black Sea, including the fortresses of Anapa and Poti. The Ottomans recognized Russia's title to Georgia and other Caucasian principalities and opened the Straits of the Dardanelles and Bosporus to Russian shipping. Furthermore, in the Balkans, the Ottomans acknowledged Greece as an autonomous but tributary state, reaffirmed the Convention of Akkerman (1826), granting autonomy to Serbia, and recognized the autonomy of the Danubian principalities of Moldavia and Walachia under Russian tutelage.

Edison, urban township, northern Middlesex county, New Jersey, U.S., just northeast of New Brunswick. It is the site of Menlo Park (*q.v.*), where the inventor Thomas A. Edison established his research laboratory. Part of Woodbridge and Piscataway townships before 1870, it was known as Raritan township until 1954, when it was renamed for Edison. Edison's manufactures are diversified, and the Raritan Center, occupying most of the former Raritan Arsenal, is a planned industrial, commercial, and research complex. Middlesex County College (1964) is in Edison. Pop. (1988 est.) 83,609.

Edison, Thomas Alva (b. Feb. 11, 1847, Milan, Ohio, U.S.—d. Oct. 18, 1931, West Orange, N.J.), American genius of technology, who held patents for more than 1,000 inventions, including the incandescent electric lamp, the phonograph, and the motion-picture projector.

A brief treatment of Thomas Alva Edison follows. For full treatment, *see* MACROPAEDIA: Edison.

Edison set up a laboratory in his father's basement when he was 10 years old. At the age of 12 he began selling newspapers and candy on the trains between Port Huron and Detroit. From 1862 to 1868 he worked as a roving telegrapher. He obtained a position as a night operator for Western Union Telegraph Company in 1868. In 1869 he decided to give up his career in telegraphy in order to pursue invention and entrepreneurship. He moved to New York City, and within a year he was successful enough to establish a workshop in Newark, N.J. During this time he produced the Edison Universal Stock Printer and other printing telegraphs. In 1876 he gave up his telegraph factory and set up a research laboratory in nearby Menlo Park. There, with the help of several highly talented associates, Edison achieved his greatest successes. In 1877 he invented the phonograph. He began work

on the light bulb in 1878 and demonstrated his carbon filament lamp in 1879. In 1883 he accidentally discovered the "Edison effect," which later became the basis of the electron tube. He also perfected motion-picture equipment.

Edison effect (physics): *see* thermionic emission.

Edjo (Egyptian goddess): *see* Buto.

Edkou (Egypt): *see* Idkū.

Edlābād (India): *see* Ādilābād.

Edmer, also spelled EADMER (b. *c.* 1060—d. *c.* 1128, Canterbury, Kent, Eng.?), English biographer of St. Anselm and historian whose accounts are a uniquely accurate and credible portrait of the 12th-century monastic community at Canterbury.

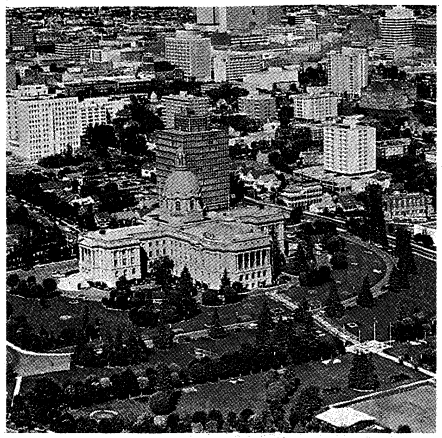
Born into a wealthy family that was impoverished by the Norman conquest, Edmer was raised at Christ Church, Canterbury, where he lived as a monk until 1093. After the accession of Anselm to the archbishopric in 1093, Edmer became a member of his household, probably acting as secretary and chaplain. Until Anselm's death in 1109, Edmer accompanied him on extensive travels to Rome, Cluny, and the councils of Bari (1098) and the Vatican (1099). Between 1109 and 1114 he remained relatively inactive, but he returned to Canterbury under Archbishop Ralph in 1119.

His two greatest works are a six-book *Historia novorum in Anglia* (*c.* 1115), an account of events in England as seen from Canterbury, stressing Anselm's role in the Investiture Controversy between the political and clerical authorities, and the *Vita Anselmi* (*c.* 1124), an authoritative biography of Anselm's private life. Edmer's importance in historiography rests on his powers of critical observation and description, a novel emphasis on psychological factors in biographical writing, and a clear recognition of the implications of the Investiture Controversy.

Edmond, city, Oklahoma county, central Oklahoma, U.S., immediately north of Oklahoma City. Settled in 1889, it was named for Eddy (Edmond) Townsend, a rancher. The West Edmond Field is one of the world's largest oil fields. The city's manufactures include petroleum products, feed, flour, and concrete blocks. Central State University was established there in 1890. Pop. (1988 est.) 50,232.

Edmondo (Italian personal name): *see under* Edmund.

Edmonton, city, capital of Alberta, Canada. It lies along the North Saskatchewan River, in the centre of the province. Edmonton traces its origin to Fort Edmonton, a Hudson's Bay Company fur-trading post built in 1795 at a site 20 miles (32 km) downstream from the present-day city and reputedly named after a former borough in London, Eng. Nearby was Fort Augustus, a North West Company trading post built on the river's opposite bank. Both posts were abandoned in 1810, and five other forts were later built along the river. A trading settlement developed at the city's site after 1864 and survived the Cree Indian Rebellion of 1885. With the arrival of the Canadian Pacific Railway at nearby Strathcona (across the river) in 1891 and the federal government's successful campaign later in that decade to lure settlers to the West, Edmonton began to prosper as an agricultural distribution and processing centre. The year 1905 saw the long-awaited arrival of the Canadian Northern Railway and the designation of the city as capital of the new province of Alberta. Edmonton and Strathcona were amalgamated in 1912. During World War II Edmonton served as the base for construction of the Alaska Highway. The discovery of petroleum in 1947 at Leduc and subsequently at several



Main Legislative Building (foreground), Edmonton, Alta.
George Hunter

other locations near Edmonton greatly stimulated the city's urban and industrial growth.

An agricultural and oil-based economy still prevails in Edmonton. The city's major industries include lumbering, flour milling, meatpacking, tanning, dairying, oil refining, and the production of petrochemicals and plastics. Oil and gas pipelines radiate from the city. Edmonton's three major rail lines, along with its international airport, have made it the wholesaling, retailing, and distribution centre of northwestern Canada.

Edmonton is the headquarters of Athabasca University (an "open university" founded in 1972) and is the site of the University of Alberta (1906), the Northern Alberta Institute of Technology, the Provincial Museum of Alberta, the Queen Elizabeth Planetarium, and the Valley Zoo. The main Legislative Building (1908–12) holds a 305-bell carillon in its dome. Ft. Edmonton Historical Park, at the south end of Quesnell Bridge, highlights a replica of the original fort. The city hosts the annual Agricultural and Industrial Exhibition, Muk-Luk Mardi Gras (a winter sports carnival), and Klondike Days (a celebration in July of the 1890s gold rush). Edmonton also has one of the world's largest shopping malls. Inc. town, 1892; city, 1904. Pop. (1986) city, 573,982; metropolitan area, 785,465.

Edmund, name of rulers grouped below by country and indicated by the symbol •.

Foreign-language equivalents:

Anglo-Saxon	Eadmund, or Edmund
Italian	Edmondo

East Anglia

• **Edmund,** byname SAINT EDMUND THE MARTYR (b. 841/842—d. Nov. 20, 870; feast day November 20), king of East Anglia (from 855).

Of his life little is known. In the year 870 the Danes, who had been wintering at York, marched through Mercia into East Anglia and took up their quarters at Thetford. Edmund engaged them fiercely in battle, but the Danes under their leaders Ubba and Inguar were victorious and remained in possession of the field of battle. The king himself was slain, whether on the actual field of battle or in later martyrdom is not certain, but the widely current version of the story which makes him fall a martyr to the Danish arrows when he had refused to renounce his faith or hold his kingdom as a vassal from the heathen overlords must have arisen early, for the St. Edmund pennies afford evidence of his cult before the end of the 9th century. He was ultimately buried at Beadoricesworth (now Bury St. Edmund's, West Suffolk), where his shrine became famous. Later, fictitious versions make him a Continental Saxon, born at Nürnberg and adopted by Offa, king of East Anglia, when on his way to Rome. They also invent names for his parents, Alkmund and Scivare.

BIBLIOGRAPHY. Thomas Arnold (ed.), *Memorials of St. Edmund's Abbey,* vol. 1 (1890, reprinted 1965), contains Abbon of Fleury's *Passio Sancti Eadmundi;* Lord Francis Hervey (ed.), *The History of King Eadmund the Martyr and of the Early Years of His Abbey* (1929), contains both text and translation.

England

• **Edmund I,** byname EDMUND THE DEED-DOER, Latin EDMUNDUS MAGNIFICUS (b. 921—d. May 26, 946, Pucklechurch, Eng.), king of the English (939–946), who recaptured areas of northern England that had been occupied by the Vikings.

He was the son of the West Saxon king Edward the Elder (reigned 899–924) and the half brother of King Athelstan (reigned 924–939), under whom the political unification of England had been accomplished. On Athelstan's death (939), Olaf Guthfrithson, the Norse king of Dublin, occupied Northumbria and raided the Midlands.

Edmund recovered the Midlands after Olaf died in 942, and in 944 he regained Northumbria, driving out the Norse kings Olaf Sihtricson and Raegnald. He captured Strathclyde in 945 and entrusted it to Malcolm I, king of Scots, in return for a promise of military support. Thus, Edmund inaugurated a policy of establishing a secure frontier and peaceful relations with Scotland. In addition, his reign marks the beginning of the 10th-century monastic revival in England. The king was killed in his palace by an exiled robber and was succeeded by his brother, Eadred (reigned 946–955); Edmund's sons eventually acceded to power as kings Eadwig (reigned 957–959) and Edgar (reigned 959–975).

• **Edmund II,** byname EDMUND IRONSIDE (b. *c.* 993—d. Nov. 30, 1016), king of the English from April 23 to Nov. 30, 1016, surnamed "Ironside" for his staunch resistance to a massive invasion led by the Danish king Canute.

The son of King Ethelred II the Unready (reigned 978–1016), Edmund defied his father's orders by marrying (1015) the widow of one of the Danish lords then occupying English territory. Nevertheless, when Canute invaded England later in 1015, Edmund raised an army in northern England and ravaged regions that would not rally to his cause.

Upon Ethelred's death (April 1016), a small number of councillors and citizens of London proclaimed Edmund as their ruler, but a larger body of nobles at Southampton declared for Canute. Edmund then launched a series of offensives against his rival. He recovered Wessex and relieved London of a siege before being decisively defeated by Canute at Ashington, Essex, on October 18. In the ensuing peace settlement, Edmund retained Wessex, while Canute held the lands north of the River Thames. After Edmund died (probably of natural causes), Canute became sole ruler of England.

Sicily

• **Edmund:** *see* Lancaster, Edmund, 1st Earl of.

Edmund OF ABINGTON, SAINT, original name EDMUND RICH (b. Nov. 20, 1175?, Abingdon, Berkshire, Eng.—d. Nov. 16, 1240, Soisy, Fr.; feast day November 16), distinguished scholar, outspoken archbishop of Canterbury, one of the most virtuous and attractive figures of the English church, whose literary works strongly influenced subsequent spiritual writers in England. After studies at Oxford—where he took a vow of perpetual

chastity—and at Paris, he lectured (*c.* 1194–1200) in Paris and in Oxford, where he reportedly was the first to teach the philosophy of Aristotle. After further theological studies in Paris, he again taught at Oxford from about 1214 to 1222, when he became canon of Salisbury Cathedral, Wiltshire. In 1227 he preached in England for the Sixth Crusade at the request of Pope Gregory IX, who effected his elevation to archbishop of Canterbury in 1233 (consecrated April 2, 1234).

Edmund soon clashed with King Henry III of England, defending church rights and criticizing the king's continental policies. Reacting against Henry, the baronage ultimately supported Edmund. Civil war threatened. Edmund forced Henry (by threat of excommunication) to expel his wife's ambitious French relatives and allies from England and to abandon their projects. Edmund further made Henry promise to observe English law, customs, and the counsel of his native magnates. In 1236 Henry requested the pope to send him a legate, Cardinal Otho, who arrived the following year. Otho's presence helped to undermine the archbishop's power.

St. Edmund, detail from the Westminster Psalter, mid-13th century; in the British Library (Royal MS. 2A xxii)

By courtesy of the trustees of the British Library

Henry upheld the monks of Canterbury in their opposition to Edmund's authority, and Otho's silence on that issue failed to help the archbishop. Edmund finally protested before Henry and generally excommunicated all who had infringed upon the liberties of his primal see. He left for Rome, planning to appeal his case before the Curia, but poor health forced him to stop at Soisy, where he died. He was buried at Pontigny Abbey. His admirers demanded his immediate canonization, which Henry opposed until 1247. Although Edmund had been made head of the English hierarchy in a crisis for which he was not prepared, the purity of his motives and the loftiness of his ideals commanded universal respect.

Of the various writings that are ascribed to Edmund, those assuredly authentic include *Speculum ecclesiae* (Eng. trans. by F.M. Steele, 1905), a widely known devotional treatise considered a major contribution to medieval theology.

BIBLIOGRAPHY. C.H. Lawrence, *St. Edmund of Abingdon: A Study in Hagiography and History* (1960), compares the source documents in order to distinguish history from legend.

Edmund OF LANGLEY: *see* York, Edmund of Langley, 1st Duke of.

Edmund OF WOODSTOCK: *see* Kent, Edmund Plantagenet, 1st Earl of.

Edmunds, George Franklin (b. Feb. 1, 1828, Richmond, Vt., U.S.—d. Feb. 27, 1919, Pasadena, Calif.), U.S. senator and constitutional lawyer, who for a quarter of a century was a participant in the most important legislative developments of the time.

Because of poor health, Edmunds received little formal education, but he studied law and was admitted to the bar in 1849. He was

Edmunds

By courtesy of the Library of Congress, Washington, D.C.

a Republican member (1854–59) and speaker (1856–59) of the Vermont House of Representatives and a member and president pro tem (1861–62) of the Vermont Senate. He was appointed to the U.S. Senate in 1866 and served until 1891; he was president pro tem of the Senate (1883–85). Edmunds was active in the impeachment (1868) of President Andrew Johnson, was chairman of the Senate Judiciary Committee (1872–79; 1882–91), and was a founding member of the electoral commission that decided the election of 1876. The act for the suppression of polygamy (1882) bears his name, and he was principal author of the Sherman Anti-Trust Act (1890), which he insisted be so worded that it would be applicable to labour unions as well as to industry.

Edmunds resigned from the Senate in 1891 to return to the private practice of law. His many major cases include *Pollock* v. *Farmers' Loan and Trust Co.* (1895), in which he argued successfully before the U.S. Supreme Court that the income tax was unconstitutional.

Edmundston, city, seat (1873) of Madawaska county, northwestern New Brunswick, Canada, at the junction of the St. John and Madawaska rivers, 177 miles (285 km) northwest of Fredericton. Settled by Acadians about 1785 as Petit-Sault (Little Falls), it was renamed in 1848 to honour Sir Edmund Head, then lieutenant governor of the province. Wood pulp is conveyed through a pipeline on the bridge across the river to Madawaska, Maine. The city is known for its wood carving and hand weaving. The Cathedral of the Immaculate Conception, in stone and marble with twin spires, is a foremost example of a distinctive style of eastern Canadian ecclesiastical architecture. Edmundston is the seat of the University of Moncton—Saint-Louis-Maillet Campus (1946). Inc. town, 1905; city, 1952. Pop. (1986) 11,497.

Edo, also called BINI, peoples of southern Nigeria who speak a language of the Kwa branch of the Niger-Congo family of African languages. The Edo numbered about 3.8 million in the late 20th century. Their territory is west of the Niger River and extends from hilly country in the north to swamps in the Niger delta. Edo is also the vernacular name for the city of Benin, the centre of the Benin Kingdom, which flourished between the 14th and the 17th century. *See also* Benin (historic kingdom).

The Edo live in compact village settlements ranging in size from hamlets of several dozen people to towns of several thousand. They subsist primarily on yams, supplemented by corn (maize), plantain, cassava, and other vegetables; the main cash crops are rubber, cocoa, palm products, and timber. Livestock includes goats, sheep, dogs, and fowl, used for sacrificial offerings rather than for ordinary fare. Blacksmiths, brass casters, wood-carvers, leatherworkers, and weavers of ceremonial cloth are among the craft specialists.

The village is the basis of Edo political life. In each village the males are divided into three age-grades. Boys enter the junior grade in their early teens and perform communal tasks such as clearing paths and caring for public buildings. The middle grade of adult males do more difficult tasks, such as roofing houses, and perform executive functions for the village council, which consists of the oldest age-grade. The council decides on matters related to tax collection, collective tasks, cult festivals, relations with central authorities, and other community concerns.

The nonhereditary village headman is usually the oldest man in the village; he also serves as priest of ancestral and earth spirits. A sacred king, the oba, was formerly the political, economic, and ritual head of the state; succession to this office is determined by primogeniture.

Many Edo are now Christians or Muslims, but traditional religion includes belief in a remote creator and in lesser gods, mythical or semimythical village heroes, and spirits of the dead.

Edo, Japanese city that was renamed Tokyo at the Meiji Restoration (1868), when the capital was moved there. In the 1590s Edo became the headquarters for Tokugawa Ieyasu and the Tokugawa shogunate and henceforth remained the capital. *See* Tokyo.

Edo period (Japanese history): *see* Tokugawa period.

Edom: *see* Esau.

Edom, ancient land bordering ancient Israel, in what is now southwestern Jordan, between the Dead Sea and the Gulf of Aqaba. The Edomites probably occupied the area about the 13th century BC. Though closely related to the Israelites (according to the Bible, they were descendants of Esau), they had frequent conflicts with them and were probably subject to them at the time of the Israelite Kingdom (11th–10th century). Edom prospered because of its strategic location on the trade route between Arabia and the Mediterranean and its copper industry at Ezion-geber. Edom and Moab were later conquered by the Nabataeans, and the Edomites migrated to southern Judaea, where they were known in New Testament times as Idumaeans.

Edred (English king): *see* Eadred.

Edric STREONA (early English ealdorman): *see* Eadric Streona.

education, discipline that is concerned, in this context, mainly with methods of teaching and learning in schools or schoollike environments as opposed to various informal means of socialization (*e.g.*, between parents and their children).

The subject of education is treated in a number of articles in the MACROPAEDIA. For a detailed treatment of the historical development and present-day status of educational systems, institutions, and goals, *see* Education, History of. For a treatment of teaching methods and the functions and training of teachers, *see* Teaching. For a description of education in various specialized fields, *see* History, The Study of; Law, The Profession and Practice of; Medicine; Science, The History of. For an analysis of educational philosophy, *see* Philosophies of the Branches of Knowledge. For an examination of some of the more important aids in education and the dissemination of knowledge, *see* Broadcasting; Encyclopaedias and Dictionaries; Libraries; Museums; Printing, Typography, and Photoengraving; Publishing. Some restrictions on educational freedom are discussed in Censorship. For an analysis of pupil attributes,

see Intelligence, Theories and Distribution of; Learning and Cognition, Human; Memory; Psychological Tests and Measurement.

For a description of the place of education in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Five, Division VI.

education, elementary, also called PRIMARY EDUCATION: *see* elementary education.

education, higher: *see* higher education.

education, preschool: *see* preschool education.

education, secondary: *see* secondary education.

educational psychology, theoretical and research branch of modern psychology, concerned with the learning processes and psychological problems associated with the teaching and training of students. The educational psychologist is concerned with the cognitive development of students and the various factors involved in learning, including aptitude and learning measurement, the creative process, and the motivational forces that influence dynamics between students and teachers. Educational psychology is a partly experimental and partly applied branch of psychology, concerned with the optimization of learning. It differs from school psychology, which is an applied field that deals almost exclusively with the problems in elementary and secondary school systems.

Educational psychology traces its origins to the experimental and empirical work on association and sensory activity by the English scientist and founder of eugenics, Sir Francis Galton (1822–1911), and the American psychologist G. Stanley Hall (1844–1924), who wrote *The Contents of Children's Minds* (1883). The major leader in the field of educational psychology, however, was the American educator and psychologist Edward Lee Thorndike (1874–1949), who designed methods to measure and test children's intelligence and their ability to learn. Thorndike proposed the transfer-of-training theory, which states that "what is learned in one sphere of activity 'transfers' to another sphere only when the two spheres share common 'elements.' "

educational system, the total pattern of formal institutions, agencies, and organizations that transmit knowledge and the cultural heritage and that influence the social and intellectual growth of the individual.

All systems of education are rooted in the past and are compounds of a variety of constituent factors influencing educational institutions and their functions. Racial and ethnic attitudes, for example, have played an important role in the formation of educational policy and in the administration of education in several countries. Language also affects education in many countries; the existence of more than one official language must be taken into account in administration, physical plant, curriculum planning, teacher preparation and selection, textbooks, and the like. The political development of a country is another potent influence on the educational system. Nations committed to a particular ideology apply these beliefs to their systems of education. Many school systems derived their educational objectives and some of their content from religious ideologies; in recent years, however, many Western nations have undertaken the secularization of their educational systems.

In a large majority of countries, there is a centralized governmental agency that organizes, administers, finances, and controls the formal and cultural aspects of education in all regions and localities. The laws, curricula, personnel, and materials and methods of instruction are in large measure determined in the central office. Centralized systems, which differ from one another in many respects, prevail in France, Italy, Denmark, Sweden, Norway, Belgium, The Netherlands, Greece, Argentina, Brazil, and El Salvador.

Examples of decentralized systems of education exist in Switzerland, the United States, Germany, India, Canada, and Australia. Local emphases in administration generally are to be found in countries where public schooling originated in grass roots or separatist movements, or where political unity was achieved out of a confederation of sovereign states. Characteristics of local control may be generalized thus: largely advisory in character; financial support for education locally derived, aid from central authorities being accepted with only rare participation in policymaking; and administrative power lodged in local boards of education. In countries such as Canada, Germany, and Australia, where the separate states are sovereign, state ministries of education are appointed and state systems of inspection prevail. In the United States, it is the responsibility of individual states to provide education and, in the delegation of power, states may tend toward either centralization or decentralization. Most state school boards disburse funds, certify teachers, recommend curricula, and supervise the building and maintenance of schools. Actual administration, however, is usually carried out by local school boards. Members of local school boards, who are usually elected officials, comply with the wishes of the community in formulating policy and drawing up budgets. Of course, centralized and decentralized systems have many common elements.

In still another type of educational system, administration and control are shared by national and local authorities. Perhaps the best example of this system is in England, where the educational laws originate in the Parliament but the actual administration is in the hands of the local governments. Though it has many vast differences from the English educational system, the Japanese system is also jointly controlled. Nonpublic or private schools and other educational facilities may be controlled but not financed by the central authority in some cases. In others they may receive full or partial subsidies with varying degrees of autonomy. The Soviet Union, China, and Spain are prime examples of educational administration as controlled by a single political party or ideological group. In various nations and regions of the world—including Spain, Ireland, certain provinces of Canada, and such Muslim countries as Pakistan—religious and denominational influences control school adminstration.

Each of these systems of education must confront change. Technological developments during the 20th century have produced industrialized societies in many parts of the world and a few emerging postindustrial societies. With its more complicated division of labour, industrialization has meant a growth in the number of occupations requiring extensive formal educational preparation. The number of people who must be able to manage and to manipulate the technical and bureaucratic apparatus in an industrial society is large and requires a constant flow of literate persons and a stream of technically competent individuals. A second major influence on contemporary education is the nature of demographic change, more particularly the rate of population growth. It is obvious that the structure, size, and growth of a society's population directly affects education. If, for example, population is growing at a rate more rapid than the rate of expansion of educational plants and personnel, the enrollment ratios, literacy rates, median school years completed, and other measures of educational attainment will tend to fall. Merely to maintain, in the coming years, the present proportion of children and youth in school will require great efforts, particularly on the part of the nations of Asia and Latin America. Demand for equality in educational opportunities has increased as education is increasingly seen as a requisite for respectable status and a good job.

Edward, name of rulers grouped below by country and indicated by the symbol •.

Foreign-language equivalents:

Anglo-Saxon	Eadweard, or Eadward
Portuguese	Duarte

ENGLAND: WESSEX

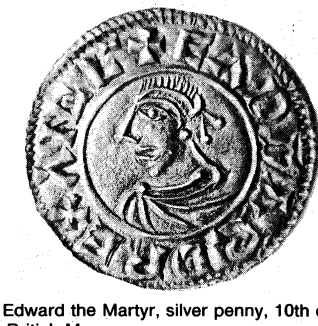
• **Edward,** byname EDWARD THE ELDER (d. July 17, 924, Farndon on Dee, Eng.), Anglo-Saxon king in England, the son of Alfred the Great. As ruler of the West Saxons, or Wessex, from 899 to 924, Edward extended his authority over almost all of England by conquering areas that had previously been held by Danish invaders.

Edward ascended the throne upon his father's death in October 899, and in a battle in 902 his forces killed a rival claimant, Aethelwald, who had allied with the Danes. After defeating the Northumbrian Danes at Tettenhall, he set out in August 912 to subdue the Danes of the eastern Midlands and East Anglia. From 910 to 916 he constructed a series of fortified enclosures around his Kingdom of Wessex.

At the same time, his sister, the Mercian ruler Aethelflaed, constructed a complementary series of fortresses in the northwest Midlands. In 917 Edward and Aethelflaed launched a massive offensive, quickly overwhelming the entire Danish army of East Anglia. Upon Aethelflaed's death in June 918, Edward assumed control of Mercia, and by the end of the year the last Danish armies in the Midlands had submitted. By that time Edward's kingdom included all the land south of the Humber estuary; in 920 he pacified Northumbria. Complete political unification of England was achieved during the reign of his son and successor, Athelstan (reigned 924–939).

ENGLAND AND THE UNITED KINGDOM

• **Edward,** byname SAINT EDWARD THE MARTYR (b. *c.* 963—d. March 18, 978, Corfe, Eng.; feast day March 18), king of England from 975 to 978. His reign was marked by a reaction against the promonastic policies of his father and predecessor, King Edgar (reigned 959–975). Upon Edgar's death a faction sought to win the throne for his younger son, Ethelred, but Edward was quickly elected king. He evidently played little part in the antimonastic



Saint Edward the Martyr, silver penny, 10th century; in the British Museum

Peter Clayton

reaction, which was led by Aelfhere, ealdorman of Mercia. Edward was assassinated while visiting Ethelred in Corfe. Although Ethelred succeeded to the throne, it is not known whether he had a hand in the murder of his brother. Edward was widely mourned; his remains were said to produce miracles, and he was declared a martyr in 1001.

Edward, byname SAINT EDWARD THE CONFESSOR (b. *c.* 1003, Islip, Eng.—d. Jan. 5, 1066, London; canonized 1161; original feast day January 5, now October 13), king of England from 1042 to 1066. Although he was a listless, ineffectual monarch overshadowed by powerful nobles, his reputation for piety

Saint Edward the Confessor, detail of a miniature from Peter Langtoft's *Chronicle,* early 14th century; in the British Library (Royal Ms. 20 A ii)

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evidently preserved much of the dignity of the crown. His close ties to Normandy prepared the way for the conquest of England by Normans under William, duke of Normandy (later King William I the Conqueror), in 1066.

Edward was the son of King Ethelred II the Unready (ruled 968–1016) and Emma, daughter of Richard II, duke of Normandy. When the Danes invaded England in 1013, the family escaped to Normandy; the following year Edward returned to England with the ambassadors who negotiated the pact that returned his father to power. After Ethelred's death in 1016 the Danes again took control of England. Edward lived in exile in Normandy until 1041, when he returned to the London court of his half brother (Emma was their mother), King Hardecanute. Edward succeeded to the throne in 1042 and quickly seized the property of his mother, who had plotted against his accession. Nevertheless, for the first 11 years of his reign the real master of England was Godwine, earl of Wessex. Edward married Godwine's daughter Edith in 1045, but by 1049 a breach had occurred between the two men. In 1051 Edward outlawed the Godwine family and dismissed Edith. During this period Edward was rapidly losing popularity by giving foreigners—particularly Normans—high positions in his government. Hence in 1053 Godwine and his sons were able to gather large forces against the King. They forced Edward to restore their lands, and they exiled many of his foreign favourites. Upon Godwine's death in 1053 his son Harold became the dominant power in the kingdom. It was Harold rather than Edward who subjugated Wales in 1063 and negotiated with the rebellious Northumbrians in 1065. Consequently, Edward on his deathbed named Harold as his successor even though he allegedly had already promised the crown to William. William killed Harold at the Battle of Hastings, Sussex, in October 1066, and two months later he ascended the throne.

• **Edward I,** byname EDWARD LONGSHANKS (b. June 17, 1239, Westminster, Middlesex, Eng.—d. July 7, 1307, Burgh by Sands, near Carlisle, Cumberland), son of Henry III and king of England in 1272–1307, during a period of rising national consciousness. He strengthened the crown and Parliament against the old feudal nobility. He subdued Wales, destroying its autonomy; and he sought (unsuccessfully) the conquest of Scotland. His reign is particularly noted for administrative efficiency and legal reform. He introduced a series of statutes that did much to strengthen the crown in the feudal hierarchy. His definition and emendation of English common law has earned him the name of the "English Justinian."

Early life. Edward was the eldest son of King Henry III and Eleanor of Provence. In 1254 he was given the duchy of Gascony, the French Oléron, the Channel Islands, Ireland, Henry's lands in Wales, and the earldom of Chester, as well as several castles. Henry negotiated Edward's marriage with Eleanor, half sister of Alfonso X of Leon and Castile. He married Eleanor at Las Huelgas in Spain (October 1254) and then travelled to Bordeaux to organize his scattered appanage. He now had his own household and officials, chancery and seal, with an exchequer (treasury) at Bristol Castle; though nominally governing all his lands, in Gascony and Ireland he merely enjoyed the revenues. He returned to England in November 1255 and attacked Llywelyn ap Gruffudd, prince of Gwynedd, to whom his Welsh subjects had appealed for support when Edward attempted to introduce English administrative units in his Welsh lands. Edward, receiving no help from either Henry or the marcher lords, was defeated ignominiously. His arrogant lawlessness and his close association with his greedy Poitevin uncles, who had accompanied his mother from France, increased Edward's unpopularity among the English. But after the Poitevins were expelled, Edward fell under the influence of Simon de Montfort, his uncle by marriage, with whom he made a formal pact. Montfort was the leader of a baronial clique that was attempting to curb the misgovernment of Henry.

Edward reluctantly accepted the Provisions of Oxford (1258), which gave effective government to the barons at the expense of the king. On the other hand, he intervened dramatically to support the radical Provisions of Westminster (October 1259), which ordered the barons to accept reforms demanded by their tenants. In the dangerous crisis early in 1260 he supported Montfort and the extremists, though finally he deserted Montfort and was forgiven by Henry (May 1260). He was sent to Gascony in October 1260 but returned early in

Edward I, watercolour, 15th century; in the British Library (Cotton MS. Julius E. IV)

By courtesy of the trustees of the British Library

1263. Civil war had now broken out between Henry and the barons, who were supported by London. Edward's violent behaviour and his quarrel with the Londoners harmed Henry's cause. At the Battle of Lewes (May 14, 1264) his vengeful pursuit of the Londoners early in the battle contributed to Henry's defeat. Edward surrendered and became a hostage in Montfort's hands. He escaped at Hereford in May 1265 and took charge of the royalist forces, penned Montfort behind the River Severn, and, by lightning strategy, destroyed a large relieving army at Kenilworth (August 1). On August 4 he trapped and slew Montfort at Evesham and rescued Henry. Shattered and enfeebled, Henry allowed Edward effective control of government, and his extreme policy of vengeance, especially against the Londoners, revived and prolonged rebel resistance. Finally, the papal legate Ottobuono, Edward's uncle Richard, earl of Cornwall, and other moderates persuaded Henry to the milder policy of the Dictum of Kenilworth (Oct. 31, 1266), and after some delay the rebels surrendered. Edward took the cross (1268), intending to join the French king Louis IX on a crusade to the Holy Land, but was delayed by lack of money until August 1270. Louis died before Edward's arrival; and Edward, after wintering in Sicily, went to Acre, where he stayed from May 1271 to September 1272, winning fame by his energy and courage and narrowly escaping death by assassination but achieving no useful results. On his way home he learned in Sicily of Henry III's death on Nov. 16, 1272.

Accession and character. Edward had nominated Walter Giffard, archbishop of York, Philip Basset, Roger Mortimer, and his trusted clerk Robert Burnell to safeguard his interests during his absence. After Henry's funeral, the English barons all swore fealty to Edward (Nov. 20, 1272). His succession by hereditary right and the will of his magnates was proclaimed, and England welcomed the new reign peacefully, Burnell taking charge of the administration with his colleagues' support. The quiet succession demonstrated England's unity only five years after a bitter civil war. Edward could journey homeward slowly, halting in Paris to do homage to his cousin Philip III for his French lands (July 26, 1273), staying several months in Gascony and reaching Dover on Aug. 2, 1274, for his coronation at Westminster on August 19. Now 35 years old, Edward had redeemed a bad start. He had been arrogant, lawless, violent, treacherous, revengeful, and cruel; his Angevin rages matched those of Henry II. Loving his own way and intolerant of opposition, he had still proved susceptible to influence by strong-minded associates. He had shown intense family affection, loyalty to friends, courage, brilliant military capacity, and a gift for leadership; handsome, tall, powerful, and tough, he had the qualities men admired. He loved efficient, strong government, enjoyed power, and had learned to admire justice, though in his own affairs it was often the letter, not the spirit of the law that he observed. Having mastered his anger, he had shown himself capable of patient negotiation, generosity, and even idealism; and he preferred the society and advice of strong counsellors with good minds. As long as Burnell and Queen Eleanor lived, the better side of Edward triumphed, and the years until about 1294 were years of great achievement. Thereafter, his character deteriorated for lack of domestic comfort and independent advice. He allowed his autocratic temper full rein and devoted his failing energies to prosecution of the wars in France and against Scotland.

Parliament and statutes. Shrewdly realistic, Edward understood the value of the "parliaments," which since 1254 had distinguished English government and which Montfort had deliberately employed to publicize government

policy and to enlist widespread, active support by summoning representatives of shires and boroughs to the council to decide important matters. Edward developed this practice swiftly, not to share royal power with his subjects but to strengthen royal authority with the support of rising national consciousness. From 1275 to 1307 he summoned knights and burgesses to his parliaments in varying manners. The Parliament of 1295, which included representatives of shires, boroughs, and the lesser clergy, is usually styled the Model Parliament, but the pattern varied from assembly to assembly, as Edward decided. By 1307, Parliament, thus broadly constituted, had become the distinctive feature of English politics, though its powers were still undefined and its organization embryonic.

Edward used these parliaments and other councils to enact measures of consolidation and reform in legal, procedural, and administrative matters of many kinds. The great statutes promulgated between 1275 and 1290 are the glory of his reign. Conservative and definitory rather than original, they owed much to Burnell, Edward's chancellor. With the vast developments and reorganization of the administrative machine that Burnell coordinated, they created a new era in English government. The quo warranto inquiry, begun in 1275, the statutes of Gloucester (1278) and of Quo Warranto (1290) sought with much success to bring existing franchises under control and to prevent the unauthorized assumption of new ones. Tenants were required to show "by what warrant" or right they held their franchises. Edward strove, unsuccessfully, to restore the feudal army and strengthen local government institutions by compelling minor landowners to assume the duties of knighthood. His land legislation, especially the clause *de donis conditionalibus* in the miscellaneous Second Statute of Westminster (1285) and the statute Quia Emptores (Third Statute of Westminster, 1290), eventually helped to undermine feudalism, quite contrary to his purpose. By the Statute of Mortmain (1279) the crown gained control of the acquisition of land by ecclesiastical bodies. The Statute of Winchester (1285) codified and strengthened the police system for preserving public order. The Statute of Acton Burnell (1283) and the Statute of Merchants (1285) showed practical concern for trade and merchants. These are but the most famous of many statutes aimed at efficiency and sound administration.

Wars. Meanwhile, Edward destroyed the autonomous principality of Wales, which, under Llywelyn ap Gruffudd, had expanded to include all Welsh lordships and much territory recovered from the marcher lords. Domestic difficulties had compelled Henry III to recognize Llywelyn's gains by the Treaty of Shrewsbury (1267), but Edward was determined to reduce Llywelyn and used Llywelyn's persistent evasion of his duty to perform homage as a pretext for attack. He invaded Wales by three coordinated advances with naval support (1277), blockaded Llywelyn in Snowdonia, starved him into submission, and stripped him of all his conquests since 1247. He then erected a tremendous ring of powerful castles encircling Gwynedd and reorganized the conquered districts as shires and hundreds. When English rule provoked rebellion, he methodically reconquered the principality, killing both Llywelyn (1282) and his brother David (1283). By the Statute of Wales (1284) he completed the reorganization of the principality on English lines, leaving the Welsh marchers unaffected. A further Welsh rising in 1294–95 was ruthlessly crushed, and Wales remained supine for more than 100 years.

After 1294, matters deteriorated. Queen Eleanor had died in 1290, Burnell in 1292, and Edward never thereafter found such good advisers. The conquest and fortification of Wales had badly strained his finances; now endless wars with Scotland and France bankrupted him. He quarrelled bitterly with both clergy and barons, behaving as a rash and obstinate autocrat who refused to recognize his limitations. Philip III and Philip IV of France had both cheated him of the contingent benefits promised by the Treaty of Paris (1259). By constant intervention on pretext of suzerainty they had nibbled at his Gascon borders and undermined the authority of his administration there. After doing homage to Philip IV in 1286, Edward visited Gascony to reorganize the administration and restore authority. On returning to England in 1289 he had to dismiss many judges and officials for corruption and oppression during his absence. In 1290, having systematically stripped the Jews of their remaining wealth, he expelled them from England. French intervention in Gascony was now intensified; affrays between English and French sailors inflamed feelings; and in 1293 Philip IV tricked Edward's brother Edmund, earl of Lancaster, who was conducting negotiations, into ordering a supposedly formal and temporary surrender of the duchy, which Philip then refused to restore. The Welsh rising and Scottish troubles prevented Edward from taking action, and when at last, in 1297, he sailed to attack France from Flanders, his barons refused to invade Gascony, and Wallace's rising forced him to return. He made peace with Philip (1299) and by Boniface VIII's persuasion married Philip's sister Margaret, and eventually recovered an attenuated Gascon duchy.

For more than 100 years relations between England and Scotland had been amicable, and the border had been remarkably peaceful. Edward inaugurated 250 years of bitter hatred, savage warfare, and bloody border forays. The deaths of Alexander III of Scotland (1286) and his granddaughter Margaret, the Maid of Norway (1290), whom Edward planned to marry to his heir, Edward of Caernarvon (afterward Edward II), ended the line of succession. Many dubious claimants arose, and the Scottish magnates requested Edward's arbitration. Edward compelled the nobles and the claimants to recognize his suzerainty, and only then adjudged John de Balliol king (1292). Balliol did homage and was crowned, but Edward's insistence on effective jurisdiction, as suzerain, in Scottish cases eventually provoked the Scottish nobles to force Balliol to repudiate Edward's claims and to ally with France (1295). Edward invaded and conquered Scotland (1296), removing to Westminster the coronation stone of Scone. William Wallace led a revolt in 1297, and Edward, though brilliantly victorious at Falkirk (July 22, 1298), could not subdue the rebellion despite prolonged campaigning (1298–1303).

Last years. The strain of these years provoked heavy collisions between Edward and his magnates. He had quarrelled violently with his archbishops of Canterbury, John Peckham (1279–92) and Robert Winchelsey (1293–1313), over ecclesiastical liberties and jurisdiction. In 1297 Winchelsey, obeying Pope Boniface VIII's bull *Clericis Laicos* (1296), rejected Edward's demands for taxes from the clergy, whereupon Edward outlawed the clergy. His barons now defied his orders to invade Gascony and, when Edward went to Flanders, compelled the regents to confirm the charters of liberties, with important additions forbidding arbitrary taxation (1297), thereby forcing Edward to abandon the campaign and eventually to make peace with France. Although Pope Clement V, more pliant than Boniface, allowed Edward to exile Winchelsey and intimidate the clergy (1306), the barons had exacted further concessions (1301) before reconciliation. Edward renewed the conquest of Scotland in 1303, captured Stirling in 1304, and executed Wallace as a traitor in 1305; but when Scotland seemed finally subjected, Robert I the Bruce revived rebellion and was crowned in 1306. On his way to reconquer Scotland, Edward died near Carlisle.

(R.F.Tr.)

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• **Edward II,** byname EDWARD OF CAERNARVON (b. April 25, 1284, Caernarvon, Caernarvonshire, Wales—d. September 1327, Berkeley, Gloucestershire, Eng.), king of England from 1307 to 1327. Although he was a man of limited capability, he waged a long, hopeless campaign to assert his authority over powerful barons.

Edward II, detail of a watercolour manuscript illumination, mid-15th century; in the British Library (Jul. MS. E IV)

By courtesy of the trustees of the British Library

The fourth son of King Edward I, he ascended the throne upon his father's death (July 7, 1307) and immediately gave the highest offices to Edward I's most prominent opponents. He earned the hatred of the barons by granting the earldom of Cornwall to his frivolous favourite (and possible lover), Piers Gaveston. In 1311 a 21-member baronial committee drafted a document—known as the Ordinances—demanding the banishment of Gaveston and the restriction of the King's powers over finances and appointments. Edward pretended to give in to these demands; he sent Gaveston out of the country but soon allowed him to return. In retaliation the barons seized Gaveston and executed him (June 1312).

Edward had to wait 11 years to annul the Ordinances and avenge Gaveston. Meanwhile, the Scottish king Robert I the Bruce was threatening to throw off English overlordship. Edward led an army into Scotland in 1314 but was decisively defeated by Bruce at Bannockburn on June 24. With one stroke, Scotland's independence was virtually secured, and Edward was put at the mercy of a group of barons headed by his cousin Thomas of Lancaster, who by 1315 had made himself the real master of England. Nevertheless, Lancaster proved to be incompetent; by 1318 a group of moderate barons led by Aymer de Valence, earl of Pembroke, had assumed the role of arbitrators between Lancaster and Edward. At this juncture Edward found two new favourites—Hugh le Despenser and his son and namesake. When the King supported the younger Despenser's territorial ambitions in Wales, Lancaster banished both Despensers. Edward then took up arms in their behalf. His opponents fell out among themselves, and he defeated and captured Lancaster at Boroughbridge, Yorkshire, in March 1322. Soon afterward, he had Lancaster executed.

At last free of baronial control, Edward revoked the Ordinances. His reliance on the Despensers, however, soon aroused the resentment of his queen, Isabella. While on a diplomatic mission to Paris in 1325, she became the mistress of Roger Mortimer, an exiled baronial opponent of Edward. In September 1326 the couple invaded England, executed the Despensers, and deposed Edward in favour of his son, who was crowned (January 1327) King Edward III. Edward II was imprisoned and in September 1327 died, probably by violence. His career is recounted in Hilda Johnstone's *Edward of Carnarvon* (1946).

• **Edward III,** byname EDWARD OF WINDSOR (b. Nov. 13, 1312, Windsor, Berkshire, Eng.—d. June 21, 1377, Sheen, Surrey), king of England from 1327 to 1377, who led England into the Hundred Years' War with France. The descendants of his seven sons and five daughters contested the throne for generations, climaxing in the Wars of the Roses (1455–85).

Edward III, watercolour, 15th century; in the British Library (Cotton MS. Julius E. IV)

By courtesy of the trustees of the British Library

Early years. The eldest son of Edward II and Isabella of France, Edward III was summoned to Parliament as earl of Chester (1320) and was made duke of Aquitaine (1325), but, contrary to tradition, he never received the title of prince of Wales.

Edward III grew up amid struggles between his father and a number of barons who were attempting to limit the king's power and to strengthen their own role in governing England. His mother, repelled by her husband's treatment of the nobles and disaffected by the confiscation of her English estates by his supporters, played an important role in this conflict. In 1325 she left England to return to France to intervene in the dispute between her brother, Charles IV of France, and her husband over the latter's French possessions, Guyenne, Gascony, and Ponthieu. She was successful; the land was secured for England on condition that the English king pay homage to Charles. This was performed on the King's behalf by his young son.

The heir apparent was secure at his mother's side. With Roger Mortimer, an influential baron who had escaped to France in 1323 and had become her lover, Isabella now began preparations to invade England to depose her husband. To raise funds for this enterprise, Edward III was betrothed to Philippa, daughter of William, count of Hainaut and Holland.

Within five months of their invasion of England, the Queen and the nobles, who had much popular support, overpowered the King's forces. Edward II, charged with incompetence and breaking his coronation oath, was forced to resign, and on Jan. 29, 1327, Edward III, aged 15, was crowned king of England.

During the next four years Isabella and Mortimer governed in his name, though nominally his guardian was Henry, earl of Lancaster. In the summer of 1327 he took part in an abortive campaign against the Scots, which resulted in the Treaty of Northampton (1328), making Scotland an independent realm. Edward was deeply troubled by the settlement and signed it only after much persuasion by Isabella and Mortimer. He married Philippa at York on Jan. 24, 1328. Soon afterward, Edward made a successful effort to throw off his degrading dependence on his mother and Mortimer. While a council was being held at Nottingham, he entered the castle by night, through a subterranean passage, took Mortimer prisoner, and had him executed (November 1330). Edward had discreetly ignored his mother's liaison with Mortimer and treated her with every respect, but her political influence was at an end.

Edward III now began to rule as well as to reign. Young, ardent, and active, he sought to remake England into the powerful nation it had been under Edward I. He still resented the concession of independence made to Scotland by the Treaty of Northampton; and the death of Robert I, the Bruce, king of Scotland, in 1329 gave him a chance of retrieving his position. The new king of Scots, his brother-in-law, David II, was a mere boy, and Edward took advantage of his weakness to aid the Scottish barons who had been exiled by Bruce to place their leader, Edward Balliol, on the Scottish throne. David II fled to France, but Balliol was despised as a puppet of the English king, and David returned in 1341.

Hundred Years' War. During the 1330s England gradually drifted into a state of hostility with France, for which the most obvious reason was the dispute over English rule in Gascony. Contributory causes were France's new king Philip VI's support of the Scots, Edward's alliance with the Flemish cities—then on bad terms with their French overlord—and the revival, in 1337, of Edward's claim, first made in 1328, to the French crown. Edward twice attempted to invade France from the north (1339, 1340), but the only result of his campaigns was to reduce him to bankruptcy. In January 1340 he assumed the title of king of France. At first he may have done this to gratify the Flemings, whose scruples in fighting the French king disappeared when they persuaded themselves that Edward was the rightful king of France. But his pretensions to the French crown gradually became more important, and the persistence with which he and his successors urged them made stable peace impossible for more than a century. This was the struggle famous in history as the Hundred Years' War. Until 1801 every English king also called himself king of France.

Edward was present in person at the great naval battle off the Flemish city of Sluis in June 1340, in which he all but destroyed the French navy. Despite this victory his resources were exhausted by his land campaign, and he was forced to make a truce (which was broken two years later) and return to England. During the years after 1342 he spent much time and money in rebuilding Windsor Castle and instituting the Order of the Garter, which became Britain's highest order of knighthood. A new phase of the French war began when Edward landed in Normandy in July 1346, accompanied by his eldest son, Prince Edward, later known as the Black Prince (born 1330). At first the King showed some lack of strategic purpose, engaging in little more than a large-scale plundering raid to the gates of Paris. The campaign was made memorable by his decisive victory over the French at Crécy in Ponthieu (August 26), where he scattered the army with which Philip VI sought to cut off his retreat to the northeast. Edward laid siege to the French port of Calais in September 1346 and received its surrender in August 1347. Other victories in Gascony and Brittany, and the defeat and capture of David II at Neville's Cross near Durham (October 1346), gave further proof of Edward's power, but Calais was to be his only lasting conquest. He ejected most of its French inhabitants, colonizing the town with Englishmen and establishing there a base from which to conduct further invasions of France. Nevertheless, in the midst of his successes, want of money forced him to make a new truce in September 1347.

Edward returned to England in October 1347. He celebrated his triumph by a series of splendid tournaments. In 1348 he rejected an offer to become Holy Roman emperor. In the same year the bubonic plague known as the Black Death first appeared in England and raged until the end of 1349. Its horrors hardly checked the magnificent revels of Edward's court, and neither the plague nor the truce stayed the slow course of the French war, though the fighting was indecisive and on a small scale. Edward's martial exploits during the next years were those of a gallant knight rather than of a responsible general. Although the English House of Commons was now weary of the war, efforts to make peace came to nothing, and large-scale operations began again in 1355, when Edward led an unsuccessful raid out of Calais. He harried the Lothians, part of southeastern Scotland, in the expedition famous as the Burned Candlemas (January and February 1356), and in the same year he received a formal surrender of the Kingdom of Scotland from Balliol. His exploits were, however, eclipsed by those of his son Edward, whose victory at Poitiers (Sept. 19, 1356), resulting in the capture of the French king, John II (who had succeeded Philip VI in 1350), forced the French to accept a new truce. Edward entertained his captive magnificently but forced him by the Treaty of London (1359) to surrender so much territory that the agreement was repudiated in France. In an effort to compel acceptance, Edward landed at Calais (October 28) and besieged Reims, where he planned to be crowned king of France. The strenuous resistance of the citizens frustrated this scheme, and Edward marched into Burgundy, eventually returning

toward Paris. After this unsuccessful campaign he was glad to conclude preliminaries of peace at Brittany (May 8, 1360). This treaty, less onerous to France than that of London, took its final form in the Treaty of Calais, ratified by both kings (October 1360). By it, Edward renounced his claim to the French crown in return for the whole of Aquitaine, a rich area in southwestern France.

The years of decline: 1360–77. The Treaty of Calais did not bring rest or prosperity to either England or France. Fresh visitations of the Black Death in England in 1361 and 1369 intensified social and economic disturbances, and desperate but not very successful efforts were made to enforce the Statute of Labourers (1351), which was intended to maintain prices and wages as they had been before the pestilence. Other famous laws enacted during the 1350s had been the Statutes of Provisors (1351) and Praemunire (1353), which reflected popular hostility against foreign clergy. These measures were frequently reenacted, and Edward formally repudiated (1366) the feudal supremacy over England still claimed by the papacy.

When the French king Charles V, son of John II, repudiated the Treaty of Calais, Edward resumed the title of king of France, but he showed little of his former vigour in meeting this new trouble, leaving most of the fighting and the administration of his foreign territories to his sons Edward and John of Gaunt, duke of Lancaster. While they were struggling with little success against the rising tide of French national feeling, Edward's want of money made him a willing participant in the attack on the wealth and privileges of the church. Meanwhile, Aquitaine was gradually lost, Prince Edward returned to England in broken health (1371), and John of Gaunt's march through France from Calais to Bordeaux (1373) achieved nothing. Edward's final attempt to lead an army abroad himself (1372) was frustrated when contrary winds prevented his landing his troops in France. In 1375 he was glad to make a truce, which lasted until his death. By it, the only important possessions remaining in English hands were Calais, Bordeaux, Bayonne, and Brest.

Edward was now sinking into his dotage. After the death of Queen Philippa in 1369 he fell entirely under the influence of his greedy mistress, Alice Perrers, while Prince Edward and John of Gaunt became the leaders of sharply divided parties in the royal court and council. John of Gaunt returned to England in April 1374 and with the help of Alice Perrers obtained the chief influence with his father, but his administration was neither honourable nor successful. At the famous so-called Good Parliament of 1376 popular indignation against John of Gaunt's ruling party came at last to a head. Alice Perrers was removed and some of Gaunt's followers were impeached. Before the Parliament had concluded its business, however, the death of Prince Edward (June 8, 1376) robbed the Commons of its strongest support. John of Gaunt regained power, and the acts of the Good Parliament had been reversed when Edward III died.

Edward's character. Edward III possessed extraordinary vigour and energy of temperament; he was an admirable tactician and a consummate knight. His court was the most brilliant in contemporary Europe, and he was himself well fitted to be the head of the gallant knights who obtained fame in the French wars. Though his main ambition was military glory, he was not a bad ruler of England, being liberal, kindly, good-tempered, and easy of access. His need to obtain supplies for carrying on the French wars made him favourable to his subjects' petitions and contributed to the growing strength of Parliament. His weak points were his wanton breaches of good faith, his extravagance, his frivolity, and his self-indulgence. His ambition ultimately transcended his resources, and before he died even his subjects had sensed his failure.

(T.F.T./J.R.L.H.)

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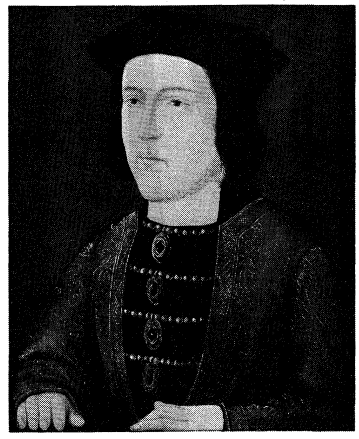
• **Edward IV,** also called (until 1459) EARL OF MARCH (b. April 28, 1442, Rouen, Fr.—d. April 9, 1483, Westminster, Eng.), king of England from 1461 until October 1470 and again from April 1471 until his death in 1483. He was a leading participant in the York-



Edward IV, portrait by an unknown artist; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

ist-Lancastrian conflict known as the Wars of the Roses.

Edward was the eldest surviving son of Richard, duke of York, by Cicely, daughter of Ralph Neville, earl of Westmorland. His father was descended from two sons of the 14th-century king Edward III and, in the 1450s, led a revolt against Henry VI; in 1460, Richard's supporters declared him Henry's successor. When his father was killed in December of that year, Edward gathered an army in Wales and defeated Henry's supporters (called Lancastrians because of Henry's descent from John of Gaunt, duke of Lancaster). Edward was crowned as King Edward IV in London on June 28, 1461.

Edward's struggle with Warwick. Edward at this time showed little promise, apparently caring only for fighting, drinking, women, and pageantry. He owed his throne largely to his cousin Richard Neville, earl of Warwick, who was in the first years of Edward's reign the most powerful man in England. Warwick crushed Lancastrian resistance in the far north of England between 1462 and 1464 and conducted England's diplomacy. Edward, however, was winning many friends (especially in London) by his comeliness and charm and was determined to assert his independence. On May 1, 1464, he secretly married a young widow, Elizabeth Woodville, of no great rank, offending Warwick and other Yorkist nobles who were planning to marry him to a French princess. By showering favours on Elizabeth's two sons by her first husband and on her five brothers and her seven sisters, Edward began to build up a group of magnates who would be a counterpoise to the Nevilles. Gradually Warwick lost all influence at court, and when he was negotiating an alliance with France, Edward humiliated him by revealing that he had already concluded an alliance (1467) with France's enemy Burgundy. Edward's sister Margaret was married in July 1468 with great pomp to Duke Charles the Bold of Burgundy, and the brothers-in-law planned a joint invasion of France.

Warwick, in a countermove encouraged by Louis XI of France, seized Edward and made him a prisoner in July 1469. But Edward had by now too many supporters (especially in London) for him to be kept under tutelage for long. He regained his freedom in October; Warwick fled to France, allied himself with the Lancastrians and with Louis, and invaded England in September 1470.

Surprised, Edward fled with a few faithful supporters to the Netherlands in October. Aided by Charles of Burgundy, he and his brother, Richard, duke of Gloucester, returned to England in March 1471. Taking London, he defeated and killed Warwick at Barnet on April 14. On the same day, Queen Margaret (Henry VI's wife) belatedly landed in Dorset from France with her only son, Edward, prince of Wales. Her advisers hoped to gain Lancastrian support in Wales, and it became a race for time between Edward IV's forces and hers as to whether she could get there before he overtook her. At Tewkesbury, after some remarkable forced marches (one of more than 40 miles at a stretch), he caught up with her army on May 4. There he won another crushing victory. Nearly all the remaining Lancastrian leaders were killed on the field or executed afterward, and, after murdering Henry (May 21–22) and repelling an attack on London, Edward was secure for the remainder of his life.

The second half of Edward's reign. He was now able to revive the project of an invasion of France in concert with the Duke of Burgundy. He made great preparations in 1474 and obtained a large grant from Parliament. In 1475 he invaded France with the largest army, it was said, that had ever left England, but he found the Duke of Burgundy very ill-prepared and the French formidable and willing to buy him out. Hence the Treaty of Picquigny was made by which Edward agreed to withdraw from France in return for 75,000 gold crowns down and a pension of 50,000 gold crowns a year. These sums helped to free Edward from dependence on parliamentary grants. As he grew older, he showed considerable ingenuity in raising money by reviving obsolescent rights and using doubtfully legal devices. Commercial treaties with France (1475), Burgundy (1468), and the Hanseatic League (1474) combined with external peace and growing internal order to revive trade strikingly after 1475, and this benefitted the customs duties and other revenues. Edward became a trader himself, transporting goods in his own ships and those of foreign merchants. He began a reorganization of the revenues from the crown estates, experimenting with methods of improving yields and promoting more efficient auditing under officials of the flexible royal household treasury instead of the unadaptable Exchequer. These and other measures enabled him to leave behind a fortune; some of his improved financial administration was continued and developed by his successors Richard III and Henry VII.

The last decade of Edward's reign also saw an improvement in law enforcement. One especially disturbed area was Wales and the Welsh marches; Edward used the royal estates there as a foundation on which to base a council that acted in the name of his infant heir, the Prince of Wales, and employed the royal prerogative to make a start in repressing disorder. It was the forerunner of the council of Wales and the marches that subjugated the area to English rule.

Modern research has emphasized these administrative achievements of Edward IV, and contemporary and Tudor historians viewed his later years as a time of prosperity and success.

He rebuilt St. George's Chapel, Windsor, and collected illuminated Flemish manuscripts. He was also a friend and patron of the printer William Caxton, and his book collection became the foundation of the Old Royal Library, later one of the glories of the British Museum.

Edward's promiscuity enabled Richard of Gloucester, after his death, to question the validity of his marriage and so to ruin his sons. As a young man Edward had been trustful and openhanded, but his experiences made him increasingly suspicious, leading him in 1478 to execute his brother George, duke of Clarence, who in former years had sided with Warwick against him. In 1482, Louis XI, in order to come to terms with the rulers of Burgundy, tacitly repudiated the Treaty of Picquigny and the annual tribute that it provided. Edward contemplated a fresh invasion of France, but before it could be carried out he fell ill and died at the age of only 40. By Elizabeth Woodville he had seven children who survived him: two sons, Edward (afterward Edward V) and Richard, duke of York, who were probably murdered in the Tower of London in August 1483, and five daughters, of whom the eldest, Elizabeth, married Henry VII. (A.R.M.)

BIBLIOGRAPHY. C.L. Scofield, *The Life and Reign of Edward IV,* 2 vol. (1923), is extremely detailed, accurate, and based on original sources; but the detail often obscures the argument, and the general outlook is now somewhat out of date. Charles Ross, *Edward IV* (1974), is a more recent biography. E.F. Jacob, *The Fifteenth Century, 1399–1485* (1961), provides a more up-to-date interpretation with an annotated bibliography. J.R. Lander, *Conflict and Stability in Fifteenth Century England* (1969), puts the reign of Edward IV in its setting and has a useful annotated bibliography. A.R. Myers, *English Historical Documents, 1327–1485* (1969), provides a large number of documents, translated into English, for the reign of Edward IV, as does Sir Nicholas Harris Nicholas, *Privy Purse Expenses of Elizabeth of York: Wardrobe Accounts of Edward the Fourth* (facsimile, 1972).

• **Edward V** (b. Nov. 2?, 1470, London—d. 1483?), king of England from April to June 1483, who was deposed and possibly murdered by King Richard III.

The eldest surviving son of King Edward IV and Queen Elizabeth (Woodville), Edward was born at Westminster Abbey while his father, momentarily deposed, was in exile in Holland. In June 1471, after Edward IV had crushed his foes and reclaimed his crown, young Edward was made prince of Wales. The boy was sent with his mother to Ludlow, Shropshire, in 1473 to be titular ruler of Wales and the Welsh Marches (border region between England and Wales), and he seems to have stayed at Ludlow, except for brief intervals, for the remainder of his father's reign.

Upon the death of Edward IV on April 9, 1483, the 12-year-old Edward became king, and his uncle Richard, duke of Gloucester, was made protector of the realm. Conflict between Gloucester and the Woodville nobles who dominated Edward V soon led the duke to arrest the leaders of the Woodville party and secure possession of Edward and his younger brother. The two princes were housed in the Tower of London, which at that time served as a royal residence as well as a prison.

Edward V's brief reign came to an end on June 26, when an assembly of lords and commons, accepting Gloucester's claim that Edward IV's marriage was invalid and his children illegitimate, proclaimed Gloucester King Richard III. Soon afterward the two princes disappeared from the Tower forever. It is possible they were murdered by Richard's agents in August 1483, but responsibility for the crime has also been attributed to the powerful Henry Stafford, duke of Buckingham, and to

Edward V (lower right) with his father, Edward IV, and mother, Elizabeth Woodville, illumination from *Dictes and Sayenges of the Phylosophers,* 1477; in Lambeth Palace Library, London

By courtesy of the Lambeth Palace Library; photograph, Royal Academy of Arts

Richard's successor, King Henry VII. Skeletons found in the Tower in 1674 are thought to be those of Edward and his brother.

• **Edward VI** (b. Oct. 12, 1537, London—d. July 6, 1553, London), king of England and Ireland from 1547 to 1553.

Edward was King Henry VIII's only legitimate son; his mother, Henry's third wife, Jane Seymour, died 12 days after his birth. Although Edward has traditionally been viewed as a frail child who was never in good health, some recent authorities have maintained that until several years before his death he was a robust, athletically inclined youth. His tutors found him to be intellectually gifted, a precocious student of Greek, Latin, French, and theology. On Jan. 28, 1547, Henry VIII died and Edward succeeded to the throne.

Henry had decreed that during Edward's minority the government was to be run by a council of regency; in fact, Edward's uncle, Edward Seymour, duke of Somerset, wielded almost supreme power as regent, with the title of protector, until he was overthrown in 1549 by the unscrupulous John Dudley, earl of Warwick (soon to be duke of Northumberland). The young king was the mask behind which Northumberland controlled the government. The measures taken by both Somerset and Northumberland to consolidate the English Reformation, however, agreed with Edward's own intense devotion to Protestantism.

In January 1553, Edward showed the first signs of tuberculosis, and by May it was evident that the disease would be fatal. Working with Northumberland, he determined to exclude his two half-sisters, Mary and Elizabeth,

Edward VI as prince, detail of a panel painting by an unknown artist, *c.* 1546; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

from the succession and to put Northumberland's daughter-in-law, Lady Jane Grey, and her male heirs in direct line for the throne. As a result, a power struggle erupted after Edward's death. Lady Jane Grey ruled for nine days (July 10–19, 1553) before she was overthrown by the more popular Mary I (reigned 1553–58).

Edward displayed a potential for effective administration, but many scholars have felt that, had he lived, his religious zeal and extreme obstinacy might have imprinted rigidity and narrowness on the Church of England. See W.K. Jordan, *Edward VI: The Young King* (1968), and *Edward VI: The Threshold of Power* (1970).

• **Edward VII,** in full ALBERT EDWARD (b. Nov. 9, 1841, London—d. May 6, 1910, London), king of the United Kingdom of Great Britain and Ireland and of the British dominions and emperor of India from 1901, an immensely popular and affable sovereign and a leader of society.

The second child and eldest son of Queen Victoria and the Prince Consort Albert of Saxe-Coburg-Gotha, Albert Edward, created prince of Wales and earl of Chester by his mother when he was one month old, attended the universities of both Oxford and Cambridge. His dalliance with an actress while serving with an Army unit in Ireland (June–September 1861) caused Victoria to hold him partly responsible for the death of the prince consort, who had indeed taken his son's brief liaison much to heart before succumbing to typhoid (Dec. 14, 1861). Subsequently, Victoria excluded her heir from any real initiation

Edward VII

The Bettmann Archive/BBC Hulton

into affairs of state. Not until he was more than 50 years old was he informed of Cabinet proceedings.

On March 10, 1863, the prince of Wales married Alexandra, eldest daughter of Prince Christian (later King Christian IX) of Denmark. Five children of this union survived to maturity (George, duke of York, subsequently King George V, was the second son). Alexandra was preoccupied with her immediate family, but the prince moved in a considerably wider circle, both at home and on the Continent, becoming a familiar figure in the sporting world. He was particularly given to racing, yachting, and game-bird shooting. His social activities involved him in several scandals.

He succeeded to the throne as Edward VII following Victoria's death on Jan. 22, 1901, and was crowned on Aug. 9, 1902. His reign did much to restore lustre to a monarchy that had shone somewhat dimly during Victoria's long seclusion as a widow. In 1902 he resumed his tours of Europe. His geniality and felicitously worded addresses (conducted in French) during a state visit to Paris in 1903 helped pave the way, by winning popularity among French citizens of all ranks, for the Anglo-French Entente Cordiale of 1904. Relations with his nephew the German emperor William II were not always easy, either officially or personally. Although incapable of

prolonged mental exertion, Edward was fortunate in his judgment of men. His support for the great military reforms of the secretary of state for war, Richard Burdon (later Viscount) Haldane, and for the First Sea Lord Sir John Fisher in his naval reforms did much to avert British unpreparedness when World War I started.

BIBLIOGRAPHY. Sir Sidney Lee, *King Edward VII,* 2 vol. (1925–27), is a highly detailed official biography, completed after Lee's death by his secretary, S.F. Markham. Sir Philip Magnus, *King Edward the Seventh* (1964), draws on sources that became available after Lee's death and is less reticent than Lee about Edward's private life. Gordon Brook-Shepherd, *Uncle of Europe* (1975), covers Edward's social life and diplomatic activities.

• **Edward VIII,** also called (from 1936) PRINCE EDWARD, DUKE OF WINDSOR, in full EDWARD ALBERT CHRISTIAN GEORGE ANDREW PATRICK DAVID (b. June 23, 1894, Richmond, Surrey, Eng.—d. May 28, 1972, Paris), prince of Wales (1911–36) and king of the United Kingdom of Great Britain and Ireland and of the British dominions and emperor of India from Jan. 20 to Dec. 10, 1936, when he abdicated in order to marry Wallis Warfield Simpson (*q.v.*) of the United States. He was the only British sovereign ever voluntarily to resign the crown.

The Duke of Windsor (formerly Edward VIII) and Duchess of Windsor on their wedding day, June 3, 1937, photograph by Cecil Beaton
Camera Press

The eldest child of George, duke of York (later King George V), and Princess Mary of Teck (later Queen Mary), he became heir to the throne on the accession of his father (May 6, 1910). Although trained (1907–11) for the Royal Navy, he was commissioned in the Army's Grenadier Guards after the outbreak of World War I (Aug. 6, 1914) and served as a staff officer. After the war and through the early 1920s he undertook extensive goodwill tours of the British Empire; and, after an illness that his father suffered in 1928, the prince took an increasing interest in national affairs. In 1932, after unemployment had reached unprecedented levels, he toured workingmen's clubs throughout Britain and enlisted more than 200,000 men and women in occupational schemes. During these years his popularity rivaled, if it did not exceed, that of his grandfather King Edward VII when the latter was prince of Wales.

In 1930 King George V gave him Fort Belvedere, an 18th-century house belonging to the crown, near Sunningdale. The Fort, as he always called it, gave him privacy and the sense of making a home that was entirely his own. He worked arduously in the garden and woodlands, becoming in the 1930s something of an authority on horticulture, especially on the growing of roses. He soon began to regard the Fort as a refuge from the official world that he increasingly disliked. There he entertained a private circle of friends, not drawn from the conventional aristocracy and perhaps better characterized as part of the "high society" of the time.

In 1930 the prince's friendship with Mrs. Simpson began. Mrs. Simpson, divorced from a U.S. Navy lieutenant in 1927, married Ernest Simpson in 1928. Members of a private circle of friends, the Simpsons were frequently in the company of the prince, and by 1934 he was deeply in love with Mrs. Simpson. It was at this point, before he could discuss the matter with his father, that George V died (Jan. 20, 1936) and Edward was proclaimed king.

As king, Edward VIII set in motion drastic economies in the royal estates. In November he opened Parliament and then toured distressed areas in South Wales. Meanwhile his attempts to gain the royal family's acceptance of Mrs. Simpson, who had obtained a preliminary decree of divorce on Oct. 27, 1936, met with firm opposition, backed by the Church of England (of which he was the head) and most politicians in both Britain and the Commonwealth. (Winston Churchill, then out of power, was his only notable ally.) His affair with Mrs. Simpson evoked much lurid comment in American and continental European newspapers and journals but, until nearly the end of his kingship, was kept out of the British press through governmental persuasions and pressures.

Prime Minister Stanley Baldwin attempted to impress upon the king the peril to the integrity of the monarchy caused by the private friendship with a divorcée. Discussions of a morganatic marriage were pursued, but on December 2 Baldwin assured him that this was impracticable. It was doomed by being somewhat hurriedly and forcibly put to the dominions and by the explosion of the whole matter in the press and Parliament on December 3. On the following day the word "abdication" appeared in the newspapers for the first time. The king therefore made his final decision and submitted his abdication on Dec. 10, 1936 ("I, Edward, do hereby declare my irrevocable determination to renounce the throne for myself and my descendants"). The instrument of abdication was endorsed by Parliament on December 11, and on the same evening the former king spoke on a radio broadcast: "I have found it impossible to carry on the heavy burden of responsibility and to discharge the duties of King as I would wish to do without the help and support of the woman I love." That night he left for the Continent, where he lived several months with friends in Austria and discreetly apart from Mrs. Simpson until after her decree of divorce became final. On June 3, 1937, Edward was married to Mrs. Simpson by a clergyman of the Church of England at the Château de Candé, France. The new king, George VI, had created his older brother duke of Windsor (Dec. 12, 1936) but in 1937, on the advice of the Cabinet, refused to extend to the new duchess of Windsor the rank of "royal highness" enjoyed by her husband; this decision severely wounded the duke.

For the next two years the duke and duchess lived mainly in France, visiting various other European countries, including Germany (October 1937), where the duke was honoured by Nazi officials and had an interview with Adolf Hitler. The outbreak of World War II failed to close the breach between the duke and his family, and, after visiting London, he accepted a position as liaison officer with the French. On the fall of France he traveled to Madrid, where he was subjected to a fanciful plan of the Nazis to remake him king and to use him against the established government in England. When he reached Lisbon, he was offered by Prime Minister Winston Churchill the governorship of the Bahamas, a British colony in the West Indies, and he remained there for the duration of the war (1940–45). After 1945 he lived in Paris. Short visits to England followed in succeeding years—notably, to attend the funerals of his brother King George VI (1952) and their mother, Queen Mary (1953)—but it was not until 1967 that, for the first time, the duke and duchess were invited to attend an official public ceremony with other members of the royal family—initially, the unveiling of a plaque to Queen Mary at Marlborough House.

After their deaths, the duke and the duchess were buried side by side at Frogmore, within the grounds of Windsor Castle.

BIBLIOGRAPHY. The duke's memoirs, *A King's Story,* were published in 1951; those of the duchess, *The Heart Has Its Reasons,* appeared in 1959. *Edward VIII: A Biography of the Duke of Windsor* (1975) is by Frances Donaldson. An excellent, but unflattering, biography of both Edward and the duchess of Windsor is *The Windsor Story* (1979) by Joseph Bryan III and Charles J.V. Murphy.

PORTUGAL

• **Edward** (b. Oct. 30, 1391, Viseu, Port.—d. Sept. 9, 1438, Tomar), king of Portugal whose brief reign (1433–38) witnessed a strengthening of the monarchy through reform of royal land-grant laws, a continuation of voyages of discovery, and a military disaster in Tangier.

A scholarly, sensitive man of high moral character, Edward was known as the philosopher-king and the author of *O Leal Conselheiro* ("The Loyal Counselor"). He ascended the throne on the death of his father, John I, well schooled in legal principles. Shortly thereafter, Edward promulgated the *lei mental* (April 8, 1434), which facilitated the recovery of certain previous royal land grants and made others subject to royal confirmation at the start of each new reign.

Edward supported the efforts of his brother Henry the Navigator to explore the west coast of Africa, and he agreed to a plan for Henry to attempt the conquest of Morocco by attacking Tangier. The expedition (1437) was a complete failure, and Edward's youngest brother, Fernando, was captured. The grief-stricken king died shortly thereafter of the plague.

SCOTLAND

• **Edward,** in full EDWARD DE BALLIOL, or BALIOL (d. January 1364, Wheatley, Yorkshire, Eng.), son of King John de Balliol of Scotland and claimant to the title of King of Scots, who was crowned in September 1332. Expelled in December 1332, he was restored in 1333–56, having acknowledged Edward III of England as his lord.

Edward inherited only the family lands in France and his father's claim to Scotland. He was kept in England from 1296 (the year of his father's death) to 1315, after which he lived mainly in France.

In 1332 Balliol led an invasion of Scotland from France by a group of English nobles whose lands in Scotland had been seized by the Scottish king Robert I the Bruce, father of David II (reigned 1329–71). On August 12, in the Battle of Dupplin Moor (*q.v.*), Edward defeated Donald, earl of Mar and regent for David II (then eight years old), and on September 24 he was crowned king at Scone. On November 23, at Roxburgh, he acknowledged Edward III of England as suzerain over Scotland.

A Scottish coalition under Sir Archibald Douglas defeated Balliol at Annan, Dumfries, on Dec. 16, 1332, but on July 19, 1333, Edward III defeated and killed Douglas in the Battle of Halidon Hill (*q.v.*) on behalf of Balliol, who in payment gave much of the Scottish lowlands to the English king. Balliol's

hold on the rest of Scotland against the adherents of David II remained precarious. He resigned his title and all his lands to Edward III on Jan. 21, 1356, and died a childless pensioner of the English sovereign.

Edward LONGSHANKS: *see* Edward I *under* Edward (England and the United Kingdom).

Edward OF CAERNARVON: *see* Edward II *under* Edward (England and the United Kingdom).

Edward OF NORWICH: *see* York, Edward of Norwich, 2nd duke of.

Edward OF WINDSOR: *see* Edward III *under* Edward (England and the United Kingdom).

Edward THE BLACK PRINCE, also called EDWARD OF WOODSTOCK, PRINCE D'AQUITAINE, PRINCE OF WALES, DUKE OF CORNWALL, EARL OF CHESTER (b. June 15, 1330, Woodstock, Oxfordshire, Eng.—d. June 8, 1376, Westminster, near London), son and heir apparent of Edward III of England and one of the outstanding commanders during the Hundred Years' War, winning his major victory at the Battle of Poitiers (1356). His sobriquet, said to have come from his wearing black armour, has no contemporary justification and is found first in Richard Grafton's *Chronicle of England* (1568).

Edward was created earl of Chester (March 1333), duke of Cornwall (February 1337)—the first appearance of this rank in England—and prince of Wales (May 1343); he was prince of Aquitaine from 1362 to 1372. His first campaign was served under his father in northern France (1346–47), and at the Battle of Crécy (Aug. 26, 1346) he won both his spurs and the famous ostrich plumes and with them the mottoes used by himself and subsequent princes of Wales, *homout; ich dene* ("Courage; I serve"; the words are here spelled as Edward himself wrote them; later variants include *houmout* and *ich dien* or *ich diene*). One of the original Knights of the Garter, he was sent to France with independent command in 1355, winning his most famous victory over the French at Poitiers on Sept. 19, 1356. The French king John II, brought captive to England, was treated by the Prince with a celebrated courtesy, but he was obligated to pay a ransom of 3,000,000 gold crowns and to negotiate the treaties of Brétigny and Calais (1360) by which Aquitaine was ceded to the English.

Edward the Black Prince, electrotype from effigy in Canterbury cathedral, c. 1376; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Edward married his cousin Joan, the divorced and widowed countess of Kent, in October 1361. He was created prince of Aquitaine in July 1362 and left England in 1363 to take up his duties. His powers and his opportunities were great, but his rule was a failure, and he himself was largely to blame. His court at Bordeaux, that of a foreign conqueror, was extravagant; the 13 *sénéchaussées* into which the principality was divided administratively followed their earlier French pattern and allowed local French loyalties to subsist; his relations with the many bishops were unfriendly, while the greater nobles, Arnaud-Amanieu, sire d'Albret, Gaston II, comte de Foix, and Jean I, comte d'Armagnac, were hostile. He summoned several estates, or parliaments, but always to levy taxes. In 1367 he undertook to restore Peter the Cruel of Castile to his throne, and though he won a classic victory at Nájera on April 3, 1367, the campaign ruined his health, his finances, and any prospect of sound rule in Aquitaine, where, in 1368, the nobles and prelates appealed against him to Charles V of France as suzerain. Edward's reply to the French king's citation to answer the appellants before the *parlement* of Paris in May 1369 is well known—he would appear with 60,000 men at his back. He had, however, alienated the towns and peasantry as well as the nobles; and by March 1369 more than 900 towns, castles, and strong places had declared against him. Relying on mercenaries whom he could not afford to pay, he was powerless to quell the revolt, and the terrible sack of Limoges (October 1370) merely redounded to his discredit. He returned to England a sick and broken man in January 1371 and formally surrendered his principality to his father in October 1372, alleging that the revenues of the country were insufficient to defray his expenses. He had no successor as prince of Aquitaine.

Edward's position in England, where, throughout his life, he was heir apparent, was that of a typical 14th-century magnate. The registers of his household from 1346 to 1348 and from 1351 to 1365 have survived and add to what is known of him from the chroniclers and from his biographer, the herald of Sir John Chandos. In one important respect all of these sources paint the same picture, that of a man constantly living beyond his means. His generosity, however, extended to his tenants as well as to his knightly companions, and faithful service was rewarded, as in 1356 when the ferry of Saltash was granted to William Lenche, who had lost an eye at Poitiers.

The Prince visited Chester in 1353 and again in 1358. Cheshire furnished many of his archers, who wore a rudimentary uniform of a short coat and hat of green and white cloth with the green on the right. Despite his title, however, Edward did not visit Wales.

He appears to have shared the interests of his class—jousting, falconry, hunting, gaming. He was literate and conventionally pious, substantially endowing a religious house at Ashridge (1376). He had the customary fine presence of the Plantagenets and shared their love of jewels. The Black Prince's ruby in the present imperial state crown may or may not have been given to him by King Peter of Castile after the Battle of Nájera, but he would certainly have prized it, as a connoisseur. Similar artistic interest is shown in his seals, adorned with their ostrich feathers, and in the elegant gold coins that he issued as prince of Aquitaine.

The last five years of the Prince's life are obscure. Some contemporaries suggest that he supported the Commons when political discontent culminated in the Good Parliament of April 1376; but he knew he was dying, and he was probably seeking the best means to ensure the succession of his second, but only surviving son, Richard of Bordeaux (afterward Richard II). Edward was buried at Canterbury, where his tomb with his accoutrements, restored and renovated, still stands.

(I.P.S.)

BIBLIOGRAPHY. Various letters, diaries, and chronicles of the period appear in Richard Barber, *Life and Campaigns of the Black Prince* (1979); Barber also wrote a biography, *Edward, Prince of Wales and Aquitaine* (1978). The most interesting and valuable records printed are *The Black Prince's Registers,* 4 vol. (HMSO, 1930–33).

Edward THE CONFESSOR, SAINT: *see* Edward *under* Edward (England and the United Kingdom).

Edward THE ELDER: *see* Edward *under* Edward (England: Wessex).

Edward THE MARTYR, SAINT: *see* Edward *under* Edward (England and the United Kingdom).

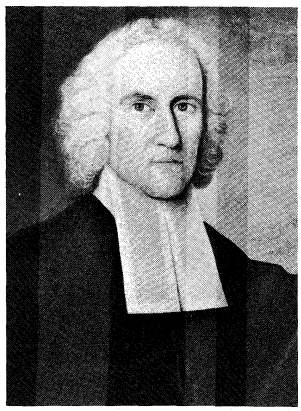
Edward, Lake, French LAC ÉDOUARD, also called (in Zaire) LAC IDI AMIN, or (in Uganda) LAKE IDI AMIN DADA, one of the great lakes of the western Rift Valley in East Africa. It lies astride the border of Zaire and Uganda at an elevation of 2,995 feet (913 m) and is 48 miles (77 km) long and 26 miles (42 km) wide. On the northeast it is connected to the smaller Lake George. The two lakes have a combined surface area of 970 square miles (2,500 square km). From Lake George, which receives the Ruwenzori River, water flows through the 20-mile-long Kazinga Channel to Lake Edward, also fed by the Rutshuru River (crossing a wide plain in the south). Lake Edward empties northward through the Semliki River to Lake Albert (after 1973, Lake Mobuto Sese Seko), the waters of which empty as the Albert Nile. Lake Edward's northern and southern shores are low plains, but most of its east and west banks are steep trough walls. To the north, the Ruwenzori Range rises to more than 16,000 feet (4,800 m). The lake abounds in fish; wildlife about its shores is protected within Zaire's Virunga National Park and Uganda's Ruwenzori National Park.

Lake George was visited in 1875 by Sir Henry Morton Stanley, who named it Beatrice Gulf (for a daughter of Queen Victoria) in the belief that it was part of Lake Albert. In 1888–89 Stanley ascended the Semliki to Lake Edward, which he named after Albert Edward, prince of Wales (later Edward VII).

Edwards, Alfred George (b. Nov. 2, 1848, Llanymawddwy, Merionethshire, Wales—d. July 22, 1937, St. Asaph, Flintshire, Wales), the first archbishop of Wales, who sought successfully to create a native church more reflective of Welsh culture than was the Anglican Church.

He graduated from Jesus College, Oxford, in 1874. After a successful headmastership of Llandovery College, Edwards became vicar of Carmarthen in 1885, where he began the great work of his life, the defense and strengthening of the Welsh national church. An ardent believer in disestablishment, he fought his church's many enemies on every ground of fact and principle by sermons, politics, and publications, of which the most important were *The Truth About the Church in Wales* (1889) and *Landmarks in the History of the Welsh Church* (1912). In 1889 he was appointed bishop of St. Asaph, and from the disestablishment in 1920 until his retirement in 1934 he was archbishop of the Church of Wales.

Edwards, Jonathan (b. Oct. 5, 1703, East Windsor, Conn. [now in U.S.]—d. March 22, 1758, Princeton, N.J.), greatest theologian and philosopher of British American Puritanism, stimulator of the religious revival known as the "Great Awakening," and one of the forerunners of the age of Protestant missionary expansion in the 19th century.



Jonathan Edwards, detail of an oil painting by Joseph Badger; in the Yale University Art Gallery

By courtesy of Yale University Art Gallery bequest of Eugene Phelps Edwards

Early life and ministry. Edwards' father, Timothy, was pastor of the church at East Windsor, Conn.; his mother, Esther, was a daughter of Solomon Stoddard, pastor of the church at Northampton, Mass. Jonathan was the fifth child and only son among 11 children; he grew up in an atmosphere of Puritan piety, affection, and learning. After a rigorous schooling at home, he entered Yale College in New Haven, Conn., at the age of 13. He was graduated in 1720 but remained at New Haven for two years, studying divinity. After a brief New York pastorate (1722–23), he received the M.A. degree in 1723; during most of 1724–26 he was a tutor at Yale. In 1727 he became his grandfather's colleague at Northampton. In the same year, he married Sarah Pierrepont, who combined a deep, often ecstatic, piety with personal winsomeness and practical good sense. To them were born 11 children.

The manuscripts that survive from his student days exhibit Edwards' remarkable powers of observation and analysis (especially displayed in "Of Insects"), the fascination that the English scientist Isaac Newton's optical theories held for him ("Of the Rainbow"), and his ambition to publish scientific and philosophical works in confutation of materialism and atheism ("Natural Philosophy"). Throughout his life he habitually studied with pen in hand, recording his thoughts in numerous hand-sewn notebooks; one of these, his "Catalogue" of books, demonstrates the wide variety of his interests.

Edwards did not accept his theological inheritance passively. In his "Personal Narrative" he confesses that, from his childhood on, his mind "had been full of objections" against the doctrine of predestination—*i.e.,* that God sovereignly chooses some to salvation but rejects others to everlasting torment; "it used to appear like a horrible doctrine to me." Though he gradually worked through his intellectual objections, it was only with his conversion (early in 1721) that he came to a "delightful conviction" of divine sovereignty, to a "new sense" of God's glory revealed in Scripture and in nature. This became the centre of Edwards' piety: a direct, intuitive apprehension of God in all his glory, a sight and taste of Christ's majesty and beauty far beyond all "notional" understanding, immediately imparted to the soul (as a 1734 sermon title puts it) by "a divine and supernatural light." This alone confers worth on man, and in this consists his salvation. What such a God does must be right; hence, Edwards' cosmic optimism. The acceptance and affirmation of God as he is and does and the love of God simply because he is God became central motifs in all of Edwards' preaching.

Under the influence of Puritan and other Reformed divines, the Cambridge Platonists, and British philosopher-scientists such as Newton and Locke, Edwards began to sketch in his manuscripts the outlines of a "Rational Account" of the doctrines of Christianity in terms of contemporary philosophy. In the essay "Of Being," he argued from the inconceivability of absolute Nothing to the existence of God as the eternal omnipresent Being. It was also inconceivable to him that anything should exist (even universal Being) apart from consciousness; hence, material things exist only as ideas in perceiving minds; the universe depends for its being every moment on the knowledge and creative will of God; and "spirits only are properly substance." Further, if all knowledge is ultimately from sensation (Locke) and if a sense perception is merely God's method of communicating ideas to the mind, then all knowledge is directly dependent on the divine will to reveal; and a saving knowledge of God and spiritual things is possible only to those who have received the gift of the "new sense." This grace is independent of human effort and is "irresistible," for the perception of God's beauty and goodness that it confers is in its very nature a glad "consent." Nevertheless, God decrees conversion and a holy life as well as ultimate felicity; and he has so constituted things that "means of grace" (*e.g.,* sermons, sacraments, even the fear of hell) are employed by the Spirit in conversion, though not as "proper causes." Thus, the predestinarian preacher could appeal to the emotions and wills of men.

Pastorate at Northampton. At Stoddard's death in 1729, Edwards became sole occupant of the Northampton pulpit, the most important in Massachusetts outside of Boston. In his first published sermon, preached in 1731 to the Boston clergy and significantly entitled *God Glorified in the Work of Redemption, by the Greatness of Man's Dependence upon Him, in the Whole of It,* Edwards blamed New England's moral ills on its assumption of religious and moral self-sufficiency. Because God is the saints' whole good, faith, which abases man and exalts God, must be insisted on as the only means of salvation. The English colonists' enterprising spirit made them susceptible to a version of Arminianism (deriving from the Dutch theologian Jacobus Arminius), which was popular in the Anglican Church and spreading among dissenters; it minimized the disabling effects of original sin, stressed free will, and tended to make morality the essence of religion.

Against these ideas Edwards also delivered a series of sermons on "Justification by Faith Alone" in November 1734. The result was a great revival in Northampton and along the Connecticut River Valley in the winter and spring of 1734–35, during which period more than 300 of Edwards' people made professions of faith. His subsequent report, *A Faithful Narrative of the Surprising Work of God* (1737), made a profound impression in America and Europe, particularly through his description of the types and stages of conversion experience.

In 1740–42 came the Great Awakening throughout the colonies. George Whitefield, a highly successful evangelist in the English Methodist movement, and Gilbert Tennent, a Presbyterian minister from New Jersey, drew huge crowds; their "pathetical" (*i.e.,* emotional) sermons resulted in violent emotional response and mass conversions. Edwards himself, though he held his own congregation relatively calm, employed the "preaching of terror" on several occasions, as in the Enfield sermon,"Sinners in the Hands of an Angry God" (1741).

The Awakening produced not only conversions and changed lives but also excesses, disorders, and ecclesiastical and civil disruptions. Though increasingly critical of attitudes and practices associated with the revival, to the extent of personally rebuking Whitefield, Edwards maintained that it was a genuine work of God, which needed to be furthered and purified. In defense and criticism of the Awakening he wrote *The Distinguishing Marks of a Work of the Spirit of God* (1741), *Some Thoughts Concerning the Present Revival of Religion in New England* (1742), and *A Treatise Concerning Religious Affections* (1746).

In the *Affections,* Edwards insisted, against the revival critics' ideal of sober, "reasonable" religion, that "the essence of all true religion lies in holy love," a love that proves its genuineness by its inner quality and practical results. In 1749 he edited, with "Reflections," the memoirs of David Brainerd, a young New Light revivalist who became a Presbyterian missionary to the Indians and died in 1747. The volume became a highly influential missionary biography. Edwards' *Humble Attempt to Promote Explicit Agreement and Visible Union of God's People in Extraordinary Prayer* (1747), written in support of a proposed international "concert of prayer" for "the Revival of Religion and the Advancement of Christ's Kingdom on Earth," helped to remove a major ideological barrier to missionary activity by arguing that the worst of the "great tribulations" (prophesied in the book of Revelation to John as preceding the millennium) were already past and that the church could thus look forward to an increasing success of the gospel among men.

Dismissal from Northampton. Meanwhile, Edwards' relations with his own congregation had become strained; one reason for it was his changed views on the requirements for admission to the Lord's Supper. In the Halfway Covenant, baptized but unconverted children of believers might have their own children baptized by "owning the covenant"; Stoddard had instituted the subsequently widespread practice of admitting to the Eucharist all who were thus "in the covenant," even if they knew themselves to be unconverted. Edwards gradually came to believe that the profession required for admission to full communion should be understood to imply genuine faith, not merely doctrinal knowledge and good moral behaviour.

The public announcement of his position in 1749 precipitated a violent controversy that resulted in his dismissal. On July 1, 1750, Edwards preached his dignified and restrained "Farewell-Sermon." In the course of this controversy he wrote two books, *Qualifications for Communion* (1749) and *Misrepresentations Corrected, and Truth Vindicated, in a Reply to the Rev. Mr. Solomon Williams's Book* (1752), one to convince his congregation, the other to correct what he considered misrepresentations of his views by a kinsman, the pastor at Lebanon, Conn. Though Edwards himself was defeated, his position finally triumphed and provided New England Congregationalism with a doctrine of church membership more appropriate to its situation after disestablishment.

Pastorate at Stockbridge. In 1751 Edwards became pastor of the frontier church at Stockbridge, Mass., and missionary to the Indians there. Hampered by language difficulties, illness, Indian wars, and conflicts with powerful personal enemies, he nevertheless discharged his pastoral duties and found time to write his famous work on the *Freedom of Will* (1754). The will, said Edwards, is not a separate, self-determining faculty with power to act contrary to the strongest motives, as he understood the Arminians to teach. Rather, it is identical with feelings or preference, and a volition is simply the soul's "prevailing inclination" in action; the will "is as the greatest apparent good." Men are free to do as they please, and God therefore rightly holds them

morally responsible for the quality of their volitions as expressions of their desires and intentions.

By 1757 Edwards had finished his *Great Christian Doctrine of Original Sin Defended* (1758), which was mainly a reply to the English divine John Taylor of Norwich, whose works attacking Calvinism (based on the thought of the 16th-century Protestant Reformer John Calvin) had "made a mighty noise in America." Edwards defended the doctrine not only by citing biblical statements about the corruption of man's heart but also by arguing that the empirical evidence of men's universal commission of sinful acts points to a sinful predisposition in every man. In answering Arminian objections to the notion that God "imputed" Adam's guilt to his posterity, Edwards proposed a novel theory of identity by divine "constitution" to account for men's unity with Adam and suggested that their innate corruption is not a judicial punishment for Adam's guilt but is really their own because of their participation (being one with him) in the sinful inclination that preceded Adam's sinful act. Edwards' was the first major contribution to the long debate about human nature in American theology and helped set the terms of that debate.

Edwards perceived the threat in Taylor's notion of man's innate goodness and autonomy; the whole Christian conception of supernatural redemption seemed to be at stake. He therefore planned further treatises, of which he completed two posthumously published dissertations: *Concerning the End for Which God Created the World* and *The Nature of True Virtue* (1765). God's glory, not human happiness, is his end in creation; but this is because God in his all-sufficient fullness must communicate himself by the exercise of his attributes. God can be said to aim at the creature's happiness, but it is a happiness that consists in contemplating and rejoicing in God's glory manifested in creation and redemption. Edwards defines true virtue as disinterested love (benevolence) toward God as Being in general and toward all lesser beings according to their degree of being. True virtue, therefore, does not spring from self-love or from any earthbound altruism (two prime 18th-century views); love to self, family, nation, or even mankind is good only if these lesser systems of being do not usurp the place of highest regard that belongs to God alone.

Edwards also projected books on other subjects, notably *A History of the Work of Redemption* (he had preached a series of sermons—posthumously published—on that subject in 1739), which was to be a complete theology combining biblical, historical, and systematic materials "in an entire new method." Late in 1757, however, he accepted the presidency of the College of New Jersey (later Princeton University) and arrived there in January. He had hardly assumed his duties when he contracted smallpox and died.

Influence. Edwards' immediate disciples, Joseph Bellamy (pastor at Bethlehem, Conn.), Samuel Hopkins (pastor at Great Barrington, Mass., later at Newport, R.I.,), and Jonathan Edwards, Jr., developed some of his "improvements" into a distinct theological school; it was first called "Hopkinsianism" and later the "New England Theology." These men and their successors, in their effort to defend Calvinism against Arminians, Unitarians (those who denied the doctrine of the Trinity), and "infidels," made important modifications in some of its doctrines and thus prepared the way for later 19th-century evangelical liberalism.

Edwards' influence on the intellectual character of American Protestantism for a century after his death was very pronounced, and he was widely read in the British Isles. In a general revolt against Puritanism and Calvinism after the U.S. Civil War (1861–65), Edwards' prestige declined, and he was remembered mainly as a hell-fire preacher or as an abstruse, absent-minded metaphysician. In the 1930s and after, he was rediscovered by theologians reacting against liberalism and by secular scholars seeking to delineate the "American mind." Edwards' ability to combine religious intensity with intellectual rigour and moral earnestness, the cosmic sweep of his theological vision, his emphasis on faith as an "existential" response to reality, his insistence that love is the heart of religion, and his uncompromising stand against all forms of idolatry are some of the reasons his life and writings are again being seriously studied.

(T.A.S.)

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Edwards, Lewis (b. Oct. 27, 1809, Penllwyn, Cardiganshire, Wales—d. July 19, 1887), Welsh educator and minister of the Calvinistic Methodist Church of Wales whose literary and theological essays greatly influenced the development of Welsh culture.

After ordination in 1837, Edwards married the granddaughter of Thomas Charles of Bala, a Methodist clergyman and Welsh Bible editor. With his brother-in-law David Charles, he opened the Bala Calvinistic Methodist College to prepare men for the ministry; in 1867 this became the theological college for his church in North Wales. Through Edwards' influence his denomination adopted a more presbyterian form of church government on the Scottish model.

Edwards was twice moderator of the general assembly, which united the Calvinistic Methodist associations in North and South Wales. Periodicals in Welsh that he established include *Yr Esboniwr* ("The Expositor," from 1844) and *Y Traethodydd* ("The Essayist," from 1845).

A man of considerable critical faculties, Edwards produced works on Goethe and Goronwy Owen and translated a number of English hymns into Welsh, including "Onward Christian Soldiers." The best known of his children, Thomas Charles Edwards (1837–1900), was first principal of the University College of Wales, Aberystwyth, from 1872 to 1891.

Edwards, Sir Owen Morgan (b. Dec. 25, 1858, Llanuwchllyn, Merioneth, Wales—d. May 15, 1920, Llanuwchllyn), Welsh writer and educator who greatly influenced the revival of Welsh literature and the development of Welsh national consciousness.

After attending colleges in Wales and Scotland, he studied history at Oxford University until 1887. As a teacher of modern history at Oxford (1889–1907), he founded and edited three Welsh magazines for popular circulation. He was knighted in 1916.

Though a scholar himself, he wrote books in a natural, charming, lucid style that reached a universal Welsh audience. They were often descriptive works dealing informally with Welsh regions, manners, history, and character, or comparisons of Welsh life and life abroad, such as *O'r Bala i Geneva* (1889; "From Bala to Geneva"). His major work in English was *Wales* (1901). Edwards also published inexpensive reprints of Welsh classics. As chief inspector of Welsh education (1907–20), he tirelessly worked to secure the study of Welsh culture in the Welsh schools.

Edwin (d. Oct. 12, 632, Hatfield Chase, Eng.), Anglo-Saxon king of Northumbria from 616 to 632. He was the most powerful English ruler of his day and the first Christian king of Northumbria.

The son of King Aelle of Deira, one of the two Northumbrian kingdoms, Edwin fled into exile when Aethelric, king of Bernicia, seized power in Deira in 588 or 590. In 616 King Raedwald of East Anglia defeated and killed Aethelric's son Aethelfrith and installed Edwin on the Northumbrian throne. Edwin conquered part of Wales and was recognized as overlord by all the other English rulers except the king of Kent.

Edwin's conversion to Christianity resulted from his marriage to the Christian princess Aethelburh of Kent. She brought to Northumbria the Roman missionary Paulinus, who converted Edwin and many of his subjects in 627. In 632 King Cadwallon of Gwynedd and King Penda of Mercia invaded Northumbria and killed Edwin in battle. Paulinus and Aethelburh fled, and the Northumbrian church was temporarily suppressed. The following year, Northumbria was united and ruled by St. Oswald, son of Aethelfrith.

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

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Edwin Smith papyrus (*c.* 1600 BC), ancient Egyptian medical treatise, believed to be a copy of a work dating from *c.* 3000 BC. Apparently intended as a textbook on surgery, it begins with clinical cases of head injuries and works systematically down the body, describing in detail examination, diagnosis, treatment, and prognosis in each case. It reveals the ancient Egyptians' knowledge of the relation of the pulse to the heart and of the workings of the stomach, bowels, and larger blood vessels. The papyrus was acquired in Luxor in 1862 by the American Edwin Smith, a pioneer in the study of Egyptian science. Upon his death in 1906, the papyrus was given to the New York Historical Society and turned over to U.S. Egyptologist James Henry Breasted in 1920 for study. A translation, transliteration, and discussion in two volumes was published by Breasted in 1930.

Edwy (Anglo-Saxon king): *see* Eadwig.

EEC: *see* European Economic Community.

Eeckhout, Gerbrand van den (b. Aug. 19, 1621, Amsterdam—d. Sept. 29, 1674, Amsterdam), Dutch biblical, genre, and portrait painter, a gifted and favourite pupil of Rembrandt (1635–40), to whom he remained a close friend. His usual style is based so closely on that of his master that many of his pictures have passed as works of Rembrandt himself. Eeckhout was one of the most successful of this school in adopting the broader and bolder technique of Rembrandt's mature style, though he seldom approached the master in humanity or depth of feeling.

In surprising contrast to his normal Rembrandtesque style are a number of highly finished genre subjects—guardroom scenes, backgammon players, and so on. An example of the early style, once thought to be by Rembrandt, is the "Christ Raising the Daughter of Jairus" in the Staatliche Museen Preussischer Kulturbesitz, Berlin. A good example of genre in the manner of Terborch is "The Music Lesson" of 1655, in the Statens Museum for Kunst, Copenhagen. The National Gallery in

"Isaac Blessing Jacob," oil painting by Gerbrand van den Eeckhout; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, bequest of Collis P. Huntington, 1925

London has a fine group portrait of "Four Officers of the Amsterdam Coopers' and Wine-Rackers' Guild" dated 1657.

Eeden, Frederik Willem van (b. April 3, 1860, Haarlem, Neth.—d. June 16, 1932, Bussum), Dutch writer and physician whose works reflect his lifelong search for a social and ethical philosophy.

Eeden studied medicine at Amsterdam and, with writers Willem Kloos and Albert Verwey, founded (1885) *De nieuwe gids*, a literary periodical devoted to modern authors and new social ideas. Later he practiced medicine at Bussum, near Hilversum, where he started a clinic for physical therapy. In 1898 he founded Walden, an agricultural colony based on the ideas of Thoreau. Van Eeden's personality was many-sided, essentially ethical in outlook, having affinities with Tolstoy. After much doubt and disappointment, he joined the Roman Catholic Church in 1922.

Although in his early days van Eeden was chiefly known outside his own country for his idealistic social theories, his fame is based on his literary work. He first attracted attention with *De kleine Johannes* (1885; *The Quest*, 1907), a symbolic fairy tale. *Het lied van schijn en wezen* ("Song of Semblance and Substance"), the first part of which appeared in 1895, is a long philosophical poem. His psychiatric experience provided material for the novel *Van de koele meren des doods* (1900; *The Deeps of Deliverance,* 1902). Van Eeden's criticism and social treatises were collected in *Studies*, 6 vol. (1890–1918). He also wrote many plays and translated Rabindranath Tagore's work into Dutch.

Eekhoud, Georges (b. May 27, 1854, Antwerp—d. May 29, 1927, Schaerbeek, Belg.), one of the first important Belgian regionalist novelists.

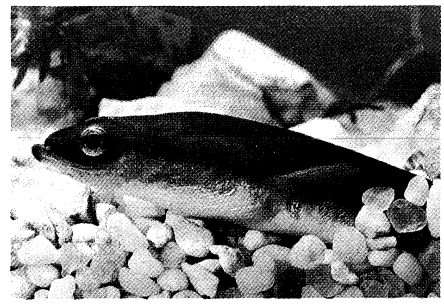
Originally a poet, in the 1880s he worked with Max Waller's review *La Jeune Belgique* to bring new life to Belgian literature. But to express his views on the reform of society, Eekhoud turned to prose. As a novelist he lacked the ability to construct satisfactory stories, and his characters rarely came alive. His strength lay in his descriptive realism. Even his best novel, *La nouvelle Carthage* (1888; "The New Carthage"), set in Antwerp, is saved only by the brilliance of its various episodes.

Unlike many regionalists, Eekhoud was able to evoke both urban and rural scenes. His cycles of stories, *Kermesses* (1884; "Country Fair") and *Nouvelles Kermesses* (1887), graphically describe the seamy side of peasant life; his city novels explore the world of the working classes and social outcasts.

eel, any of more than 500 species of fish of the order Anguilliformes.

A brief treatment of eels follows. For full treatment, *see* MACROPAEDIA: Fishes.

Eels are slender, elongated, usually scaleless fish with long dorsal and anal fins that are continuous around the tail tip. Some, the snipe eels (families Nemichthyidae, Cyemidae, and Serrivomeridae), have long jaws; and others, the snake eels (family Ophichthidae), have pointed tails that enable them to burrow backward into sand or mud. Young eels are transparent, leaflike larvae (leptocephali) totally unlike the adults. Eels are found in all



American eel (*Anguilla rostrata*)

Grant Heilman—EB Inc.

seas, from coastal regions to the mid-depths. One group, the freshwater eels of the family Anguillidae, live in freshwater but return to the sea to breed.

The freshwater eels are active, predacious fish with small, embedded scales. They comprise about 16 species and are found almost worldwide. They grow to maturity in fresh water and, as adults, make a single spawning migration to the sea (the Sargasso Sea in the case of the European and American species). After spawning, they die. The young hatch in the sea and drift to the coast, where they metamorphose into slender forms known as elvers and make their way upstream.

Freshwater eels are valued food fish. Species include the American eel (*Anguilla rostrata*), which grows about one metre (40 inches) long; the European eel (*A. anguilla*), a very similar species reaching a maximum length of about 1.4 metres; and the Indo-Pacific *A. marmorata,* which grows about 1.8 metres long.

There are about 19 families of true eels, including the moray and conger eel (*qq.v.*) groups, families Muraenidae and Congridae, respectively. The gulpers (*q.v.*) of the deep sea are included in this order by some authorities and separated as the order Saccopharyngiformes by others. Unrelated eel-like fish include spiny eels and the electric eel.

eelgrass, any of two different groups of ribbonlike aquatic plants. *Vallisneria* species (family Hydrocharitaceae), also called tape grass, are native to temperate and tropical waters; *V. spiralis*, often grown in aquariums, is a favourite food of wild ducks. (For its unusual pollination *see* Hydrocharitales.)

The Zosteraceae, commonly called the eelgrass family, is remarkable for *Zostera marina* (grass weed or grass wrack), an important tidewater plant whose dried leaves have been used for packing glass articles and for stuffing cushions.

eelpout, any of about 80 species of elongated marine fishes of the family Zoarcidae, found in cold waters and abundant in Arctic and Antarctic regions. Eelpouts are thick-lipped, eel-shaped fishes with the dorsal and anal fins connected around the end of the tail and with small pelvic fins that, if present, are near the gills. They live on the bottom and range from shallow to deep water. Length may be up to about 90 centimetres (3 feet) but is usually half that or less. Some species lay eggs; others, including the abundant European eelpout, or viviparous blenny (*Zoarces viviparus*), give birth to live young.

eelworm, any of several worms of the class Nematoda (phylum Aschelminthes), so called because they resemble miniature eels. The term is most often applied to smaller members of the class Nematoda that are either free-living or parasitic in plants.

Most eelworms are 0.1 to 1.5 millimetres (0.004 to 0.06 inch) long. They are found in all parts of the world. Free-living forms occur in salt water, fresh water, and damp soil. Parasitic forms are found in the roots of many plant species; the potato-root eelworm, *Heterodera rostochiensis,* for example, is a serious pest of potatoes. Some species occur in both animals and plants.

Eemian Interglacial Stage, major division of Pleistocene time and deposits in Europe (the Pleistocene Epoch began about 2,500,000 years ago and ended about 10,000 years ago). The Eemian Interglacial followed the Saale Glacial Stage and preceded the Weichsel Glacial Stage; the Eemian is correlated with the Ipswichian Interglacial of Britain and the Riss-Würm Interglacial Stage of the Alpine region of Europe. The Eemian is also approximately contemporaneous with the Sangamon Interglacial Stage of North America. The Eemian was named for a stream in the eastern Netherlands.

The sediments of the Eemian are varied and include deposits formed in lakes, rivers, weathered soil zones, and shallow seas. The distribution of the marine deposits indicates that the Eemian seas made great incursions onto the land. These seas were probably higher than at present; the Eemian appears to have been a time of very moderate climate, warmer than at present. Most of the ice of the previous glacial period must have melted: it is likely that Scandinavia was ice-free, as was the Arctic Ocean. The Fennoscandia landmass was probably isolated as an island. Eemian fossil vertebrates are known from several localities and indicate a rich and varied mammalian fauna in Europe, including horse, bison, various sorts of elephants, cave bear, and others.

Eemian Sea, marine transgression during the Eemian Interglacial Stage of the Pleistocene Epoch (the Pleistocene began about 2,500,000 years ago and ended about 10,000 years ago). The Eemian Sea flooded much of northern Europe and converted Scandinavia into a virtual island. The sea also deposited a thick sequence of sediments that contains a fossil fauna indicating that water temperatures were at least as warm as those of the region today. Late in the history of the Eemian Sea, climatic conditions became more severe, as indicated by a change to a cooler water fauna.

Eems River (Germany): *see* Ems River.

Éfaté, also called VATÉ, formerly SANDWICH, most important island of Vanuatu, in the southwestern Pacific Ocean. Volcanic in origin, it occupies an area of 353 sq mi (915 sq km), and its highest peak is Mt. Macdonald, 2,123 ft (647 m). Its terrain is rugged and covered by tropical rain forest, nurtured by its warm and humid climate.

Vila (*q.v.*), capital of the Republic of Vanuatu, lies on the southwest coast of Éfaté; it has a good harbour (Mélé Bay) and an international airport. Havannah Harbour, on the north coast, also provides good anchorage. The island produces copra, coffee, cacao, cattle, and sheep and has potential for a lumbering industry. Manganese ore is mined at Forari under Australian management. Pop. (1979 prelim.) 16,921.

effective atomic number, abbreviation EAN, number that represents the total number of electrons surrounding the nucleus of a metal atom in a metal complex. It is composed of the metal atom's electrons and the bonding electrons from the surrounding electron-donating atoms and molecules. Thus the effective atomic number of the cobalt atom in the complex $[Co(NH_3)_6]^{3+}$ is 36, the sum of the number of electrons in the trivalent cobalt ion (24) and the number of bonding electrons from six surrounding ammonia molecules, each of which contributes an electron pair ($2 \times 6 = 12$).

The English chemist Nevil V. Sidgwick made the observation, since known as the EAN rule, that in a number of metal complexes the metal atom tends to surround itself with sufficient ligands that the resulting effective atomic number is numerically equal to the atomic number of the noble-gas element found in the same period in which the metal is situated. This rule seems to hold for most of the metal complexes with carbon monoxide, the metal carbonyls. By using this rule it is possible to predict the number of ligands in these types of compounds and also the products of their reactions.

effective population size, in genetics, the size of a breeding population, a factor that is determined by the number of parents, the average number of children per family, and the extent to which family size varies from the average. The determination of the effective population size of a breeding population is necessary for studies of population growth rates and of gene flow.

Effen, Justus van (b. Feb. 21, 1684, Utrecht, Neth.—d. Sept. 18, 1735, 's-Hertogenbosch), Dutch essayist and journalist whose straightforward didactic pieces, modelled on foreign examples, had a wholesome influence on the contemporary Dutch fashion of rococo writing. His other occupations included private tutor, secretary at the Netherlands embassy in London (1715 and 1727), and clerk in the Dutch government's warehouses (1732). An admirer of the English press and of *The Spectator* in particular, he launched first *Le Spectateur Français* (1725) and then in his native language *De hollandsche spectator* (1731), a weekly that he edited for the rest of his life. The descriptive realism and homely prose of his essays on common life and customs influenced the emerging novelists of the Dutch domestic scene.

Justus van Effen, engraving by J.C.G. Fritzsch, 1735

By courtesy of the Iconographisch Bureau, The Hague

effigy mound, earthen mound in the form of an animal or bird found throughout the northcentral United States. The effigy mounds are sometimes mistakenly classified with the numerous mounds that dot the area east of the Mississippi River, believed to be the work of prehistoric Indians broadly, and not accurately, designated as the "mound builders."

Less is known about the effigy mounds than about any of the others. Explorers such as Hernando de Soto (1539–42) have recorded, for example, that temple mounds in the southeastern U.S. served as earthen platforms on which the Indians built their temples and sometimes the houses of their chiefs. It is also known that the Hopewell culture (*q.v.*) was responsible for a great proliferation of mound building in the Ohio River Valley, including hundreds of burial mounds in which a treasure of artifacts, especially effigy pipes and gorgets (ornamental collars), have been found. Although it is known that most of the effigy mounds are burial sites, some are not, and their significance remains a mystery. Grave offerings are seldom found. The Effigy Mound culture has been dated from AD 300 to the mid-1600s.

Many effigy mounds are in the form of birds, but other animal forms—such as those of bears, deer, turtles, and buffalo—are common. The largest bird effigy mound has a wingspan of 624 feet (190 metres) and is located near Madison, Wis. Many other effigy mounds are found in southern and southwestern Wisconsin and in some areas of adjacent Minnesota, Iowa, and Illinois. The largest effigy mound is located in southern Ohio. In the form of an uncoiling snake holding an egg-shaped object in its mouth, the mound is more than 1,300 ft (400 m) long and 2½ to 3 ft (75 to 90 cm) high. *See also* burial mound.

Effigy Mounds National Monument, area of 1,475 ac (597 ha) containing numerous ancient Indian burial mounds, in northeastern Iowa, U.S., on the Mississippi River, a few miles north of McGregor. Established in 1949 and located on bluffs overlooking the river, the monument has 183 known mounds, some of which are in the shape of birds and bears. One mound has been dated as being about 2,500 years old, but the effigy mounds were built by a later culture (probably AD 500–1300). Many of the mounds have yielded copper, bone, and stone tools of Indian origin. One of the bear mounds is 137 ft (42 m) long and 3.5 ft high.

Effingham, city, Effingham County, east central Illinois, U.S. Settled in 1854 with the arrival of the Illinois Central Railroad and originally called Broughton, it was renamed, when it became the county seat (1859), for Thomas Howard, 3rd earl of Effingham, who had opposed British colonial policy. The community grew as pioneers moved westward along the Cumberland (National) Road, which had been extended through the area in 1831. The economy is based on agriculture, dairying, manufacturing (chiefly home appliances), and printing. Lake Sara, a recreational area, is nearby to the west. Inc. village, 1854; city, 1861. Pop. (1980) 11,270.

Effingham, Charles Howard, 2nd Baron Howard of: *see* Nottingham, Charles Howard, 1st earl of.

efflorescence, spontaneous loss of water by a hydrated salt, which occurs when the aqueous tension of the hydrate is greater than the partial pressure of the water vapour in the air. For example, because the vapour pressures of washing soda ($Na_2CO_3 \cdot 10H_2O$) and Glauber's salt ($Na_2SO_4 \cdot 10H_2O$) normally exceed that of the water vapour in the atmosphere, these salts effloresce (*i.e.*, lose all or part of their water of hydration), and their surfaces assume a powdery appearance. Hydrated cupric sulfate, or blue vitriol ($CuSO_4 \cdot 5H_2O$), the aqueous tension of which is lower, undergoes efflorescence only if the air in contact with it is relatively dry. *See also* deliquescence.

Effon-Alaiye, also spelled EFON-ALAYE, town, Ondo State, southwestern Nigeria, in the Yoruba Hills, at the intersection of roads from Ilesha, Ondo, and Ado-Ekiti. It was probably founded in the late 19th century, when both the Ilesha and Effon belonged to the Ekiti-Parapo, a Yoruba confederation that fought against the town of Ibadan, 68 mi (109 km) west-southwest, for control of the trade routes to the coast. Now a collecting point for cocoa, cotton, and palm oil and kernels, Effon-Alaiye also serves as an agricultural trade centre (yams, cassava, corn [maize], palm produce, fruits, pumpkins, okra) for the local branches of the Yoruba people (the Ilesha [Ijesha] and Effon). The town has a teacher-training college, secondary schools, and a hospital. Pop. (1983 est.) 110,600.

Efik, people inhabiting the lower Cross River in Cross River state, Nigeria; their dialect of Efik-Ibibio (in the Kwa branch of Niger-Congo languages) has become the literary language of all educated Efik-Ibibio speakers. The Efik, an offshoot of the Ibibio, migrated down the Cross River during the first half of the 17th century and founded Creek Town, Duke Town, and other settlements. Because of a European error in confusing their territory with that of the Kalabari Ijaw (known as New Calabar), the Efik area became known as Old Calabar. Originally a community of fishermen, Old Calabar developed into a major trading centre from the 17th to the 19th centuries, exporting slaves and later palm oil in return for European goods. European ships had to pay a duty (*comey*) to Efik chiefs for the privilege of trading.

During the 20th century, a large part of the Efik population moved from the towns and settled in farming villages in the forest. The staple foods are yam and cassava, supplemented by taro, corn (maize), fruits and vegetables, and fish.

Households formerly consisted of a man, his several wives, and their children; but polygyny has become relatively rare. Groups of households related through male descent form a House, the leader of which was formerly the eldest male member but now is chosen for ability. Related Houses occupy the wards into which settlements are divided.

The Obung, or chief, elected from among the heads of various Houses, traditionally exercised his authority as head of the Ekpe (Egbo), or Leopard Society. In addition to ritual propitiation of forest spirits to ensure the well-being of the community, this graded, secret male society made and enforced laws by fines, capital punishment, or boycotts; judged cases; maintained internal peace; and served as the executive government of Efik society. The Ekpe was composed of the leading men of the community, and its higher grades were open only to those who could pay the heavy entrance fees. It also functioned as a force for tribal unity, for society members from one village were accepted by members in another village. The Ekpe continues to exist; but its dominant role in legislative, judicial, and economic affairs has been taken over by the state. Its supernatural powers have also waned.

Traditional Efik religion includes belief in a supreme creator god, ancestral and other supernatural beings, magic, sorcery, and witchcraft. Most Efik, however, are now Christians.

Efod, also spelled EFODI (Jewish philosopher): *see* Duran, Profiat.

efod (Judaism): *see* ephod.

Efon-Alaye (Nigeria): *see* Effon-Alaiye.

Efron, Marina Ivanovna: *see* Tsvetayeva, Marina Ivanovna.

eft (salamander): *see* newt.

EFTA: *see* European Free Trade Association.

Egadi Islands, Italian ISOLE EGADI, also called AEGADIAN ISLANDS, Latin AEGATES INSULAE, small mountainous group of islets belonging to Italy, in the Mediterranean just off the western coast of Sicily, with a total area of 15 sq mi (39 sq km). The principal islands are Favignana, the largest (7 sq mi), Levanzo, and Marettimo. In the Battle of the Aegates in 241 BC the Carthaginian fleet was defeated there by the Roman fleet under Gaius Lutatius Catulus, signalling the end of the First Punic War. The Egadi are of archaeological interest, excavations having revealed traces (rare in Sicily) of Paleolithic habitation, most notably the cave paintings in the Grotta Genovese on Levanzo. The islands have important tunny fisheries and administratively comprise Favignana commune of Trapani province, Sicily. Pop. (1981 prelim.) mun., 4,490.

Égalité, Philippe: *see* Orléans, Louis-Philippe-Joseph, duc d'.

Egan, Pierce, THE ELDER (b. 1772, London—d. Aug. 3, 1849, London), sporting writer whose works were considered indispensable reading for English men-about-town in the early 19th century.

Egan, detail of an engraving by C. Turner after a drawing by G. Sharples
BBC Hulton Picture Library

Egan made his reputation as a boxing reporter. His best known work is *Boxiana* (1818–24), a racy but accurate account of the lives of famous pugilists. Egan also became an authority on other sports and developed a flair for sensational literature describing the contemporary "fast" life.

Egas Moniz, António (Caetano de Abreu Freire) (b. Nov. 29, 1874, Avança, Port.—d. Dec. 13, 1955, Lisbon), Portuguese neurologist, statesman, founder of modern psychosurgery, who received with Walter Hess the 1949 Nobel Prize for Physiology or Medicine for the development of prefrontal leucotomy (lobotomy) as radical therapy for certain psychoses, or mental diseases.

As the University of Lisbon's first professor of neurology (1911–44), Egas Moniz introduced and developed (1927–37) cerebral angiography (arteriography), a method of making visible the blood vessels of the brain by injecting into the carotid artery substances that are opaque to X-rays. This technique has proved to be of considerable value in the diagnosis of intracranial diseases such as tumours of the pituitary gland.

Egas Moniz, *c.* 1950
Archiv fur Kunst und Geschichte, West Berlin

Realizing that certain psychoses, particularly degenerated schizophrenia and severe paranoia, involve recurrent thought patterns that dominate normal psychological processes, Egas Moniz reasoned that severing the nerve fibres between the prefrontal lobes, known to be closely associated with psychological responses, and the thalamus (a relay centre for sensory impulses at the centre of the brain) might force a transformation of existing thought patterns into more normal ones. In 1936 he and his associate, Almeida Lima, performed the operation known as a prefrontal leucotomy, the first instance of human brain surgery for the treatment of a psychological disorder. The operation, though successful in eliminating certain intractable psychoses, is known to have serious side effects, and Egas Moniz cautioned that it was a radical procedure to be followed only after all other forms of treatment had proved to be ineffective. While rarely employed, especially since the introduction of tranquillizing drugs, the operation has led to increased knowledge of brain function.

Egas Moniz was also active politically. He served several times between 1903 and 1917 in the Portuguese chamber of deputies, was Portuguese minister at Madrid (1917–18), and led the Portuguese delegation at the Paris Peace Conference (1918–19).

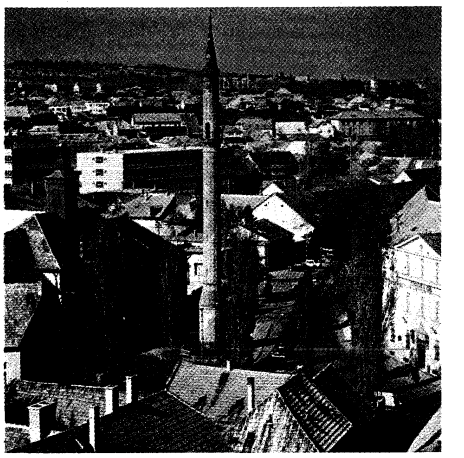
Egbert, also spelled ECGBERHT, OR ECGBRYHT (d. 839), king of the West Saxons from 802 to 839, who formed around Wessex a kingdom so powerful that it eventually achieved the political unification of England (mid-10th century).

The son of Ealhmund, king in Kent in 784 and 786, Egbert was a member of a family that had formerly held the West Saxon kingship. In 789 Egbert was driven into exile on the Continent by the West Saxon king Beorhtric and his ally, the powerful Mercian king Offa (died 796). Nevertheless, Egbert succeeded to Beorhtric's throne in 802. He immediately removed Wessex from the Mercian confederation and consolidated his power as an independent ruler. In 825 he decisively defeated Beornwulf, king of Mercia, at the Battle of Ellendune (now Wroughton, Wiltshire). The victory was a turning point in English history because it destroyed Mercian ascendancy and left Wessex the strongest of the English kingdoms. By virtue of long-dormant hereditary claims, Egbert was accepted as king in Kent, Sussex, Surrey, and Essex. In 829 he conquered Mercia itself, but he lost it in the following year to the Mercian king Wiglaf. A year before his death Egbert won a stunning victory over Danish and Cornish Briton invaders at Hingston Down (now in Cornwall).

Ege Deniz: *see* Aegean Sea.

Eger (Czechoslovakia): *see* Cheb.

Eger, German ERLAU, town, seat of Heves *megye* (county), northern Hungary. In the valley of the Eger, a tributary of the Tisza, between the Mátra and the Bükk mountains, it is an old Magyar tribal city (with a bishopric founded in the 11th century). The Tatar invasion of the 13th century levelled most of the town, which was one of the richest in early medieval Hungary. The remains of the fortress from which the town was defended from the Turks in 1551 are on the hill to the northeast. The Turks returned to take and occupy the town from 1596 to 1687. It was an important Muslim outpost and the 115-ft- (35-m-) high minaret is one of Eger's landmarks. From the early 18th century Eger revived and the number of ecclesiastical buildings that were built in the town gave rise to its name of "the Hungarian Rome." The former Minorite Church (1758–71) is one of the finer architectural monuments of Hungary, and the observatory tower is of historical interest to astronomers. Beneath Eger lie 60 mi (96 km) of tunnels that in times past provided building stone, sanctuary against invading Turks, and, more recently, cellars to mature wine. The tunnels were dug in a soft rock and subsidence has caused extensive surface damage. The national government has provided subsidies to save the town's many historic buildings from further destruction. The rich soils and the favourable microclimate on the hill slopes have supported grape vines, with viticulture dating from the 13th century. Bikavér, a full-bodied red wine, is Eger's best known wine. The town has a limited manufacturing industry (furniture, cigarettes, and precision instruments). Eger is the tourist centre for the Mátra Mountains (*q.v.*), and there is a spa with numerous bathing facilities. Pop. (1983 est.) 63,000.



Minaret dating from the Turkish occupation, Eger, Hung.
ZEFA

Eger River (Europe): *see* Ohře River.

Egeria, in Roman religion, a water spirit worshipped in connection with Diana at Aricia and also with the Camenae in their grove outside the Porta Capena at Rome. Like Diana, she was a protectress of pregnant women and, like the Camenae, was considered prophetic. Traditionally she was the wife, or mistress, and adviser of King Numa Pompilius, who established the grove at Rome and consorted with her there.

Egerton, Thomas: *see* Brackley, Thomas Egerton, Viscount.

Egesta (ancient Sicily): *see* Segesta.

Egfrith (Anglo-Saxon king): *see* Ecgfrith.

egg, in biology, the female sex cell, or gamete. In botany the egg is sometimes called a macrogamete. In zoology the Latin term for egg, ovum, is frequently used to refer to the single cell, while the word egg may be applied to the entire specialized structure or capsule that consists of the ovum, its various protective membranes, and any accompanying nutritive materials. The human female reproductive cell is also usually called an ovum.

The egg, like the male gamete, bears only a single (haploid) set of chromosomes. The egg, however, is usually larger than its male counterpart because it contains material to nourish the embryo during its early stages of development. In many animal species a large quantity of nutritive material, or yolk, is deposited in the egg, the amount depending on the length of time before the young animal can feed itself or, in the case of mammals, begins to receive nourishment from the maternal circulation. The plant egg is never so disproportionately large, because the developing sporophyte embryo is nourished until self-supporting by the plant on which it is formed (in liverworts, mosses, and ferns by the gametophyte; in seed plants by the sporophyte on which the gametophyte is parasitic).

With the exception of those of some cnidarians (coelenterates), all animal eggs are enclosed by membranes, the innermost of which is called the vitelline membrane. The vitelline membrane is the only membrane in the eggs of various invertebrates—ctenophores, many worms, and echinoderms—and of certain lower chordates. All higher vertebrates and many invertebrates have one or more additional membranes. Insect eggs, for example, are covered by a thick, hard chorion, and the amphibian egg is surrounded by a jelly layer. The bird egg includes the vitelline membrane, the white of the egg, two egg shell membranes, and the outermost membrane, the shell. As pointed out above, this entire structure is commonly referred to as an egg.

Mature eggs remain functional for a relatively short period of time, after which fertilization cannot occur. The eggs of most invertebrates, fish, and amphibians must be fertilized a few minutes after they are shed into the water; an exception is sea urchin eggs, which are viable for about 40 hours after their release. Most other animal eggs have life spans similar to that of the human egg—*i.e.*, 12 to 24 hours. *See also* ovum.

egg, the content of the hard-shelled reproductive body produced by a bird or reptile, considered as food.

A brief treatment of eggs and egg products follows. For full treatment, *see* MACROPAEDIA: Food Processing.

The egg has been a protein source for man since earliest times but was only locally important and seasonal until the domestication of fowls became widespread. In the 2nd millennium BC, Indian jungle fowls, the ancestors of the modern hen, were dispersed throughout Europe, the Middle East, and China. The birds were brought to the New World with Columbus's second voyage in 1493. These fowls, which laid year-round, were more valuable for their eggs than for their meat.

By far the preponderance of eggs eaten today are hen's eggs. The eggs of ducks, both domestic and migratory, are also widely eaten; salted and preserved duck eggs are a specialty of Chinese cuisine. Other eggs often eaten are those of geese, quail, pigeons, gulls, lapwings, plovers, pheasants, and ostriches. Local regulations govern the gathering and sale of the eggs of wild birds. The eggs of some reptiles are edible, but of these only turtle's eggs are notable.

A two-ounce (56.6-gram) egg provides 6 grams of complete protein, about 15 percent of an adult's daily requirement, and 12 grams of fat, for about 80 calories. In addition, the egg contains significant amounts of iron, vitamins A and D, thiamine, and riboflavin. The mineral and vitamin content varies with the diet of the chicken. Brown and white hen's eggs are nutritionally identical, although one is sometimes preferred over the other for aesthetic reasons.

Because the protein in the liquid albumen of the egg coagulates as it is heated, eggs are used in many foods as a structural component. Sponge and angel food cakes are leavened by the expansion with heat of the air trapped in stiffly beaten egg whites. Soufflés and meringues also exploit this characteristic. In cake batters, eggs provide leavening, moisture, and texture. Foods to be coated in bread crumbs or flour are first dipped in beaten egg, which makes the coating adhere and binds it. Soups and sauces are thickened by the addition of egg yolks. In terrines, croquettes, and other mixtures, egg contracts as the dish is cooked, helping maintain the shape. In ice cream and sherbet, egg white acts as an interfering agent that prevents the formation of large ice crystals. In both hot and cold sauces, eggs enable a stable emulsion to be formed of substances that would otherwise separate. When beaten into hot stock or coffee, egg whites trap solid particles and render the liquid clear.

In cooking eggs, a major consideration is the use of low to moderate heat. At 165° F (74° C) both the yolk and the white of the egg coagulate. Above this temperature the protein becomes tough and rubbery. In custards and meringues, high heat will cause "weeping," the loss of water. Eggs can be boiled, fried, poached, scrambled, and baked. They can be a component of any course of a meal and combine well with virtually any sweet or savoury food.

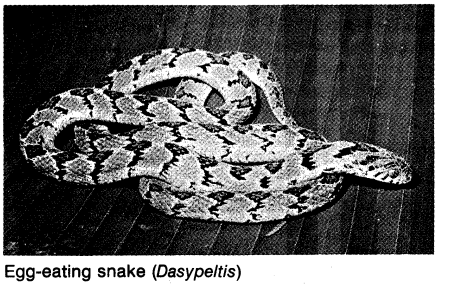
Egg, Augustus (Leopold) (b. May 2, 1816, London—d. March 26, 1863, Algiers), genre painter and actor.

Egg studied at the Royal Academy, of which he became a member in 1860. He travelled in Italy with Charles Dickens and Wilkie Collins in 1853. Egg was an excellent actor and played in Dickens' company of amateurs; one of his best parts was as John Want in Collins' *Frozen Deep.* As a painter, he was famous in his day for small anecdotal paintings, many of them on subjects from contemporary novelists, including Scott and Thackeray.

egg and dart, in architecture, design shape used in moldings. It consists of a series of bas-relief ovals alternating with pointed, narrow, dartlike carvings.

Ovolo moldings, as the Classical egg designs are called in general, are usually wider than many other styles. Their ovals may be separated by other narrow elements, shaped to resemble arrowheads, anchors, or tongues.

egg-eating snake, any of the five species of the genus *Dasypeltis* of sub-Saharan Africa and *Elachistodon westermanni* of northeastern India. These snakes comprise the subfamily Dasypeltinae, family Colubridae. They eat only eggs. The mouth is enormously distensible and the teeth greatly reduced, to accommodate a bird's egg as large as a chicken's. Ventral spines on the neck vertebrae extend into the esophagus and serve to rip open the eggshell. Contents of the egg are pressed into the stomach and the bits of shell are regurgitated.



Egg-eating snake (*Dasypeltis*)
E.S. Ross

Egg-eating snakes are primarily arboreal, and they are oviparous (egg laying), laying each egg in a separate place. All are slender and about 76 centimetres (30 inches) long.

egg-laying topminnow (fish): *see* killifish.

egg tooth, tooth or toothlike structure used by the young of many egg-laying species to break the shell of the egg and so escape from it at hatching. Some lizards and snakes develop a true tooth that projects outside the row of other teeth, helps the young to hatch, and then is shed. Turtles, crocodilians, and birds have an analogous horny structure that performs a similar function. The only mammal to hatch from an egg, the duck-billed platypus, also develops an egg tooth before birth.

Eggert Ólafsson (Icelandic poet and antiquarian): *see* Ólafsson, Eggert.

Eggjum Stone, inscribed stone that bears 200 runic characters. It is the longest known text in the old-style futhark (runic alphabet) and was discovered inside a tomb in western Norway in 1917. The runes are arranged in three unequal lines, separated by an engraving of a stylized horse's head. The date is uncertain; archaeologists place it in the 7th century, whereas runologists, citing transitional rune forms and the relatively modern language of the sample, estimate the 8th or even the 9th century.

Parallel constructions and alliterations appear in the text, which remains enigmatic. Only a few passages are clear; among these is a statement that the stone is not illuminated by the Sun and has not been carved with a knife. There is also a probable conjuration and an explanation of the death of the person in the tomb.

Eggleston, Edward (b. Dec. 10, 1837, Vevay, Ind., U.S.—d. Sept. 4, 1902, Lake George, N.Y.), clergyman, novelist, and historian who realistically portrayed various sections of the U.S. in such books as *The Hoosier Schoolmaster.*

By the age of 19, Eggleston had become an itinerant preacher, but circuit riding broke his health. He held various pastorates, serving from 1874 to 1879 in Brooklyn; he was an editor of the juvenile paper, *Little Corporal* (1866–67), the *National Sunday School Teacher* (1867–73), and other periodicals.

In all of his work he sought to write with "photographic exactness" of the real West. The most popular of his books for adults was *The Hoosier Schoolmaster* (1871), a vivid study of backwoods Indiana. His other novels include *The End of the World* (1872), *The Mystery of Metropolisville* (1873), *The Circuit Rider: A Tale of the Heroic Age* (1874), *Roxy* (1878), and *The Graysons* (1888). His later novels and children's books are considered less significant. After a trip to Europe in 1879 he turned to the writing of history. His *Beginners of a Nation* (1896) and *Transit of Civilization from England to America* (1900) contributed to the growth of social history.

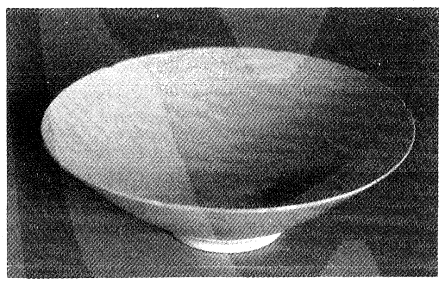
eggplant, also called AUBERGINE, or GUINEA SQUASH (*Solanum melongena*), tender perennial plant of the nightshade family (Solanaceae), closely related to the potato. Eggplant requires a warm climate and is grown extensively in eastern and southern Asia and in the United States. It is native to southern and eastern Asia, where it has been cultivated since remote antiquity for its fleshy fruit. For this purpose it is usually grown as an annual. It has an erect, bushy stem, sometimes armed with a few spines; large ovate, slightly lobed

Eggplant (*Solanum melongena*)
Ingmar Holmasen

leaves; and pendant, violet, usually solitary flowers, about two inches across. The fruit is a large, egg-shaped berry, varying in colour from dark purple, to red, yellowish, or white (the colour and shape of the white variety is the source of the common name); it is sometimes striped and has a glossy surface.

A staple in cuisines of the Mediterranean region, the eggplant figures prominently in such classic dishes as the Greek moussaka, Italian eggplant parmigiana, and the Middle Eastern relish *baba ganoush.* It is also frequently served as a baked, grilled, fried, or boiled vegetable and is used as a garnish and in stews.

eggshell porcelain, also called TAN-P'I BODILESS, or T'O T'AI, WARE, Chinese porcelain the body of which is excessively thin under the glaze and often has decoration engraved on it before firing that is visible, like a watermark in paper, only when held to the light; such



Eggshell porcelain bowl, a copy of a Yung-lo period bowl, Ch'ing dynasty, K'ang-hsi reign (1661–1722); in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

decoration is called *an hua,* literally "secret language." Eggshell porcelain was a refinement introduced in the Ming dynasty during the reign of the emperor Yung-lo (1402–24); it reappeared in the reign of the emperor Ch'eng-hua (1464–87), and later Yung-lo wares were copied under the emperor Wan-li (1572–1620). The paper-thin porcelain again occurred during the Ch'ing dynasty (1644–1911/12), especially in the reign of the emperor K'ang-hsi (1661–1722), in *famille verte* and *famille rose* porcelain, chiefly in bowls and plates. Thin-walled porcelain has occasionally been made in modern factories.

Egill SKALLAGRÍMSSON (b. *c.* 910, Borg, Ice.—d. 990), one of the greatest of Icelandic skaldic poets (*see* skaldic poetry), whose adventurous life and verses are preserved in *Egils saga* (*c.* 1220), attributed to Snorri Sturluson. The saga portrays Egill as having a dual nature derived from his mixed descent from fair, extroverted Vikings and dark, taciturn Lapps. He was headstrong, vengeful, and greedy for gold, but also a loyal friend, a shy lover, and a devoted father. As a young man he killed the son of King Erik Bloodax and placed a curse upon the King, which he inscribed on a pole in magic runes. Later, shipwrecked off the coast of Northumbria, Eng., he fell into Erik's hands (*c.* 948) but saved his own life by composing in a single night a "Höfudlausn" ("Head Ransom") praising Erik in a unique end-rhymed metre. Shortly after the death of two of his sons, Egill locked himself in his enclosed bed and refused food. His daughter coaxed him into writing a poem; so he composed (*c.* 961) the deeply personal lament "Sonatorrek" ("Loss of Sons"). The poem is also a family portrait in which he recalls the deaths of his parents as well; in it desire for revenge and hatred of the gods overwhelm him, but gradually he bows his head in resignation. After finishing the poem, Egill resumed his normal life. He lived to be old and blind and to write a lament on his senility.

Eginhard (Frankish historian): *see* Einhard.

Egisheim und Dagsburg, Bruno, Graf von (count of): *see* Leo IX *under* Leo (papacy).

Egk, Werner, original name WERNER MAYER (b. May 17, 1901, Auchsesheim, near Donauwörth, Ger.—d. July 10, 1983, Inning, W.Ger.), German composer primarily of music for the theatre.

Egk studied composition with Carl Orff in Munich, where he settled and composed music for puppet plays and radio plays. He conducted his own first opera for the stage, *Die Zaubergeige* (1935), in Frankfurt am Main.

His operas and ballets, often satirical, usually portray historical or legendary figures, and he wrote his own librettos. The immediate appeal of Egk's music owed largely to its neoromantic spirit. His primary influence was Stravinsky. In 1938, while in Berlin, he conducted his highly successful opera, *Peer Gynt* (after Ibsen), one of his most popular stage works. His ballets, such as *Abraxas* (1948) and *Casanova in London* (1969), also attracted wide attention. *Abraxas* was banned, after five sold-out performances, by the Bavarian Minister of Culture on grounds of obscenity. Egk also wrote instrumental music, including a piano sonata and several pieces for orchestra.

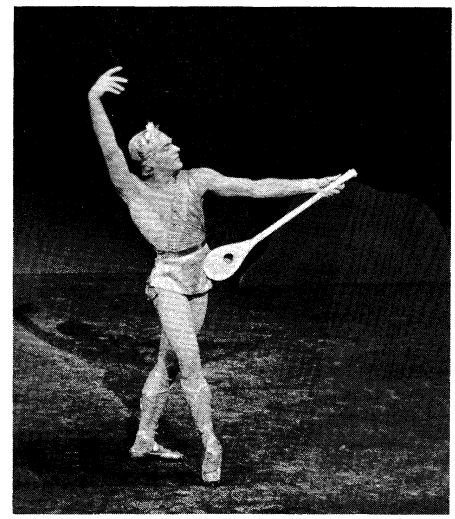
eglantine: *see* sweetbrier.

Églantine, Philippe (-François-Nazaire) Fabre d': *see* Fabre d'Églantine, Philippe (-François-Nazaire).

Eglevsky, André (b. Dec. 21, 1917, Moscow—d. Dec. 4, 1977, Elmira, N.Y., U.S.), Russian-born American ballet dancer and teacher widely regarded as the greatest male classical dancer of his generation.

Though he left Russia as a child during the Revolution, Eglevsky acquired the traditional style and technique of the Imperial Russian Ballet by studying in Paris (from age eight) with such outstanding émigré dancers as Lubov Egorova, Mathilde Kschessinska, and Alexandre Volinine and with Nicholas Legat in London. At 14 he became premier danseur with Col. W. de Basil's Ballet Russe de Monte Carlo, in which he introduced his characteristic and spectacular series of slow, controlled pirouettes in *Les Présages.*

He danced with such companies as the René Blum–Michel Fokine Ballets de Monte Carlo, American Ballet, and Ballet (now American Ballet) Theatre before joining the New York City Ballet (1951–58), where he created leading roles in several Balanchine ballets including *Scotch Symphony* (1952) and *Caracole* (1952; now called *Divertimento No. 15*). Among his other well-known roles were Albrecht in *Giselle* and Prince Siegfried in *Swan Lake;* principal parts in Fokine's ballets *Les Sylphides, Prince Igor, Le Spectre de la Rose,* and *Petrushka;* the burlesque Paris in David Lichine's *Helen of Troy;* and the title role of Léonide Massine's surrealistic *Mad Tristan.* Eglevsky, a U.S. citizen since 1937, established



Eglevsky in *Apollo,* 1944
Fred Fehl

a school and small performing group in Massapequa, N.Y., in 1958, which grew into the Eglevsky Ballet Company that survived him.

Église Reformée de France (French Reformed church): *see* Reformed Church of France.

Egmond, Lamoraal, graaf van (count of), Egmond also spelled EGMONT (b. Nov. 18, 1522, La Hamaide, Hainaut—d. June 5, 1568, Brussels), leader in the early stages of the opposition to the policies of Philip II of Spain in the Netherlands. He is the hero of Goethe's drama *Egmont.* Although Egmond did not favour the overthrow of Spanish sovereignty, he became one of the first and most illustrious of the victims of the Duke of Alba's repressive regime (1567–73).

Belonging to a powerful family of the Netherlands, Lamoraal succeeded to the countship, in Holland, in 1541 and three years later married Sabina of Bavaria, daughter of John II, count palatine of Simmern. A trusted adviser of the emperor Charles V, Egmond represented the Emperor's son, Philip II, in asking for the

Graaf van Egmond, painting by an unknown artist, 16th century; in the Germanisches Nationalmuseum, Nürnberg
By courtesy of Germanisches Nationalmuseum, Nurnberg

hand of Mary I, the Roman Catholic queen of England. He had a distinguished military record, most notably in the victories over the French at Saint-Quentin (1557) and Gravelines (1558). In 1559 he was named stadholder (chief provincial executive) of Flanders and Artois and a member of the advisory council

of the regent, Margaret of Austria, duchess of Parma.

Egmond and other leading noblemen resented Philip II's policy of encroachment on local privileges and religious liberties and to the elevation of Cardinal Antoine Perrenot de Granvelle to virtual head of the government. Together with William, prince of Orange (William I the Silent), and Filips van Montmorency, graaf van Hoorne, Egmond successfully petitioned Philip to remove Granvelle from office (1564).

When Philip, despite Egmond's personal appeal in Spain (1565), maintained his harsh decrees against Protestants, Egmond, along with William and Hoorne, withdrew from the Council of State (November 1565); but he remained loyal to the sovereign, giving only limited support to a league of lesser nobles formed in 1566 to petition Margaret for greater religious toleration. He then withdrew to his government of Flanders, where he severely repressed Calvinist uprisings.

After the appointment of the Duke of Alba as captain general in 1567, William appealed to Egmond to join him in armed resistance. Egmond's refusal troubled William, who vacillated for several months before seeking aid from German Protestant princes. Egmond meanwhile took the oath of allegiance demanded by Margaret in the spring of 1567 and ignored William's warning of danger on Alba's arrival. He was seized by Alba on Sept. 9, 1567, and, with others, beheaded for high treason after appeals by high nobles and princes had been ignored.

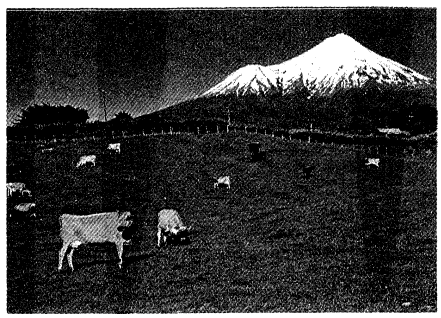
Egmont, John Perceval, 2nd earl of, 1ST BARON LOVEL AND HOLLAND (b. Feb. 24, 1711, Westminster, near London—d. Dec. 4, 1770, London), eccentric British politician and pamphleteer, a confidant of George III.

Perceval sat in the Irish House of Commons from 1731 to 1748, when he succeeded to his father's earldom in the Irish peerage. His interests, however, were in British politics. Elected in 1741 to represent Westminster in the British House of Commons, he became a critic of Sir Robert Walpole's administration. In 1748 he threw his support to Frederick Louis, prince of Wales, and soon became the principal adviser for the Prince's Leicester House faction as well as opposition leader in the Commons. In conjunction with the Prince, who regarded Perceval as his prospective prime minister, he drafted the Glorious Plan, a blueprint to take control of the government at Frederick's accession. After the Prince died unexpectedly on March 20, 1751, Perceval drew closer to Frederick Louis's son and successor, Prince George (the future George III). In May 1762 Perceval moved from the Commons to the Lords after his elevation to the English peerage as Baron Lovel and Holland. In the ministry of George Grenville, he was appointed 1st Lord of the Admiralty (September 1763), and by 1765 he had become known as a leader of the "King's Friends." Egmont resigned from Pitt's administration in August 1766, when, as a proponent of an Austro-British alliance, he opposed Pitt's plan to ally with Prussia. His enmity to Pitt was such that in the summer of 1767 he refused office in any government in which Pitt served.

Egmont was a gifted pamphleteer, and his *Faction Detected* (1743) is an elaborate vindication of opposition politics. His seventh son was the prime minister Spencer Perceval.

Egmont, Lamoraal, graaf van (count of): *see* Egmond, Lamoraal, graaf van.

Egmont, Mount, Maori TARANAKI, mountain, west central North Island, New Zealand, on the Taranaki Peninsula. Named after the British earl of Egmont, the symmetrical volcanic cone rises from sea level to 8,260 ft (2,518 m) and has a subsidiary cone, 6,438-ft Fanthams Peak, 1 mi (1½ km) south of the main crater. Both have been dormant since the early 17th century. Streams issuing from the snowfields at the summit have carved deep gorges down the slopes. Dense forests clothe



Part of the ringplain and Mt. Egmont, New Zealand
G.R. Roberts, Nelson, N.Z.

the mountain, giving way to the fertile plain at its base. Mt. Egmont is the youngest and most southerly of a group of volcanoes, including Pouakai and Kaitake, that are within Egmont National Park. The peak was sighted (1770) by the British navigator Capt. James Cook and was first climbed in 1839.

ego, in psychoanalytic theory, that portion of the human personality which is experienced as the "self" or "I" and is in contact with the external world through perception. It is the part which remembers, evaluates, plans, and in other ways is responsive to and acts in the surrounding physical and social world. The ego coexists, in psychoanalytic theory, with the id and superego (*qq.v.*), as one of three agencies proposed by Sigmund Freud in attempting to describe the dynamics of the human mind. Ego (Latin for "I") comprises, in Freud's term, the executive functions of personality; it is the integrator between the outer and inner worlds, as well as between the id and the superego. The ego gives continuity and consistency to behaviour by providing a personal point of reference, which relates the events of the past (retained in memory) and actions of the present and of the future (represented in anticipation and imagination). The ego is not coextensive with either the personality or the body, although body concepts form the core of early experiences of self. The ego, once developed, is capable of change throughout life, particularly under conditions of threat, illness, and changes in life circumstances.

Ego development. The newborn human infant reacts to but cannot control, anticipate, or alter sources of stimulation, whether external or internal. Perception is primitive and diffuse, motor activity gross and uncoordinated, and self-locomotion impossible. Learning is limited to the simplest type of stimulus–response conditioning.

The infantile ego develops in relation to the external world and reflects, as psychoanalysis has emphasized, the helpless and dependent infant's efforts at altering and alleviating painfully intense stimuli. Such a possibility being inconceivable, mechanisms evolve for controlling tension while seeking means by which gratifications can be obtained, and these mechanisms in time develop into increasingly complex forms of mastery.

At the outset, perception and motor activity are closely tied. Immediately on stimulation there is motor discharge. To delay action, while tolerating the consequent tension, is the basis for all more advanced ego functions and is prototypic of the ego's role in later personality functioning. The learned separation of stimulation and response allows the interposition of more complex intellectual activities such as thinking, imagining, and planning. Instead of reacting directly, the ego has the capacity to test reality vicariously, to fantasize the consequences of one or another course of action, and to decide upon future directions to achieve its ends. The accumulation and retention of memories of past events is necessary for internal processes of thought and judgment. The acquisition of language, started during the second and third years, provides a powerful tool for the development of logical thought processes as well as allowing communication and control of the environment.

As the individual continues to develop, the ego is further differentiated and the superego develops. The superego represents the inhibitions of instinct and the control of impulses through the incorporation of parental and societal standards. Thus, moral standards as perceived by the ego become part of the personality. Conflict, a necessary ingredient for the growth and maturity of the personality, is introduced. The ego comes to mediate between the superego and the id (agency of primitive drives) by building up what have been called defense mechanisms (*see* defense mechanism).

Since the concept and structure of the ego were defined by Freud and explored by Jung, other theorists have developed somewhat different conceptualizations of the ego.

Ego strength. Progress from immediate to directed behaviour, from pre-logical to rational thinking, is slow and moves through a number of intermediate stages during childhood. Even in physical maturity, persons differ considerably in the forms and effectiveness of ego functioning. An important dimension has been characterized as ego strength. The person of strong ego has the following characteristics: he is objective in his apprehension of the external world and in self-knowledge (insight); his activity is organized over longer time spans and he is thus able to maintain schedules and plans; he can follow resolves, and choose decisively among alternatives; he is not overwhelmed by his drives and can direct them into socially useful channels; he can resist immediate environmental and social pressure while contemplating and choosing a self-selected course. On the other hand, the ego-weak person is more like the child: behaviour is impulsive and immediate; perception of reality and self is distorted; he is less capable of productive work because his energy is drained into the protection of warped and unrealistic self-concepts; he may be burdened by neurotic symptoms. *See also* psychoanalysis.

ego, transcendental (philosophy): *see* transcendental ego.

egoism (from Latin *ego*, "I"), in philosophy, an ethical theory holding that the good is based on the pursuit of self-interest. The word is sometimes misused for egotism, the overstressing of one's own worth.

Egoist doctrines are less concerned with the philosophic problem of what is the self than with the common notions of a person and his concerns. They see perfection sought through the furthering of a man's own welfare and profit—allowing, however, that sometimes he may not know where these lie and must be brought to recognize them.

Many ethical theories have an egoist bias. The hedonism of the ancient Greeks bids each man to seek his own greatest happiness; in the 17th century, Thomas Hobbes, a Materialist, and Benedict de Spinoza, a Rationalist, held in different ways that self-preservation is the good; and those who stress the tending of one's own conscience and moral growth are likewise egoists in this sense. In contrast with such views is an ethics that is governed more by man's social aspects, which stresses the importance of the community rather than that of the individual. Under this head come such theories as Stoic cosmopolitanism, tribal soli-

darity, and utilitarianism, which are all forms of what the positivist Auguste Comte called altruism. The distinction, however, cannot always be neatly drawn.

Egorevsk (Russian S.F.S.R.): *see* Yegoryevsk.

egret, any member of several species of herons (family Ardeidae, order Ciconiiformes), especially members of the genus *Egretta*. Most egrets have white plumage and develop long ornamental nuptial plumes for the breeding season. Their habits are generally like those

Common egret (*Egretta alba*)

R.F. Head from The National Audubon Society Collection/Photo Researchers—EB Inc.

of other herons, but some perform elaborate mating displays involving the plumes. The name egret, or aigrette, is also used to refer to these plumes; they are highly prized as ornaments in Oriental ceremonial dress and were formerly used in the Western millinery trade. The high prices paid for the plumes, along with the vulnerability of the birds, who nest in large breeding colonies, resulted in the near extinction of egrets because of unscrupulous hunters. Changes in fashion and strict conservation measures have since allowed their numbers to increase.

Egrets typically frequent marshes, lakes, humid forests, and other wetland environments. They are wading birds and catch small fishes, amphibians, reptiles, mammals, and crustaceans in shallow waters. They build large, untidy nests in trees and bushes or on the ground.

The great white egret, *Egretta* (sometimes *Casmerodius*) *alba,* of both hemispheres, is about 90 cm (35 inches) long and bears plumes only on the back. The American populations of this bird are sometimes called American, or common, egrets.

The cattle egret, *Bubulcus* (sometimes *Ardeola*) *ibis,* spends much of its time on land and associates with domestic and wild grazing animals, feeding on insects that they stir up and sometimes removing ticks from their hides. It is a compactly built heron, 50 cm (20 inches) long, white with yellowish legs and bill and short, fluffy nuptial plumes. It has extended its range from Europe, Africa, and Asia to Australia and the Americas.

The little egret (*E. garzetta*), of the Old World, about 55 cm (22 inches) long, is white with firm plumes on the head and lacy plumes on the back.

The reddish egret, *Hydranassa* (or *Dichromanassa*) *rufescens,* of warm coastal regions of North America, has two colour phases: white and dark. The snowy egret, *E.* (or *Leucophoyx*) *thula,* ranging from the United States to Chile and Argentina, is white, about 60 cm (24 inches) long, with filmy recurved plumes on the back and head.

Eguren, José María (b. July 7, 1874, Lima, Peru—d. April 19, 1942, Lima), poet considered one of the leading post-Modernist poets of Peru.

His first book of poetry, *Simbólicas* (1911; "Symbolisms"), signaled a break with the Modernismo tradition, while still maintaining contacts with the Romantic and early French Symbolist poets who had influenced the Modernist movement. Eguren's often fantastic creations reflect his desire to escape to an imagined medieval world of adventure peopled with knights and princesses. The language of these poems is musical and highly pictorial. His second book, *La canción de las figuras* (1916; "The Ballad of the Figures"), highly personal and hermetic poems, continues in the same tradition.

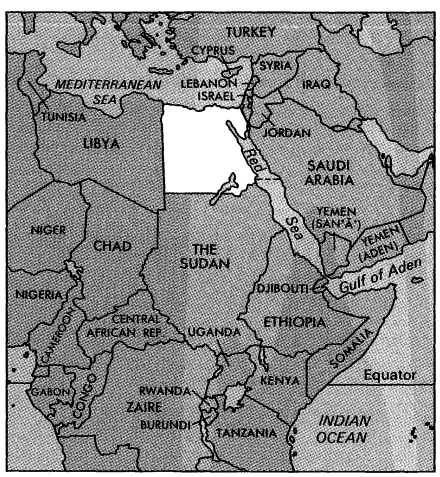
With the appearance of César Vallejo's *Trilce* (1922), poets like Eguren, who wrote isolated in their ivory towers, were censured by the left for not being in tune with the pressing social problems of the day. The communist editor José Carlos Mariátegui, who published a collection of Eguren's poems, *Poesías* (1929; "Poetry"), admired his technical mastery but considered him out of touch with reality. After 1929 Eguren wrote mostly prose criticism, collected in *Motivos estéticos* (1959; "Aesthetic Motifs").

Egwanga (Nigeria): *see* Ikot Abasi.

Egypt, officially ARAB REPUBLIC OF EGYPT, Arabic MIṢR, or JUMHŪRĪYAT MIṢR AL-ʿARABĪYAH, country located in the northeastern corner of Africa, covering an area of 385,229 square miles (997,739 square km). The capital is Cairo. Egypt extends about 655 miles (1,055 km) from north to south and about 780 miles (1,250 km) from east to west at the country's widest extent along its southern boundary. Egypt is bordered on the east by Israel, the Gulf of Aqaba, and the Red Sea; on the south by The Sudan; on the west by Libya; and on the north by the Mediterranean Sea. The population in 1990 was estimated to be 53,170,000.

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

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.



Egypt

The land. Egypt is divided into two unequal, extremely arid regions by the landscape's dominant feature, the northward-flowing Nile River. The larger of the desert areas, the Western Desert, is a low-lying plateau without wadis (often-dry riverbeds, or arroyos); the smaller Eastern Desert is a limestone and sandstone plateau area that is extensively dissected by wadis and fringed by rugged mountains in the southeast. The Sinai, northeast of the Eastern Desert, is a peninsula similarly marked by wadis. The mountains in the south of the Sinai, containing the country's highest peak, Mount Catherine (Jabal Kātrīnā), rise to 8,668 feet (2,642 m). The Red Sea Hills, in the Eastern Desert, have a number of peaks exceeding 6,000 feet (1,800 m) above sea level.

The Nile River has no significant tributaries in Egypt and forms a flat-bottomed valley, generally 5 to 10 miles (8 to 16 km) wide, that is bordered by precipitous scarps until it fans out into the delta lowlands north of Cairo. The Nile delta, which is 100 miles (160 km) long and 150 miles (240 km) wide, is densely populated and perennially irrigated. Natural vegetation varies throughout the country. The arid Western Desert is generally devoid of life, but, where moisture is available at all, desert perennials and grasses do grow. The Eastern Desert, which is less arid than the Western, receives sporadic rainfall and supports some vegetation, including tamarisk and acacia and a great variety of thorny shrubs, small succulents, and aromatic herbs. The Nile valley and delta—and scattered oases—support all of Egypt's agriculture and are home to more than 99 percent of its population.

Egypt's climate consists of only two seasons, with winter lasting from November to March and summer from May to September. The winters are cool and mild (mean January minima and maxima vary between 51° F [11° C] and 65° F [18° C] at Alexandria), and the summers are generally hot (Cairo's July temperature averages 85° F [29° C]). Annual rainfall varies from about 7 inches (175 mm) at Alexandria to about 1 inch (25 mm) at Cairo and only about 0.1 inch (2.5 mm) near Aswān in southern Egypt. The Red Sea coastal plain is almost rainless. Egypt's modest mineral reserves include iron ore, petroleum, natural gas, gypsum, and phosphates.

The people. The population of Egypt forms a fairly homogeneous group whose dominant physical characteristics are the result of the admixture of Hamitic and Semitic peoples. The inhabitants of the Nile delta have had greater contact with the rest of the Middle East and Europe than have the inhabitants of Upper Egypt (*i.e.,* southern Egypt, which lies along the "upper" course of the Nile), who are generally more conservative. Minority groups include the Nubians, in the southern part of the Nile valley; the Hamitic Beja, in the southern part of the Eastern Desert; and peoples of mixed Arab and Berber stock, in the Western Desert. The European communities in Cairo and Alexandria are not numerically significant.

For almost 13 centuries, Arabic has been the written and spoken language of Egypt. Before the Arab invasion in AD 639, Coptic, which descended directly from the ancient Egyptian language, was the language of both religious and daily life. By the 12th century, however, it had been almost entirely replaced by Arabic, Coptic continuing only as a liturgical language in the Coptic church.

Islām is the official religion of Egypt, and about nine-tenths of the population is Muslim, nearly all of whom are Sunnites. Most of the Christian minority are Copts.

The Egyptian birth and death rates are about average for North Africa. The annual rate of population increase is relatively high by world standards, and the infant mortality rate is also high. Two-fifths of the population is less than 15 years old. Priority is given to providing and upgrading health services for mothers and children, especially for children of school age,

in order to reduce the high infant and child mortality rates. Immigration and emigration traditionally have been very slight. There has, however, been an increase in the number of persons emigrating or seeking temporary employment abroad.

The population is concentrated largely in the highly fertile Nile delta (Lower Egypt), where, including the urban *muḥāfaẓah* of Cairo, more than half of the total population lives. Half of all Egyptians, however, still live in rural areas. There has been a steady increase in urbanization during the 20th century. Part of the apparent increase, though, is due to administrative changes designating some villages as urban units or towns, even though they retain much of their rural character.

The economy. Egypt has a developing, mainly socialist but partly free-enterprise economy. Although the gross national product (GNP) is increasing more rapidly than the population, the GNP per capita remains relatively low in comparison with other countries. The GNP originates primarily from industry (including petroleum production), followed by agriculture, public administration and defense, and trade and finance.

Agriculture accounts for about 12 percent of the GNP but employs more than 40 percent of the labour force. Arable land in Egypt is nearly entirely confined to the Nile valley and delta, and irrigation is essential. The Aswān High Dam (completed 1970) has allowed the annual Nile flood to be totally controlled for the first time in history. Cash crops occupy about three-fourths of the arable land; sugarcane, tomatoes, cotton, watermelons, oranges, onions, and potatoes yield the largest harvests. Domestic food crops include corn (maize), rice, wheat, millet, pumpkins and squashes, and especially dates. Because of the rapidly growing population and the amount of land devoted to cash crops, more than one-half of the country's food must be imported.

Although there is no pastureland, livestock are kept on farms and in villages. Commonly found animals include water buffalo, cattle, asses, sheep, and goats. Chickens, ducks, and pigeons are raised, and milk is obtained from both the water buffalo and dairy cows, which are also used in rural areas as draught animals; asses are used widely for transport.

Fishing is well-developed; the total catch is about four-fifths freshwater and the rest marine. Mediterranean coastal fishing has declined, because the Aswān High Dam has cut off river-borne nutrients; but Lake Nasser, behind the Aswān High Dam, has been stocked with fish.

The mineral industry, dominated by petroleum and natural gas, produces about 14 percent of the GNP, although it employs only 0.3 percent of the labour force.

Manufacturing employs 15 percent of the labour force and produces about 11 percent of the GNP. The principal products are refined petroleum products, cement, cotton and woolen textiles and clothing, and wheat flour.

Ancient and medieval monuments, a mild winter climate, and beaches and resorts along the Mediterranean coast all attract tourists.

About 70 percent of Egypt's industry is nationalized. The government manages the economy through five-year plans and encourages free enterprise and foreign investment. As the Suez Canal resumed operations (in 1975) and petroleum and natural gas came into production, the economy improved. Foreign investments began to aid development projects. Inflation, however, remained high into the 1980s.

The labour force totals about one-fourth of the population; trade unions are legal. Because of high population growth, Egypt has continued to suffer from underemployment.

The national budgetary revenue is primarily derived from taxes. Expenditures traditionally have exceeded the national revenue.

The railway network is operated by Egyptian Railways, a state-owned company. Less than one-half of the road network is paved. There are more than 2,000 miles (3,200 km) of inland waterways, all but the more than 100-mile- (160-kilometre-) long Suez Canal being on the Nile. Some 20,000 vessels annually transit the canal. Government-owned Egypt Air provides international and domestic service.

Egypt's exports consist primarily of crude petroleum and refined products (more than half of the total) and cotton-textile products and fibre. The leading importer of Egyptian products is Italy. The value of imports is about three times that of exports. Principal imports are foodstuffs (about one-fourth of the total) and machinery and electrical equipment (an additional fourth), followed by cereals, transport equipment, and chemical products. The major sources of imports are the United States, Germany, and Italy. Remittances from Egyptian workers abroad help reduce the large trade deficit.

Government and social conditions. A strong executive dominates the Egyptian political system. The president is nominated by the national legislature and elected to a six-year term (renewable) by national referendum. He serves as the head of state and the supreme commander of the armed forces; he also appoints the vice president, the prime minister, the Cabinet, and 10 members of the 458-member unicameral legislature, the People's Assembly. The assembly, whose primary responsibilities are reviewing and approving governmental policy, is elected to five-year terms by popular vote. Egypt has a limited multiparty system; the government party, the National Democratic Party, encourages the existence of loyal opposition parties but prohibits communists and Islāmic fundamentalists from organizing into political groups and competing for political power. Egypt's constitution, adopted in 1971, vests highest judicial authority in the Supreme Constitutional Court.

The social-welfare system covers most employed persons and provides benefits for work injury, unemployment, old age, death, maternity, disability, and sickness. The system also operates a large network of facilities that offer free health care. Despite these programs, Egypt continues to be plagued with such health problems as poor sanitary conditions, inadequate nutrition, chronic debilitating diseases, and a shortage of medical personnel in rural areas. These problems have kept life-expectancy rates low, at only 59 years for men and 62 years for women.

There are three stages of state general education in Egypt—primary (six years), preparatory (three years), and secondary (three years). Primary education between the ages of 6 and 12 is compulsory. Pupils who are successful in examinations have the opportunity to continue their education. Alongside the government's system of general education there is that provided by Muslim institutes. Al-Azhar University (founded in 970) is a principal centre of Islāmic and Arabic learning in the world. In spite of an advance in the provision of education services, Egypt's illiteracy rate still stands as high as 40 percent of the population over age 15.

The press in Egypt has been relatively free to critically discuss political and economic issues since censorship was lifted in 1973. The broadcast media are operated by the government.

Although its sociocultural tradition is unquestionably Arabic and Islāmic, Egyptian culture is cosmopolitan in certain respects and betrays much Western influence. The impact of the West is one of the recurring themes in the modern Egyptian novel, as in Tawfiq al-Hakīm's *ʿUsfūr min ash-Sharq* ("The Bird from the East") and Yaḥyā Ḥaqqī's novella *Quindīl Umm Hāshim* ("The Lamp of Umm Hāshim"). The modern theatre in Egypt is a European importation. Two dramatists, both born at the turn of the century, have dominated its development—Maḥmūd Taymūr and Tawfīq al-Ḥakīm. Popular Egyptian music consists of a blend of classical Arabic music, folk songs, and Western music. Muḥammad ʿAbd al-Wahhāb has been one of the leading figures in the development of this genre, as both composer and singer. Umm Kulthūm was the leading vocalist not only of Egypt but also of the whole Arab world for almost 50 years.

History. Egypt is one of the world's oldest continuous civilizations. Sometime about 2925 BC, Upper and Lower Egypt were united, perhaps by a king named Menes. This unification ushered in an efflorescence of cultural achievement and began an almost unbroken line of native rulers that lasted nearly 3,000 years. Historians divide the ancient history of Egypt into Old, Middle, and New kingdoms, spanning 31 dynasties and lasting to 332 BC. The Pyramids date from the Old Kingdom; the cult of Osiris and the refinement of sculpture, from the Middle Kingdom; the era of empire and the Exodus of the Jews, from the New Kingdom. (*See also* Egyptian art; Egyptian religion; Egyptian law.)

An Assyrian invasion occurred in the 7th century, and the Persian Achaemenids established a dynasty in 525 BC. The invasion by Alexander III the Great in 332 inaugurated the Macedonian Ptolemaic period, during which the rulers of Egypt remained firmly planted in the Hellenic world. The city of Alexandria, founded by Alexander, developed into a centre not only of Hellenism but of Semitic learning as well and was soon a focal point of the highest developments of Greek scholarship and science.

The Romans held Egypt from 30 BC to AD 395; after the latter date it was administratively placed under the control of Constantinople, the capital of the East Roman (later, Byzantine) Empire. The granting of tolerance in 313 to the Christians by the emperor Constantine the Great gave impetus to the development of a formal Egyptian church. Alexandria was the scene of the labours of such early Christian figures as Arius, Athanasius, Origen, and Clement. The Byzantine Empire's control of Egypt came to an end in 642, when Byzantine forces evacuated Egypt after three years' armed conflict with invading Arabs. Within a few hundred years, Egypt was transformed into an Arabic-speaking state, with Islām as the dominant religion. Egypt was part of the Umayyad and ʿAbbāsid caliphates. It later became the centre of the Fāṭimid caliphate, in 969, and achieved a significant degree of independence and importance. In 1171 it was returned to the ʿAbbāsids.

The collapse of the ʿAbbāsid caliphate brought the Mamlūks into ascendancy in 1250. The Mamlūks were slaves of non-Arab and non-Muslim origin who were used to augment the armies of the Arab world. They established a dynasty in Egypt that lasted until 1517 and made Egypt the centre of the eastern Arabic-speaking zone of the Muslim world. By this time, the Arabization of Egypt was almost complete.

In 1517 Egypt fell to the Ottoman Turks, and the country reverted to the status of a province governed from Istanbul (old Constantinople). The economic decline that began under the late Mamlūks continued, and with it came a decline in Egyptian culture.

A French invasion in 1798 lasted only a few years but brought Egypt into the world of European politics. After the departure of the French, the government passed into the hands of Muḥammad ʿAlī, probably an Albanian, who created a dynasty and an empire nom-

inally under Ottoman control. His accumulation of wealth and his expansionist policies and those of his successors left Egypt in debt to the British, who occupied the country in 1882 during a period of civil unrest.

Egypt became a British protectorate in 1914 and received nominal independence in 1922, when a constitutional monarchy was established. A coup overthrew the monarchy in 1952, and Gamal Abdel Nasser emerged as the first native Egyptian ruler in more than 2,000 years. He nationalized the Suez Canal, briefly attempted a federation with Syria and Yemen, built the Aswān High Dam, and waged two unsuccessful wars with Israel (1956, 1967). His successor, Anwar el-Sādāt, attempted to reverse some of Nasser's more socialistic policies, also lost a war against Israel (1973), and ultimately played a leading role in Middle East peace talks, until his assassination by Muslim fundamentalists in October 1981. He was succeeded by his vice president, Hosnī Mubārak, who followed the peace initiatives of Sādāt; in 1982 Egypt regained sovereignty (lost in 1967) over the Sinai Peninsula.

Consult the INDEX *first*

Egyptian art, the ancient architectural monuments, sculptures, paintings, and decorative crafts produced mainly during the dynastic periods of the first three millennia BC in the Nile valley regions of Egypt and Nubia. The course of art in Egypt paralleled to a large extent the country's political history, but it depended as well on the entrenched Egyptian social system. A hierarchical class structure, sustained by official religion, demanded obedience to authoritarian laws and adherence to obligatory ethics. Egyptian art, perhaps more than any other art, served those in power as a forceful propaganda instrument that perpetuated the existing framework of society.

A brief treatment of ancient Egyptian art follows. For full treatment, see MACROPAEDIA: Egyptian Arts and Architecture, Ancient.

Ancient Egyptian art reflected the culture's religious beliefs and grew from the conviction that life on earth is merely a brief interlude compared with the eternal life to come. Persons of all classes collected useful and decorative objects to accompany them in the afterlife, and they lavished as much care on their burial sites as means permitted. Consequently, a large portion of the artworks that have survived are associated with ancient tombs.

Archaeological excavations have turned up artistic remains from Predynastic Egypt (to *c.* 2925 BC) including rock carvings, decorated vases, terra-cotta figurines, and toilet articles. Wood was scarce, and buildings were constructed of Nile mud and reeds until builders learned how to make sun-dried bricks. The best-known object from the Early Dynastic Period (*c.* 2925–*c.* 2575 BC) is the "Palette of Narmer," a carved slate object that depicts King Narmer defeating his enemies and symbolizes the unification of Upper and Lower Egypt. In its clarity of individual scenes and glorification of the pharaoh, it marks a style that was to persist over the long course of Egyptian art.

During the period of the Old Kingdom (*c.* 2575–*c.* 2130 BC), stone began to be used for monumental construction. Great pyramids were built to contain the burial chamber of the ruler and were surrounded by an architectural complex of tombs and temples. The so-called step pyramid at Saqqarah is the earliest-known pyramid. The famous monuments at Giza represent the most classic form of pyramid construction. Nobles were buried in rectangular structures called mastabas close to the king's pyramid, and the Great Sphinx, carved in the form of a lion with the ruler's head, lies near the pyramid of Khafre. Temples were built for worship of the dead pharaohs and the various Egyptian gods. Within the tombs furniture, jewelry, and other crafted objects have been preserved through the ages.

The stone tombs and temples of the Old Kingdom were decorated with brightly painted reliefs illustrating with vigour and realism the daily life of the Egyptian people. Large and small statues carved in wood or stone presented convincing portraits of the deceased. During this period, rules for depicting the human figure were established, specifying correct proportions, postures, and placement of details. Rulers and officials were always portrayed in certain dignified postures befitting their status. Servants and labourers, shown performing their various tasks, were represented in a freer manner. This canon of sculpture lent a continuity of style and a high standard of workmanship.

At the end of the Old Kingdom civil war and general economic depression made elaborate tomb building impossible, and artistic quality declined. A revival in the arts accompanied the more stable political climate of the Middle Kingdom (1938–*c.* 1600? BC). Particularly notable were the portrait sculptures of the kings, with faces that displayed feelings of worry or pessimism in contrast to the majestic serenity of Old Kingdom figures. The royal funerary pyramids and temples, built near the Fayyūm oasis, were smaller during this time and were mainly of dried brick with a stone facing. Relief sculpture and painting, however, attained a high level of artistry and precision of execution.

After another interval of political turmoil, the prosperous New Kingdom (1539–1075 BC) brought a magnificent flowering of the arts. Temples, chapels, rock-cut tombs, and inscribed stones were erected along the entire length of the Nile valley in Egypt and Nubia. Great granite statues and wall reliefs glorified rulers and gods. Painting became an independent art, and the decorative crafts reached new peaks. The treasures found in the tomb of King Tutankhamen typify the variety of luxury articles created for both royalty and persons of lesser rank.

During the 18th dynasty particularly, painting and sculpture displayed elegance and refinement, following the classical canon of representation a bit more freely. Human figures were light and graceful, and details were precisely rendered. A brief revolutionary episode, the Amarna style, accompanied the reign of King Akhenaton (Amenhotep IV). Complete freedom of expression was allowed, and members of the royal family were depicted with unblinking realism in their informal daily activities.

The most notable architectural works of the New Kingdom were the great stone temples for worship of the gods. In both their interior layout and their monumental size, they attested to the rising power of the priesthood. A typical structure might include a massive gateway, a colonnaded courtyard, a hall of columns, a shrine chamber, and one or more chapels. The innermost regions were accessible only to the pharaoh and the high priest. The design of columns and capitals was based on plants, such as the palm and papyrus, and plant motifs embellished the walls. Huge statues of gods and rulers served to inspire awe and dread. Burial at this time took place in tombs cut into the rock face of desert cliffs. New Kingdom rulers built elaborate complexes of tombs and mortuary temples in the Valley of the Tombs of the Kings at Thebes. Imposing temple remains can be seen today at Luxor, Karnak, Abydos, Tell el-Amarna, and Abu Simbel.

In the late centuries BC and early centuries AD, Greece and Rome dominated the Mediterranean world, and in Nubia their artistic traditions were fused with those of Roman Egypt. A distinctively Egyptian contribution to art, however, was made by the coffin portraits of Roman Egypt (30 BC–AD 642), which marked the emergence of a new painting style that was to culminate in Byzantine icons.

Egyptian calendar, dating system established several thousand years before the Christian era, the first calendar known to use a year of 365 days, approximately equal to the solar year, or year of the seasons. Until the creation of the Julian calendar, about 46 BC, the Egyptian was also the only civil calendar in which years and months were of fixed duration rather than being established by ad hoc proclamations. Twelve months of 30 days each plus 5 additional days, belonging to no month and grouped at the end of the year, made up the year. The months were numbered within the year but were not named until the 6th century BC, when they came to be called after their various festivals.

Egyptian language, extinct language of the Nile valley. Egyptian belongs to the Hamito-Semitic language family, along with the Semitic, Cushitic, Chadic, and Berber language groups. On the basis of texts in the language, scholars generally divide the history of Egyptian language into five periods: Old Egyptian (from before 3000 to *c.* 2200 BC), Middle Egyptian (*c.* 2200–*c.* 1600 BC), Late Egyptian (*c.* 1550–*c.* 700 BC), Demotic (*c.* 700 BC–*c.* AD 400), and Coptic (*c.* 2nd century AD until at least the 17th century).

The main sources for knowledge of Old Egyptian are the biographical texts (beginning at the end of the 3rd dynasty, *c.* 2575 BC), the royal decrees of the 4th to 6th dynasties (*c.* 2575–*c.* 2150 BC), and the pyramid texts, which were magic spells for the well-being of the king's soul after death, from the 5th and 6th dynasties (*c.* 2465–*c.* 2150 BC). Some passages of the pyramid texts are believed to have been composed before the 1st dynasty (*c.* 2925–*c.* 2775 BC).

Scholars consider Middle Egyptian to be the classical stage of the language. The literary language was based on the spoken language of about 2200 BC. Although the Late Egyptian written language replaced Middle Egyptian as the official language during the reign of Akhenaton (1353–36 BC), Middle Egyptian continued to be used for most monumental inscriptions and for some literary compositions into Christian times. The hieroglyphic text of the Rosetta Stone, which dates from about 196 BC, was an attempt to write the classical language.

Late Egyptian texts are mainly manuscripts, although a small number of inscriptions also exist. There are several important differences between Late Egyptian and earlier stages of the language. Among these are the use of definite and indefinite articles and the occurrence of a number of phonetic changes.

Demotic was the language in use throughout the periods of Persian, Greek, and Roman dominance. Many Demotic texts are legal documents, although literary and religious texts also exist. The middle section of the Rosetta Stone is a good example of demotic script. There are also a few demotic inscriptions written in hieroglyphs. The latest demotic inscriptions date from the end of the 5th century AD; they are from the Temple of Isis on the island of Philae (in Egypt), where worship of the goddess was permitted to continue until the time of the emperor Justinian I (reigned from 527 to 565).

With the change from paganism to Christianity, Coptic, used primarily for Christian religious writings, completely replaced Demotic. It differs from Demotic chiefly in substituting Greek religious terms and expressions for the native pagan terms. Coptic is the only stage of the Egyptian language in which the spellings of words give a clear idea of their pronuncia-

tions. The latest Coptic writing dates from the 14th century.

Egyptian was originally written in hieroglyphs. Monumental hieroglyphic was used from about 3000 BC until the 3rd century AD. Written hieroglyphs developed into two scripts, hieratic and demotic. The earliest hieratic writing dates from the 1st dynasty (*c.* 2925–*c.* 2775 BC). The demotic script was used for writing the language during its Demotic stage; after the 26th dynasty (664–525 BC), the use of hieratic was largely confined to copying religious and other traditional texts on papyrus, while the demotic script was used for all other purposes. Coptic was written in a Greek alphabet modified by the addition of seven characters taken from the demotic script.

In all stages of Egyptian, nouns were classified as being either of masculine or of feminine gender. In earlier stages of Egyptian, verbs were conjugated by the addition of suffixes; by late Egyptian times, however, verbal phrases that included verbal nouns were used instead of suffixes for indicating the different verb forms. *See also* Coptic language.

Egyptian law, the law that originated with the unification of Upper and Lower Egypt under King Menes (*c.* 2925 BC) and grew and developed until the Roman occupation of Egypt (30 BC). The history of Egyptian law is longer than that of any other civilization. Even after the Roman occupation, elements of Egyptian law were retained outside the major urban areas.

No formal Egyptian code of law has been preserved, although several pharaohs, such as Bocchoris (?722–715? BC), were known as lawgivers. After the 7th century BC, however, when the Demotic language (the popular form of the written language) came into use, many legal transactions required written deeds or contracts instead of the traditional oral agreement; and these extant documents have been studied for what they reveal of the law of ancient Egypt.

The ultimate authority in the settlement of disputes was the pharaoh, whose decrees were supreme. Because of the complex nature of legal administration, the pharaoh delegated powers to provincial governors and other officials. Next to the pharaoh, the most powerful individual was the vizier, who directed all administrative branches of the government. He sat in judgment on court cases and appointed magistrates as part of his legal duties.

In a legal proceeding, the plaintiff was required to bring suit. The tribunal then ordered the defendant to appear in court if a point of law seemed to be involved in the dispute. Scribes employed in the legal system supplied procedural information; the parties were not represented by legal advocates. Both parties spoke for themselves and presented any pertinent documentary evidence. Witnesses sometimes were called, but usually the judge ruled on the grounds of the documents and the testimony of each party. The judgment included recommendations for preserving the written record of the trial—possibly the main reason why many of these documents are extant.

Although masculine primogeniture dominated in some periods of Egyptian history, there are records of property being divided equally among the children, male and female. Even with masculine primogeniture, the other children and the surviving spouse usually received a share of the estate. The usual law of succession could be circumvented by a special enregistered document: a parent, for example, could favour a daughter by guaranteeing her rights over the family property. Legal judgments pertaining to the family and rights of succession clearly demonstrate that women as well as men were granted full rights under the laws of ancient Egypt. Women owned and bequeathed property, filed lawsuits, and bore witness in court proceedings without the authority of their father or husband. The working class also had some legal rights; even slaves were allowed to own property under certain circumstances.

Property transfers and contractual agreements were conducted as if they were the same type of legal transaction. Rental of slaves, for example, was regarded as a sales agreement. Work was often bartered for various commodities. The individual parties were allowed to determine restrictions and guarantees in their transaction concerning possible defects in the property or service as well as defects in the law.

Criminal justice necessitated a hierarchy in the judicial system, depending on the severity of the charge. The most heinous criminals could be judged only by the pharaoh, often with the vizier conducting the investigation and turning to the pharaoh for final judgment. In some cases, the pharaoh appointed a special commission with full authority to pass judgment. Punishment for serious crimes included penal servitude and execution; mutilation and flogging were often used to punish lesser offenders.

Although punishment for criminal offenders could be severe—and, in the modern viewpoint, barbaric—Egyptian law nevertheless was admirable in its support of basic human rights. The pharaoh Bocchoris, for example, promoted individual rights, suppressed imprisonment for debt, and reformed laws relating to the transferral of property. His legal innovations are one example of the far-reaching implications of Egyptian law: the Greek lawgiver Solon (6th century BC) visited Egypt and adapted aspects of the legal system to his own ideas for Athens. Egyptian law continued to influence Greek law during the Hellenistic period, and its effects on Roman imperial law may still be felt today.

Egyptian Museum, Arabic AL-MAṬḤIF AL-MIṢRĪ, museum of Egyptian antiquities in Cairo, founded in the 19th century by the French Egyptologist Auguste Mariette and housing the world's most valuable collection of its kind. The museum was founded in 1858 at Būlāq, moved to Giza, and moved to its present site in 1897–1902. It is unique in its presentation of the whole history of Egyptian civilization, especially of antiquities of the Pharaonic and Greco-Roman periods. The more than 100,000 items in the museum include some 1,700 items from the tomb of Tutankhamen, including the solid-gold mask that covered the pharaoh's head. Other treasures include reliefs, sarcophaguses, papyri, funerary art and the contents of various tombs (including that of Queen Hetepheres), jewelry, ornaments of all kinds, and other objects. There is a block statue of Queen Hetepheres, one of the earliest examples of its type, and also a black granite sculpture of Queen Nefertiti. A sculpture of Amenhotep II shows him as the god Tenen, and there are also two granite figures of Queen Hatshepsut and colossal figures of Amenhotep IV from Karnak.

Egyptian religion, religion of ancient Egypt from the Late Neolithic period to the first centuries AD, including both folk traditions and the court religion.

A brief treatment of Egyptian religion follows. For full treatment, *see* MACROPAEDIA: Middle Eastern Religions, Ancient.

Egyptian religion is characterized by numerous deities having both animal and human forms. This diversity reflects the vast number of local cult centres that sprang up all along the Nile valley prior to political unification (*c.* 2925 BC). Once a central government arose, national deities and cults came into existence as well as the cult of the living king. The king came to be represented by the falcon deity Horus as the son of the gods and as the god-king ruling the universe.

With the advent of national cults a number of theological concepts developed to define the world for the Egyptians. Foremost of these was the concept of *maʿat*. *Maʿat* signified the correct world order as given to man by the gods. This concept included the ideas of truth, justice, and correct social behaviour. The king was the administrator of *maʿat* and is frequently shown presenting *maʿat* to the gods, showing that he has properly maintained Egypt on their behalf.

The Egyptians developed a concept of syncretism to reconcile the divergent and contradictory features of the various local cults. For example, Ptah was the creator god in the Memphite cosmogony, while Atum created the world in the Heliopolitan cosmogony. The Egyptians reconciled these views by associating one deity with another, such that the features of one became part of another. Deities with common features were combined to form composite deities. The sun god Re was frequently associated with many deities because of his universal nature. The Egyptians did not feel that the various features or powers of their gods contradicted each other but felt that they were simply different aspects of that deity. This resulted in male (or female) deities acquiring characteristics of the opposite sex, whereby the deity became self-creating and self-sustaining.

The Egyptians developed a belief in the continuity of life. Life upon earth was only one aspect of a person's existence. Death did not destroy the individual, it merely transformed him into a further facet of the universe. The dead were active agents in the world of the living, and preparations for death were actually preparations for a new life in association with the gods. In the Old Kingdom only the king could be initiated into that spiritual world. As time went on, private individuals, by means of ritual, could achieve the same mystical aspects as the king.

The Egyptians felt that time was cyclical. When the king died, he became Osiris, the dead king and ruler of the netherworld, and his son became the new Horus, administrator of *maʿat*. After a living king had ruled for 30 years, he underwent a series of rituals whereby he ritually died, became the dead Osiris, and was mystically rejuvenated. This was a symbolic rejuvenation for the entire land and perhaps was associated with the yearly inundation of the land by the Nile.

The temple at all periods remained the focus of Egyptian community worship. With time the temples acquired major economic and political roles. By the end of the New Kingdom the temple of Amon-Re at Karnak was the chief political power in all of Upper Egypt. At different periods local temples came to national prominence, such as the temple of Re at Heliopolis during the Old Kingdom and the temple of Neith at Sais during the 26th dynasty. While the king in theory acted as high priest for all the gods, in practice he appointed others to carry on his daily ritual functions.

In the sanctuary of each temple the image of the local deity resided. Only the ritually pure attended to the daily needs of the god. During festivals the god emerged from the temple carried on a sacred bark and could be viewed by the general populace. Private individuals could worship the deities at shrines or chapels in their homes. Most temples had areas at their rear walls where the general public could worship.

On a miniature scale, temples represented the Egyptian cosmos. The sanctuary was normally higher than any other portion of the temple and represented the primordial mound where the universe was created. The ceilings were decorated with the stars and the pillars

were in the forms of lotus and papyrus plants, also symbolic of the primordial marsh at creation. The rituals in the temple reenacted this creation and aided in the rejuvenation of the land.

The majority of archaeological evidence from Egypt comes from the funerary monuments. Beginning with small pits in the predynastic era, they developed into a variety of structures from the small, excavated cave tomb to the massive pyramids at Giza. Each served as the eternal resting place of the soul. In the Old Kingdom the major tombs were congregated near that of the king. Individuals believed that they could achieve safe passage to the netherworld by association with the king. Later, individuals obtained entrance by their own means, usually by elaborate rituals and magic. The Coffin Texts and the Book of the Dead (derived from the royal Pyramid Texts) provided a series of spells to purify the deceased, protect him from evil creatures, and give him the requisite passwords and magical spells to enter the netherworld.

With the advent of periods of political instability, pessimistic trends crept into the Egyptian view of the world and greater emphasis was placed on the importance of the individual cult. Along with the rise of the personal cults, greater evidence of the use of magic is found. The Egyptians began to believe that they could control a portion of their mystical environment. Scarabs, wadjet eyes, and other potent symbols became common by the New Kingdom as means of protection from, and identification with, the gods.

The most significant aspect of all of Egyptian religion was its ability to remain a unifying force for the Egyptian culture, despite the fact that there was often a lack of any systematic grouping of the deities.

Egyptology, the study of pharaonic Egypt, spanning the period *c.* 4500 BC to AD 641. Egyptology began when the scholars accompanying Napoleon Bonaparte's invasion of Egypt (1798–1801) published the *Description de l'Égypte* (1809–28), which made large quantities of source material about ancient Egypt available to European scholars.

Written Egyptian documents date back to *c.* 3350 BC, when the first pharaohs developed the hieroglyphic script in Nubia (southern Upper Egypt). The documents of these kings and their successors and of their subjects, as well as the archaeological material of their culture, well preserved by Egypt's arid climate, provide the source material for Egyptological study.

After the Roman conquest (31 BC) the knowledge of pharaonic Egypt was gradually lost as Hellenism infused Egyptian culture. The temples alone preserved pharaonic religion and the hieroglyphic script. Christianity, introduced by St. Mark in the 1st century, slowly eroded this last bastion of pharaonic culture. By *c.* 250 AD the Greek alphabet with six added letters from the demotic (cursive hieroglyphic script) replaced the hieroglyphic system. The last known hieroglyphs were carved in 394 at Philae, where the worship of Isis survived until *c.* 570. Some observations about pharaonic Egypt had passed into Greco-Roman civilization through such Classical authors as Herodotus and Strabo. The worship of Isis and Osiris had also spread throughout the Roman Empire; and Manetho, an Egyptian priest, had compiled a list of kings for Ptolemy I that preserved the outline of Egyptian history in Greek. These factors helped keep a dim memory of ancient Egypt alive in Europe.

With the Arabic conquest (641) only the Christian Egyptians, the Copts, kept alive the ancient language, written in Greek characters. In Europe, the Coptic texts taken from Egypt during the Renaissance awakened interest in the Egyptian language. Athanasius Kircher, a German Jesuit, published a Coptic grammar (1643), and European travellers to Egypt returned with antiquities and stories of wondrous ruins. The first known scholar to engage in scientific work, the 17th-century English astronomer John Greaves, measured the pyramids of Giza.

In 1799, when a French engineer found the Rosetta Stone, a trilingual stela with Greek, hieroglyphic, and demotic texts, knowledge of Coptic permitted the stone's decipherment, a work completed in 1822 by Jean-François Champollion. He and an Italian scholar, Ippolito Rosellini, led a combined expedition to Egypt in 1828 and published their research in *Monuments de l'Égypte et Nubie.* Karl Richard Lepsius followed with a Prussian expedition (1842–45), and the Englishman Sir John Gardner Wilkinson spent 12 years (1821–33) copying and collecting material in Egypt. Their work made copies of monuments and texts widely available to European scholars. Muhammad 'Alī's government (1805–49) opened Egypt to Europeans and consular agents, and adventurers began to collect antiquities, often in ways that amounted to plunder. From this arose the great European Egyptian museum collections. Auguste Mariette went from the Louvre in 1850 and began excavations at Memphis, where he found the Serapeum. He convinced Sa'īd Pasha, viceroy of Egypt, to found the first Egyptian museum at Būlāq (1858; moved to Cairo 1903) and also to found the Service des Antiquités (1863), whose first director he became. This organization checked the hitherto uncontrolled digging and collection of antiquities.

The researches of Emmanuel de Rougé in France, Samuel Birch in England, and Heinrich Brugsch established Egyptology as an academic discipline. In 1880 Flinders Petrie brought to Egypt his technique of controlled, scientifically recorded excavation, which revolutionized archaeology; he pushed back the origins of Egyptian culture to 4500 BC. The British Egypt Exploration Fund (later Society), founded in 1882, promoted excavations using Petrie's principles, and other professional associations of Egyptologists spread these standards of excavation. Adolf Erman and Hermann Grapow published in Berlin the *Wörterbuch der ägyptischen Sprache,* an exhaustive dictionary of hieroglyphic Egyptian. The Germans Eduard Meyer, Erman, and Kurt Sethe, the English scholars Francis Llewellyn Griffith and Sir Alan H. Gardiner, and the Czech Egyptologist Jaroslav Černý conducted research that shaped the currently accepted outlines of Egyptian history. James Henry Breasted founded the Oriental Institute at the University of Chicago and pioneered American Egyptology with his survey of Egypt and Nubia (1895–96). He started the Epigraphic Survey (1924) to record scientifically and publish reliefs and paintings on standing monuments that are more subject to rapid deterioration. American museums opened Egyptian collections in the late 19th and early 20th centuries, and excavations in Egypt helped enlarge their exhibits. The University of Pennsylvania, the Metropolitan Museum of Art, the Museum of Fine Arts (Boston), the Brooklyn Museum, and the Institute of Fine Arts of New York University all have conducted work in Egypt. The discovery of Tutankhamen's tomb (1922), as well as Pierre Montet's excavations of the intact royal tombs at Tanis, heightened public awareness of Egyptology.

The building of the Aswān dams (1902 and 1970) led to international salvage excavations in Nubia, the results of which have further refined Egyptian history. The worldwide UNESCO-sponsored effort to raise the temples of Nubia and Philae above the waters of Lake Nasser (1960–75) and the Egyptian government-sponsored tours of objects from Tutankhamen's tomb have spurred international interest in Egypt. Expeditions that worked in Nubia gained access to Egyptian sites, especially in the poorly explored Delta. In the 1970s, excavation of ancient Avaris-Per Ramessu (biblical Raamses) and Mendes yielded important evidence.

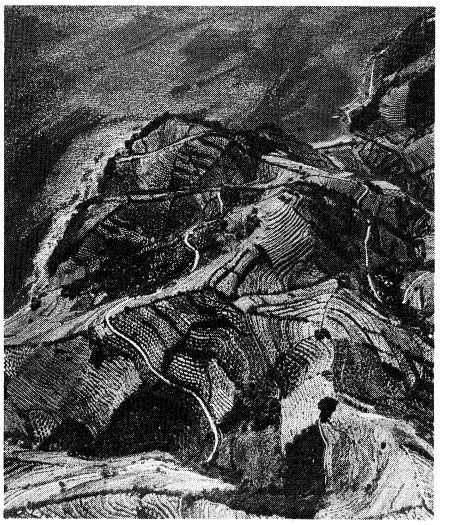
Hans J. Polotsky, an Israeli Egyptologist, made wide advances in understanding of the Egyptian verb system, starting in the 1940s; Janet Johnson-Whitcomb began work on a demotic dictionary in 1978 at the Oriental Institute in Chicago; and in Germany, the *Lexikon der Ägyptologie,* a multivolume encyclopaedia of Egyptology was underway in the 1980s. In the 1970s Egyptologists began cooperative work with specialists from other disciplines. Among the first such ventures was the joint project of the University of Michigan, the Egyptian Department of Antiquities, and the Oriental Institute, involving dentists, geneticists, and Egyptologists in studying the royal mummies in the Cairo Museum, using advanced technology.

In 1976 the First International Congress of Egyptology convened in Cairo; reconvening at three-year intervals it brought closer contacts among scholars from the whole world. Since 1952 Egyptians themselves became more involved in Egyptology. Regional museums opened at Alexandria, Al-Minyā, Mallawī, Luxor, and Aswān, as increasing numbers of tourists visited Egypt. Still, despite 200 years of excavation and research, many little-explored sites remain in Egypt.

Eh–pH diagram, any of a class of diagrams that illustrate the fields of stability of mineral or chemical species in terms of the activity of hydrogen ions (pH) and the activity of electrons (Eh). Consequently, the reactions illustrated on Eh–pH diagrams involve either proton transfer (*e.g.,* hydrolysis) or electron transfer (oxidation or reduction) or both. In natural environments, pH values extend from 1 to 9.5, and Eh values from −500 to +800 millivolts. Rarely are temperatures and pressures other than those normally encountered on the Earth's surface considered.

The area on an Eh–pH diagram that represents the range of these variables within which a particular mineral is stable is called the stability field of that mineral. Such a representation enables a geochemist to determine whether a mineral is in equilibrium with its surroundings or subject to chemical transformation. *See also* geochemical facies.

Ehime, prefecture (*ken*), northwestern Shikoku, Japan, facing the Inland Sea (north) and Bungo-suidō (Bungo Strait; west). It oc-



Terraced farmland near Uwajima, Ehime Prefecture, Japan

Photos Pack—EB Inc.

cupies an area of 2,188 sq mi (5,667 sq km). The interior is mountainous, and most of the population is grouped on the shallow coastal plains. Crops grown on terraced farmland include rice, wheat, tea, soybeans, and mandarin oranges. The cities of Niihama, Saijō, Hashihama, and Imabari are industrial centres. In an effort to counteract air pollution, chemical factories were established in Niihama to produce fertilizer from sulfur dioxide gas emitted from the copper refineries. Fishing and forestry support Uwajima and other west coast cities. The prefectural capital of Matsuyama (*q.v.*) is Shikoku's largest city, and Ehime University (1949) is located there. Pop. (1983 est.) 1,518,000.

Ehlers-Danlos syndrome, rare, heritable disorder characterized by great elasticity of the skin, skin fragility with a tendency to hemorrhage, poor scar formation, and hyperextensibility of the joints ("elastic men"). The skin is velvety and bruises easily, and the ears tend to droop; dislocations of joints are frequent. It is inherited with a varying degree of expression in affected individuals.

Ehlsheimer, Adam (German painter): *see* Elsheimer, Adam.

Ehrenberg, Christian Gottfried (b. April 19, 1795, Delitzsch, Saxony—d. June 27, 1876, Berlin), German biologist, microscopist, scientific explorer, and a founder of micropaleontology—the study of fossil microorganisms.

Ehrenberg studied at the University of Berlin (M.D., 1818) and was associated with the university throughout his career. He took part in a scientific expedition (1820–25) to Egypt, Libya, the Sudan, and the Red Sea under the auspices of the university and the Prussian Academy of Sciences. The expedition's only survivor, he collected about 34,000 animal and 46,000 plant specimens. With Alexander von Humboldt, he participated in 1829 in an expedition, sponsored by Tsar Nicholas I of Russia, to Central Asia and Siberia.

Ehrenberg identified and classified many terrestrial and marine plants, animals, and microorganisms collected on expeditions. He proved that fungi come from spores and demonstrated the sexual reproduction of molds and mushrooms. He was the first to study in detail the anatomy, habits, and life history of coral, and he identified planktonic microorganisms as the cause of phosphorescence in the sea. He discovered the microscopic fossil organism content of various geological formations and noted that certain rock layers are composed of such single-cell fossils.

Ehrenberg advanced the view that all animals, from the most minute to the largest, possess complete organ systems, such as muscles, sex organs, and stomachs; he believed his concept of "complete organisms" (later refuted by Félix Dujardin) disproved both the theory of spontaneous generation and the validity of the traditional arrangement of animals in a simple-to-complex series. Arguing that a single "ideal type" may be applied to all animals, he worked toward a comprehensive system of classification, in which he used social behaviour as an important criterion, but he placed humans apart from other animals on the basis of intelligence.

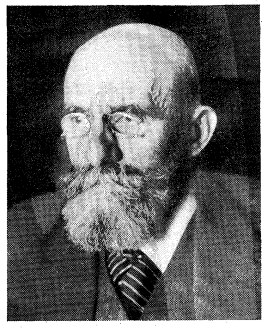
Ehrenberg's most important works include *Reisen in Aegypten, Libyen, Nubien und Dongola* (1828; "Travels in Egypt, Libya, Nubia and Dongola") and *Die Infusionsthierchen als volkommene Organismen* (1838; "The Infusoria as Complete Organisms").

Ehrenburg, Ilya Grigoryevich (b. Jan. 27 [Jan. 15, old style], 1891, Kiev—d. Aug. 31, 1967, Moscow), prolific writer and journalist, one of the most effective Soviet spokesmen to the Western world.

Born into a middle-class Jewish family who later moved to Moscow, Ehrenburg became involved as a youth in revolutionary activity and was arrested in his early teens. He emigrated to Paris, where he began publishing poetry in 1910. During World War I he was a war correspondent at the front, returning to Russia in 1917. He experienced the civil war in the Ukraine and, between 1917 and 1921, wavered between supporting and rejecting the Bolsheviks. He returned to Europe, living in France, Belgium, and Germany and publishing his first novel—generally considered his best work—the philosophical-satirical *Neobychaynyye khozhdeniya Khulio Khurenito i yego uchenikov* (1922; *The Extraordinary Adventures of Julio Jurenito and His Disciples,* 1930). By 1924, however, his attitude had changed again, and he was granted permission to return to the Soviet Union. He participated in writers' meetings and other literary activities in Moscow, and soon afterward was sent back to Europe, this time as foreign editor of several Soviet newspapers. Most of the period 1936–40 Ehrenburg spent in Spain and France as war correspondent for the newspaper *Izvestiya.* In 1941 he returned to the Soviet Union, where his *Padeniye Parizha* (*The Fall of Paris,* 1942)—a bitter attack on the West—was published that year, winning the 1942 Stalin Prize.

Besides his activities as a journalist and novelist, Ehrenburg wrote poetry, short stories, essays, travelogues, and memoirs. After his acceptance of the Soviet regime, he adapted his writing to Soviet literary demands and was successful in avoiding the political purges that destroyed the careers of many other writers and artists. In 1946–47 he won a second Stalin Prize with *Burya* (*The Storm,* 1948), and in 1951–52 another major novel was published, *Devyaty val* (*The Ninth Wave,* 1955). Shortly after Stalin's death Ehrenburg produced the novel, *Ottepel* (1954; *The Thaw,* 1955), which provoked intense controversy in the Soviet press, and the title of which has become descriptive of that period in Soviet literature. It dealt with Soviet life in a more realistic way than had the officially approved literature of the preceding period. In succeeding years he devoted himself to promoting new and different tendencies in writing. In his autobiography, *Goda, lyudi, zhizn* ("Years, People, Life"), Ehrenburg ranged over many topics (*e.g.,* Western art) and people (*e.g.,* writers lost in the purges of the 1930s) normally not considered proper material for Soviet authors. This attitude brought official censure upon him in 1963 when the "thaw" began to reverse. But Ehrenburg survived and remained prominent in Soviet literary circles until his death.

Ehrenfels, Christian, Freiherr von (baron of), in full MARIA CHRISTIAN JULIUS LEOPOLD KARL, FREIHERR VON EHRENFELS (b. June 20, 1859, Rodaun, Austria—d. Sept. 8, 1932, Lichtenau), German philosopher remembered for his introduction of the term *Gestalt* ("figure") into psychology and for his contribution to value theory.



Ehrenfels

By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

As a student at the University of Vienna, Ehrenfels came under the influence of Franz Brentano and Alexius Meinong. Ehrenfels, licensed to teach at Vienna in 1888, moved to Prague in 1896 as extraordinary professor of philosophy at the German university there and served as ordinary professor (1900–29).

Ehrenfels' article "Über Gestaltqualitäten," which appeared in the *Vierteljahrsschrift für wissenschaftliche Philosophie,* xiv (1890; "Quarterly Journal for Scientific Philosophy"), was the starting point of Gestalt psychology. He used the term *Gestalt* to refer to the complex data that require more than immediate sense experience in order to be perceived. For example, an immediate sense experience of sound is insufficient to signify a melody to the hearer. Recollection and sometimes other components are also necessary for apprehension. All the components taken together form a Gestalt, or whole structure. He extended the same principle to logic and number theory.

In his *System der Werttheorie,* 2 vol. (1897–98; "System of Value Theory"), also a pioneer work, Ehrenfels treated the concept of value psychologically, as a function of desire. The value placed by persons on various objects thus became the basis of both his social and his individual ethics. Ehrenfels' other writings include plays, choral dramas, two pamphlets on the composer Richard Wagner (1896 and 1913); *Grundbegriffe der Ethik* (1907; "Foundations of Ethics"); *Sexualethik* (1907; "Sexual Ethics"); *Kosmogonie* (1916); and *Die Religion der Zukunft* (1929; "The Religion of the Future").

Ehringsdorf skull, human fossil remnant, consisting of a fragmented braincase and lower jaws, found in 1925 near Weimar, Ger. The skull was found in association with a temperate forest flora and with elephant, rhinoceros, horse, and cow fossil remains; it has been dated to the last half of the Third Interglacial Period (perhaps 85,000 years ago). In the size of the browridges the Ehringsdorf skull resembles that of Neanderthal man; but with its globular cranium, vertical forehead, and pyramidal mastoid process, it approximates the skull of modern man. The Ehringsdorf skull is usually classified as an early representative of the Neanderthal people, *Homo sapiens neanderthalensis.*

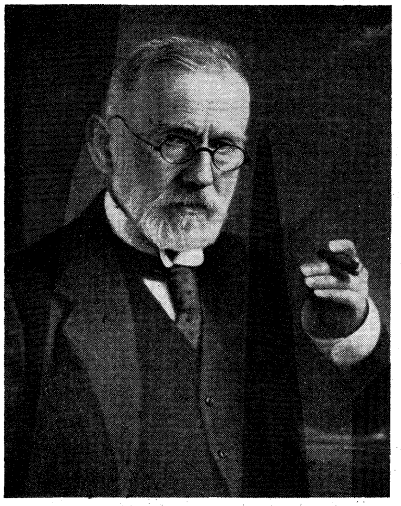
Ehrlich, Eugen (b. Sept. 14, 1862, Czernowitz, Austrian Empire—d. May 2, 1922, Vienna), Austrian legal scholar and teacher generally credited with founding the discipline of the sociology of law.

Educated in law at the University of Vienna, Ehrlich taught there for several years and then (1899–1914) served as associate professor of Roman law at the University of Czernowitz. As a young man he was converted from Judaism to Roman Catholicism, but late in life he devoted much attention to Jewish problems. Anti-Semitism prevented him from teaching after World War I.

Ehrlich's sociology of law was based in part on the free-law or sense-of-justice conception formulated in Germany by Hermann Kantorowicz. He recognized two complementary sources: first, legal history and jurisprudence (*i.e.,* precedents that seem useful and their written explications); and, second, "living law" as shown in current social custom. Because the second component was more novel, readers of Ehrlich tended to overlook the first, and some believed mistakenly that he had dismissed formal law entirely. His major work, *Grundlegung der Soziologie des Rechts* (1913), was translated into English as *Fundamental Principles of the Sociology of Law* (1936).

Ehrlich, Paul (b. March 14, 1854, Strehlen, Silesia, Prussia—d. Aug. 20, 1915, Bad Homburg vor der Höhe, Ger.), German medical

scientist known for his pioneering work in hematology, immunology, and chemotherapy and for his discovery of the first effective treatment for syphilis. He received jointly with Élie Metchnikoff the Nobel Prize for Physiology or Medicine in 1908.



Paul Ehrlich

By courtesy of the Paul Ehrlich Institute, Frankfurt, West Germany

Early life. Ehrlich was born into a Jewish family prominent in business and industry. Although he lacked all formal training in experimental chemistry and applied bacteriology, he did independent work even as a medical student at the University of Leipzig, writing about the distribution of foreign substances in the body and proving, with the aid of early discoveries in colour analysis, that the chemical mechanism that operates in therapeutic and toxic processes also determines cell nutrition. As a result of this work, Ehrlich was invited to do research at the famous Charité Hospital in Berlin, where he invented a new staining technique for the tuberculosis bacillus discovered by the German bacteriologist Robert Koch. This was an advance that proved to be of decisive importance for the microscopic diagnosis of tuberculosis. While developing new methods for the dyeing of live tissue, he discovered the uses of methylene blue in the treatment of nervous disorders. In other diagnostic advances, he traced a specific chemical reaction in the urine of typhoid patients, tested various medications for reducing or removing fever, and made valuable suggestions for the treatment of eye diseases. Of the 37 scientific contributions that he published between 1879 and 1883, Ehrlich considered the last as the most important: "The Requirement of the Organism for Oxygen." In it he established that oxygen consumption varies with different types of tissue and that these variations constitute a measure of the intensity of vital cell processes. In 1883 he married Hedwig Pinkus, with whom he had two daughters.

Immunity and the side-chain theory. A bout with tuberculosis forced Ehrlich to interrupt his work and to seek a cure in Egypt. When he returned to Berlin in 1889, the disease had been permanently arrested. After working for some time in a tiny and primitive private laboratory, he transferred to Koch's Institute for Infectious Diseases, where he concentrated on the problem of immunity. Very little was known at this time about the precise manner in which bacteria bring about disease, and even less was known about the body's defenses and about therapeutic effects. The working hypothesis that Ehrlich developed and by which he proceeded was the side-chain theory, according to which each cell has a vital centre of protein substance and a series of side chains, or receptors, which absorb and assimilate nutrients and certain toxic substances as well. Only if the haptophore group of a toxic molecule combines with the side chain of the cell can a bacterial toxin act upon a cell. The affected organism then produces great quantities of side chains, all of them "gauged" to the disease-producing toxic agent. These immune bodies prevent a renewed infection, so that the organism is actively immunized.

This much-debated hypothesis in all its ramifications was destined to have a profound influence on Ehrlich's later work and on that of his successors. Thus Ehrlich was able to show experimentally that rabbits subjected to a slow and measured increase of toxic matter were able to survive 5,000 times the fatal dose. In the end, he established the precise quantitative patterns of immunity. These findings assumed great importance in 1890, when he met Emil von Behring, who had succeeded in creating an antitoxin against diphtheria. Behring had tried to prepare a serum that could be used in clinical practice, but it was only by adopting Ehrlich's technique of using the blood of live horses that the preparation of a serum of optimum antitoxic effectiveness became possible. Ehrlich developed a way of measuring the effectiveness of serums that was soon adopted all over the world for the standardization of diphtheria serum.

On the basis of these achievements Ehrlich was made director of a government-supported institute in Berlin, which was transferred to Frankfurt am Main in 1899 as the Royal Institute for Experimental Therapy. No restrictions of any kind were placed upon the direction of his research. While this corresponded to Ehrlich's own talents and inclinations, it did not please Behring, who endeavoured to have his colleague specialize in immunology and serum therapy. The strained relationship between the two men was exacerbated by personality differences. Ehrlich, utterly indifferent to monetary rewards, had no ambition to become an industrialist like Behring; he was content to do his research in study and laboratory.

He had by now recognized the limitations of serum therapy. Many infectious disorders, in particular those caused by protozoa rather than bacteria, failed to respond to serum treatment. The recognition of this fact marks the birth of chemotherapy. Ehrlich started experimenting with the identification and synthesizing of substances, not necessarily to be found in nature, that could kill parasites or inhibit their growth without damaging the organism. He began with trypanosomes, a species of protozoa that he unsuccessfully attempted to control by means of coal-tar dyes. There followed compounds of arsenic and benzene; other compounds proved to be too toxic. Instead of declaring himself vanquished by these difficulties, Ehrlich now turned his attention to the spirochete *Treponema pallidum,* the causal organism of syphilis.

Syphilis studies. He had at this time several institutes at his disposal as well as sizable research funds. He also had a staff of highly competent collaborators; in fact, his colleague, Sahachiro Hata, contributed much to Ehrlich's eventual success in combating syphilis. His preparation 606, later called Salvarsan, was extraordinarily effective and harmless despite a large arsenic content. The first tests, undertaken in the spring of 1910, proved to be surprisingly successful in the treatment of a whole spectrum of diseases; in the case of yaws, a tropical disease akin to syphilis, a single injection was sufficient. It seemed, indeed, as if a "magic bullet," to use a favourite expression of Ehrlich's, had been found.

Given the devastation wrought by syphilis, a worldwide demand soon arose for a new weapon against the disease. Ehrlich, however, would not yet release his discovery for general use, believing as he did that the usual few hundred clinical tests did not suffice in the case of an arsenic preparation, the injection of which required special precautions. In an unheard-of transaction, the manufacturer with whom Ehrlich had collaborated closely, Farbwerke-Hoechst, released a total of 65,000 units gratis to physicians all over the globe. Although harmful side effects remained nominal in number, some envious competitors did not hesitate to attack Ehrlich. Eventually he was forced to sue the most slanderous among them, and this detractor was given a jail sentence. The greatest distinction bestowed by the Prussian state was the title, "Wirklicher Geheimer Rat," or Privy Councillor, with the predicate of "Exzellenz." Along with many other honours, Ehrlich was given honorary doctorates by the universities of Oxford, Chicago, and Athens, and an honorary citizenship by Frankfurt am Main, where the institute he founded still bears his name.

Having suffered a first stroke in December 1914, Ehrlich succumbed to a second stroke in August of the following year. In its obituary the London *Times* acknowledged Ehrlich's achievement in opening new doors into the unknown, saying, "the whole world is in his debt." (H.Sa.)

BIBLIOGRAPHY. F. Himmelweit edited Ehrlich's writings in 1956, with a bibliography and four volumes of text in German, English, and French, but this publication does not cover all the posthumous work. There is as yet no comprehensive biography of Ehrlich. See the article by C.H. Browning "Emil Behring and Paul Ehrlich: Their Contributions to Science," *Nature,* 175:570–575, 616–619 (1955); Heinrich Satter, *Paul Ehrlich, Begründer der Chemotherapie* (1962); H. Loewe, *Paul Ehrlich* (1950); and W. Greiling, *Im Banne der Medizin-Paul Ehrlich* (1954).

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

Ehrlichman, John D(aniel) (b. March 20, 1925, Tacoma, Wash., U.S.), U.S. presidential assistant for domestic affairs during the Nixon administration, best known for his participation in the Watergate Scandal.

Ehrlichman grew up in Washington and California and held several jobs before enlisting in the U.S. Army Air Corps in 1943. He was discharged a first lieutenant in 1945. He graduated from the University of California, Los Angeles (UCLA), in 1948, received a law degree from Stanford University (Stanford, Calif.) in 1951, and with associates established a law firm in Seattle.

In 1969 Ehrlichman was appointed Nixon's domestic affairs adviser. With H.R. Haldeman, he formed the so-called palace guard to insulate the President from the public and from other members of the government. The two exercised authority in the President's name and filtered information from all levels of government.

Early in the Nixon administration, Ehrlichman set up a group, known as the "plumbers," to acquire political intelligence and repair "information leaks." In an attempt to obtain damaging information on the supplier of the "Pentagon Papers" to *The New York Times,* the plumbers burglarized the office of Daniel Ellsberg's psychiatrist. Five members of the group were apprehended at the headquarters of the Democratic National Committee in the Watergate complex on June 17, 1972.

Ehrlichman initially counselled a confession of White House involvement, but he later became an active participant in the cover-up. When his complicity became clear, Ehrlichman resigned from the administration in April 1973. He went on trial the following year,

charged with conspiracy, perjury, and obstruction of justice. He was convicted and served 18 months of his 2½- to 5-year sentence before being released in April 1978.

Ehrlichman wrote several books based on his experiences as a presidential aide during the Nixon administration: *The Company* (1976), *The Whole Truth* (1979), and *Witness to Power: The Nixon Years* (1982).

Ehud, also spelled AOD, in the Old Testament (Judges 3:12–4:1), son of Gera, the Benjaminite, Israelite hero who delivered Israel from 18 years of oppression by the Moabites. A left-handed man, Ehud tricked Eglon, king of Moab, and killed him. He then led the tribe of Ephraim to seize the fords of the Jordan, where they killed about 10,000 Moabite soldiers. As a result, Israel enjoyed peace for about 80 years.

E.I. du Pont de Nemours & Company: *see* Du Pont Company.

EIA (animal disease): *see* equine infectious anemia.

Eibar, city, Guipúzcoa province, in the autonomous Basque Country, northern Spain, lying east of Bilbao on the Bilbao–San Sebastián railway. The city was chartered by Alfonso XI of Castile in 1346. Its chief industry since the 16th century has been the manufacture of armaments, particularly finely engraved small arms. Other metallurgical products are sewing machines, auto parts, and surgical instruments. Its armament works made it a target of heavy Nationalist aerial bombardment during the Spanish Civil War of 1936–39. Pop. (1981) 36,494.

Eichelberger, Robert L(awrence) (b. March 9, 1886, Urbana, Ohio, U.S.—d. Sept.

Eichelberger
By courtesy of the U.S. Army

26, 1961, Asheville, N.C.), U.S. Army general who during World War II retrieved strategic Japanese-held islands in the Pacific, thus helping end the war in the Far East.

A 1909 graduate of the U.S. Military Academy at West Point, N.Y., Eichelberger served with the American Expeditionary Force in Siberia (1918–20) and later was superintendent of West Point (1940–42).

Eichelberger first saw action in World War II when he was summoned (December 1942) to revitalize the U.S. front in Buna, on the island of New Guinea. The following month he directed a successful attack on this strongly fortified enemy position—one of the first ground victories against the Japanese in the war. In September 1944 he took command of the newly activated U.S. 8th Army in Netherlands New Guinea. The following months saw him effectively employing amphibious tactics to lead his forces through many severe island engagements, particularly New Guinea and New Britain. In 1945 he launched the Philippines reoccupation campaign, cleaning up Japanese resistance on such strongholds as Mindanao by August. With the total Japanese surrender that month, Eichelberger shortly landed a small detachment at Atsugi Air Field to begin the Allied occupation of Japan. For the next three years he directed all 8th Army military government units throughout that country.

Eichelberger retired in 1948 and published his memoirs, *Our Jungle Road to Tokyo,* in 1950.

Eichendorff, Joseph, Freiherr von (baron of) (b. March 10, 1788, near Ratibor, Prussia—d. Nov. 26, 1857, Neisse), poet and novelist, considered one of the great German Romantic lyricists.

From a family of Silesian nobility, Eichendorff studied law at Heidelberg (1807), where he published his first verse and became acquainted with the circle of Romantics. Continuing his studies in Berlin (1809–10), he met the leaders of the Romantic national movement. When the Prussian war of liberation broke out in 1813, Eichendorff enlisted in the Lützowsche Freikorps and fought against Napoleon.

The French Revolution appears in the novella *Das Schloss Dürande* (1837; "Castle Dürande") and in the epic poem *Robert und Guiscard* (1855). The Napoleonic Wars, which brought about the decline of the Eichendorff family and the loss of the Lubowitz castle, are the sources of nostalgia in his poetry. During these war years he wrote two of his most important prose works: a long Romantic novel, *Ahnung und Gegenwart,* (1819; "Premonition and Present"), which is pervaded by the hopelessness and despair of the political situation and the need for a spiritual, rather than a political, cure for moral ills; and *Novellen des Marmorbilds* (1819; "Novellas of a Marble Statue"), which contains supernatural elements and is described by Eichendorff as a fairy tale. After the war he held posts in the Prussian civil service in Danzig and Königsberg and, after 1831, in Berlin. Eichendorff's poetry of this period (*Gedichte,* 1837), particularly the poems expressing his special sensitivity to nature, gained the popularity of folk songs and inspired such composers as Schumann, Mendelssohn, and Richard Strauss. In 1826 he published his most important prose work, *Aus dem Leben eines Taugenichts* (*Memoirs of a Good-for-Nothing,* 1955), which, with its combination of the dreamlike and the realistic, is considered a high point of Romantic fiction. In 1844 he retired from the civil service to devote himself entirely to his writing, publishing his history of German literature and several translations of Spanish authors.

Eichhorn, Johann Gottfried (b. Oct. 16, 1752, Dörrenzimmern, Württemberg—d. June 27, 1827, Göttingen, Hannover), German biblical scholar and orientalist who taught at Jena and Göttingen, one of the first commentators to make a scientific comparison between the biblical books and other Semitic writings. A pioneer in distinguishing the various documentary and cultural sources of the Old Testament law, traditionally considered a Mosaic composition, he also questioned the Pauline authorship of the New Testament letters to Timothy and Titus, challenged the genuineness of the Second Letter of Peter, and suggested that the four Gospels derived from a single Aramaic text. His chief works included *Historisch-Kritische Einleitung ins Alte Testament* (3 vol., 1780–83; "Historical and Critical Introduction to the Old Testament"), and a corresponding work for the New Testament (5 vol., 1804–12). Although only partially accurate, they stimulated research and criticism in biblical literature.

Eichhorn, engraving by Christian Gottlieb Geyser after a painting by Ernst Gottlob
Archiv fur Kunst und Geschichte, West Berlin

Eichler, August Wilhelm (b. April 22, 1839, Neukirchen, Hesse, Ger.—d. March 2, 1887, Berlin), German botanist who developed one of the first widely used natural systems of plant classification.

Eichler studied mathematics and natural science at the University of Marburg (Ph.D., 1861). He then went to Munich, where he became a private assistant to the naturalist Karl Friedrich Philipp von Martius, with whom he edited *Flora Brasiliensis* (15 vol., "The Flora of Brazil"), the first volume of which had appeared in 1861. After the death of Martius in 1868, Eichler worked on the *Flora* unassisted, issuing 46 of 100 parts. In 1865 he became a lecturer at the University of Munich and, six years later, professor of botany at the Technische Hochschule (Technical University) at Graz. In 1872 he received an appointment at the University of Kiel, where he remained until 1878, when he became director of the herbarium at the University of Berlin. That same year, the second and last volume of his *Blütendiagramme* appeared (first vol., 1875; "Diagrams of Flowers"), his principal contribution to the study of the comparative structure of flowers.

Eichler's system of plant classification, developed in 1886, eventually won worldwide acceptance. He divided the plant kingdom into four divisions: Thallophyta (the algae and fungi), Bryophyta (the liverworts and mosses), Pteridophyta (the club mosses, horsetails, and ferns), and Spermatophyta (the seed plants), the last of which were in turn divided into two major categories: the angiosperms (the flowering plants) and gymnosperms (such as pines, spruces, and firs). Eichler's system was eventually modified into a more natural system of classification.

Eichmann, (Karl) Adolf (b. March 19, 1906, Solingen, Ger.—d. May 31, 1962, Tel Aviv, Israel), German war criminal hanged by the state of Israel for his part in the Nazi extermination of Jews during World War II.

During World War I, Eichmann's family moved from Germany to Linz, Austria, and in April 1932 he joined the then secret Nazi Party there. In November 1932 he became a member of Heinrich Himmler's SS (Schutzstaffel) elite organization and, on leaving Linz in 1933, joined the terrorist school of the "Austrian Legion" at Lechfeld, Bavaria. From January to October 1934 he was attached to an SS unit at Dachau and then was appointed to the SD (Sicherheitsdienst) central office in Berlin, where he was attached to the section that dealt with Jewish affairs. He advanced steadily in the SS hierarchy and, after the annexation of Austria (March 1938), was sent to Vienna with the mission of ridding the city of Jews. One year later, with a similar mission, he was sent to Prague. When in 1939 Himmler formed the Reichssicherheitshauptamt (RSHA), Eichmann was transferred to its Jewish section in Berlin. In January 1942, at Wannsee, near Berlin, a conference of Nazi

high officials was convened to organize schedules and logistics arrangements necessary to implement the "final solution" of the Jewish problem. Eichmann was to coordinate these arrangements; thus, although the fact that the "final solution" was mass execution had not become generally known, Eichmann had in effect been named chief executioner. Thereupon he organized the identification, assembly, and transportation of Jews from all over occupied Europe to their final destinations at Auschwitz and other death camps.

Following the war, Eichmann was captured by U.S. troops, but in 1946 he escaped from the prison camp. After dodging in and out of the Middle East for several years Eichmann finally settled in Argentina in 1958. He was arrested by Israeli secret service agents near Buenos Aires on May 11, 1960; nine days later he was smuggled out of the country and taken to Israel. Following the settlement of the controversy that arose over this Israeli violation of Argentine law, the Israeli government arranged his trial before a special three-judge court in Jerusalem. The trial lasted from April 11 to Dec. 15, 1961, and Eichmann was sentenced to be hanged.

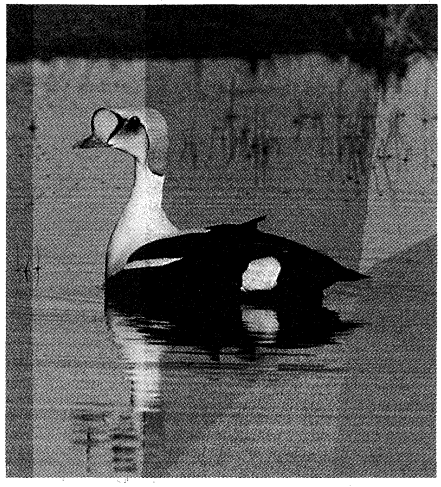
Eichrodt, Walther (b. Aug. 1, 1890, Gernsbach, Ger.—d. May 20, 1978, Basel, Switz.), German scholar who showed the importance to biblical studies of an understanding of the theology of the Old Testament.

After studying theology at Bethel, Greifswald, Heidelberg, and Erlangen, Eichrodt taught at Bethel and Erlangen, then became professor of Old Testament at the University of Basel (1922), where he was later rector (1953–55). His chief work, *Theologie des Alten Testaments*, 2 vol. (1933–35, 4th ed. 1957; *Theology of the Old Testament*), marked the beginning of a new epoch in Old Testament studies. Without reducing the theology of the Old Testament to the history of Israelite religion, Eichrodt made extensive use of the results of literary and comparative analysis to envisage the religion of the Old Testament as a unity of permanent reality throughout the vicissitudes of history. The triple aspect of God's covenant, with his people, with the world, and with man, formed the plan of Eichrodt's book. By this method he presented the great dogmatic realities in a dialectic appropriate to the Old Testament, preserving both the historical character of the revelation and the unity of the Old and the New Testaments. Eichrodt's other principal works include *Die Quellen der Genesis* (1916; "The Sources of Genesis"), *Die Hoffnung des ewigen Friedens im alten Israel* (1920; "The Hope of Eternal Peace in Ancient Israel"), *Das Menschenverständnis des Alten Testaments* (1946; *Man in the Old Testament*).

Eichstätt, city, Bavaria *Land* (state), southern Germany. It lies along the Altmühl River, south of Nürnberg.

Originally a Roman station, it developed after St. Boniface founded a bishopric there in 741. Chartered in 908, the town was ruled by its prince-bishops until the see was secularized in 1802. In 1817 the king of Bavaria gave it, with the landgraviate of Leuchtenberg, to his son-in-law Eugène de Beauharnais. An episcopal see was reestablished in Eichstätt in 1821, and the town reverted to Bavaria in 1855. Among Eichstätt's notable churches are included the Cathedral of St. Willibald (consecrated 1060; incorporating numerous styles); the church of the former Benedictine abbey (founded 870), with the tomb of St. Walburga; and the Capuchin Church (1189), with a copy of the Holy Sepulchre. Other landmarks include the 15th-century town hall; the partially restored 14th- and 17th-century Willibaldsburg, the residence of the bishops until 1730, now housing a museum; and the Baroque palace of the bishops and later of the dukes of Leuchtenburg. A railroad junction, Eichstätt is a lively trading centre with little industry. Pop. (1989 est.) 12,118.

eider, any of several large sea ducks variously classified as members of the tribe Mergini or placed in a separate tribe Somateriini (family Anatidae, order Anseriformes). Eiders are heavy and round-bodied, with humped bills that produce the bird's characteristic sloping profile. They are the source of eiderdown—down feathers the hen plucks from her breast to line the nest and cover the eggs in her absence. Eiderdown is used as warm filling for jackets, pillows, quilts, and sleeping bags; in Iceland, where the birds are rigidly protected,



King eider drake (*Somateria spectabilis*)
Stephen J. Krasemann/DRK PHOTO

a pound of down can be harvested from every 35–40 nests without interrupting the breeding cycle. Hens are mottled dark brown, but drakes of the four species are strikingly patterned and show a peculiar green pigment on the head. In the common eider (*Somateria mollissima*), with four or five races, differing mainly in length and colour of bill, the drake is mostly white above with black crown, belly, and tail. Like all eiders, this species is at home in the far north. It breeds along icy coasts south to The Netherlands and the Gulf of St. Lawrence; it winters at sea south to France, New England, and the Aleutians.

Eider Program (1848–64), the domestic and foreign policy cornerstone of Denmark's National Liberal governments during the Schleswig-Holstein crises. The program, which called for the incorporation of the duchy of Schleswig into Denmark, was brought to an end by the German occupation of both duchies in 1864.

Along with Holstein, Schleswig—separated from its sister duchy by the Eider River—had long been affiliated with Denmark through personal, rather than national, union under the Danish kings. The National Liberal government sought to have Schleswig made part of Denmark by the provisions of the constitution of 1849 and fought for this end in the Schleswig War (1848–50) against rebels in Schleswig-Holstein, who were helped by Prussian armed intervention. When the war came to an end in 1850 with an international agreement to maintain the affiliation of the two duchies with the Danish crown, but to maintain as well the constitutional separation of Schleswig from Denmark, the National Liberals were turned out of office and the Eider Program was set aside. International tensions engendered by the status of the duchies continued, however, and the National Liberals returned to power in 1857. In 1863, with Prussia preoccupied with the Polish rebellion, the Danes thought the time right to incorporate Schleswig into Denmark. But Prussia invaded the duchies, and in the Danish-German war of 1864 Denmark lost Schleswig. *See also* Schleswig-Holstein.

Eider River, river, Schleswig-Holstein *Land* (state), northern Germany. It rises in the hills south of Kiel, flows through Westensee (West Lake) northward to a point northwest of Kiel, and then bends westward and flows across the low peninsula in a sluggish, winding course of 117 miles (188 km) to the North Sea. Tönning stands at the head of the river's long, shallow estuary. It is navigable up to Rendsburg and is embanked through the marshes along its lower course. The Eider was regarded as *Romani terminus imperii* (the [northern] "limit of the Roman Empire") from the reign of the Frankish king Charlemagne (768–814) on, was recognized as the boundary of the Holy Roman Empire in 1027 by the emperor Conrad II, and formed the traditional frontier between Schleswig and Holstein. The Eider Canal (built 1777–84) makes the river navigable above Rendsburg and connects it with Kiel Bay at Holtenau. The canal was hampered by six sluices, but, as the only direct connection between the North and Baltic seas, it was heavily used. In 1887–95 it was converted into the Kaiser-Wilhelm, later the Nord-Ostsee Canal, or Kiel Canal.

eidetic image, an unusually vivid subjective visual phenomenon. An eidetic person not only can imagine an absent object but behaves as if he really can see it, either with closed eyes or while looking at some surface that serves as a convenient background for the image. A particular object may be recalled eidetically either immediately after its disappearance or removal from sight or after a lapse of several minutes, days, or even years; spontaneously appearing eidetic images have also been reported. In some instances, eidetic images and the objects they represent differ in colour, form, apparent size, position in space, richness of detail, and many other characteristics; in other instances, objects may be eidetically reproduced with almost photographic fidelity. Phenomena corresponding to eidetic images in the visual field are believed to exist in other sense fields as well. Investigations have revealed little about the nature, causes, and significance of eidetic images.

eidetic reduction, in phenomenology, a method by which the philosopher moves from the consciousness of individual and concrete objects to the transempirical realm of pure essences and thus achieves an intuition of the eidos (Greek: "shape") of a thing—*i.e.*, of what it is in its invariable and essential structure, apart from all that is contingent or accidental to it. The eidos is thus the principle or necessary structure of the thing. Being a science of essences, phenomenology finds this reduction important for its methodology.

Because the eidetic reduction uses the method of free variation, it is not dependent on either mental constructs or concrete factual objects, although it takes its starting point in the knowledge of facts. Beginning with a concrete object, the philosopher can imaginatively vary its different aspects. The limitations of the fanciful variation are the effectively given—*i.e.*, that which is given immediately and indubitably—and the eidos itself. The series of variations overlap, and the aspect in which they overlap is the essence. By thus moving from evidence in the perceptual sphere to evidence in the imaginative sphere, he can arrive at the invariable and essential structure of the object.

Thus, the eidetic reduction is neither a form of induction nor an abstraction. In accordance with the phenomenological reduction, it abstains from any sort of positing of the actual existence of its objects, and it brackets,

or holds in suspense, the concrete and factual content. On the other hand, it is not an empirical generalization that takes place at the level of man's natural attitude.

Eiermann, Egon (b. Sept. 29, 1904, Neuendorf, near Berlin—d. July 20, 1970, Baden-Baden, W.Ger.), one of the most prominent German architects to emerge after World War II, whose wide variety of buildings have been admired for their elegant proportions, precise detail, and structural clarity.

Eiermann studied at Berlin Technical University under Hans Poelzig, later working in the building department of the Karstadt department store company. Beginning in 1930 he practiced architecture in Berlin and, from 1947, in Karlsruhe, where he also served on the faculty of the university. Adhering to an aesthetic of making order visible, Eiermann created a number of major achievements in functional design, including the textile mill at Blumberg (1951), the West German pavilion at the Brussels World Exhibition (with Sep Ruf, 1958), the West German embassy in Washington, D.C. (1958–64), and the IBM-Germany Headquarters in Stuttgart (1967).

Perhaps his most popular work is the Kaiser Wilhelm Memorial Church (1956–63) in Berlin. Originally, a medieval revival building constructed in the late 19th century stood on the site, but after a World War II bombing raid only the bell tower remained. This ruin was ingeniously incorporated by Eiermann into his strikingly simple design for a modern church that has become a symbol of postwar Berlin.

Eifel, plateau region of western Germany, lying between the Rhine, the Mosel (French Moselle), and the Luxembourg and Belgian frontiers. Continuous with the Ardennes and the Hohes Venn (French Haute Fagnes) of Belgium, the German plateau falls into three sections: Schneifel or Schnee-Eifel, Hocheifel, and Voreifel. In the Schneifel (Snow Eifel), near the Belgian frontier, scrub and forest are common, with cultivation only on the richer soils. The Hocheifel (High Eifel), which includes the highest point in the plateau, Hohe Acht (2,451 ft [747 m]), is a dissected highland drained to the east by the Ahr River, which flows through a vine-growing region. The Voreifel (Fore-Eifel) slopes south to the Mosel, the tributaries of which dissect its smooth surface. Evidence of volcanic action can be seen in the explosion craters (*Maare*) and small cones. Much of the eastern Hocheifel contains lava and tuffs (volcanic rocks). Another igneous rock, basalt, is used for building and millstones; tuffs and pumice are also quarried in the area.

The plateau from Bitburg to Cologne shows signs of ancient habitation; in the Middle Ages, iron, lead, and zinc were mined. The Maifeld was settled early by the Germans, and near the Laacher See (lake) an abbey was founded in the 11th century. The current sparse population dates mainly from the clearing of the forest in medieval times, when monasteries and castles were established. The three-field and common-pasture systems still show the remains of this period. Scrub is still cut, burned, and planted with a rotation of rye, potatoes, oats, and 10 years' fallow. Holdings are small, and land is minutely divided. Metalworking industries have disappeared, and many people have emigrated since 1870 to the Ruhr and Aachen.

Eifelian stage, standard division of the Devonian period and the marine rocks formed during that time (the Devonian occurred from 408 to 360 million years ago). The Eifelian is the lower of the two stages generally recognized for the Middle Devonian; it was named for exposures studied in the Eifel region of Germany. The term Couvinian stage (*q.v.*) is often employed by French geologists instead of Eifelian, the more widely accepted designation.

Eifelian strata are characterized by rocks that include an ammonoid cephalopod of the genus *Anarcestes.* Typically, the Eifelian consists of richly fossiliferous shales and limestones in which the genera *Spirifer* and *Calceola* are distinctive. In addition to the German outcrops, important Eifelian sections occur in Great Britain, where the Calceola Shales and Torquay Limestone are prominent, as well as in France and southeastern Australia. Shales and limestones, in which the genus *Calceola* is prominent, dominate the Eifelian of the U.S.S.R. In northeastern North America, the Eifelian begins with the Onondaga Limestone, especially well developed in New York, and is followed by shales.

Eiffel, (Alexandre-) Gustave (b. Dec. 15, 1832, Dijon, Fr.—d. Dec. 28, 1923, Paris), French civil engineer renowned for the tower in Paris that bears his name.

After graduation from the École Centrale des Arts et Manufactures in 1855, Eiffel began to specialize in metal construction, especially bridges. He directed the erection of an iron bridge at Bordeaux in 1858, followed by several others, and designed the lofty, arched Galerie des machines for the Paris Exhibition of 1867. In 1877 he bridged the Douro River at Oporto, Port., with a 525-foot (160-metre) steel arch, which he followed with an even greater arch of the same type, the 540-foot (162-metre) span Garabit viaduct over the Truyère in southern France, for many years the highest bridge in the world, 400 feet (120 metres) over the stream. He was one of the first engineers to employ compressed-air

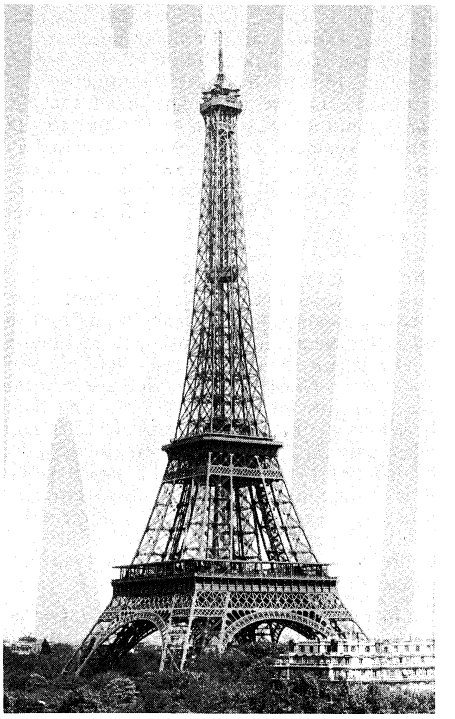
Eiffel, photographed by Nadar (Gaspard-Félix Tournachon)

By courtesy of the Caisse Nationale des Monuments Historiques, Paris

caissons in bridge building. He designed the movable dome of the observatory at Nice and the framework of the Statue of Liberty in New York Harbor.

Eiffel startled the world with the construction of the Eiffel Tower (1887–89), which brought him the nickname "magician of iron." It also directed his interest to problems of aerodynamics, and he used the tower for a number of experiments. At Auteuil, outside Paris, he built the first aerodynamic laboratory, where he continued to work throughout World War I; in 1921 he gave the laboratory to the state.

Eiffel Tower, French TOUR EIFFEL, Parisian landmark and technological masterpiece in building-construction history. When the French government was organizing the Centennial Exposition of 1889 to commemorate



The Eiffel Tower, Paris, designed by Alexandre-Gustave Eiffel, 1889

Giraudon—Art Resource/EB Inc.

the French Revolution, a competition was held for designs for a suitable monument. More than 100 plans were submitted, and the Centennial Committee accepted that of the noted bridge engineer Gustave Eiffel. Eiffel's conception of a 984-foot (300-metre) tower of open-lattice wrought iron aroused amazement, skepticism, and no little opposition on aesthetic grounds.

Nothing remotely like it had ever been built; it was twice as high as the dome of St. Peter's in Rome or the Great Pyramid of Giza. In contrast to such older monuments, Eiffel's tower was raised in a matter of months, with a small labour force, at slight cost. Making use of advanced knowledge of the behaviour of metal arch and metal truss forms under loading, including wind forces, the structure presaged a revolution in civil engineering and architectural design. And despite long-continued protests, it ultimately vindicated itself aesthetically.

The tower's base, of four semicircular arches, dictated partly by engineering considerations but also partly by Eiffel's artistic sense, required elevators to ascend on a curve; the glass-cage machines designed by the Otis Elevator Company of the United States became one of the principal features of the building, helping establish it as one of the world's premier tourist attractions. The Eiffel Tower remained the tallest building in the world until completion of the Chrysler Building in New York City in 1930.

Eigen, Manfred (b. May 9, 1927, Bochum, Ger.), German physicist who was co-recipient, with R.G.W. Norrish and George Porter, of the 1967 Nobel Prize for Chemistry for work on extremely rapid chemical reactions.

Eigen was educated in physics and chemistry at the University of Göttingen, taking his doctorate in 1951. He joined the university's Institute of Physical Chemistry as an assistant in 1951, and in 1953 he became a member of the Max Planck Institute of Physical Chemistry, Göttingen, where he became director in 1964 and later chairman.

By means of a variety of methods known as relaxation techniques, involving the application of bursts of energy to a solution, Eigen was able to study many high-speed reactions in

the state of equilibrium. Among specific topics thus investigated were the rate of hydrogen ion formation through dissociation in water, diffusion-controlled protolytic reactions, and the kinetics of keto-enol tautomerism.

eigenvalue, one of a set of discrete values of a parameter, k, in an equation of the form $P\psi = k\psi$, in which P is a linear operator (that is, a symbol denoting a linear operation to be performed), for which there are solutions satisfying given boundary conditions. The symbol ψ (psi) represents an eigenfunction (proper or characteristic function) belonging to that eigenvalue. The totality of eigenvalues is a set. In quantum mechanics P is frequently a Hamiltonian, or energy, operator and the eigenvalues are energy values, but operators corresponding to other dynamical variables such as total angular momentum are also used. Experimental measurements of the proper dynamical variable will yield eigenvalues.

Eight, The, group of American painters who exhibited together only once, in New York City in 1908, but established one of the main currents in 20th-century American painting. The original Eight included Robert Henri, leader of the group, Everett Shinn, John Sloan, Arthur B. Davies, Ernest Lawson, Maurice Prendergast, George Luks, and William J. Glackens. Later the group was joined by George Bellows. Their contribution to American art was not a style held in common but a determination to bring art into closer touch with life.

"Sunday, Women Drying Their Hair," oil painting by John Sloan, one of the members of a group of American painters called The Eight, 1912; in the Addison Gallery of American Art, Andover, Mass.

By courtesy of the Addison Gallery of American Art, Phillips Academy, Andover, Mass.

Reacting against an academic and aesthetic tradition that was subservient to European aesthetics, The Eight established their own artistic society in the bustling neighbourhoods of New York City and set out to create a native American painting. Luks, Sloan, Glackens, and Shinn worked as newspaper illustrator-cartoonists; the teeming life they found in New York became the subject of their art, as well as the art of the other four, which presented unidealized views of city life—the saloons, tenements, pool halls, and slums. Most of The Eight adopted a rough, realistic style, flashy brushwork on a dark ground reminiscent of Édouard Manet, Gustave Courbet, and the German Düsseldorf school, where Henri had studied. Some of the group took other directions: Prendergast utilized the decorative patterns of colour he found in the work of the French Nabi group in his translations of the American landscape; Arthur Davies painted dreamy twilight scenes evolving from lyrical allegories rather than contemporary life; Lawson's style was lyrically atmospheric. In spite of these deviations from realistic views of city life, their 1908 exhibition at the Macbeth Gallery, a direct reaction against slights by the National Academy of Design, gained all eight the reputation of "apostles of ugliness." A few years after their single joint exhibition, the eight painters were absorbed into a larger group called the Ashcan School, which included Bellows, Edward Hopper, Glenn Coleman, Eugene Higgins, and Jerome Myers. The Ashcan School, whose principles and aims were similar to those of The Eight, paved the way for the development of a vital and native trend in American painting of the 20th century.

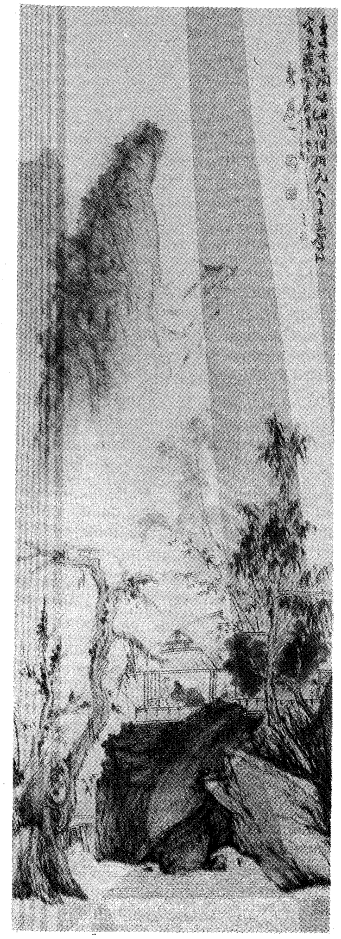
eight ball, U.S. pocket-billiards game in which 15 balls numbered consecutively and a white cue ball are used. Those numbered 1–7 are solid colours; 9–15 are circled in white; and the eight ball is black. To begin, the balls are racked in a pyramid with the eight ball in the centre. One player or a side plays numbers 1–7, while the other plays 9–15; but choice of group is not made until a ball is legally pocketed. Once a side has pocketed all of its group, that side tries to pocket the eight ball and thus win the game. Should a player pocket the eight ball before all of his group is sunk, or misplay the eight ball (as by playing it into a pocket other than the pocket designated before the shot), that player loses.

Eight Eccentrics of Yang-chou, Pinyin YANGZHOU, Chinese painters who worked in the area of Yang-chou, in Kiangsu Province, during the Ch'ien-lung era (1735–96) of the Ch'ing dynasty (*see* Ch'ing dynasty). The group includes Cheng Hsieh, Chin Nung, Huang Shen, Kao Hsiang, Li Fang-ying, Li Shan, Lo P'ing, and Wang Shih-shen. Other artists, such as Hua Yen, are sometimes included. Although the grouping is more a geographical than a stylistic one, certain similarities are discernible: generally, the paintings are rather briefly sketched, small-scale renditions of the less monumental aspects of nature, and a certain creative independence of style is perceptible—thus the appellation *pa-kuai,* "eight eccentrics," or "eight strange ones."

Eight Immortals (Chinese mythology): *see* Pa Hsien.

Eight Masters of Nanking, Wade–Giles romanization CHIN-LING PA-CHIA, Pinyin JINLING BAJIA, group of Chinese artists who lived and worked during the late 17th century in Nanking (known as Chin-ling during the early T'ang dynasty, 618–907). Although their group identity derives largely from the locale in which they worked, certain aesthetic similarities are discernible: their paintings, usually landscapes, are often uneven in quality and rather rustic.

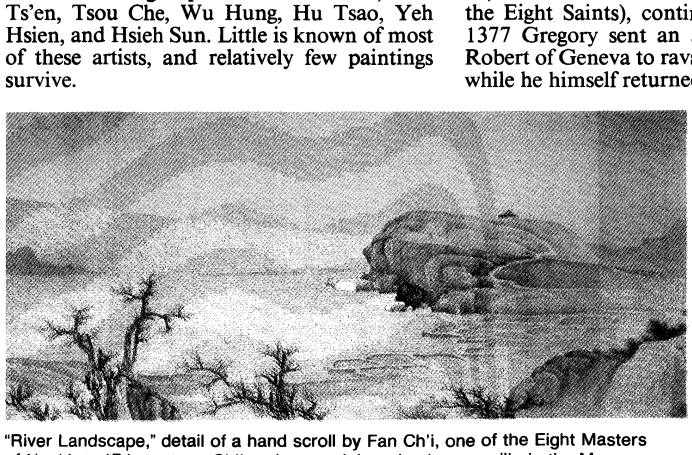
The outstanding artist of the group, Kung Hsien (*q.v.*), is known particularly for his dense, moist landscapes, which are virtually unique in the history of Chinese painting. Others of the group include Fan Ch'i, Kao Ts'en, Tsou Che, Wu Hung, Hu Tsao, Yeh Hsien, and Hsieh Sun. Little is known of most of these artists, and relatively few paintings survive.



"Conversation in Autumn," hanging scroll by Hua Yen, one of the Eight Eccentrics of Yang-chou, early 18th century, Ch'ing dynasty, ink and colour on silk; in the Cleveland Museum of Art

By courtesy of the Cleveland Museum of Art, John L. Severance Fund

Eight Saints, War of the (1375–78), conflict between Pope Gregory XI and an Italian coalition headed by Florence, which resulted in the return of the papacy from Avignon to Rome. In 1375, provoked by the aggressiveness of the Pope's legates in Italy, Florence incited a widespread revolt in the Papal States. The Pope retaliated by excommunicating the Florentines (March 1376), but their war council, the Otto di Guerra (popularly known as the Eight Saints), continued to defy him. In 1377 Gregory sent an army under Cardinal Robert of Geneva to ravage the areas in revolt, while he himself returned to Italy to secure his



"River Landscape," detail of a hand scroll by Fan Ch'i, one of the Eight Masters of Nanking, 17th century, Ch'ing dynasty, ink and colour on silk; in the Museum für Ostasiatische Kunst, in the Staatliche Museen Preussischer Kulturbesitz, West Berlin

By courtesy of Staatliche Museen Preussischer Kulturbesitz, Museum fur Ostasiatische Kunst, West Berlin

possession of Rome. Thus ended the papacy's 70-year stay in France. The war ended with a compromise peace concluded at Tivoli in July 1378.

1801, Concordat of, agreement reached on July 15, 1801, between Napoleon Bonaparte and papal and clerical representatives in both Rome and Paris, defining the status of the Roman Catholic Church in France and ending the breach caused by the church reforms and confiscations enacted during the French Revolution. The Concordat was formally promulgated on Easter day, 1802.

In the agreement the First Consul (Napoleon) was given the right to nominate bishops; the bishoprics and parishes were redistributed; and the erection of seminaries was allowed. The Pope (Pius VII) condoned the actions of those who had acquired church property, and by way of compensation the government engaged to give the bishops and curés suitable salaries. The government added to it unilateral provisions of Gallican tendencies, which were known as the Organic Articles. After having been the law of the church of France for a century, it was denounced by the French government in 1905, when by the "Separation Law" church and state were sundered.

1812, War of (June 18, 1812–Dec. 24, 1814), inconclusive British–U.S. conflict arising chiefly out of U.S. grievances over oppressive maritime practices during the Napoleonic Wars. The long struggle between Great Britain and France, fought intermittently between 1793 and 1815, led both belligerents to infringe on the rights and impair the interests of neutrals. Napoleon averted hostilities by agreeing not to interfere with U.S. trade to Britain. Britain, on the other hand, confident in its naval supremacy, continued to enforce its order in council of 1807, which led to the blockade of all French ports, and insisted that neutral vessels first call at British ports and pay duties. In addition, U.S. sensibilities were offended by the British practice of stopping U.S. ships on the high seas and impressing seamen alleged to be deserters from the Royal Navy. The new nation reacted with the Embargo Act (1807) and the Non-intercourse Act (1809). A third measure (1810) removed trade restrictions but provided for revival of nonintercourse against whichever belligerent should fail to revoke its blockade. This Great Britain failed to do in time to prevent a declaration of war signed by Pres. James Madison on June 18, 1812.

International tension was increased by U.S. resentment of British actions along the Canadian frontier. British authorities were supplying arms and encouragement to the Shawnee leader, Tecumseh, in an effort to check the advance of white settlers into Indian country. After a Shawnee attack led to the pitched Battle of Tippecanoe (Nov. 7, 1811), Westerners raised the cry that the British must be expelled from Canada to ensure frontier security. This theme was espoused vigorously by a group of expansionist congressmen called War Hawks, who also included Florida in their territorial ambitions.

The U.S. entered the war ill-prepared. Ambitious plans to invade Canada were never realized. American warships won three notable victories in duels with British frigates in 1812, including that of the USS "Constitution" against the "Guerrière," though the three later frigate duels of the war were won by the British. Numerous naval skirmishes were fought for control of Lakes Erie, Ontario, and Champlain. Despite limited U.S. success, including the recapture of Detroit, by the summer of 1814 the British still controlled access to Lake Michigan and occupied the northern Mississippi River. An amphibious British force ravaged the shores of Chesapeake Bay and, after winning the Battle of Bladensburg, burned public buildings in Washington, D.C., in retaliation for similar U.S. acts in York (Toronto). U.S. morale was lifted when U.S. ships hindered British commerce, but this action failed to disturb Britain's control of the sea and its blockade of the American coast.

Weary of futile warfare, both sides signed the Treaty of Ghent in Belgium on Dec. 24, 1814, restoring prewar conditions. This settlement forestalled a New England separatist movement, proposed at the Hartford Convention (December 1814–January 1815) in response to the extremely unpopular war. Though the U.S. gained none of its avowed aims, popular legend soon converted defeat into the illusion of victory. Several circumstances contributed to this process: the series of military successes in the war's closing months created a sense of victory (the most imposing of which, the Battle of New Orleans, was won before news of the peace treaty reached that part of the U.S.); the end of war in Europe brought an end also to the issues of impressment and paper blockades; and finally, the war did actually subdue Indian resistance with the death of Tecumseh in battle and the crushing of the Creek confederacy in the South by Maj. Gen. Andrew Jackson in 1814. (This led indirectly to the acquisition of Florida in 1819.) The war also marked a decline of U.S. dependence on Europe and stimulated a sense of nationality.

1830, revolutions of, rebellions against conservative kings and governments by liberals and revolutionaries in different parts of Europe in 1830–32.

The movement started in France, prompted by Charles X's publication on July 26 of three ordinances dissolving the Chamber of Deputies, abolishing freedom of the press, and modifying the electoral laws so that three-fourths of the electorate lost their votes. Strikes and protests were followed by armed confrontations. The royal forces were unable to contain the insurrection; and, after three days of fighting (July 27–29), Charles fled to England. The radicals wanted to establish a republic, and the aristocracy were loyal to Charles, but the upper-middle class were victorious in their decision to offer the crown to the Duke of Orléans, Louis-Philippe, who had fought for the French Republic in 1792. Louis agreed to be "King of the French." When the "July Revolution" was over, the Chamber had been transformed from a hereditary body into a nominated house, special tribunals were abolished, the alliance of throne and church ended, and the white flag of the Bourbons was replaced by the tricolour. (*See also* July Revolution.)

Liberals throughout Europe were encouraged to hope for a general war of liberation, but most were disappointed. Louis-Philippe did not want a war and, contrary to expectations, did not support the Poles, who had revolted against the Russian tsar. Their revolt was ruthlessly suppressed, and Poland was incorporated into the Russian Empire. Revolts in Italy and the German kingdoms were equally unsuccessful. Belgium declared its independence from The Netherlands, and it was recognized in 1831 as a separate nation. For several years the Greeks had been fighting for their independence from the Ottoman Empire, and in 1832 the European powers recognized Greece as an independent sovereign state.

1848, Revolutions of, series of republican revolts against European monarchies, beginning in Sicily, and spreading to France, Germany, Italy, and the Austrian Empire. They all ended in failure and repression, and were followed by widespread disillusionment among liberals.

The revolutionary movement began in Italy with a local revolution in Sicily in January 1848; and, after the revolution of February 24 in France, the movement extended throughout the whole of Europe with the exception of Russia, Spain, and the Scandinavian countries. In Great Britain it amounted to little more than a Chartist demonstration and a republican agitation in Ireland. In Belgium, The Netherlands, and Denmark it manifested itself in peaceful reforms of existing institutions; but democratic insurrections broke out in the capitals of the three great monarchies, Paris, Vienna, and Berlin, where the governments, rendered powerless by their fear of "the revolution," did little to defend themselves. The revolution was successful in France alone; the Second Republic and universal suffrage were established, but the quarrel between the supporters of the *république démocratique* and the partisans of *république démocratique et sociale* culminated in a workers' insurrection in June 1848.

In Austria, where the new ministers promised to grant constitutions, the monarchy withstood the storm; and in Prussia King Frederick William IV, who led the movement for the unification of Germany, hoisted the black, red, and gold flag that had become the symbol of German unity. The German governments agreed to the convocation of three constituent assemblies at Berlin, Vienna, and Frankfurt by which democratic constitutions were to be drafted for Prussia, Austria, and Germany.

In Italy, at first, the revolution only took the form of a nationalist rising against Austria led by the king of Sardinia under the Italian tricolour, the "white, red and green." The republic was proclaimed in 1849, and then only in Rome and Tuscany. Within the Austrian empire the nationalities subjected to the German Government of Vienna agitated for a national government, and Hungary succeeded in organizing itself on an autonomous basis.

This upheaval seemed to indicate a redistribution of the territories of Europe. In the name of the Provisional Government in France, Alphonse de Lamartine declared that the treaties of 1815 were no longer valid in the eyes of the French Republic, but he added that he accepted the territorial delimitations effected by those treaties. France did not lend its support to the revolutionaries in Europe.

The restoration had commenced even before the revolution was over, and it was accomplished by the armies that had remained faithful to their respective governments. Military repression was first employed in Paris by Louis-Eugène Cavaignac against the insurgents in June, and by Alfred, prince von Windischgrätz, on June 17 against the Czechs in Prague, and later by the Austrian Army in Lombardy and in Vienna; then in Berlin in December, and in 1849 by the Prussian Army in Saxony and Baden. Order was restored in Rome only by French intervention, and in Hungary with the help of the Russian Army. The king of Prussia, having refused the title of emperor offered to him by the Frankfurt Assembly, sought to achieve the unity of Germany by a union between the German princes. Austria and Russia, however, compelled him to abandon his design by the Convention of Olmütz in 1850. The immediate result of the reaction became manifest in the withdrawal of liberal democratic or nationalist concessions which had been made during the revolution: universal suffrage, liberty of the press and of assembly. Absolute monarchy was reestablished in Germany, Austria, and Italy; and the governments, in alliance with the middle classes and the clergy, who were terrified by the Socialist proposals, strengthened the police forces and organized a persecution of the popular press and associations that paralyzed political life. In France the reaction led to the coup d'etat against the assembly on the part of Prince Louis-Napoléon on Dec. 2, 1851, and the reestablishment of the hereditary empire under Napoleon III in 1852.

The restoration, however, was not complete, for universal suffrage was not abolished in

France; in Prussia, the Constitution of January 1850, which established an elective assembly, and, in Sardinia, the Constitution of March 1848 were retained; the signorial rights were not restored in Austria.

1850, Compromise of, series of compromise measures passed by the U.S. Congress in an effort to settle several outstanding slavery issues and to avert the threat of dissolution of the Union. The crisis arose from the request of the territory of California (Dec. 3, 1849) to be admitted to the Union with a constitution prohibiting slavery. The problem was complicated by the unresolved question of slavery's extension into other areas ceded by Mexico the preceding year.

To maintain an even balance between free and slave states, a series of measures was offered by the "great compromiser," Sen. Henry Clay of Kentucky. In an attempt to give satisfaction to both proslavery and anti-slavery forces, the important sections of the omnibus bill called for the admission of California as a free state, the organization of the territories of New Mexico and Utah with the slavery question left open (*see* popular sovereignty), settlement of the Texas–New Mexico boundary dispute, a more rigorous provision for the return of runaway slaves, and the prohibition of the slave trade in the District of Columbia.

With the influential support of Sen. Daniel Webster and the concerted unifying efforts of Sen. Stephen A. Douglas, the five compromise measures were enacted in September. These measures were accepted by moderates in all sections of the country, and the secession of the South was postponed for a decade. The Compromise, however, contained the seeds of future discord. The precedent of popular sovereignty led to a demand for a similar provision for the Kansas Territory in 1854, causing bitterness and violence there (*see* Bleeding Kansas). Furthermore, the application of the new Fugitive Slave Law triggered such a strong reaction throughout the North that many moderate anti-slavery elements became determined opponents of any further extension of slavery into the territories. While the Compromise of 1850 succeeded as a temporary expedient, it also proved the failure of compromise as a permanent political solution when vital sectional interests were at stake.

eighteen schools, the division of the Buddhist community in India in the first three centuries following the death of the Buddha in *c.* 483 BC. Although texts speak of the "18 schools," the lists differ considerably; and more than 30 names are mentioned in various chronicles.

The first division in the Buddhist community occurred as a result of the second council, held 100 years after the Buddha's death, at Vaiśālī (Bihār state), when the Acariyavādins (followers of the traditional teaching) split away from the Sthaviravādins (followers of the Way of the Elders) and formed their own school, known as the Mahāsaṅghikas. The Mahāsaṅghikas' views on the nature of the Buddha and the *arhat* ("saint") foreshadowed the development of the Mahāyāna form of Buddhism. Further subdivisions of the Mahāsaṅghikas over the next seven centuries included the Lokottaravādins, the Ekavyāvahārikas, and the Kaukkuṭikas.

A subdivision within the Sthaviravādins emerged in the 3rd century BC, when the Sarvāstivādins (followers of the Doctrine That All Is Real) broke away from the Vibhajyavādins (Those Who Make Distinctions). Other prominent offshoots of the Sthaviravādins were the Sammatīyas and the Vātsīputrīyas, both known for their theory of *pudgala* ("person"); the Sautrāntikas, who recognized the authority of the *sūtras* (words of the Buddha) but not of the *Abhidharma,* the more schematic part of the canon; the Mahīśāsakas and the Dharmaguptas, whose names probably reflect their place of origin and founding teacher; and the Theravādins (Pāli form of Sthaviravādins), the school that travelled to Ceylon (modern Sri Lanka) and gave origin to the modern Theravādins, now prevalent in Sri Lanka, Burma, Thailand, and Cambodia.

Eightfold Path, Pāli AṬṬHAṄGIKA-MAGGA, Sanskrit AṢṬĀṄGIKA-MARGA, doctrine taught by Gautama Buddha in his first sermon at the deer park near Benares (Vārānasi), in India. Together with the Four Noble Truths, of which it forms a part, it sums up the whole of Buddhist teaching. It is also called the Middle Path, as it steers a course between the sensual pleasures of the materialists and the self-mortification of the ascetics. Those who follow the noble Eightfold Path are freed from the suffering that is an essential part of human existence and are led ultimately to Nirvāṇa, or Enlightenment. Some Buddhist teachings have held that to enter this path in itself implies an experience of Nirvāṇa.

The Eightfold Path consists of: (1) right understanding—faith in the Buddhist view of the nature of existence in terms of the Four Noble Truths; (2) right thought—the resolve to practice the faith; (3) right speech—avoidance of falsehoods, slander, or abusive speech; (4) right action—abstention from taking life, stealing, and improper sexual behaviour; (5) right livelihood—rejection of occupations not in keeping with Buddhist principles; (6) right effort—avoidance of bad and development of good mental states; (7) right mindfulness—awareness of the body, feelings, and thought; and (8) right concentration—meditation.

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

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Eightfold Way, also called SU(3), classification of subatomic particles into groups on the basis of their symmetrical properties, the number of members of each group being 1, 8 (most frequently), 10, or 27. The system was proposed in 1961 by the U.S. physicist Murray Gell-Mann and the Israeli physicist Yuval Ne'eman. The name of the system was suggested by analogy with the Eightfold Path of Buddhism because of the centrality of the number eight. One of the early triumphs of the Eightfold Way was the prediction of the existence of a heavy subatomic particle required to complete one of the groups. The particle, called omega-minus, was discovered in 1964. That same year, Gell-Mann set forth the concept of quarks as the physical basis for the classification system, thereby establishing the foundation for the modern quark model. *See also* quark.

eighth cranial nerve: *see* vestibulocochlear nerve.

Eighth Route Army, larger of the two major Chinese Communist forces that fought the Japanese from 1937 to 1945. The 8th Route Army also engaged in political and propaganda work, helping to increase Communist support among the populace. The army grew from 30,000 troops in July 1937 to 156,000 in 1938 and 400,000 in 1940. Reduced to about 300,000 by the fierce fighting between 1941 and 1944, its size almost doubled to a total of 600,000 men in 1945.

Formed in 1937 at the time of the second United Front (the anti-Japanese alliance between the Chinese Nationalists under Chiang Kai-shek and the Chinese Communists), the 8th Route Army was headed by Mao Tse-tung's old comrade in arms Chu Teh but was placed under the overall direction of the Nationalist government. In 1938 the 8th Route Army was reorganized as the 18th Army Group under the Nationalist commander Yen Hsi-shan. In practice, however, the army remained under Chu Teh's control and operated independently of the Nationalists, especially after 1941, when relations between the Communists and Nationalists had deteriorated.

Following the end of World War II, the 18th Army Group was incorporated into the new People's Liberation Army. Units from the former 8th Route Army were active in the 1948 capture of Manchuria (Northeast Provinces) from the Nationalists, which placed the Communist forces in a position to take North China and turn the civil war in their favour.

Eighty Mile Beach, coastal edge of the arid, sedimentary Great Sandy Desert and the Canning Basin (*qq.v.*), northwestern Western Australia, bordering the Indian Ocean. Extending in a curve northeast from Cape Keraudren (east of the De Grey River mouth) to Cape Bossut, it is about 85 mi (140 km) long. The beach, generally low and sandy but with an expanse of dunes in the area around Anna Plains, experiences a tidal range as great as 28 ft (9 m). It is bordered with salt and samphire (plant) marshes with a dreary waste region extending inland. Formerly called Ninety Mile Beach, it was renamed in 1946 to avoid confusion with a beach of the same name in Victoria. In 1887, a large pearling fleet was wrecked by a cyclone off the harbourless beach. The Great Northern Highway parallels the beach from Port Hedland to Broome.

80 Ursae Majoris (star): *see* Alcor.

Eighty Years' War (1568–1648), the war of Netherlands independence from Spain, which led to the separation of the northern and southern Netherlands and to the formation of the United Provinces of the Netherlands (the Dutch Republic). The first phase of the war began with two unsuccessful invasions of the provinces by mercenary armies under Prince William I of Orange (1568 and 1572) and foreign-based raids by the Geuzen, the irregular Dutch land and sea forces. By the end of 1573 the Geuzen had captured, Calvinized, and secured against Spanish attack the provinces of Holland and Zeeland. The other provinces joined in the revolt in 1576, and a general union was formed.

In 1579 the union was fatally weakened by the defection of the Catholic Walloon provinces. By 1588 the Spanish, under Alessandro Farnese (the duke of Parma), had reconquered the southern Low Countries and stood poised for a death blow against the nascent Dutch Republic in the north. Spain's concurrent enterprises against England and France at this time, however, allowed the republic to begin a counteroffensive. By the Twelve Years' Truce, begun in 1609, the Dutch frontiers were secured.

Fighting resumed in 1621 and formed a part of the general Thirty Years' War. After 1625 the Dutch, under Prince Frederick Henry of Orange, reversed an early trend of Spanish successes and scored significant victories. The Franco-Dutch alliance of 1635 led to the French conquest of the Walloon provinces and a sustained French drive into Flanders. The republic and Spain, fearful of the growing power of France, concluded a separate peace in 1648 by which Spain finally recognized Dutch independence.

Eijkman, Christiaan (b. Aug. 11, 1858, Nijkerk, Neth.—d. Nov. 5, 1930, Utrecht), Dutch physician and pathologist whose demonstration that beriberi is caused by poor diet led to the discovery of vitamins. Together with Sir Frederick Hopkins, he was awarded the 1929 Nobel Prize for Physiology or Medicine.

Eijkman received a medical degree from the University of Amsterdam (1883) and served as a medical officer in the Dutch East Indies (1883–85). He then worked with Robert Koch

in Berlin on bacteriological research and in 1886 returned to Java to investigate the cause of beriberi. Appointed director of the research laboratory for pathological anatomy and bacteriology and of the Javanese Medical School (1888) in Batavia (now Jakarta), he sought a

Eijkman
By courtesy of the World Health Organization

bacterial cause for beriberi. In 1890 polyneuritis broke out among his laboratory chickens. Noticing this disease's striking resemblance to the polyneuritis occurring in beriberi, he was eventually (1897) able to show that the condition was caused by feeding the fowl a diet of polished, rather than unpolished, rice.

Eijkman believed that the polyneuritis was caused by a toxic chemical agent, possibly originating from the action of intestinal microorganisms on boiled rice. He maintained this theory even after his successor in Batavia, Gerrit Grijns, demonstrated (1901) that the problem was one of nutritional deficiency. Eijkman returned to The Netherlands in 1896 to become professor of public health and forensic medicine at the University of Utrecht (1898–1928).

Eilat (Israel): *see* Elat.

Eileithyia, pre-Hellenic goddess of childbirth, who hindered or facilitated the procedure according to her disposition. The earliest evidence for her cult is at Amnisus, in Crete, where excavations indicate that she was worshiped continuously from Neolithic to Roman times. In Homer she appears, sometimes in the plural, as a personification of birth pangs and is described as the daughter of Hera, the consort of Zeus, the chief god. In later times Eileithyia tended to be identified with Hera or Artemis, goddesses who were also associated with marriage and childbirth.

Eilhart VON OBERG (fl. late 12th century AD), German poet important in the history of the court epic and the development of the Tristan story in Romance literature. He was a member of a Brunswick family mentioned in records of Henry the Lion. His epic, *Tristrant und Isalde,* a laboured version of an Old French source now lost, dates from the last quarter of the 12th century. Uncertainty about his chronological position in relation to Heinrich von Veldeke (the Flemish author of *Eneit,* a retelling of the story of Aeneas) and the corruptness of the early fragment and later complete but modified versions of his epic make it difficult to assess Eilhart's importance. His epic was popular, for it provided the basis of a 15th-century prose novel, *Tristan und Isalde,* and of a tragedy by Hans Sachs. Its relationship to the classic epic by Gottfried von Strassburg (fl. 1210) is clear but less significant.

Eimeria, genus of parasitic protozoans of the sporozoan subclass Coccidia. *Eimeria,* which causes coccidiosis in livestock and wild animals, infects mainly the cells of the digestive tract, although it also attacks cells of the liver and the bile duct. Symptoms of infection are diarrhea, weight loss, and general weakness. *Eimeria* is characterized by spore cases that contain four spores, each with two infective sporozoites. Among the common species are *E. necatrix* and *E. tenella* (in chickens); *E. stiedae* (in rabbits); and *E. bovis, E. ellipsoidalis,* and *E. zurnii* (in cattle).

Ein Gedi (Israel): *see* 'En Gedi.

Einar Benediktsson (Icelandic poet): *see* Benediktsson, Einar.

Einar Hjörleifsson Kvaran (Icelandic writer): *see* Kvaran, Einar Hjörleifsson.

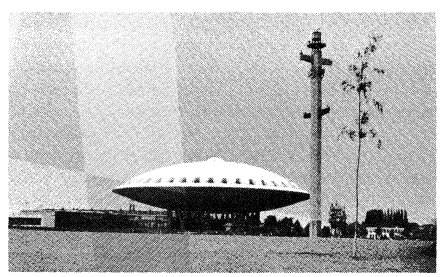
Einaudi, Luigi (b. March 24, 1874, Carrù, Italy—d. Oct. 30, 1961, Rome), Italian economist and statesman, the first president (1948–55) of the Republic of Italy.

After graduating from the University of Turin (1895), Einaudi contributed many economic articles to *La Stampa,* Turin's leading newspaper. Between 1900 and 1935, his articles also appeared in *Corriere della sera* and *Riforma sociale,* of which he became director in 1908. He served on the faculty of the University of Turin (1900–43) and also taught at Milan.

In 1919 Einaudi was nominated to the Italian Senate, an honorary body, in which he urged a liberal economic policy, free from protectionism. In 1936–43 he was the editor of *Rivista di storia economica* ("Review of Economic History"), which was suppressed by the Fascists, of whom he was an unwavering opponent. In 1943 he fled to Switzerland, where, along with other exiled Italians, he advocated the idea of a European federation.

Returning to Italy in 1945, Einaudi was appointed governor of the Bank of Italy (1945–48). He was a member of the Constituent Assembly (1946–48), becoming deputy prime minister and minister of the budget (1947), a new post in which he successfully curbed inflation and stabilized the currency. In 1948 Einaudi became a member of the Senate of the Italian republic and on May 11 its first president. His term lasted until 1955, when he was appointed senator for life, although he retired to private life. Einaudi wrote several works on economics and government.

Eindhoven, *gemeente* (commune), Noordbrabant *provincie,* southern Netherlands, on the Dommel River. Chartered in 1232, it developed after 1900 from a small village of the Kempen heathland into one of the largest industrial centres of The Netherlands. Its population increased tenfold between 1900 and 1920 and has since more than tripled. Much of this growth was due to the Philips Electric Company (1891), manufacturers of electrical apparatus, radio and television sets, plastics, and X-ray and radar equipment. Tobacco and textile industries and the manufacture of trucks and automobiles are also important. Eindhoven is a rail junction and is served by the Eindhoven and Beatrix canals and by an airfield at Welschap, 2 miles (3 km) west.



Philips Exhibition Centre, Eindhoven, Neth.
J. Allan Cash—EB Inc.

There is a technical university (1957), the Van Abbe Museum of Modern Art (1936), an astronomical observatory (1938), and a neo-Gothic church designed by Petrus Cuypers (1868). Badly damaged in World War II, the city has been rebuilt. Pop. (1987 est.) 190,962; metropolitan area, 378,247.

Einem, Gottfried von (b. Jan. 24, 1918, Bern), Austrian composer of operas, such as *Dantons Tod* (*Danton's Death*) and *Der Prozess* (*The Trial*), and instrumental works in the modern idiom. His works combine the influence of late 19th-century Romantic composers such as Gustav Mahler and Modest Mussorgsky with later styles, such as jazz, various kinds of dissonance, and atonality, in which the key or tonal centre of traditional music is rejected.

The son of an Austrian military attaché to Switzerland, Einem grew up in Holstein. Suspected of anti-Nazi sympathies, he was arrested by the German Gestapo in 1938 and was imprisoned for four months. He later studied under the composer Boris Blacher and in 1941 became a conductor and coach at the Berlin State Opera and the Bayreuth Festival. His *Capriccio* was performed by the Berlin Philharmonic Orchestra in 1943 and his ballet, *Prinzessin Turandot,* in Dresden in 1944.

In 1945 Einem moved to Salzburg. *Dantons Tod,* his first opera, with text by Blacher based on Georg Büchner's play, was produced in 1947 at the Salzburg Festival, where his opera *Der Prozess,* based on Franz Kafka's novel, was performed in 1953.

When he toured the United States by invitation of the U.S. State Department in 1953, his *Orchestra Music* was performed by the New York Philharmonic Orchestra. *Meditations for Orchestra* was commissioned and performed by the Louisville Orchestra (1954), *Symphonic Scenes* by the Boston Symphony Orchestra (1957), and *Ballade* by the Cleveland Orchestra (1958). *Philadelphia Symphony* was commissioned by the Philadelphia Orchestra and first performed in Vienna (1961). His later operas included *Der Besuch der alten Dame* (*The Visit of the Old Woman,* 1970, based on Friedrich Dürrenmatt's play) and *Kabale und Liebe* (*Cabal and Love,* 1975, based on Friedrich von Schiller's play).

Einhard, also spelled EGINHARD (b. *c.* 770, Maingau, Franconia [Germany]—d. March 14, 840, Seligenstadt, Franconia), Frankish historian and court scholar whose writings constitute an invaluable source of information on the life of Charlemagne and the Carolingian Empire.

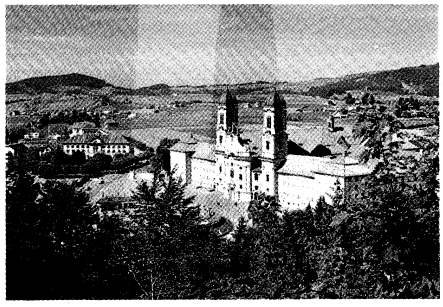
Einhard was educated after 779 in the monastery of Fulda; his brilliance was soon recognized, and he was sent to Charlemagne's Palace School at Aachen in 791. He quickly became the trusted friend and adviser of the king and even proved to have a good deal of architectural skill, which he applied to the construction of the royal palace at Aachen. His political prominence increased after Charlemagne's death in 814 and the succession of Louis I the Pious, whom Einhard had been influential in raising to the throne. At that time Einhard was made abbot of several monasteries and was granted extensive lands.

The *Vita Karoli Magni* ("Life of Charles the Great") was probably written about 830–833, after Einhard had left Aachen and was living in Seligenstadt. Based on 23 years of service to Charlemagne and research in the royal annals, the book was expressly intended to convey Einhard's gratitude and admiration for Charlemagne's aid to his education. Following the model of Suetonius' *Lives of the Caesars,* and particularly the "Life of Augustus," the work was composed in an excellent Latin style and analyzed Charlemagne's family, his foreign and domestic achievements, his personal tastes, the administration of his kingdom, and his death.

The *Vita Karoli Magni* is brief and limited in scope and detail, but it provides a generally accurate and direct account of the period. As an example of the classical renaissance at the

Carolingian court and as the first medieval biography of a lay figure, the work was highly admired and copied in its own time.

Einsiedeln (German), French NOTRE-DAME-DES-ERMITES, town, Schwyz canton, northeast central Switzerland, on the right bank of the Alp stream, northeast of Schwyz city. It developed around the Benedictine abbey, founded in 934. The abbey became a principality of the Holy Roman Empire in 1274 and belonged



Benedictine abbey, Einsiedeln, Switz.
Beringer and Pampaluchi

to Schwyz after 1386. Its wooden statue, the "Black Virgin" (which owes its name to the discoloration caused by the candles burned before it through the centuries), became a sacred object of European pilgrims from the 14th century. Huldrych Zwingli, the religious reformer, was the parish priest from 1516 to 1518, and the Renaissance physician Paracelsus was born near the town. In addition to being the largest and most famous Swiss pilgrimage resort, Einsiedeln is a winter sports centre and has printing, machinery, and furniture industries. The population is largely German speaking and Roman Catholic. Pop. (1980) 9,629.

Einstein, Albert (b. March 14, 1879, Ulm, Württemberg, Ger.—d. April 18, 1955, Princeton, N.J., U.S.), German-American physicist who developed the special and general theories of relativity, the equivalence of mass and energy, and the photon theory of light.

A brief account of the life and works of Albert Einstein follows; for a full biography, *see* MACROPAEDIA: Einstein.

Einstein earned a doctorate at the Polytechnic Academy in Zürich in 1905, and in the same year he published four research papers, each containing a great discovery in physics. International fame came to Einstein in 1919 with the announcement that a prediction of his general theory of relativity was verified. Two years later he was awarded the Nobel Prize for Physics for his photoelectric law and work in theoretical physics.

During the winter of 1933 Einstein joined the Institute for Advanced Study in Princeton, N.J., and became a U.S. citizen in 1940. At the institute Einstein continued his work on general relativity, the unified field theories, and the critical discussion of the interpretation of quantum theory. He also cooperated with charitable and social organizations to help the large number of refugees who were arriving in the United States from Nazi Germany.

In 1939 it became known that two German physicists had discovered the fission of uranium. Enrico Fermi, an Italian physicist who at that time had arrived in the United States, became aware of the fact that if the fission could be made into a self-perpetuating chain reaction, enormous quantities of energy could be released. Fermi and the Hungarian physicist Leo Szilard decided to point this out to the U.S. government. Szilard and Eugene Wigner, another Hungarian physicist, asked Einstein to appeal directly to Pres. Franklin D. Roosevelt, pointing out the dangers if Germany succeeded in developing a bomb based on these principles. Einstein's letter to President Roosevelt resulted in the Manhattan Project and in the development of the atom bomb. In 1945 Einstein retired from his position at the institute but continued to work there until his death.

Einstein, Alfred (b. Dec. 30, 1880, Munich—d. Feb. 13, 1952, El Cerrito, Calif., U.S.), eminent German-American musicologist and critic.

Einstein was born into a family of scholars (Albert Einstein was his cousin), and, as a young man, studied law for a year before completing his doctorate (1903) in musicology and composition at the University of Munich. As the first editor (1918–33) of the *Zeitschrift für Musikwissenschaft* ("Journal of Musicology"), he held a position of considerable authority in his field. Einstein lived in Munich until 1927, where he was also the music critic of the *Münchner Post.* From 1927 to 1933 he was music critic for the *Berliner Tageblatt.* After the advent of the Nazi regime, he settled first in London and then near Florence. In 1939 he came to the United States, which became his permanent home, and taught music at Smith College until his retirement in 1950. He also taught at Columbia University, Princeton, the University of Michigan, and Yale. His writings include *Geschichte der Musik* (1917; *A Short History of Music,* 1936) and many valuable papers for the publications of the International Music Society and other learned editions; his articles for the *Musical Quarterly* are especially notable. A skilled editor, Einstein revised Riemann's *Musik Lexicon* (1919–29) and Köchel's catalogue of Mozart's works (1937) and produced new editions of Mozart's last 10 string quartets and a biography, *Mozart, His Character, His Work* (1945). His most significant work, however, is considered to be *The Italian Madrigal,* 3 vol. (1949), which was the first comprehensive study of this subject in any language.

einsteinium (Es), synthetic chemical element of the actinide series in Group IIIb of the periodic table, atomic number 99. Not occurring in nature, einsteinium (as the isotope einsteinium-253), produced by intense neutron irradiation of uranium-238, was identified in December 1952 by Albert Ghiorso and co-workers at Berkeley, Calif., in debris taken from the first thermonuclear or hydrogen-bomb explosion, in the South Pacific (November 1952).

The material was first collected on filter paper by drone airplanes flying through the radioactive-explosion clouds; later, einsteinium and element 100 (fermium) were positively identified in coral gathered from Eniwetok Atoll. Einsteinium metal has not yet been prepared.

All einsteinium isotopes are radioactive. Mixtures of the isotopes einsteinium-253 (20.5-day half-life), einsteinium-254 (276-day half-life), and einsteinium-255 (38.3-day half-life) can be produced by intensive slow-neutron irradiation of elements of lower atomic number, such as plutonium. Tracer studies indicate that the +3 oxidation state exists in aqueous solution, presumably as the Es^{3+} ion; there is also some evidence for a +2 state. Einsteinium has chemical properties very similar to those of the other actinide elements in the tripositive state. Einsteinium-255 and einsteinium-256 eject electrons (beta particles) to form isotopes of fermium (atomic number 100), and einsteinium-253 was used to produce mendelevium (atomic number 101).

atomic number	99
stablest isotope	254
valence	2,3
electronic config.	2-8-18-32-29-8-2 or $(Rn)5f^{11}7s^2$

Einstein's mass–energy relation, relationship between mass (m) and energy (E) in the special theory of relativity of Albert Einstein, embodied by the formula $E = mc^2$, where c equals 300,000 kilometres (186,000 miles) per second—*i.e.*, the speed of light.

In physical theories prior to that of special relativity, mass and energy were viewed as distinct entities. Furthermore, the energy of a body at rest could be assigned an arbitrary value. In special relativity, however, the energy of a body at rest is determined to be mc^2. Thus, each body of mass m possesses mc^2 of "rest energy," which potentially is available for conversion to other forms of energy. The mass–energy relation, moreover, implies that if energy is released from the body as a result of such a conversion, then the mass of the body will decrease. Such a conversion of rest energy to other forms of energy occurs in ordinary chemical reactions, but much larger conversions occur in nuclear reactions. This is particulary true in the case of nuclear-fusion reactions that transform hydrogen to helium, in which 0.7 percent of the original rest energy of the hydrogen is converted to other forms of energy.

Einthoven, Willem (b. May 21, 1860, Semarang, Java, Dutch East Indies—d. Sept. 29, 1927, Leiden, Neth.), Dutch physiologist who was awarded the 1924 Nobel Prize for Physiology or Medicine for his discovery of the electrical properties of the heart through the electrocardiograph, which he developed as a practical clinical instrument and an important tool in the diagnosis of heart disease.

Einthoven
Archiv fur Kunst und Geschichte, West Berlin

Einthoven was graduated in medicine from the University of Utrecht and served as professor of physiology at the University of Leiden from 1886 until his death. In 1903 he devised the first string galvanometer, known as the Einthoven galvanometer; with this instrument he was able to measure the changes of electrical potential caused by contractions of the heart muscle and to record them graphically. He coined the term electrocardiogram for this process. Einthoven recognized differences in the records or tracings obtained from different kinds of heart disease. From 1908 to 1913 he studied the patterns of records of normal heart activity in order to gain precision in recognizing and interpreting deviations.

Einthoven continued to develop electrode arrangements, and the present-day standard limb leads were originally described and used by him.

Éire: *see* Ireland.

Éireann, Muir: *see* Irish Sea.

Eirik (Norwegian personal name): *see under* Erik.

Eiseley, Loren (Corey) (b. Sept. 3, 1907, Lincoln, Neb., U.S.—d. July 9, 1977, Philadelphia), U.S. anthropologist, educator, and author who wrote about anthropology for the lay person in eloquent, poetic style.

Eiseley was educated at the University of

Nebraska (B.A., 1933) and the University of Pennsylvania (M.A., 1935; Ph.D., 1937) and began his academic career at the University of Kansas (1937–44) and Oberlin College (1944–47). In his long association with the University of Pennsylvania he served as professor of anthropology (1947–61), curator of early man at the University Museum (1947–77), provost of the university (1959–61), and professor of anthropology and the history of science (1961–77). He also served as a consultant to museums, foundations, and the U.S. government and was the host–narrator of the television series *Animal Secrets* (1966–67). He received numerous honours, including membership in the National Institute of Arts and Letters and the American Academy of Arts and Sciences.

Eiseley's scientific research centred on the dating of index fossils of the Pleistocene Epoch and the extinction of Ice Age fauna. His writings, however, covered the wide range of the question of evolution and its implications for humanity. He published more than a dozen books, including *The Immense Journey* (1957), *Darwin's Century* (1958), *The Firmament of Time* (1960; reprinted 1970), *The Unexpected Universe* (1969), and *The Night Country* (1971). He also published an autobiography, *All the Strange Hours* (1975), and a collection of poetry, *Another Kind of Autumn* (1977). A collection of his poems and selected essays, *The Star Thrower,* was published in 1979.

Eiselsberg, Anton, Freiherr von (baron of) (b. July 31, 1860, Schloss Steinhaus, Austrian Empire—d. Oct. 25, 1939, near St. Valentin, Austria), Austrian surgeon, teacher, and researcher who carried out important studies in the physiology of the thyroid gland and surgery of the central nervous system.

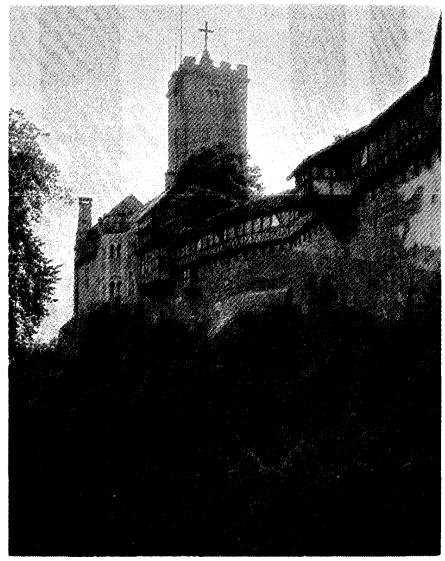
Eiselsberg studied medicine at Vienna, Würzburg, Zürich, and Paris. In 1884 he received his M.D. from Vienna, where he was a pupil of and assistant to the brilliant Viennese surgeon Theodor Billroth. He was professor of surgery at Utrecht (1893), Königsberg (1896), and Vienna (1901). In 1890 he made note of the frequent occurrence of tetany cramps after goiter operations and two years later produced tetany experimentally by removal of the parathyroid glands. He later studied thyroid cancer and did important work in pituitary surgery.

It was while he was a professor at Vienna that Eiselsberg achieved a reputation as the leader of neurosurgery in Austria. He was one of the founders of modern gastrointestinal surgery and the first surgeon in Europe to remove a spinal column tumor. He pioneered in brain surgery and also performed studies on streptococcic infections.

Eiselsberg received honorary degrees from universities at Athens, Budapest, Debrecen, Edinburgh, Geneva, Leiden, Paris, and Vienna.

Eisenach, city, Thuringia *Land* (state), central Germany, on the northwestern slopes of the Thüringer Wald, at the confluence of the Hörsel and Nesse rivers, west of the city of Erfurt. Founded by the landgraves of Thuringia *c.* 1150, Eisenach fell to the Saxon House of Wettin in 1264 and was chartered in 1283. It was intermittently the seat of a separate Saxon duchy between 1596 and 1741, when it fell to Saxe-Weimar. In 1817 the festival of the national political student movement took place there; in 1859 the German Nationalverein (National Society) to promote unification was founded there; and in 1869 the Social Democratic Workers' Party was founded at the Congress of Eisenach.

Notable landmarks include the Romanesque Church of St. Nicholas; the Gothic St. George's Church; the Thuringian Museum in the former ducal palace (1742–45); the 13th-century Dominican Church; the Lutherhaus, where Martin Luther stayed as a schoolboy; museums in memory of the composers Johann S. Bach (born at Eisenach in 1685) and Richard Wagner and the novelist Fritz Reuter; and a botanical garden. On a hill above the city is the Wartburg, an ancient castle of the landgraves, where Martin Luther began his translation of the Bible.



The Wartburg, on a hill above Eisenach, Ger.

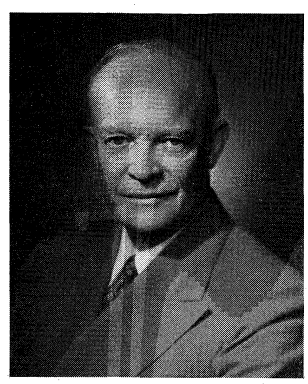
© Caio Garrubba—Madeline Grimoldi

Tourism thrives, and industries include the manufacture of motor vehicles (the Wartburg cars), machinery, metal and wood products, chemicals, and electrotechnical goods. Eisenach is a centre of the important Werra potash field. Pop. (1989 est.) 48,361.

Eisenberg, Cora (puppeteer): *see* Baird, Bil and Cora.

Eisenerz, town, *Bundesland* Steiermark (federal province of Styria), Austria, in the Erzbach Valley, at the northern foot of the Erzberg (Ore Mountain; 5,033 ft [1,534 m]), northwest of Leoben. Iron has been mined on the Erzberg by terraced open-pit methods since Roman times, and Eisenerz ("iron ore") is the principal centre of Austrian iron mining, supplying most of the nation's total output. Notable landmarks include the fortified St. Oswald's Church (1279–1517), the old mining Shift Tower with a bell that signaled changes of shifts in the mine (1581), and a mining museum. A few miles northwest of Eisenerz are the castle of Leopoldstein and the Leopoldsteiner See, a lake 1½ mi (2.4 km) long. Pop. (1981) 10,074.

Eisenhower, Dwight D(avid) (b. Oct. 14, 1890, Denison, Texas, U.S.—d. March 28, 1969, Washington, D.C.), 34th president of the United States (1953–61), who had been supreme commander of the Allied forces in western Europe during World War II.



Eisenhower, 1952

Fabian Bachrach

Early career. He was the third of seven sons of David Jacob and Ida Elizabeth (Stover) Eisenhower. In the spring of 1891 the Eisenhowers returned to Abilene, Kan., where their ancestors had settled as part of a Mennonite colony. Dwight's father worked in a creamery; the family was poor, and Dwight and his brothers were introduced to hard work and a strong religious tradition at an early age.

"Ike," as Dwight was called, was a fun-loving youth who enjoyed sports, while taking only a moderate interest in his studies. He graduated from Abilene High School in 1909, supported a brother's college education for a year, and then entered the U.S. Military Academy at West Point. He excelled in football but injured a knee in his second year at the academy and was forced to stop playing. In the remarkable class of 1915—which was to produce 59 generals—he ranked 61st academically and 125th in discipline out of the total of 164 graduates.

He was commissioned a second lieutenant and was sent to San Antonio, Texas, where he met Mamie Geneva Doud, daughter of a successful Denver meat packer. They were married in 1916 and had two sons: Doud Dwight, born in 1917, who died of scarlet fever in 1921, and John Sheldon Doud, born in 1922.

During World War I, Eisenhower commanded a tank training centre, was promoted to captain, and received the Distinguished Service Medal. The war ended just before he was to be sent overseas. From 1922 to 1924 he was assigned to the Panama Canal Zone and there came under the inspiring influence of his commander, Brig. Gen. Fox Conner. With Conner's assistance, Eisenhower was selected to attend the army's command and general staff school at Ft. Leavenworth. Then a major, he graduated first in a class of 275 in 1926 and two years later graduated from the Army War College. He then served in France, writing a guidebook of World War I battlefields, and in Washington, D.C., before becoming an aide to army chief of staff Gen. Douglas MacArthur in 1933. Two years later he accompanied MacArthur to the Philippines to assist in the reorganization of the commonwealth's army and while there was awarded the Distinguished Service Star of the Philippines and the rank of lieutenant colonel. He returned to the United States shortly after Germany's invasion of Poland initiated the European phase of World War II and in March 1941 became a full colonel. Three months later he was made chief of staff of the 3rd Army and soon won the attention of army chief of staff Gen. George C. Marshall for his role in planning war games involving almost 500,000 troops.

Supreme commander. When the United States entered World War II in December 1941, Marshall appointed Eisenhower to the army's war plans division in Washington, where he prepared strategy for an Allied invasion of Europe. He was made a brigadier general in September 1941, and he was promoted to major general in March 1942 and named head of the operations division of the War Department. In June, Marshall selected him over 366 senior officers to be commander of U.S. troops in Europe. Eisenhower's rapid advancement, after a long army career spent in relative obscurity, was due not only to his knowledge of military strategy and a talent for organization but also to his ability to persuade, to mediate, and to be agreeable. Men from a variety of backgrounds and nationalities, impressed by his friendliness, humility, and persistent optimism, liked and trusted him.

Eisenhower was promoted to lieutenant general in July 1942 and named to head Operation Torch, the Allied invasion of French North Africa. This first major Allied offensive

of the war was launched on Nov. 8, 1942, and successfully completed in May 1943. Eisenhower's decision to work during the campaign with the French admiral Jean-François Darlan, who had collaborated with the Germans, aroused a storm of protest from the Allies; but his action was defended by Pres. Franklin D. Roosevelt. A full general since February, Eisenhower then directed the amphibious assault of Sicily and the Italian mainland, which resulted in the fall of Rome on June 4, 1944.

During the fighting in Italy, Eisenhower participated in plans to cross the English Channel for an invasion of France. On Dec. 24, 1943, he was appointed supreme commander of the Allied Expeditionary Forces, and the next month he was in London making preparations for the massive thrust into Europe. On June 6, 1944, he gambled on a break in bad weather and ordered the Channel crossed. About 1,000,000 men in nearly 4,000 ships landed in Normandy and began to fight their way into the heart of France. On August 25 Paris was liberated. After overcoming a fierce German counterattack in the Ardennes in December, the Allies crossed the Rhine on March 7, 1945. Germany surrendered on May 7, and the war in Europe was over. In the meantime, in December 1944, Eisenhower had been made a five-star general.

He was given a hero's welcome upon returning to the United States for a visit in June 1945. His intended retirement was delayed by Pres. Harry S. Truman when he was named in November to replace General Marshall as chief of staff. For more than two years Eisenhower directed demobilization of the wartime army and worked to unify the armed services under a centralized command. In May 1948 he left active duty, the most popular and respected soldier in the United States, to become president of Columbia University. His book *Crusade in Europe,* published that fall, made him a wealthy man.

Eisenhower's brief career as an academic administrator was not especially successful. His technical education and military experience prepared him poorly for the post, and his distrust of intellectuals made relations with faculty members difficult. In the fall of 1950 President Truman asked him to become supreme commander of the North Atlantic Treaty Organization (NATO), and in early 1951 he flew to Paris to assume his new position. For the next 15 months he devoted himself to the task of creating a united military organization in western Europe to be a defense against the possibility of Communist aggression.

First term as president. As early as 1943 Eisenhower was mentioned as a presidential candidate. His personal qualities and military reputation prompted both parties to woo him. As the campaign of 1952 neared, Eisenhower let it be known that he was a Republican, and the eastern wing of the party, headed by Gov. Thomas E. Dewey of New York, made an intensive effort to persuade him to seek the Republican presidential nomination. His name was entered in several state primaries against the more conservative Sen. Robert A. Taft of Ohio. Although the results were mixed, Eisenhower decided to run. In June 1952 he retired from the army, after 37 years of service, returned to the United States, and began to campaign actively. At the party convention in July, after a bitter fight with Taft supporters, Eisenhower won the nomination on the first ballot. His running mate was Sen. Richard M. Nixon of California. Democrats nominated Gov. Adlai E. Stevenson of Illinois for president and Sen. John Sparkman of Alabama for vice president.

Despite his age, Eisenhower campaigned tirelessly, impressing millions with his warmth and sincerity. He urged economy and honesty in government and promised to visit Korea to explore the possibilities for ending the Korean War, which had broken out in 1950 between Communist North Korea and pro-Western South Korea and soon involved United Nations (mainly United States) and Communist Chinese forces. Many Republicans, including Nixon, spoke of pro-Communist disloyalty within the Truman administration and called for stringent anti-subversive measures. The Eisenhower–Nixon ticket won handily, carrying 39 states, winning the electoral vote, 442 to 89, and collecting more than 33,000,000 popular votes. The Republican Party won control of Congress by a slim margin but lost both houses two years later.

Unlike his two Democratic predecessors, Eisenhower did not believe in strong executive leadership of the federal government. Because of his military background and limited knowledge of government, he delegated authority to his advisers and Cabinet members and did not participate actively in the detailed work of the executive departments. His assistant, former New Hampshire governor Sherman Adams, was a powerful figure in the administration. The Chief Executive, Adams wrote,

> expected me to manage a staff that would boil down, simplify and expedite the urgent business that had to be brought to his attention and to keep as much work of secondary importance as possible off his desk.

Eisenhower's basically conservative views on domestic affairs were shared by his secretary of the treasury, George M. Humphrey. The administration's domestic program, which came to be labelled "modern Republicanism," called for reduced taxes, balanced budgets, a decrease in government control over the economy, and the return of certain federal responsibilities to the states. Controls over rents, wages, and prices were allowed to expire, and in 1954 there was a slight tax revision. At Eisenhower's insistence, Congress transferred title to valuable tideland oil reserves to the states. But there was no sharp break with policies inherited from previous Democratic administrations. The needs of an expanding population (from 155,000,000 to 179,000,000 during the Eisenhower era) and the country's overseas commitments caused budget deficits during five out of eight years. The minimum wage was increased to $1 per hour, the Social Security System was broadened, and in the spring of 1953 the Department of Health, Education, and Welfare was created.

The right wing of his party clashed with the President more often than did the Democrats during his first term. In part to preserve party unity, he refused to condemn publicly Sen. Joseph R. McCarthy's irresponsible charges of Communist influence within the government. Although privately Eisenhower expressed his distaste for the Senator, at times he seemed to encourage the attacks of McCarthyites. Hundreds of federal employees were fired under his expanded loyalty-security program. With his approval, Congress passed a law designed to outlaw the American Communist Party. Following the sensational hearings on McCarthy's charges against army and civilian officials, televised nationally for five weeks in the spring of 1954, McCarthy's popularity waned, as did the anti-Communist hysteria.

Foreign affairs drew much of Eisenhower's attention; he and his secretary of state John Foster Dulles worked hard at achieving peace and constructing collective defense agreements designed to check the spread of Communism. Eisenhower visited Korea shortly after his inauguration. Partly, perhaps, because of Joseph Stalin's death in March, the President was able to negotiate a truce for the Korean War in July 1953. In December of that year, he proposed that the countries of the world pool atomic information and materials under the auspices of an international agency. This "Atoms for Peace" suggestion bore fruit in 1957, when 62 countries formed the International Atomic Energy Agency.

In July 1955 the President met with leaders of Great Britain, France, and the Soviet Union at a summit conference in Geneva. His "open-skies" proposal, by which the United States and the Soviet Union would permit continuous air inspection of each other's military installations, was welcomed by world opinion but was rejected by the U.S.S.R. In September 1954, Eisenhower and Dulles succeeded in creating the Southeast Asia Treaty Organization (SEATO) to prevent further Communist expansion in that part of the world. It was composed of the United States, France, Great Britain, Australia, New Zealand, the Philippines, Thailand, and Pakistan. NATO was strengthened in 1955 by the inclusion of West Germany.

Critics contended that there were frequent disparities between the administration's words and deeds in the field of foreign relations. While threatening to "unleash" Nationalist Chinese leader Chiang Kai-shek, the United States signed a defense treaty with Nationalist China in December 1954 that inhibited Chiang's ability to attack the Communist Chinese. Dulles spoke of "liberating" captive peoples in Communist countries, but the administration limited itself to protests when uprisings occurred in East Germany (1953) and Hungary (1956). While the Secretary of State promised "massive retaliation" against Communist aggression, the President made the decision to limit America's role in the Indochina crisis between France and Ho Chi Minh's guerrillas to financial and military aid.

Second term. A heart attack in September 1955 and an operation for ileitis in June 1956 raised considerable doubt about Eisenhower's ability to serve a second term. But he recovered quickly, and the Republican Convention unanimously endorsed the Eisenhower–Nixon ticket on the first ballot. Democrats again selected Adlai E. Stevenson and named Sen. Estes Kefauver of Tennessee as his running mate. Eisenhower's great personal popularity turned the election into a landslide victory, the most one-sided race since 1936. The Democrats, however, once more captured both houses of Congress, a feat they were to duplicate in 1958. Eisenhower was the first president to serve with three Congresses controlled by the opposition party.

The election campaign of 1956, however, had been complicated by a crisis in the Middle East over Egypt's seizure of the Suez Canal. The subsequent attack by Great Britain, France, and Israel on Egypt and Egypt's support by the Soviet Union prompted the President to go before Congress in January 1957 to urge adoption of what came to be called the Eisenhower Doctrine, a pledge to send U.S. armed forces to any Middle Eastern country requesting assistance against Communist aggression.

When the U.S. Supreme Court, on May 17, 1954, declared racial segregation in public schools unconstitutional, controversy and violence broke out, especially in the South. In September 1957 Eisenhower dispatched 1,000 federal troops to Little Rock, Ark., to halt an attempt by Gov. Orval E. Faubus to obstruct a federal court order integrating a high school. This action was the most serious challenge of his presidency. On several occasions Eisenhower had expressed distaste for racial segregation, though he doubtless believed that the process of integration would take time. The Civil Rights Act of 1957 was the first such law passed since 1875.

On Oct. 4, 1957, the Soviet Union launched Sputnik I, the first man-made satellite to orbit the Earth. Americans were shocked by the achievement, and many blamed Eisenhower for the administration's insistence on low military budgets and its failure to develop a space

program. Steps were taken to boost space research and to provide funds to increase the study of science. The National Aeronautics and Space Administration was created in July 1958. The administration again came under fire in the fall of 1957 for a recession in the economy that lasted through the following summer. The President refused to lower taxes or increase federal spending to ease the slump for fear of fuelling inflation.

Following the death of Dulles in the spring of 1959, Eisenhower assumed a more personal role in the direction of American foreign policy. He travelled to Europe, Africa, and Asia in December 1959 and toured Latin America in February and March 1960. To improve relations with the Soviet Union, the President invited Premier Nikita S. Khrushchev to visit the United States. Khrushchev toured parts of the country in September 1959 and held private talks with Eisenhower. Another summit meeting was planned, and a new era of personal diplomacy seemed at hand. But when a United States U–2 reconnaissance plane was shot down over the U.S.S.R. in May 1960 Khrushchev scuttled the talks and angrily withdrew his invitation to the President to visit the Soviet Union. Eisenhower admitted that the flights had gone on for four years and shouldered much of the blame for the ill-timed affair. In January 1961, during the last weeks of the Eisenhower administration, the United States broke diplomatic relations with Cuba, for two years under the control of Fidel Castro.

Though his administrations had a great many critics, Eisenhower remained extraordinarily popular with the American people. When he left office, Congress restored his rank as general of the army. He retired to his farm in Gettysburg, Pa., and devoted much of his time to his memoirs. In 1963 he published *Mandate For Change,* which was followed in 1965 by *Waging Peace.* A lighter work, *At Ease: Stories I Tell to Friends,* appeared in 1967.

(T.C.R.)

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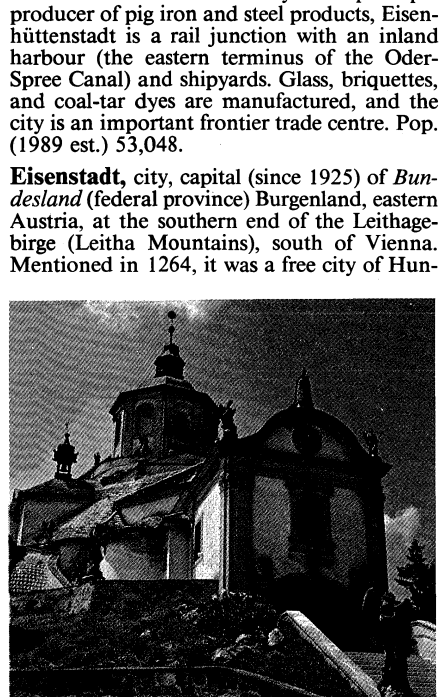
Eisenhower Doctrine (Jan. 5, 1957), in the Cold War period after World War II, U.S. foreign policy pronouncement by Pres. Dwight D. Eisenhower promising military or economic aid to any Middle Eastern country needing help in resisting Communist aggression. The doctrine was intended to check the increase of Soviet influence in the Middle East resulting from the supply of arms to Egypt by Communist countries, as well as from strong Communist support of Arab states against an Israeli, French, and British attack on Egypt in October 1956. Eisenhower proclaimed with congressional approval that he would use the armed forces to protect the independence of any Middle Eastern country seeking American help. The Eisenhower Doctrine represented no radical change in U.S. policy; the Truman Doctrine had pledged similar support to Greece and Turkey 10 years earlier. It was a continuation of the U.S. policy of containment of or resistance to any extension of the Soviet sphere of influence.

Articles are alphabetized word by word, not letter by letter

Eisenhower Trophy, golf trophy awarded to the winner of a biennial international amateur competition open to three- or four-man teams from all nations. The competition was first held, under sponsorship of the World Amateur Golf Council, in 1958, and the trophy was named for Pres. Dwight D. Eisenhower, a golf enthusiast. The contest consists of 72 holes of stroke play (the team with the lowest number of strokes wins). The three low scores of each national team for each 18-hole round are totalled to give the team score for that round. For winning teams, *see* Sporting Record: *Golf.*

Eisenhüttenstadt, city, Brandenburg *Land* (state), eastern Germany, on the Oder River at the Polish border, southeast of Frankfurt an der Oder. It was formed in 1961 by the union of Fürstenberg, Stalinstadt, and Schönfliess. Stalinstadt was a planned-residence town for workers employed in a metallurgical complex established in 1951 just west of the old town of Fürstenberg. Now one of the chief industrial cities of eastern Germany and a principal producer of pig iron and steel products, Eisenhüttenstadt is a rail junction with an inland harbour (the eastern terminus of the Oder-Spree Canal) and shipyards. Glass, briquettes, and coal-tar dyes are manufactured, and the city is an important frontier trade centre. Pop. (1989 est.) 53,048.

Eisenstadt, city, capital (since 1925) of *Burgenland* (federal province) Burgenland, eastern Austria, at the southern end of the Leithagebirge (Leitha Mountains), south of Vienna. Mentioned in 1264, it was a free city of Hungary from 1648 until Burgenland was ceded to Austria in 1920. Notable landmarks include the former castle of the Esterházy princes (14th century, rebuilt 1663–72); the Kalvarienbergkirche (Mt. Calvary Church) with the tomb of the composer Joseph Haydn; the house where Haydn lived from 1766 to 1790, now a museum; the parish church (1450–1522); and the Franciscan church (1625–30), with the Esterházy family vault. The castle of Forchtenstein, former seat of the counts von Mattersdorf, is nearby. Eisenstadt has orchards and vineyards and manufactures textiles, ski equipment, and metal kitchen ware. Pop. (1981) 10,150.



Kalvarienbergkirche (Mount Calvary Church) housing the tomb of the composer Joseph Haydn in Eisenstadt, Austria

H.R. Schneider—ZEFA

Eisenstaedt, Alfred (b. Dec. 6, 1898, Dirschau, West Prussia [now Tczew, Pol.]), pioneering German photojournalist whose widely printed pictures vividly chronicle the period since the early 1930s.

He served in the German Army in World War I from 1916 to 1918, sustaining injuries in both legs. After becoming an enthusiastic amateur photographer, he decided in 1929 to turn professional, thus becoming a part of the active photojournalism field that was developing in Germany during the 1920s and early 1930s. In this period he was particularly influenced by Erich Salomon, a pioneer in candid photography.

In the early 1930s he developed skill in the use of the 35-mm Leica camera, and his work began to appear in many European picture magazines. He covered the rise of Hitler and in 1935 made a notable series on Ethiopia, just before the Italian invasion. Also in 1935 he left Germany for the United States and in April 1936 joined the new picture magazine *Life.* One of his pictures appeared on the cover of the second issue, and they continued to appear in following issues.

Eisenstaedt's assignments have been many and varied. He made outstanding portraits of kings, dictators, and motion picture stars, but he also sensitively photographed ordinary people in workaday situations. Characterizing his work, Eisenstaedt once said that all a photojournalist has to do is "to find and catch the storytelling moment."

Eisenstaedt described his life and work in *The Eye of Eisenstaedt* (1969). Other anthologies of his photographs include *People* (1973) and *Eisenstaedt: Germany* (1981).

Eisenstein, Ferdinand Gotthold Max (b. April 16, 1823, Berlin, Germany—d. Oct. 11, 1852, Berlin), German mathematician whose work on the theory of elliptic functions and on quadratic and cubic forms led to several theorems for quadratic and biquadratic residues, a reciprocity theorem for cubic residues, cyclotomy, and quadratic partition of prime numbers.

Eisenstein graduated from the University of Berlin in 1843 and the following year published no fewer than 25 papers in German mathematical journals. His writings led to an exchange of correspondence with German mathematician and physicist Carl Friedrich Gauss (1777–1855), during which time he extended Gauss' work in ternary quadratic forms from two to three. He became a professor of mathematics at the University of Berlin. Eisenstein wrote *Mathematisch Abhandlungen* (1847). He was elected to the Berlin Academy shortly before his death at age 29.

Eisenstein, Sergey (Mikhaylovich) (b. Jan. 23, 1898, Riga, Latvia, Russian Empire—d. Feb. 11, 1948, Moscow), Russian film director and theorist whose work includes the three film classics *Potemkin* (1925), *Alexander Nevsky* (1938), and *Ivan the Terrible* (released in two parts, 1944 and 1958). In his concept of film montage, images, perhaps independent of the "main" action, are presented to create maximum psychological impact.

Eisenstein, of Jewish descent through his paternal grandparents, lived in Riga, where his father, Mikhail, a civil engineer, worked in shipbuilding until 1910, when the family moved to St. Petersburg (now Leningrad). After studying in 1916–18 at the Institute of Civil Engineering, Eisenstein decided on a career in the plastic arts and entered the School of Fine Arts.

With the outbreak of the Russian Revolution of 1917, he enlisted in the Red Army and helped to organize and construct defenses and to produce entertainment for the troops. Having now found his vocation, he entered, in 1920, the Proletkult Theatre (Theatre of the People) in Moscow as an assistant decorator. He rapidly became the principal decorator and then the co-director. As such, he designed the costumes and the scenery for sev-

Eisenstein, on location for *October* in 1927
Sovfoto

eral notable productions. At the same time, he developed a strong interest in the Kabuki theatre of Japan, which was to influence his ideas on film. For his production of *The Wise Man,* an adaptation of Aleksandr Ostrovsky's play, he made a short film, "Glumov's Diary," which was shown as part of the performance in 1923. Soon afterward the cinema engaged his full attention, and he produced his first film, *Strike,* in 1924, after having published his first article on theories of editing in the review *Lef,* edited by the great poet Vladimir Mayakovsky. He said there that in place of the static reflection of an event, expressed by a logical unfolding of the action, he proposed a new form: the "montage of attractions"—in which arbitrarily chosen images, independent of the action, would be presented not in chronological sequence but in whatever way would create the maximum psychological impact. Thus, the filmmaker should aim to establish in the consciousness of the spectators the elements that would lead them to the idea he wants to communicate; he should attempt to place them in the spiritual state or the psychological situation that would give birth to that idea.

These principles guided Eisenstein's entire career. In the realistic films that he undertook, however, such a technique is effective only when it utilizes the concrete elements implicit in the action; it loses validity when its symbols are imposed upon reality instead of being implied by it. Thus, in *Strike* (1924), which recounts the repression of a strike by the soldiers of the tsar, Eisenstein juxtaposed shots of workers being mowed down by machine guns with shots of cattle being butchered in a slaughterhouse. The effect was striking, but the objective reality was falsified.

Possessed by his theory, Eisenstein was bound to succumb often to this failing. *Potemkin,* also called *The Battleship Potemkin,* happily escaped it. Ordered by the Central Executive Committee of the U.S.S.R. to commemorate the Revolution of 1905, the film, made in the port and the city of Odessa in 1925, had a momentous impact and still remains among the masterpieces of the world cinema. (In 1958 it was voted the best film ever made, by an international poll of critics.) Its greatness lies not merely in the depth of humanity with which the subject is treated, nor in its social significance, nor in the formal perfection of its rhythm and editing; but rather, it is each of these magnified and multiplied by the others.

Having by this accomplishment earned recognition as the epic poet of the Soviet cinema, Eisenstein next made a film entitled *October,* or *Ten Days That Shook the World,* which in the space of two hours dealt with the shifts of power in the government after the 1917 Revolution, the entrance on the scene of Lenin, and the struggle between the Bolsheviks and their political and military foes. If the film was sometimes inspired, it was also disparate, chaotic, and often confused.

Also uneven, but better balanced, was *Old and New* (originally titled *The General Line*), filmed in 1929 to illustrate the collectivization of the rural countryside. Eisenstein made of it a lyric poem, as calm and as expansive as *Potemkin* had been violent and compact.

In 1929, putting to profit a visit to Paris, he filmed *Romance sentimentale* (*Sentimental Melody*), an essay in counterpoint of images and music. Engaged by Paramount studios in 1930, he left for Hollywood, where he worked on adaptations of the novels *L'Or* ("Sutter's Gold"), by Blaise Cendrars, and *An American Tragedy,* by Theodore Dreiser. Refusing to modify his scripts to meet studio demands, however, he broke the contract and went to Mexico in 1932 to direct *Que viva Mexico!,* with capital collected by the novelist Upton Sinclair.

The film never was completed. After disagreements between Eisenstein and Sinclair, some of the negatives were sold and released as the films *Thunder over Mexico, Eisenstein in Mexico,* and *Death Day* (1933–34). In 1939 a fourth film, entitled *Time in the Sun,* was made from the footage. None of these films bears more than a distant resemblance to the original conception.

After his return to Moscow in 1933, Eisenstein undertook *Bezhin Meadow.* Several weeks before its completion, however, he was ordered to suspend its production. The scenes already shot were put together by Eisenstein, but the film, which was never released, was attacked as "formalistic" because of its poetic interpretation of reality. Eisenstein thus suffered from the same governmental policies toward art that had embroiled the composer Sergey Prokofiev, the writer Isaac Babel, and many other artists in difficulties with Soviet officialdom.

Having expressed contrition for the errors of his past works, Eisenstein was able to make a film recounting the medieval epic of *Alexander Nevsky,* in accordance with Stalin's policy of glorifying Russian heroes. Made in 1938, this film transfigured the actual historical events, majestically leading to a final resolution that represented the triumph of collectivism. As in medieval epics, the characters were the strongly stylized heroes or demigods of legend. Produced in close collaboration with Prokofiev, who wrote the score, the film represented a blend of images and music into a single rhythmic unity, an indissoluble whole.

During World War II Eisenstein achieved a work of the same style as *Alexander Nevsky* and even more ambitious—*Ivan the Terrible*—about the 16th-century tsar Ivan IV, whom Stalin admired. Begun in 1943 in the Ural Mountains, the first part was finished in 1944, the second at the beginning of 1946. A third part was envisaged, but Eisenstein, suffering from angina pectoris, had to take to his bed for several months. He was about to return to work when he died, only a few days after his 50th birthday.

Most critics would agree that though Eisenstein's three greatest films stand far above the others, all of his work is significant; their flaws are those common to artists probing the limits of their craft. It may be that in the entire history of motion pictures, no other filmmaker has surpassed him in his understanding of his art. (Je.M.)

MAJOR WORKS. *Films. Strike* (1924); *Potemkin* (1925); *October* (*Ten Days That Shook the World;* 1928); *Old and New* (*The General Line;* 1929); *Alexander Nevsky* (1938); *Ivan the Terrible, Part One* (1944); *Ivan the Terrible, Part Two* (1958).
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Eiserne Kreuz (Prussia and Germany): *see* Iron Cross.

Eisk (Russian S.F.S.R.): *see* Yeysk.

Eisleben, city, Saxony-Anhalt *Land* (state), central Germany, in the eastern foothills of the Harz Mountains. First mentioned in 994 as a market, called Islebia, and in 1180 as a town, it belonged to the counts of Mansfeld until it passed to Saxony in 1780 and was assigned to Prussia in 1815. It is divided into the old and new towns (Altstadt and Neustadt), the latter having originated as a residential district for miners in the 14th century. The houses where Martin Luther was born (1483) and where he died (1546) have been preserved, and the SS. Peter and Paul's Church (1486–1513) contains his baptismal font. The town has a mining-engineering school and a training institute for miners. The centre of the Mansfeld copper–slate-mining region, Eisleben manufactures textiles, clothing, machinery, and furniture and has important seed nurseries. Pop. (1989 est.) 26,852.

Eisner, Kurt (b. May 14, 1867, Berlin—d. Feb. 21, 1919, Munich), German Socialist journalist and statesman who organized the Socialist Revolution that overthrew the monarchy in Bavaria (1918).

Eisner studied literature and philosophy at Hermann Cohen's neo-Kantian school at Marburg. In 1892 he published *Friedrich Nietzsche und die Apostel der Zukunft* ("Friedrich Nietzsche and the Apostle of the Future"). He began his journalism career by working on the *Frankfurter Zeitung* (1892–93); later he wrote for several Berlin journals and from 1898 was editor of *Vorwärts,* the official Social Democratic paper. After Eisner became a Bavarian citizen, he worked as a free-lance writer in Munich.

In 1914 he opposed German aid to Austria-Hungary against Serbia. During the early stages of World War I, however, Eisner supported the government; but in 1917, influenced by pacifist principles, he joined the Independent Social Democratic Party (USDP) of which he later became the leader. Eisner was arrested in 1918 as a strike leader but was shortly released and resumed his leadership of the USDP. In November 1918 he successfully organized a revolution that overthrew the monarchy, proclaimed the Bavarian Republic, and demanded peace. Eisner became first prime minister and minister of foreign affairs of the new republic. He strove to bring about internal security, to reconcile and unite the various Socialist parties in Bavaria, and to effect economic and social reform. In February 1919 he was assassinated by a zealous reactionary student.

Eisner's collected works were published in two volumes in 1919.

Eissner, Clara: *see* Zetkin, Clara.

Eisstockschiessen (German: "ice-stock shooting"), also called EISSCHIESSEN, or GERMAN CURLING, a game played on ice in the winter and on asphalt or other surfaces during the rest of the year, similar to curling and shuffleboard. The game became popular in Bavaria and Austria by the late 19th century.

Teams consist of four players and one substitute. The rink is 28 metres (30.8 yards) long and 3 m (3.3 yd) wide. Players slide (shoot) cylindrical *Eisstöcken* ("ice stocks") down the rink, aiming to come as close as possible to a *Runddaube* ("rubber ring") inside a 6-m- (6.6-yd-) long area called a house. The stock

weighs from 4.5 to 6 kilograms (about 10 to 13 pounds), is about 30 to 38 centimetres (12 to 15 inches) high and 35.5 cm (14 in.) in diameter, and consists of a solid plastic body (*Stockkörper*) fitted with a stainless steel ring and a bottom of pressed plywood and reinforced steel; a wooden handle (*Stiele*); and a sole (*Laufsohle*), made of rubber for use on ice or of hardwood and plastic for use on other surfaces. The composition of the rubber determines the speed stocks attain on the ice. Players switch soles depending on the kind of shot they need to make. Tournaments consist of 19 teams and have three parts: regular team competition; individual skills competition in which a player tests his ability to place the stock in precise spots; and long shooting, in which maximum distance is the goal and the rink is not used.

Eisstockschiessen was a demonstration sport in the 1936 and 1964 Winter Olympic Games. Men, women, and children compete in the sport, which is most popular in Austria and Germany, where more than 200,000 participate. There are clubs in more than 18 countries, including Canada and the United States. There are national championships and an annual European championship. The sport is governed by the Internationale Föderation für Eisstockschiessen (IFE), with headquarters in Frankfurt, Ger.

eisteddfod (Welsh: "session"), formal assembly of Welsh bards and minstrels that originated in the traditions of court bards of medieval times. The modern National Eisteddfod, revived in the 19th century and held each summer alternately in a site in north or south Wales, has been broadened to include awards for music, prose, drama, and art, but the chairing and investiture of the winning poet remains its high point.

Earlier assemblies were competitions of musicians (especially harpists) and poets from which new musical, literary, and oratorical forms emerged. The assembly at Carmarthen (1451) is famous for establishing the arrangement of the strict metres of Welsh poetry in forms that are still authoritative. In the 17th century the custom fell into disuse, though poetry remained a popular art and a form of eisteddfod survived in informal gatherings of rhymesters who met to compose verses on impromptu subjects. In the 18th century, when local eisteddfodau were revived, it was apparent that many ordinary farmers and workingmen were still sufficiently skilled in the complicated craftsmanship of bardic versification to win prizes. In the 19th century the eisteddfod exerted a dominant influence on Welsh poetry through its annual national assembly and a number of local competitions. Though it succeeded in preserving the bardic forms, the quality of eisteddfod poetry was normally mediocre and degenerated to its lowest level in the late 19th century. The subjects assigned for the competition were celebrations of Welsh history or the Welsh countryside, biblical subjects such as the creation or the resurrection, or abstract subjects, such as almsgiving. Such poetry was necessarily impersonal and resulted in lengthy, descriptive compositions in which form was the major concern and content and emotional depth were secondary. With World War I and the Depression, in which Wales was particularly hard hit, many Welsh poets turned to more personal and relevant poetry, and the eisteddfod became primarily a forum for a youthful poet to gain a hearing.

Eitner, Robert (b. Oct. 22, 1832, Breslau, Prussia—d. Feb. 2, 1905, Templin, Ger.), German musicologist, editor, and bibliographer.

Largely self-taught in music, Eitner in 1853 settled in Berlin, where he gave lessons and performed his own compositions in concerts. In 1863 he opened a music school, but his growing interest in historical research led him to produce a dictionary of Dutch composers.

In 1868 Eitner founded the Gesellschaft für Musikforschung and was elected its secretary. The following year he established the society's journal, *Monatshefte für Musikgeschichte,* acting as its editor from its founding until his death. His concern with the music of the 16th and 17th centuries developed into a monumental project begun in 1873; the 29-volume *Publikationen älterer praktischer und theoretischer Musikwerke,* a collection of largely unpublished works that took him 32 years to complete.

In 1877, in collaboration with other scholars, he issued the *Bibliographie der Musik-Sammelwerke des XVI. und XVII. Jahrhunderts* ("Bibliography of Music Collections of the 16th and 17th Centuries"). Alphabetically organized, indexed, and with locations given for all the pieces mentioned, this work became the model for later music bibliographies. Soon thereafter, Eitner began his greatest work, the 10-volume *Quellen-Lexikon* (1900–04), a unique reference book that located both printed music and manuscripts of early composers and theoreticians in more than 200 European libraries, and which was for 50 years a primary guide for music research.

ejaculation, the release of sperm cells and seminal plasma from the male reproductive system. Ejaculation takes place in two phases: in the first, or emission, stage, sperm are moved from the testes and the epididymis (where the sperm are stored) to the beginning of the urethra, a hollow tube running through the penis that transports either sperm or urine; in the second stage, ejaculation proper, the semen is moved through the urethra and expelled from the body.

Sperm cells that are stored in the male body are not capable of self-movement because of the acidity of the accompanying fluids. When the sperm receive fluids, called seminal plasma, from the various internal accessory organs (prostate gland, ejaculatory ducts, seminal vesicles, and bulbourethral glands [*qq.v.*]), the acidity decreases. As they leave the body, the sperm receive oxygen, which is vital to motility. Unable to leave the male body by their own motivation, the sperm cells are transported by muscular contractions. During the emission phase, the muscles around the epididymis and ductus deferens (the tube extending from the epididymis) contract to push the sperm into the prostate and urethra. During ejaculation, the semen is expelled by strong spasmodic contractions of the bulbocavernosus muscle, which encircles the corpus spongiosum (the structure in the penis that encloses the urethra). The whole process of ejaculation is accomplished by nerve impulses received from the penis; once ejaculation is started it becomes a reflex reaction that cannot be voluntarily interrupted.

The seminal fluid is not passed from the various accessory glands simultaneously. A small amount of mucus-like secretion is first passed from the bulbourethral and urethral glands to flush out the urethra and prepare it for the sperm. Next follows the fluid from the prostate gland, and then that from the seminal vesicles. Finally, the fluid actually containing the sperm is ejaculated. After the bulk of the sperm cells have passed, more fluids follow and again flush out the urethra. The total volume of the ejaculate averages between 2 and 5 millilitres (0.12 to 0.31 cubic inch) in the human; of this, only about 1 to 5 percent are actually sperm cells. The other constituents of semen include nutrients, water, salts, waste products of metabolism, and cellular debris. The secretions of the testes and accessory glands are produced under the influence of the male hormone testosterone; without sufficient testosterone the glands degenerate and cannot secrete fluids. *See also* erection.

ejaculatory duct, either of two hollow tubes, each formed by union of the ampulla of a ductus deferens (*q.v.*) and the excretory duct of a seminal vesicle (*q.v.*). The ducts, which open into the urethra about halfway through the prostate gland (*q.v.*), function to mix the sperm stored in the ampulla with fluids secreted by the seminal vesicles and to transport these substances to the prostate.

Eje Volcánico (Mexico): *see* Neo-Volcánica, Cordillera.

ejectment, in Anglo-American property law, legal action for recovery of land from one wrongfully in possession and monetary compensation for his unlawful detention of the land. The action, traceable to the Roman law, had its early development in feudal England. By the second half of the 16th century, ejectment was in common use to adjudicate title to any real property. In its technical operation it was highly fictitious, primarily because it was a personal action and not a real action and could be maintained only to right a wrong done to the person. The action of ejectment was preferred against the various forms of real action because of legal complexities that left many landowners either without a remedy or at the mercy of hairline technical procedures in pleading and proof. Thus landowners who wanted to establish their rightful titles would often use fictitious tenants to maintain the ejectment action; because a determination of the legal validity of the landlord's title was necessary to establish a tenant's right to possession, the important outcome of the action, in many cases, was the court's recognition of the landlord's lawful title.

As a form of action, ejectment fell into disuse in England as a result of the Common Law Procedure Act of 1852. In the United States, ejectment became part of the law of the colonies but was early reformed to abolish the technical fictions attending the law, thus making it a title action that could be used directly by any landowner. Today there are ejectment statutes in most states of the U.S.

ejido, in Mexico, village lands communally held in the traditional Indian system of land tenure that combines communal ownership with individual use. The ejido consists of cultivated land, pastureland, other uncultivated lands, and the *fundo legal* (townsite). In most cases the cultivated land is divided into separate family holdings, which cannot be sold although they can be handed down to heirs.

Measures taken during the reform period that began in 1855 abolished the landownership rights of civil and religious corporations. Although the primary purpose of this reform was to dissolve the large ecclesiastical estates, the law also forced the Indians to give up their village lands. The land reform measures in the 1917 constitution restored land that had been taken from ejidos, made land grants to landless villages, and divided large estates into smaller private land holdings. Today ejidos constitute some 55 percent of Mexico's cultivated land.

The increasing fragmentation of the land caused by the family inheritance pattern has in some cases resulted in an inefficient scale of operation. This result, together with a lack of capital and limited educational attainment, has retarded progress in ejido agriculture. Some cooperatively run ejidos, however, particularly in the cotton-raising areas, have shown great success.

Ekaterina (Russian personal name): *see under* Catherine.

Ekaterinburg (Russian S.F.S.R.): *see* Sverdlovsk.

Ekaterinodar (Russian S.F.S.R.): *see* Krasnodar.

Ekaterinoslav (Ukrainian S.S.R.): *see* Dnepropetrovsk.

EKD (German church federation): *see* Evangelical Church in Germany, The.

Ekeberg, Anders Gustav (b. Jan. 16, 1767, Stockholm—d. Feb. 11, 1813, Uppsala, Swed.), Swedish chemist who in 1802 discovered the element tantalum. After graduation from the University of Uppsala (1788) and travels in Germany, Ekeberg returned to Uppsala and began teaching (1794), introducing the chemistry of Antoine-Laurent Lavoisier. Though he was partly deaf from a childhood infection and had been blinded in one eye by an exploding flask (1801), he carried on admirably. Perhaps his greatest contribution to chemistry was the discovery of the talent of his student Jöns Jacob Berzelius.

Ekelöf, Gunnar (b. Sept. 15, 1907, Stockholm—d. March 16, 1968, Sigtuna, Swed.), outstanding Swedish poet and essayist.

Ekelöf exerted great influence on his contemporaries. His radically modern style was influenced by such poets as Charles Baudelaire, Arthur Rimbaud, Ezra Pound, and T.S. Eliot. In such poetry from the 1930s as *Sent på jorden* (1932; "Late on Earth"), Ekelöf was drawn to the Surrealist technique of automatism (the spontaneous release of the subconscious in the creative act), but his work also reflects an interest in musical forms and Oriental mysticism. A student of Oriental languages, Ekelöf felt divided between mystical tendencies and rationalism. This conflict is apparent in *Färjesång* (1941; "Ferry Song") and *Non Serviam* (1945; "I Will Not Serve"). Central to Ekelöf's work is *En Mölna-elegi* (1960; "A Mölna Elegy"), published in several earlier versions from the mid-1940s. Its starting point is within the mind of the poet, sitting at Mölna dock on a summer day in 1940. Memories from his individual past intermingle with those of history in an endless panorama.

In the 1950s Ekelöf turned away from finished compositions to work in fragmentary forms, as in *Strountes* (1955; "Nonsense"). The last decade of his work is dominated by the Akritas trilogy, *Dīwān över Fursten av Emgión* (1965; "Diwan over the Prince of Emgión"), *Sagan om Fatumeh* (1966; "The Tale of Fatumeh"; Eng. trans., *Selected Poems*), and *Vägvisare till underjorden* (1967; *Guide to the Underworld*). The trilogy contains Ekelöf's finest poetic expression of the simultaneous experience of presence and transitoriness. In 1958 Ekelöf became a member of the Swedish Royal Academy.

Ekhmīn (Egypt): *see* Akhmīm.

Ekhof, (Hans) Konrad (Dieterich), Ekhof also spelled ECKHOF (b. Aug. 12, 1720, Hamburg, Den. [now in Germany]—d. June 16, 1778, Gotha, Saxe-Gotha [Germany]), actor and director who, with Caroline Neuber and Friedrich Schröder, was a major influence in the development of a German theatrical tradition.

In 1739 Ekhof became a member of the company managed by Johann Friedrich Schönemann, an association that extended over 17 years. Ekhof played leading roles in German translations of French plays. During the company's stay at Schwerin (1751–56), domestic drama was added to the repertory, giving Ekhof the opportunity to perform in plays of George Lillo, Gotthold Lessing, and Edward Moore.

In Schwerin, Ekhof initiated a dramatic academy (1753) with fortnightly meetings in which he discussed with his colleagues the problem of the actor's craft and civic responsibility. His prestige lent dignity to the short-lived but important Hamburg National Theatre. He spent the last three years of his life in Gotha in charge of the new court theatre. Ekhof was among the earliest theorists on German drama and was responsible for a freer, more natural style of acting.

Ekibastuz, city and major opencut coal-mining centre in Pavlodar *oblast* (province), Kazakh Soviet Socialist Republic, on the Irtysh-Karaganda Canal. Coal was discovered in the region in 1876 and was mined on a small scale. Only after construction of a railway in 1953 did large-scale exploitation of Ekibastuz' rich but low-grade coal seams begin. In the 1970s Ekibastuz was the third largest coal-mining centre in the Soviet Union, but still consisted of isolated settlements, although a city centre was emerging. A regional station for the production of electrical power is located near the city to provide power for export to the European Russian S.F.S.R. and to the Urals. The city has a plant for the production of reinforced concrete, a repair plant for transport and mining equipment, a dairy, a brewery, and a number of educational institutions. Pop. (1987 est.) 141,000.

ekistics, science of human settlements. Ekistics involves the descriptive study of all kinds of human settlements and the formulation of general conclusions aimed at achieving harmony between the inhabitants of a settlement and their physical and sociocultural environments. Descriptive study involves the examination of the content, such as man alone or in societies, of a settlement, and the settlement container, or the physical settlement, composed of natural and human-made elements. The examination of settlement content and the physical settlement involves the investigation of five basic elements of human settlement: nature, including physical geography, soil resources, water resources, plant and animal life, and climate; human biological and emotional needs, sensations and perceptions, and moral values; society, including population characteristics, social stratification, cultural patterns, economic development, education, health and welfare, and law and administration; shells, or structures, in which people live and function, such as housing, schools, hospitals, shopping centres and markets, recreational facilities, civic and business centres, and industries; and networks, or systems, that facilitate life and day-to-day functions of inhabitants such as water and power systems, transportation networks, communication systems, and the settlement's physical layout.

A result of the descriptive study of human settlement and its five basic elements is settlement classification according to the size and number of units which form the settlement; the permanency of the settlement or the degree to which it is continually inhabited; the method by which the settlement was created, such as a settlement that emerged or evolved naturally or one that was preconceived; and the most important form of settlement classification, that according to purpose or function. The most common functional classifications are rural settlements, institutional settlements established for a specific purpose, and urban settlements.

The descriptive study of human settlements also analyzes the anatomy of the settlement. Settlements or parts of settlements can be classified according to their degree of functional homogeneity, the type and number of central place functions, the circulatory patterns found within the settlement, or any special function or purpose observable in the settlement. The main purpose or function of a settlement can serve to categorize the settlement as a homogeneous region, such as a single farmstead classified as a homogeneous agricultural region or a bedroom community identified as a homogeneous residential region. Human settlements can be identified as central places that function as marketplaces, administrative centres, and social and cultural meeting places serving surrounding hinterlands. Circulatory patterns unite settlements by providing transport of people, goods, and information along lines of circulation such as roads. Nodal regions, or settlements, often form at the intersection of circulatory lines. Unique functions observable within a settlement sometimes are identified as a special settlement area, such as an army camp within a larger residential settlement or a large factory or business in the midst of a relatively homogeneous residential area. Most human settlements possess some form of all these types at some geographic scale.

Unlike other disciplines or sciences interested primarily in one element of human settlement—such as society (sociology) or shells (architecture or engineering)—ekistic study draws upon the knowledge of economics, social science, technical disciplines, and cultural disciplines. Two fields of study closely allied to ekistics are urban geography and regional science, but neither claims the comprehensive approach advocated in ekistics. By drawing from the knowledge of other fields of study in the classification and anatomical study of human settlements, ekistics seeks to draw general conclusions or formulate theories or laws that can be used by builders, planners, architects, engineers, and other creators of human settlements in prescriptive action to cure the maladies of existing settlements and prevent such ills in future settlements.

Ekkehard I THE ELDER, also called EKKEHARD I OF ST. GALL, Ekkehard also spelled EKKEHART (b. *c.* 910, Toggenburg?, Alemannia [now in Switzerland]—d. Jan. 14, 973, Sankt Gallen), teacher, monk, hymnist, and poet who until about 1941 was regarded the author of *Waltharius,* a celebrated Latin heroic poem based on the life of King Walter of Aquitaine.

Of noble birth, Ekkehard was educated at the Benedictine monastery of Sankt Gallen (St. Gall) in Switzerland, then one of Europe's greatest centres of learning, at which he later taught.

After being elected dean of the monastery in 957, Ekkehard went to Rome, where he was well received by Pope John XII. He retired to Sankt Gallen and was chosen abbot but declined the position, recommending one Burkard, whom he continually advised. A noted economist, Ekkehard rejuvenated the intellectual and ecclesiastical prestige that had distinguished Sankt Gallen for centuries. Adjacent to the monastery, he founded a hospice for travelers and the sick.

Among his extant hymns are those honouring the Trinity and Saints Columban, John the Baptist, and Stephen. The belief that Ekkehard was also the author of the famous *Waltharius* epic stems from a statement in the *Casus Sancti Galli,* a history of Sankt Gallen written in part by Ekkehard IV, that Ekkehard I—while still in abbey school—composed a *Vitam Waltharii manu fortis* as a school exercise for his master Geraldus. That an individual named Geraldus, or Gerald, dedicated the work to Bishop Erkanbald of Strasbourg is clear; scholars now tend to attribute the entire 1,456-line *Waltharius* epic to Geraldus. Certain scholars have suggested that the life of Waltharius to which Ekkehard IV refers is in fact a different Waltharius.

Ekkehard IV (b. 980?, Alsace [now in France]—d. Oct. 21, 1069?, Sankt Gallen [now in Switzerland]), teacher, glossarist, writer, famous as one of the principal authors of *Casus Sancti Galli* ("The Events of Sankt Gallen [St. Gall]")—an important history of the monastery.

He grew up at Sankt Gallen, being educated by the celebrated German scholar Notker

Labeo, Ekkehard I's nephew. From sometime after 1022 until 1031 he was director and teacher of the cathedral school of Mainz, where he became known for his vast store of knowledge, earning the patronage of the emperor Conrad II.

Returning to Sankt Gallen, Ekkehard began work on the *Casus,* begun and carried on by others. *Casus* records traditions of the ancient abbey and, despite its uneven Latin and inaccuracies, supplies a valuable source for contemporary history and culture. About 1030 Ekkehard revised and corrected a *Waltharius,* which he claims in *Casus* to have been written by Ekkehard I. Since the mid-20th century scholars have disputed Ekkehard I's authorship of the famous *Waltharius.*

Among Ekkehard IV's other important literary works is the *Liber benedictionum* ("Book of Benedictions"), a collection of inscriptions, blessings, and poems (some of them his own and others attributed to Notker Labeo). Ekkehard was also known to have been a skillful church musician.

Ekklēsia (in ancient Greece): *see* Ecclesia.

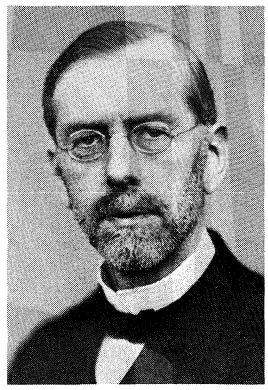
Ekman, Gösta (b. Dec. 28, 1890, Stockholm—d. Jan. 12, 1938, Stockholm), Swedish actor and director noted for his versatility on stage and screen.

Ekman premiered in 1906 at Stockholm's Oscar Theatre and, after an apprenticeship on tour and in the provinces, returned to Stockholm (1913) to win acclaim for his classic portrayals, such as Lionel in Friedrich Schiller's *Maid of Orleans* (1914), Claudio in *Much Ado About Nothing* (1916), and Romeo in *Romeo and Juliet* (1919). His later career fit the same mold. During his tenures in the company of the Svenska Theatre (1913–25), as comanager of the Oscar Theatre (1926–31) with John and Pauline Brunius (the latter, an actress of note, became Ekman's wife), and as manager of the Vasa Theatre (1931–35), Ekman starred in such roles as Tartuffe (1927), Hamlet (1934), and Shylock (1936) while also directing and appearing in plays by Henrik Ibsen, August Strindberg, George Bernard Shaw, and others. His film career, begun in 1912, followed a similar path. His appearance in a silent film *Hamlet* (1918) aroused considerable interest, his title role in *Charles XII* (done in two parts, in 1924 and 1925) received international attention, and his *Faust,* directed by F.W. Murnau (1926), remains of contemporary interest. Ekman co-directed the film *A Perfect Gentleman* (1927) and appeared in the Swedish version of *Intermezzo* (1937) with Ingrid Bergman.

Ekman was the author of several books and received the medal Litteris et Artibus from the Swedish king. His son, Hasse Ekman, himself a prominent film actor and director, wrote a biography of his father in 1938.

Ekman, V(agn) Walfrid (b. May 3, 1874, Stockholm—d. March 9, 1954, Gostad, near Stockaryd, Swed.), Swedish physical oceanographer best known for his studies of the dynamics of ocean currents. The common oceanographic terms Ekman layer, denoting certain oceanic or atmospheric layers occurring at various interfaces; Ekman spiral, used in connection with vertical oceanic velocity; and Ekman transport, denoting wind-driven currents, derive from his research.

Ekman was the youngest son of Fredrik Laurentz Ekman, a Swedish physical oceanographer. After finishing secondary school in Stockholm, Ekman studied at the University of Uppsala, where he majored in physics. But lectures on hydrodynamics in 1897 by Vilhelm Bjerknes, one of the founders of meteorology and oceanography, definitely decided the direction of Ekman's work.



V. Walfrid Ekman, 1928

By courtesy of the Lunds Universitet, Sweden

While still a student at Uppsala, Ekman made important contributions to oceanography. When it was observed, during the Norwegian North Polar Expedition, that drift ice did not follow the wind direction but deviated by 20° to 40°, Bjerknes chose Ekman to make a theoretical study of the problem. In his report, published in 1902, Ekman took into account the balance of the frictions between the wind and sea surface, within layers of water, and the deflecting force due to the Earth's rotation (Coriolis force).

After taking his degree at Uppsala in 1902, he joined the staff of the International Laboratory for Oceanographic Research in Oslo, where he remained until 1909. During those years he proved to be a skilled inventor and experimentalist. The Ekman current meter, an instrument with a simple and reliable mechanism, has been used, with subsequent improvements, to the present, while the Ekman reversing water bottle is used in freshwater lakes and sometimes in the ocean to obtain water samples at different depths with a simultaneous measurement of water temperatures. He displayed his theoretical and experimental talents in his study of so-called dead water, which causes slow-moving boats to become stuck because of a thin layer of nearly fresh water spreading over the sea from melting ice. This phenomenon, frequently occurring in fjords, seriously impeded the Norwegian explorer Fridtjof Nansen in Arctic waters. Ekman demonstrated by experiments in a wave tank that the resistance to the motion of the vessels is increased by the waves that are formed at the interface between layers of water of different densities.

He also derived an empirical formula for the mean compressibility (compression ratio divided by pressure) of seawater as a function of pressure and temperature. This formula is still in use today to determine density of deep seawater which is compressed by hydrostatic pressure.

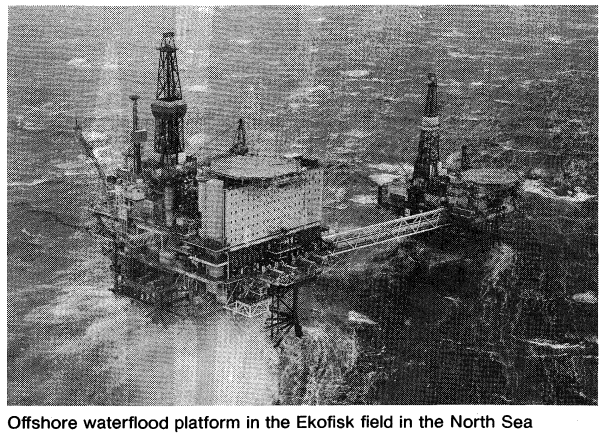
From 1910 to 1939, Ekman was professor of mechanics and mathematical physics at the University of Lund in Sweden, where he pursued his main interest, the dynamics of ocean currents. He published theories on wind-driven ocean currents, including the effects of coasts and bottom topography, and on the dynamics of the Gulf Stream. He also tried, with partial success, to solve the complex problem of ocean turbulence.

In 1925 Ekman participated in a cruise of a German research ship to the Canary Islands. On finding that data on currents obtained for several days at several marine stations between the Bay of Biscay and the Canary Islands were not sufficient to obtain an average figure, he and a colleague, during the years 1922–29, improved the technique for measuring currents for a prolonged period by collecting data from an anchored ship. After several preparatory cruises for that purpose off the Norwegian coast aboard a Norwegian research vessel, they made a cruise to the trade-wind region off northwestern Africa in the summer of 1930 to determine the average current at various ocean depths at stations occupied for two weeks or longer. Preliminary reports were published soon after the cruise, but Ekman wrote the final report in 1953 at the age of 79. The long delay in publication, partly owing to the loss of important data during the German occupation of Norway, also indicates the unparalleled care he took with his work.

Although his name and achievements were well known among oceanographers, he rarely attended international meetings—but his genuine kindliness prevented him from becoming a recluse. Most of his teachers and friends, such as Nansen and Bjerknes, were Norwegian; he spent many vacations in Bergen. He sang a beautiful bass, spent much time at the piano, and occasionally composed music. In the fall of 1953, he began a study of turbid currents, which he continued until a few days before his death. (T.Ic.)

BIBLIOGRAPHY. Further information on his life and a selected bibliography of his works may be found in Charles Coulston Gillispie (ed.), *Dictionary of Scientific Biography,* vol. 4 (1971), pp. 344–345.

Ekofisk, group of Norwegian offshore natural-gas and oil fields located in the North Sea about 180 miles (290 km) southwest of Norway, halfway between Norway and the United Kingdom. The Ekofisk district includes the Ekofisk field itself (1969; petroleum) and the original, relatively small natural-gas discovery at Cod (1968), as well as petroleum fields at Tor (1970), West Ekofisk (1970), and Albuskjell (1972). Production began in 1971; by 1980 there were 18 offshore platforms and 50 operating wells. The Ekofisk field is the major producer in the group. A pipeline carries petroleum from Ekofisk to refineries in Teesside, England; a natural-gas pipeline extends from the Cod field to Emden, Ger.



Offshore waterflood platform in the Ekofisk field in the North Sea

By courtesy of *Oil and Gas Journal;* photograph, Phillips Petroleum Company

Ekoi, also called EKOID BANTU, group of peoples situated in extreme southeastern Nigeria and extending into neighbouring Cameroon. Some of the many ethnic groups related by language include the Atam, Boki, Ejagham, Mbembe, Ufia, and Yako. The Ekoi live in proximity to the Efiks of southeastern Nigeria and claim to have migrated from the north to that area. A possible origin for the Ekoi in the lower end of the Nile Valley is based in part on the nature of a secret script called *nsibidi.* The inhabitants of Kwa, near Calabar, claim to be the first Ekoi to have come from the north.

Land was conceived as belonging to the heirs of the first settler, and while it could not be sold, rights of settlement could be purchased by newcomers. Ekoi men have traditionally hunted while women have engaged in agricultural work. Among the crops are yams, plantains, and corn (maize). Women also fish, while both men and women have roles in weaving.

Ekoi towns were ruled by councils of elders, with townspeople free to attend meetings. Native courts instituted under British administration created an appeals system outside of the decision making by the elders. Representatives from various towns sit on the courts.

The primary traditional Ekoi deities are Obassi Osaw, the sky god, and Obassi Nsi, the earth god. Ancestors and natural forces are also emphasized in the Ekoi concepts of worship. Various Ekoi cults are devoted to the welfare of common activities, such as farming. Before the establishment of British colonial administration, the *egbo* was a prominent Ekoi secret society that had strong social regulatory functions as well as influence in religious matters.

The Ekoi practice traditional medicine and have treated such diseases as smallpox with local medicinal plants. In addition to displaying an extensive knowledge of and aesthetic appreciation for flowers, the Ekoi create mural paintings on sanctuaries, make pottery, and carve figures in solid basaltic blocks.

Ekrem Bey, Recaizade Mahmud (b. 1847, Constantinople—d. 1914, Constantinople), writer who was one of the most outstanding figures in 19th-century Turkish literature.

The son of a poet and scholar, he was apprenticed to a number of government offices after his formal education. Later on he became an official in the Şura-yi Devlet (Council of State) and a Turkish-literature teacher at the renowned Galatasaray Lycée and at the Mülkiye Mektebi (Imperial School of Political Science) in Constantinople. After the Young Turk Revolution in 1908, he held several government posts, finally becoming senator.

Writing in the traditional Ottoman classical style early in his literary career, he came under the influence of the famous Turkish modernist Namık Kemal. Although never a great poet himself, Ekrem Bey strove to redefine art and poetical form. Writing for *Servet-i fünun,* an avant-garde literary and sometimes political periodical, Ekrem Bey developed a great following among younger poets. "Art for art's sake" was a major tenet, as it was for much of the French Parnassian school of poetry in the second half of the 19th century. Among his most important works are *Talim-i Edebiyyat* (1882; "The Teaching of Literature"), literary criticism and theory; and *Tefekkür* (1888; "Meditations"), poems and prose. He also wrote plays and made translations from the French. As a theorist he had considerable influence on literary taste and ideas and on the work of later Turkish poets.

Ekron, ancient Canaanite and Philistine city, one of the five cities of the Philistine pentapolis, and currently identified with Tel Miqne (Arabic Khirbat al-Muqanna'), south of the settlement Mazkeret Batya, central Israel. Although allocated to Judah after the Israelite conquest (Joshua 15:11), Ekron was a Philistine stronghold in David's time (I Samuel 17:52); during the time of King Ahaziah of Israel, it was associated with the worship of the deity Baalzebub (Baal of the Flies; though some would read instead Baal-zebul, or Baal of the Abode; II Kings 1:2–18). Taken by Egyptian Pharaoh Sheshonk I, the biblical Shishak, in his conquest of Palestine (*c.* 918 BC), it was later tributary to Esarhaddon and his son Ashurbanipal, kings of Assyria (7th century BC). Known as Akkaron or Accaron in Hellenistic and later times, the church historian and topographer Eusebius (*c.* AD 260/264–*c.* 340) mentions the existence of a Jewish population there in his lifetime.

By the late Middle Ages, Ekron had been abandoned; unlike other Philistine cities, such as Ashqelon or Ashdod, no tell (or mound) bore its name throughout the centuries, though it survived in the Arab village of 'Aqir, first identified with Ekron by the U.S. biblical scholar Edward Robinson (1794–1863). In 1883 Baron Edmond de Rothschild (1845–1934), the French-Jewish banker and philanthropist, founded a Jewish settlement adjoining 'Aqir. The official name of this settlement is Mazkeret Batya (Hebrew: Memorial [to] Batya), in honour of the Baron's mother; the name Ekron (now officially Qiryat 'Eqron) was subsequently given to an adjoining new immigrants' settlement, established in 1949. However, the names 'Eqron and 'Aqir are still often used for the older settlement.

Another site suggested by some scholars for ancient Ekron is Qidron (Arabic, Qatra), 3 mi south of Mazkeret Batya.

ekthesis (Greek: "to expose," or "to set forth"), in logic, process used by Aristotle to establish the validity of certain propositions or syllogisms. For example, in the *Analytica priora* he argued: "If A belongs to no B; neither will B belong to any A; for if it did belong to any A, say Γ (gamma), it would not be true that A belonged to no B; for Γ is one of the B's." Ekthesis refers in particular to the creation of a new term (in this case, Γ) that, together with the principle of *reductio ad impossibile* (a method of proving a proposition by showing that its denial leads to a contradiction), allows the deduction of the desired result.

Ekvthime Mthatzmideli (religious leader): *see* Euthymius the Hagiorite.

Ekwensi, Cyprian (Odiatu Duaka) (b. Sept. 26, 1921, Minna, Nigeria), Ibo novelist, short-story writer, and children's author whose strength lies in his realistic depiction of the forces that have shaped the African city dweller.

Ekwensi was educated at Ibadan (Nigeria) University College and at the Chelsea School of Pharmacy in London. His first published works include the novellas *When Love Whispers* (1947) and *The Leopard's Claw* (1950). They combine a fascination for urban life with earnest exhortations to avoid its pitfalls. *People of the City* followed in 1954 (rev. ed., 1969); it is a commentary in a journalistic style on the problems of corruption, bribery, and despotism as seen through the eyes of a crime reporter and dance-band leader in Lagos.

Jagua Nana (1961), his most successful novel, has as its protagonist Jagua, a colourful and impressive prostitute full of charm. Around her, Ekwensi sets in motion a whole panoply of vibrant, amoral, big-city Nigerians who have rejected their rural pasts and have become bound by the opportunistic, pleasure-seeking urban code. Similar characters and themes emerge from the well-written *Lokotown and Other Stories* (1966), where the glitter and excitement of Lagos life is sharply contrasted with its seediness and degradation. *Burning Grass* (1962) is a story of the Fulani cattlemen in the north of Nigeria. Ekwensi also wrote a number of children's books and a collection of Ibo folktales.

Ekwensi's led a varied career, but communications remained his major interest. He served as head of features for the Nigerian Broadcasting Corporation; director of information in the Federal Ministry of Information, Lagos; and chairman of the bureau for external publicity in Biafra. He was also active in reorganizing Biafra's former radio station at Orlu after civil war brought an end to the state. Although some of his writings suffer from shallow characterization, his work remains an outstanding chronicle of Nigerian city life and appealed to a broad audience. His later works include *Survive the Peace* (1976), which deals with the Biafran War.

El (Semitic: "god"), the chief deity of the West Semites. In the ancient texts from Ras Shamra (ancient Ugarit) in Syria, El (El the Bull) was described as the titular head of the pantheon, husband of Asherah, and father of all the other gods (except for Baal). Although a venerable deity, he was not active in the myths, which primarily concerned his daughters and sons. He was usually represented as an old man with a long beard and, often, two wings. He was the equivalent of the Hurrian god Kumarbi and the Greek god Cronus. In the Old Testament, El was used both as a general term for "deity" and as a synonym for Yahweh.

El Aaiún, also spelled AAIÚN, AIUN, or LAÂYOUNE, town, capital of Western Sahara from 1940 to 1976 (when Western Sahara was a northwest African overseas province of Spain) and capital since 1976 of the not internationally recognized Laâyoune province of Morocco. It lies in the Saguia el Hamra region, in the northern part of Western Sahara, 8 mi (13 km) inland from the Atlantic Ocean. The town, whose Arabic name means "water sources," was developed by the Spaniards in 1938 as the administrative, military, and European population centre of the former province. Nearby oases supply water. Prior to 1976 phosphate deposits were exploited at Bu Craa (Bou Craa) to the south, and a conveyor 60 mi (100 km) long was constructed to bring the ore from there to a loading pier at El Aaiún beach. During the guerrilla warfare conducted against Morocco by the Polisario Front, the conveyor was often damaged. Pop. (1982 est.) 50,000.

El Agustino, community of El Agustino district, Peru, in the east central Lima–Callao metropolitan area. It was founded about 1955, when tenant farmers found it more profitable to lease land for residences than to cultivate it. El Agustino and neighbouring communities were granted district status in 1965. Within walking distance of Lima, the town is poorly laid out; adobe or brick houses and shops line its narrow, twisting alleys. There are schools and a clinic. Pop. (1981 prelim.) district, 171,-127.

El-al ben Shachar: *see* Hillel ben Samuel.

El Al Israel Airlines, Hebrew EL AL NETIVE AWIR LE-YISRA'EL, Israeli airline founded by Israel in November 1948 after the establishment of the new nation. It flew its first commercial scheduled flights—to Rome and Paris—in July 1949, and by the 1980s it was flying routes from Jerusalem and Tel Aviv to many of the major cities of Europe, as well as to Asia, Africa, and the Americas. In 1981 and 1982 the government considered liquidating El Al on account of financial difficulties exacerbated by a government ban on Sabbath flights.

A subsidiary, Teshet, wholly owned by El Al,

operates travel agencies, catering facilities in Israeli and U.S. airports, and hotels in Israel. Another subsidiary, Arkia Inland Airlines, founded in 1950 and owned 50 percent by El Al, provides scheduled air services within Israel.

el-Araish (Morocco): *see* Larache.

El Argar, culture characterized by a flourishing metallurgy of bronze, silver, and gold that appeared at the beginning of the 2nd millennium BC in the Almería (southeastern) region of the Iberian Peninsula; the culture, which developed a lively trade with centres in the eastern Mediterranean, reached its peak between 1700 and 1000 BC and spread throughout the southern, central, and Levantine regions as well as to the Balearic Islands.

El Banco, city, Magdalena department, northern Colombia, at the junction of the Magdalena and César rivers. The conquistador Gonzalo Jiménez de Quezada arrived at the site in 1537 and found the Indian village of Sompallón; he called it Barbudo ("Bearded One") because of its bearded chief. In 1544 Alonzo de San Martín renamed it Tamalameque (now the name of a town a few miles to the southeast). In 1749 José Domingo Ortiz, a freed black slave carrying a statue of the Virgin Mary, led a group of settlers to the locality that became known as Nuestra Señora de la Candelaria de El Banco ("Our Lady of Candlemas of the Riverbank"). Fishing and stock raising are the chief occupations, although small factories produce mattresses and brooms. Pop. (1973) city, 21,508; mun., 46,910.

El-Buheyrah (The Sudan): *see* Buḥayrah, al-.

El Callao, town, Bolívar State, eastern Venezuela, on the right bank of the Río Yuruari, about 135 miles (272 km) east-southeast of Ciudad Bolívar in the Venezuelan Guiana Highlands. The town has been a gold-mining centre since 1871, following the discovery of the metal in that year and by 1885 had become the world's leading producer. The first gold rush was over by 1899, and the mines were for long thought to be exhausted, but a combination of new technology and high gold prices in the 1970s led to the redevelopment of the mines by Minerven, a Venezuelan national mining corporation; production at its new facilities began in 1981. Pop. (1981) 6,615.

El Cayo (Belize): *see* San Ignacio.

El Centro, city, seat (1907) of Imperial County, southeastern California, U.S., 120 miles (193 km) east of San Diego. A desert community located 52 feet (16 m) below sea level, it is the largest settlement in the United States below sea level. El Centro was laid out in 1905 by W.F. Holt and developed as a commercial and transportation centre for the irrigated Imperial Valley. The National Parachute Test Range is there, and geothermal energy based on local well drilling was being developed in the 1980s. Inc. 1908. Pop. (1986 est.) 28,050.

El Cerrito, city, Contra Costa County, Calif., U.S., on the eastern shore of San Francisco Bay, north of Oakland, and 14 miles (22.5 km) northeast of San Francisco via the San Francisco–Oakland Bay Bridge. The early village, named Rust after a German blacksmith and storeowner who lived there, did not grow until the establishment of a railroad terminal and harbour at neighbouring Richmond in the early 1900s. The San Francisco earthquake and fire of 1906 resulted in a spurt of settlement, and thereafter a slow growth took place, culminating in the incorporation of the city of El Cerrito in 1917. Subsequent growth accompanied the economic development of the San Francisco Bay area but was particularly affected by that of Richmond. El Cerrito is largely residential, with the greater part of the working population employed in Richmond, Oakland, and San Francisco. The city has had a council-manager form of government from 1948. Pop. (1986 est.) 23,400.

el-Djem (Tunisia): *see* Thysdrus.

El Dorado, city, seat (1843) of Union County, southern Arkansas, U.S. The site was selected in 1843 by Robert Black, John Hampton, and Green Newton, who were instructed to centrally locate the county seat. Its Spanish name was supposedly given by Matthew Rainey, the first settler. Lumber and cotton were the basic products before oil was discovered in 1921 in the Busey Well. The town boomed, and oil production, refining, and petrochemicals are now the major industries. Conservation methods pioneered in the nearby Schuler Field have been adopted by the national oil industry. Inc. town, 1845; city, 1905. Pop. (1982 est.) 25,291.

El Dorado, city, seat of Butler County, southeastern Kansas, U.S., on the Walnut River east-northeast of Wichita. Settled in the 1860s, El Dorado grew considerably after petroleum was discovered in the vicinity in 1915. The city is now the centre of an agricultural and oil-producing area; oil refining is important, and oil-field tools and supplies are manufactured. Northeast of the city are the Flint Hills, known for their stock breeding and bluestem grass, and Bluestem Lake is to the east. Butler County Community Junior College was established in 1927. Inc. 1870. Pop. (1982 est.) 11,835.

El Escorial, village, Madrid province and autonomous community (region), central Spain, in the Guadarrama mountains, 26 miles (42 km) northwest of Madrid. It is the site of the Real Monasterio de San Lorenzo del Escorial, a monastery originally Hieronymite but occupied since 1885 by Augustinians.

Philip II decided to construct a monastery at El Escorial and to make it the royal pantheon, where all Spanish sovereigns beginning with the emperor Charles V were to be buried; all of them have been interred there, with the exception of Philip V, Ferdinand VI, and Alfonso XIII. One of the largest religious establishments in the world (about 675 by 528 feet [206 by 161 m]), El Escorial was begun in 1563 by Juan Bautista de Toledo, a Renaissance Spanish architect, who had worked earlier in Italy.

El Escorial, Spain
By courtesy of the Spanish National Tourist Office

Toledo is responsible for the general plan of El Escorial monastery, consisting of a great rectangle of three parts, the centre being occupied by the church. On the south are five cloisters in which are included the royal palace and offices; on the north, the living quarters of the monks. After his death in 1567, Toledo was succeeded by Juan de Herrera, who made extensive revisions in the designs, prepared new plans for the church (1572), and brought the whole building to completion in 1584. The church, about 200 feet (60 m) square, is of Greek-cross plan and is surmounted by a monumental dome about 60 feet (18 m) high at its centre. Although it was clearly inspired by Michelangelo's plan for St. Peter's in Rome, Herrera's building was far more sober. The massive walls of the interior, relieved only by Doric pilasters with no concession to decorative richness, produced a monument that was austere beyond anything the Italian Renaissance ever envisaged. On the exterior the gigantic scale of the monastery and the severe gray granite walls are forbidding. There Herrera established his fame and the Herreran style, which was to prevail in Spain for half a century.

The most interesting parts of the royal palace are the apartments of Philip II, with 16th-century furnishings and personal possessions of the monarch. The art collection of El Escorial is exhibited primarily in the sacristy and the chapter halls.

El Escorial library, founded by Philip II, houses a rare collection of more than 4,700 manuscripts, many of them illuminated, and 40,000 printed books. Some of the choicest items include the Arabic manuscripts, the Mozarabic codices, the early Gothic *Cantigas de Santa María* and the *Lapidarium* (both belonging to the reign of Alfonso X the Wise, 1221–1284), and the *Golden Gospels of Otto II* (1033–39). Pop. (1981) 6,192.

El Ferrol, also called EL FERROL DEL CAUDILLO, city, La Coruña province, in the autonomous community (region) of Galicia, in extreme northwestern Spain on the Ría (inlet) del Ferrol of the Atlantic Ocean. Named for a *farol* ("lighthouse") that marked the entrance to its harbour, the then fishing village of El Ferrol was chosen in 1726 by King Philip V as the site for a naval base. Ferdinand VI set up (1746–59) shipbuilding yards there; and between 1769 and 1774 Charles III added the royal naval arsenal and erected fortifications. After 1939 the city's name became El Ferrol del Caudillo because it was the birthplace of General Francisco Franco, who had become caudillo (leader) of Spain; but in the 1980s the shorter name came to be preferred.

Now one of the principal Spanish naval stations, El Ferrol's natural harbour, protected from the sea by rocky hills, is the third largest in Spain. It did not develop commercially, however, because of competition from La Coruña, 12 miles (19 km) to the southwest by sea, and because it had no railway until 1904. The port has shipbuilding yards and a large arsenal basin, with workshops and foundries, as well as a naval academy and several dry docks. Exports, mainly pit props, are insignificant, and imports are mostly materials for use in the shipbuilding industry. Nearby are the Atlantic submarine base La Graña and the notable 10th-century Chamorro church surrounded by Celtic megalithic ruins. Pop. (1981) 91,764.

El-Gedaraf (The Sudan): *see* Qaḍārif, al-.

El-Gezira (The Sudan): *see* Jazīrah, al-.

El-Kelaa des-Sraghna (Morocco): *see* Kelaa des Srarhna, el-.

El Lahun (ancient Egyptian site): *see* Lāhūn, al-.

El Monte, city, Los Angeles County, Calif., U.S., 12 miles (19 km) east of downtown Los Angeles. The site, on the banks of the San Gabriel River, is considered the western terminus of the Old Spanish Trail (sometimes called the Santa Fe Trail, though unrelated

to the trail of that name from Missouri to New Mexico). Early on, the site was merely a camping place for pioneers, but in 1849 a stage station was established there, and the first dwellings (of adobe brick) and a schoolhouse were erected in 1852. El Monte was incorporated in 1912. It is now a residential suburb, with some light industry; its population increased more than fivefold between 1960 and 1970. Pop. (1987 est.) 99,062.

El Morro National Monument, national monument in west-central New Mexico, U.S., 12 miles (19 km) southeast of Ramah. The national monument was established in 1906, with an area of 2 square miles (5 square km). El Morro (the "Headlands," or "Bluff"), or Inscription Rock, is a soft sandstone mesa rising 200 feet (60 m) above the valley floor and covering several acres. A water catchment basin and sheltered coves at its foot made it an important camping place on the trail to Cibola. Indians, Spaniards, and Americans left their inscriptions (1605–1774) on the cliff sides of the mesa. El Morro also has a number of pre-Columbian petroglyphs, and on its top lie ruins of Zuni Indian pueblos.

El Niño (Spanish: "The Christ Child"), in oceanography and climatology, the anomalous appearance, every few years, of unusually warm ocean conditions along the tropical west coast of South America. This event is associated with adverse effects on fishing, agriculture, and local weather from Ecuador to Chile and with far-field climatic anomalies in the equatorial Pacific and occasionally in Asia and North America as well.

The name El Niño was originally used during the 19th century by the fishermen of northern Peru in reference to the annual flow of warm equatorial waters southward around Christmas time. Peruvian scientists later noted that more intense changes occurred at intervals of several years and were associated with catastrophic seasonal flooding along the normally arid coast, while the thermal anomalies lasted for a year or more. The more unusual episodes gained world attention during the 20th century, and the original annual connotation of the name was replaced by that of the anomalous occurrence.

The timing and intensity of El Niño events vary widely. The first recorded occurrence of unusual desert rainfall was in 1525, when the Spanish conquistador Francisco Pizarro landed in northern Peru. Historians suggest that the desert rains and vegetation encountered by the Spaniards may have facilitated their conquest of the Inca empire. The intensity of El Niño episodes varies from weak thermal anomalies (2–3° C [about 4–5° F]) with only moderate local effects to very strong anomalies (8–10° C [14–18° F]) associated with worldwide climatic perturbations. El Niño events typically occur at three- to four-year intervals, with the strong events being less common. The intermittency varies widely, however, and the phenomenon is neither periodic nor predictable in the sense that ocean tides are.

Beginning with the work of Sir Gilbert Walker in the 1930s, climatologists recognized a similar interannual change in the tropical atmosphere, which Walker termed the Southern Oscillation (SO). El Niño and the Southern Oscillation appear to be the oceanic and atmospheric components of a single large-scale, coupled interaction—the El Niño/Southern Oscillation (ENSO). During the warm phase of ENSO, the South Pacific trade-wind system undergoes a change of state, or "seesaw," in which the westward-blowing trades weaken along the equator as the normally high pressure in the eastern South Pacific decreases and the low pressure over northern Australia and Indonesia rises. The pressure change and diminished trade winds cause warm surface water to move eastward along the equator from the western Pacific, while the warm surface layer in the east becomes thicker. Under normal conditions, the northward-blowing winds off South America cause nutrient-rich waters to upwell from below the shallow, warm surface layer. The nutrients (mainly phosphates and nitrates) provide a plentiful supply of food for photosynthesizing plankton, on which the fish feed. During El Niño, however, the thicker surface layer acts as a barrier to effective upwelling by the coastal winds. The unenriched surface waters are poor in nutrients and cannot support the normally productive coastal ecosystem. Fish populations are decimated as great numbers migrate to less-affected areas in search of food, resulting in temporarily reduced yields for the countries in the region. In 1972–73 this led not only to local economic setbacks but to repercussions in the world commodity markets as well.

The warm ocean conditions in the equatorial Pacific induce large-scale anomalies in the atmosphere. Rainfall increases manyfold in Ecuador and northern Peru, causing coastal flooding and erosion and consequent hardships in transportation and agriculture. Additionally, strong El Niño events are associated with droughts in Indonesia, Australia, and northeastern South America and with altered patterns of tropical storms in the tropical belt. During the stronger El Niño episodes, the atmospheric "teleconnections" are extensive enough to cause unusually severe winter weather at the higher latitudes of North and South America.

The most intense event of the 20th century began in mid-1982 and ended in mid-1983. Sea-surface temperatures in the eastern tropical Pacific and much of the equatorial zone farther west were 5–10° C (9–18° F) above normal. Australia was hit by severe drought; typhoons occurred as far east as Tahiti; and central Chile suffered from record rainfall and flooding. Also, the west coast of North America was unusually stormy during the winter of 1982–83, and fish catches were dramatically altered from Mexico to Alaska. (D.B.En.)

El Oriente, region of eastern Ecuador, comprising the eastern slopes of the Ecuadorian Andes and the lowland areas of rain forest in the Amazon basin. It is bounded on the north by San Miguel and Putumayo rivers and on the east and south by Peru. El Oriente has an area of about 50,000 square miles (130,000 square km) and consists of little-explored and virtually unexploited tropical forest inhabited by a tiny fraction of the country's population, living mostly in small villages along the river courses. A sizable fraction of the population are Indians. Illiteracy is widespread, although the Roman Catholic Salesian missions have established a few boarding schools.

Timber and petroleum are the major economic resources, although their exploitation has been minimal. Agriculture includes grazing for cattle and limited cultivation of corn (maize) and oranges. Plantains and cassava are important staple food crops.

El Paraíso, also called CHUQUITANTA, Late Preceramic site in the present-day Chillón Valley on the central Peruvian coast, generally believed to date just before the beginning of the Initial Period (*c.* 2100–1800 BC). It is notable for its large mud and rock apartment-like dwelling units. It is believed to be roughly contemporaneous with the Preceramic Period structures of Kotosh, in the Peruvian highlands. El Paraíso buildings show a similar level of population density and architectural sophistication. The inhabitants of El Paraíso presumably depended upon both fishing and plant cultivation (probably not including corn [maize]) for their subsistence.

El Paso, city, seat (1850) of El Paso county, extreme western Texas, U.S., on the Rio Grande, there bridged to Ciudad Juárez, Mex., just south of the New Mexico line. The largest of the U.S.-Mexican border cities, it lies at the foot of the Franklin Mountains (at an elevation of 3,762 feet [1,147 m]) below a narrow pass where the Rio Grande issues from the bare southernmost spurs of the Rocky Mountains. The strategic site was recognized in 1598 by Juan de Oñate, colonizer of New Mexico, who called it El Paso del Norte ("The Pass of the North"). Franciscans established the Mission Nuestra Señora de Guadalupe there in 1659; the original church stands in the central square of Juárez. Spanish survivors of the Pueblo Revolt (1680–92) took refuge there and built other missions nearby, including one at Ysleta, site of the oldest town in Texas and now in El Paso. In 1776 the settlement comprised a string of hamlets and farms inhabited by 5,000 people. Not until after 1827 did a village exist on the river's north bank at the present site of El Paso. It became U.S. territory in 1848, when an army post was built (commemorated by the Fort Bliss Replica Museum).

The town, laid out in 1859, was on the Butterfield Stage Route to California. It grew slowly until 1881, when four railways arrived; by 1890 its population had increased more than 10-fold to 10,338. Meanders of the Rio Grande to the south resulted in border disputes in the 1860s; Mexican claims to El Chamizal, a wedge of land on the Texas side, were first filed in 1895. The dispute, involving relocating the river's channel, was finally resolved in 1967 and is commemorated by the Chamizal National Memorial.

Spanish language and culture distinguish the city. Its old adobe buildings are unmistakably Mexican, yet in general appearance El Paso is a modern American metropolis. It is the commercial and financial centre for an extensive trade territory where livestock ranching, irrigated cotton farming, and mineral production are major economic activities. El Paso has a highly diversified industrial structure centring on primary metals, petroleum and gas operations, food products, and apparel. Its copper-lead custom smelter and electrolytic copper refinery refines a significant portion of the nation's copper. Fort Bliss (home of the U.S. Army Air Defense Center), the William Beaumont General Hospital, and nearby White Sands Missile Range (in New Mexico) augment El Paso's economy.

A port of entry and an important foreign-trade and transcontinental crossroad on several major highways, it is served by both U.S. and Mexican railroads. It is a tourist gateway to Ciudad Juárez and the interior of Mexico and to scenic areas of the United States. The University of Texas at El Paso (site of the Sun Bowl) originated as the Texas State School of Mines and Metallurgy in 1913. El Paso Community College opened in 1969. Inc. 1873. Pop. (1987 est.) city, 494,954; metropolitan area (MSA), 572,800.

El Progreso, city, northwestern Honduras, on the Ulúa River, southeast of San Pedro Sula. The city, founded in 1927 as a banana trade centre, grew in the 1970s into a commercial and transshipment centre for the Caribbean ports and the interior. Industries include cement products, metalware, shoes, and coffee processing. The city is linked by rail to Puerto Cortés and is a hub for highways leading to San Pedro Sula, Tela, Yoro, and the Inter-Oceanic Highway; it also has an airfield. A steamship line operating on the Ulúa provides access to the Caribbean. Pop. (1986 est.) 58,300.

El Puerto de Santa María, port city, Cádiz *provincia,* in Andalusia *comunidad autónoma* ("autonomous community"), southern Spain, at the mouth of Guadalete River on Bahía

(bay) de Cádiz, southwest of Jerez de la Frontera. The Roman Portus Menesthei, it was once the site of naval arsenals and shipyards and was an oceanic captaincy general. It was from El Puerto de Santa María that the explorer Alonso de Ojeda sailed to the West Indies. Its chief economic activity is the production and blending of sherry wines, which are exported. Pop. (1981) 57,437.

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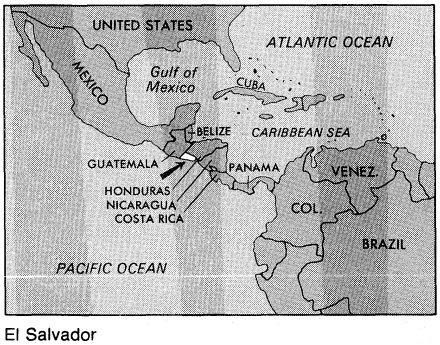
El Reno, city, seat of Canadian County, central Oklahoma, U.S., on the North Canadian River, immediately west of Oklahoma City. Settled in 1889 when the Rock Island Railroad arrived, the town was named for old Fort Reno (1874; now a livestock experiment station). The opening (1901) of the Kiowa–Apache–Comanche reservation to settlement stimulated development. El Reno is an agricultural processing and shipping centre with diversified industry, including railroad shops and the manufacture of trailers, metal products, and fertilizers. El Reno Junior College was opened in 1938. A federal correctional centre, a state game farm, and the Cheyenne and Arapaho Agency and School are nearby. The Canadian County Historical Society maintains a museum of Indian and pioneer artifacts in the city. Inc. 1893. Pop. (1982 est.) 17,011.

El Salvador, officially REPUBLIC OF EL SALVADOR, Spanish REPÚBLICA DE EL SALVADOR, smallest of the seven Central American countries, covering an area of 8,124 sq mi (21,041 sq km) along the Pacific Ocean. The capital is San Salvador. It is bounded on the south by its 210-mi (335-km) Pacific coast, on the northwest by Guatemala, and on the northeast and east by Honduras. The population in 1985 was estimated to be 5,235,700,



El Salvador

making El Salvador, with a population density of some 644 people per sq mi (249 per sq km), one of the more densely populated countries in the world.

A brief treatment of El Salvador follows. For full treatment, *see* MACROPAEDIA: Central America. For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. El Salvador is divided into two highland mountain ranges and three lowland areas. The northern mountains, composed of the Metapán and the Chalatenango chains, form the border with Honduras in the north and descend in the south to the Lempa River Valley, running generally east to west; the valley then rises to meet higher volcanic ranges to the south. Of the more than 20 volcanoes located in the southern ranges, several are active and one erupted as recently as 1946. Santa Ana, an inactive volcano, is the country's highest peak, at 7,812 ft (2,381 m) above sea level. A narrow coastal plain south of the volcanic ranges extends the length of the country along the Pacific. The central plain, with its rich volcanic soils, covers roughly a fourth of the total land area. Of El Salvador's more than 300 rivers, only the Lempa is partly navigable.

The lowland areas are generally hot and humid, with temperatures averaging approximately 75° F (23° C) and rainfall averaging between 40 and 80 in. (1,000 and 2,000 mm) annually. About 95 percent of the rainfall is received during the May–September wet season. Much of the previously forested lowland area has been cleared for agriculture and pasture. The highlands are wetter, averaging more than 80 in. of precipitation annually. At the higher elevations (above 6,000 ft) temperatures seldom reach above 65° F (18° C), and cloud forests predominate. Below 2,500 ft the rain forests have been modified by extensive slash-and-burn cultivation. In between the two elevations, temperate oak and pine forests are found.

The people. Before the Spanish arrived in Salvadoran territory in the 16th century, it was occupied by five Indian tribes, of which the Pipils, whose civilization resembled that of the Aztecs in Mexico, were predominant. Almost 94 percent of the contemporary population is mestizo; about 5 percent is Indian, and 1 percent is white. Before the Spanish conquest the most important Indian languages were Nahuatl, spoken in the central region, and Poton, spoken in the east; when Spanish was made the official language, the Indian dialects slowly fell into disuse. About 96 percent of the people are Roman Catholic.

In the early 1980s the birth rate was about 28 per 1,000 and the death rate about 6 per 1,000; the number of infant deaths was about 42 per 1,000 live births. The annual rate of growth was 2.9 percent. In 1985, 45 percent of the population was under 15 years of age. The government has attempted to reduce birth, morbidity, and mortality rates.

The economy. El Salvador has a developing, mainly free-enterprise economy. The gross national product (GNP) in 1983 was U.S. $3,690,000,000, or about $710 per capita. Average annual growth of the GNP in the period 1970–79 was 1.4 percent, but civil war, beginning in 1979, caused a decline in growth that continued into the mid-1980s. The major components of the GNP are trade, agriculture, and manufacturing.

Agriculture accounts for about 23 percent of the GNP but employs about two-fifths of the labour force. Fighting in rural areas has caused crop production to fall. Traditionally, most land has been owned by a small upper class, but in the early 1980s the government began to redistribute the largest holdings. About 35 percent of the total land area is arable, and some 15 percent of the agricultural land is irrigated. The principal cash crops grown for export include coffee, sugarcane, and cotton. Crops grown for local consumption include corn (maize), sorghum, oranges, bananas, rice, beans, avocados, cassava, and tomatoes.

Pastures cover about 29 percent of the land area; the principal livestock include cattle, pigs, and chickens. The output of cereal, milk, and dairy products is not adequate for domestic needs, and some of these products must be imported.

Remaining forests cover only about 6 percent of the land area. Most of the wood cut is used for fuel or charcoal, and the remainder is used in domestic industries.

Commercial fishing in Pacific waters has become important. Lobster and shrimp are the main catch, and both are exported.

El Salvador has few large mineral deposits. The principal minerals extracted include limestone, gypsum, salt, silver, and gold.

Manufacturing accounts for about 16 percent of the GNP and employ 15.5 percent of the labour force. Warfare and sabotage have destroyed or damaged many industrial plants and caused insecurity among businessmen, investors, and workers. Major industries include petroleum refining; processing of sugar and cotton; and manufacture of textiles, clothing and footwear, cement, crude steel and semimanufactured steel products, pharmaceuticals, beer, and cigarettes. Electrical energy production is 53 percent hydroelectric, 40 percent geothermal, and 6 percent from fossil fuels.

Construction accounts for about 3.5 percent of the GNP and employs 5 percent of the labour force, but many resources have had to be expended on the reconstruction of facilities damaged in the civil war.

The labour force was estimated in 1982 to be 37 percent of the population. Unemployment, as high as 30 to 40 percent, has been aggravated by the civil war, but a shortage of skilled labour has resulted from the war's dislocations. Unions are legal but only a small percent of the labour force is unionized, largely because legislation to protect union organizers is lacking.

The government nationalized banking in 1980 but has placed few other restrictions on industry. Falling production and escalating military expenditures generated budgetary and trade deficits in the early and mid-1980s, and El Salvador has become increasingly dependent on foreign aid, more than half of which comes from the United States.

Budgetary revenue is derived mostly from customs duties and taxes on domestic goods and services, income, profits, and capital gains. Expenditures are mainly for economic services, education, general public services, health, and defense.

An autonomous state agency operates railways (374 mi) and the road network of some 7,600 miles, only one-seventh of which is paved and half of which is usable only in dry weather. Sabotage and fighting have damaged many of the nation's roads and destroyed several bridges. The principal seaports are Acajutla, Cutuco (near La Unión), and La Libertad. There is an international airport at Cuscutlán, near San Salvador.

El Salvador's exports (1981) fell about $287,000,000 short of imports after two years of balanced or positive trade, and the annual shortfall continued into the mid-1980s. The principal exports are coffee, cotton textiles and clothing, and chemicals, mainly to the United States, Germany, and Guatemala. The main imports are chemical products (including medicines), crude petroleum, food products (including dairy products and wheat), and electrical machinery and appliances, chiefly from the United States, Guatemala, Mexico, and Venezuela.

Government and social conditions. El Salvador is a republic whose government consists of a president and a legislative body (the Legislative Assembly). The president is elected for a term of five years, and the 60 members of the Legislative Assembly are elected for three-year terms. The judiciary is headed by the Supreme Court. The government faces armed opposition from both the left and the right. The armed forces have a strong voice in all decisions. There are numerous political parties and organizations active in El Salvador. Of these the conservative Alianza Republicana Nacional (National Republican Alliance) and the moderate leftist Partido Demócrata Cristiano (Christian Democratic Party) are the most important. The most significant guerrilla opposition to the government comes from the Farabundo Martí de Liberación Nacional, which is a coalition of several left-wing groups. Fighting between government forces and the guerrillas has caused thousands of civilian deaths. The government has relied heavily on military and economic aid from the United States.

El Salvador's social welfare system provides

benefits to most employed persons for work injury, sickness, maternity, old age, and disability. Despite these benefits, many parts of the country experience poor health and sanitary conditions. Such diseases as typhoid fever and amoebic and bacillary dysentery can be found in rural areas. Moreover, most of the populace live in areas where malaria is endemic. Trained medical personnel are lacking in many parts of the country. Life expectancy at birth is about 63 years. Although primary education is free and compulsory in El Salvador, the outbreak of civil war and other difficult conditions have reduced the enrollment of children of primary school age from 72 percent in 1978 to 56 percent in 1981. This low enrollment is one of many factors keeping almost two-thirds (64 percent) of the people of El Salvador illiterate.

The press is free and is owned by mostly conservative interests. Most news articles reflect a conservative point of view, but the press carries advertising by labour unions and other government critics.

Cultural life. The country's culture has both Indian and Spanish elements. Just outside San Salvador are Mayan ruins. The capital's Museo Nacional David J. Guzmán displays Indian artifacts from throughout El Salvador. In the modern town of Chalchuapa is the site of Tazumal, an important centre of pre-Hispanic civilization. Salvadorans continue to make traditional handicrafts.

History. When the Spaniards reached El Salvador in 1524, they found the Pipil Indians and their kingdom of Cuzcatlán situated in the western half of the country. The Pipil, of Nahua descent, probably arrived in the 11th century. Campaigns by Pedro de Alvarado subjugated them by 1539, and Spain divided El Salvador into two *alcaldías mayores,* San Salvador and Sonsonate, both attached to Guatemala. In 1786 San Salvador was raised to the rank of what was called an *intendencia,* but still subordinate to Guatemala.

The first call for independence in Central America was made in San Salvador in 1811, by José Matías Delgado. When independence came in 1821, San Salvador was incorporated into the Mexican Empire. Upon its collapse in 1823, the United Provinces of Central America was formed, and Sonsonate and San Salvador constituted the new state of El Salvador, which was the last state to withdraw from the United Provinces (1840).

From its founding, El Salvador experienced a high degree of political turmoil, but power was usually in the hands of the wealthy; presidents generally handpicked their successors. Political violence diminished somewhat until 1931, when, with the beginning of a succession of military dictatorships, it became a fact of life.

In the 1970s violence by both right- and left-wing groups increased substantially. The government, accused of atrocities, was ousted in 1979 in a coup. The resulting junta promised reform, order, and free elections. Elections held in 1982 set up a new government, with power centred in the popularly elected Legislative Assembly, which was given the authority to legislate and to draft a new constitution.

In 1983 a new constitution was adopted, and in 1984 presidential elections were held. José Napoleón Duarte of the Christian Democratic Party won the presidency, and the United States vowed its support for the new regime.

El Seibo, province, eastern Dominican Republic, bounded on the north by Samaná Bay. Established in 1845, it was later reduced in size by the formation of Samaná and La Altagracia provinces. Now covering 1,154 sq mi (2,989 sq km), El Seibo is a region of moderate relief, occupying the northern section of the broad eastern peninsula of Hispaniola. Sugarcane is the principal crop; cacao, rice, corn (maize), and cattle are also significant. El Seibo has the largest gold deposits in the Dominican Republic. The province is traversed by paved and secondary highways that centre on El Seibo city, the provincial capital. Pop. (1981) 157,866.

El Seibo, in full SANTA CRUZ DE EL SEIBO, city, capital of El Seibo province, eastern Dominican Republic, on the Río Soco. Founded in 1502, the city serves as a trading centre for the agricultural hinterland. The region yields cacao, coffee, sugarcane, and corn (maize), in addition to beeswax and medicinal plants. Cattle are also raised. The city lies on the main highway linking Santo Domingo with Higüey. Pop. (1981) 13,511.

El Teniente, mining settlement, O'Higgins region, Machali commune, central Chile. The site of the world's largest underground copper mine, it lies in the Andes about 60 mi (100 km) southeast of Santiago. It accounts for more than one-fourth of Chile's annual copper production. Copper is smelted at El Teniente and transported by rail to Rancagua. Molybdenum is found in association with the copper ores. El Teniente also has a hydroelectric plant. Pop. (1970) 8,919.

El Tigre, city, central Anzoátegui state, northeastern Venezuela, situated in the highlands east of the Barcelona gap. The city is a commercial centre in the Oficina oil fields. Oil is piped 100 mi (160 km) north-northeastward to Puerto La Cruz, which produces about one-tenth of Venezuela's domestically refined oil. El Tigre is also a transportation hub on the road linking Puerto La Cruz and Barcelona with Ciudad Bolívar, and it is the terminus of the highway running eastward along the southern flanks of the Andes from San Cristóbal, near the Colombian border. Pop. (1981) 73,595.

El Yopal, town, *cabecera* (administrative seat) of Casanare intendency, eastern Colombia. The original settlement (*caserío*) of El Yopal was founded in 1935 by Pedro Pablo González, and it has been the seat of Casanare intendency since the creation of Casanare in 1974. An isolated settlement at the western edge of the Llanos (Plains), El Yopal has road connections to Sagamosa in the Cordillera Oriental. The local economy depends upon cattle raising and agriculture; the principal crops are rice, corn (maize), coffee, sugarcane, beans, plantains, and citrus fruits. Pop. (1973) 4,846.

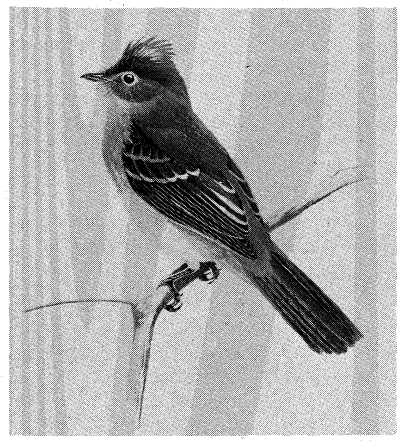
Elaeagnales, the oleaster order of dicotyledonous flowering plants comprising the family Elaeagnaceae, with three genera of shrubs and small trees of the Northern Hemisphere, especially in steppe and coastal regions.

The plants have a characteristic silvery or rusty-coloured sheen, produced by a covering of tiny, distinctive scales. The flowers are radially symmetrical, bisexual or separately male and female, and lack petals but have a tubular structure of four sepals (the outer whorl of floral parts). The stamens (male, pollen-producing structures) occur in the same number as, or in twice the number of, sepals. The female structure, or pistil, is positioned above the attachment point of the other flower parts and is composed of one carpel (ovule-bearing structural unit) containing one ovule.

The genera are *Elaeagnus* (45 species), *Hippophae* (3 species), and *Shepherdia* (3 species). The order is considered to have evolutionary ancestors close to the order Myrtales.

Several shrubs of the order are cultivated ornamentally, especially the buffalo berry or silverberry (*Shepherdia argentea*), oleaster (*q.v.*), or Russian olive (*Elaeagnus angustifolia*), and the sea buckthorn (*q.v.; Hippophae rhamnoides*). The berries of several species are edible.

Elaenia, genus of about 20 species of plain-coloured New World flycatchers, family Tyrannidae (order Passeriformes), with a short bill and modest, ragged crest, usually concealing a white or yellow crown patch. Found in Central America, South America, and the



Yellow-bellied elaenia (*Elaenia flavogaster*)
Drawing by John P. O'Neill

West Indies, most species are olive above and have yellowish underparts. Field identification of species must often be based on distinctive vocal patterns. Some taxonomists place the yellow-crowned species in the genus *Myiopagis.*

Elagabalus, also spelled HELIOGABALUS, byname of CAESAR MARCUS AURELIUS ANTONINUS AUGUSTUS, original name VARIUS AVITUS BASSIANUS (b. 204, Emesa, Syria—d. 222), Roman emperor from 218 to 222, notable chiefly for his eccentric behaviour.

The family of his mother, Julia Soaemias, were hereditary high priests of the sun god Baal at Emesa, worshipped in that locality under the name Elah-Gabal (thus Elagabalus). The emperor Caracalla (211–217), Bassianus' cousin, was murdered in 217 and replaced by

Elagabalus, marble bust; in the Capitoline Museum, Rome
Alinari—Art Resource/EB Inc.

the praetorian prefect Macrinus. The mother and grandmother of Bassianus won the support of the nearby troops by passing Bassianus off as an illegitimate son of Caracalla. Soon thereafter (218) the remainder of the Eastern armies deserted Macrinus.

Acknowledged as emperor by the Senate, Bassianus, by virtue of his priestly function, became generally known as Elagabalus. He imposed the worship of Baal upon the Roman world, executed a number of dissident generals, and pushed into high places many favourites distinguished by personal beauty and humble and alien origins. The homosexual orgies held openly by the young emperor

outraged Roman opinion. He was persuaded by Julia Maesa, the real power in the government, to adopt his docile cousin Alexander as his son and heir (221). When Elagabalus changed his mind and sought to depose Alexander, the Praetorian Guards mutinied, killed Elagabalus and his mother, and made Alexander emperor.

Elam, Elamite ḪALTAMI, Akkadian ELAMTU, also called SUSIANA, ancient country in southwestern Iran approximately equivalent to the modern region of Khuzistan. Four prominent geographical names within Elam are mentioned in ancient sources: Awan, Anshan, Simash, and Susa. Susa was Elam's capital, and in classical sources the name of the country is sometimes Susiana.

Ruins of Susa, Elam, capital of the Achaemenian Empire during the reign of Darius I, 522–486 BC

By courtesy of Erich F. Schmidt, Oriental Institute, The University of Chicago

Throughout the late prehistoric periods, Elam was closely tied culturally to Mesopotamia, and later, perhaps because of domination by the Akkadian dynasty (*c.* 2334–*c.* 2154 BC), Elamites adopted the Sumero-Akkadian cuneiform script. Eventually Elam came under the control first of the Guti, a mountain people of the area, and then of the 3rd dynasty of Ur. As the power of Ur in turn declined, the Elamites reasserted their independence.

In that turbulent period Elam's unique system of matrilinear succession emerged; sovereignty was hereditary through women, in that a new ruler was always "son of a sister" of some member of an older sovereign's family.

About 1600 BC new invaders of Mesopotamia, the Kassites, may have caused the fall of both Babylonia and Elam. Thereafter almost nothing is known of Elam until the latter part of the 13th century BC, when it began re-emerging as a substantial international power. The Elamite kings Shutruk-Nahhunte and Kutir-Nahhunte invaded Mesopotamia and succeeded in securing a large number of ancient monuments (such as the Victory Stele of Naram-Sin and the stele bearing the law code of Hammurabi). Shilkhak-In-Shushinak campaigned vigorously, and for at least a short period his domain included most of Mesopotamia east of the Tigris River and reached eastward almost to Persepolis. This greatest period of Elamite conquest ended when Nebuchadrezzar I of Babylon (reigned *c.* 1124–*c.* 1103 BC) captured Susa. For almost 300 years thereafter nothing is known of Elamite history. In 640 BC, however, the Assyrian king Ashurbanipal invaded Elam, sacked Susa, and deported some of the leading citizens to Samaria in Palestine. Later Elam formed a satrapy of the Achaemenian Empire and Susa became one of the three most important cities of the Persian realm.

Elam's cultural accomplishments do not appear to have been extensive. Written business and governmental documents are limited in scope; still less is known of Elamite religious beliefs because no epic or religious materials in the Elamite language have been discovered. The language itself is not clearly understood and had no known ancient relatives and no modern descendants. Elam's art and architecture clearly derived much of its inspiration from Babylonia.

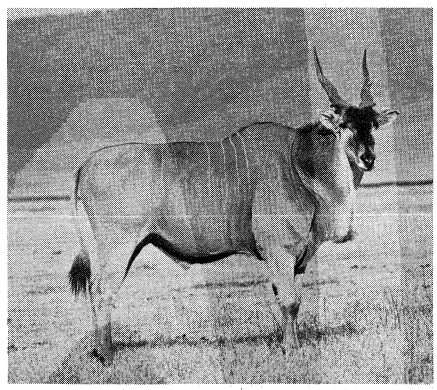
Elamite language, extinct language spoken by the Elamites in the ancient country of Elam, which included the region from the Mesopotamian plain to the Iranian Plateau. Elamite documents from three historical periods have been found. The earliest Elamite writings are in a figurative or pictographic script and date from the middle of the 3rd millennium BC. Documents from the second period, which lasted from the 16th to the 8th century BC, are written in cuneiform; the stage of the language found in these documents is sometimes called Old Elamite. The last period of Elamite texts is that of the reign of the Achaemenid kings of Persia (6th to 4th century BC), who used Elamite, along with Akkadian and Old Persian, in their inscriptions. The language of this period, also written in the cuneiform script, is often called New Elamite.

Although all three stages of Elamite have not been completely deciphered, a number of grammatical features of the language are known to scholars. These include a plural formation using the suffix *-p,* the personal pronouns, and the endings of several verb forms.

Elamite writing: *see* cuneiform writing.

eland (*Taurotragus*), either of two easily tamed, oxlike antelopes, family Bovidae (order Artiodactyla), found in herds on the open plains or in lightly wooded areas of central and southern Africa.

The largest of living antelopes, elands may stand up to 1.8 metres (6 feet) at the shoulder. They have a short, dark mane, a dewlap (flap of skin) hanging from the throat, and long horns twisted in a tight, screwlike spiral. The males have shorter, heavier horns than the females and have a tuft of dark hair on their foreheads. The common eland (*Taurotragus oryx*; also called the Cape, or Livingstone's, eland) is pale brown, becoming blue-gray with age, and is often marked with narrow, vertical white stripes. The giant, or Derby, eland (*T. derbianus*) is reddish brown with a blackish neck and vertical white striping. It has heavier, more widely divergent horns than the common eland. A subspecies, the western giant eland (*T.d. derbianus*), extinct in some of its former range, is considered endangered.



Giant eland (*Taurotragus derbianus*)

Leonard Lee Rue III

elapid, any of about 200 venomous species of the snake family Elapidae, characterized by short fangs fixed in the front of the upper jaw. Otherwise, elapids resemble the more abundant colubrids. Most species lay eggs; a few, chiefly in Australia, bear living young.

Elapids tend to be slender and agile. Most are small and inoffensive to man, but the family contains some of the largest and most lethal of snakes. An elapid strikes with a downward stab, followed by chewing. The venom is primarily neurotoxic (paralyzing the heart and lungs) but often contains moieties that damage the body tissues or blood cells. The bite is relatively painless, but death may be swift. Elapids occur in America, Africa, southern Asia, Pacific Islands, and Australia (main group of snakes there: about 60 species).

For further information about elapid species and groups, *see:* bandy-bandy; black snake; brown snake; cobra; coral snake; krait; mamba; taipan; tiger snake.

ELAS (National Popular Liberation Army; Greece): *see* EAM-ELAS.

Elasmotherium, also called GIANT UNICORN, extinct genus of rhinoceros found as a fossil in Pleistocene deposits in northern Eurasia (the Pleistocene Epoch began 2,500,000 years ago and ended 10,000 years ago). Its popular name derives from the very large horn on its forehead, which reached a length of about 2 metres (more than 6 feet). *Elasmotherium* was much larger than any modern rhinoceros. The incisors had been lost, whereas the cheek teeth were well adapted to grazing. *Elasmotherium* is primarily known from skull parts; the remainder of the skeleton is poorly represented in the fossil record. Its ancestry has been traced to smaller forms of the preceding Pliocene Epoch found as fossils in China.

elastic fibre, any of the yellowish branching fibres composed primarily of the protein elastin, frequently arranged in plates or perforated membranes, as in the walls of the large arteries. Unlike collagenous fibres, they show no orderly fibrous subunits under microscopic examination but sometimes appear to be composed of minute fibrils around a solid core. Elastic fibres are not broken down by hot water, as are collagenous fibres; and they are resistant to most enzymes. As is suggested by their name, the fibres are highly elastic and impart elasticity to structures such as the skin, the lungs, and some large blood vessels, such as the aorta.

elastic wave, motion in a medium in which, when particles are displaced, a force proportional to the displacement acts on the particles to restore them to their original position. If a material has the property of elasticity and the particles in a certain region are set in vibratory motion, an elastic wave will be propagated. For example, a gas is an elastic medium (if it is compressed and the pressure is then released, it will regain its former volume), and sound is transmitted through a gas as an elastic wave.

elasticity, ability of a deformed material body to return to its original shape and size when the forces causing the deformation are removed. A body with this ability is said to behave (or respond) elastically.

A brief treatment of elasticity follows. For full treatment, *see* MACROPAEDIA: Mechanics: *Elasticity.*

To a greater or lesser extent, most solid materials exhibit elastic behaviour, but there is a limit to the magnitude of the force and the accompanying deformation within which elastic recovery is possible for any given material. This limit, called the elastic limit, is the maximum stress or force per unit area within a solid material that can arise before the onset of permanent deformation. Stresses beyond the elastic limit cause a material to yield or flow. For such materials the elastic

limit marks the end of elastic behaviour and the beginning of plastic behaviour. For most brittle materials, stresses beyond the elastic limit result in fracture with almost no plastic deformation.

The elastic limit depends markedly on the type of solid considered; for example, a steel bar or wire can be extended elastically only about 1 percent of its original length, while for strips of certain rubberlike materials, elastic extensions of up to 1,000 percent can be achieved. Steel is much stronger than rubber, however, because the tensile force required to effect the maximum elastic extension in rubber is less (by a factor of about 0.01) than that required for steel. The elastic properties of many solids in tension lie between these two extremes.

The different macroscopic elastic properties of steel and rubber result from their very different microscopic structures. The elasticity of steel and other metals arises from short-range interatomic forces that, when the material is unstressed, maintain the atoms in regular patterns. Under stress the atomic bonding can be broken at quite small deformations. By contrast, at the microscopic level, rubberlike materials and other polymers consist of long-chain molecules that uncoil as the material is extended and recoil in elastic recovery. The mathematical theory of elasticity and its application to engineering mechanics is concerned with the macroscopic response of the material and not with the underlying mechanism that causes it.

In a simple tension test, the elastic response of materials such as steel and bone is typified by a linear relationship between the tensile stress (tensile force per unit area of cross-section of the material), σ, and the extension ratio (difference between extended and initial lengths divided by the initial length), e. In other words, σ is proportional to e; this is expressed $\sigma = Ee$, where E, the constant of proportionality, is called Young's modulus. The value of E depends on the material; the ratio of its values for steel and rubber is about 100,000. The equation $\sigma = Ee$ is known as Hooke's law and is an example of a constitutive law. It expresses, in terms of macroscopic quantities, something about the nature (or constitution) of the material. Hooke's law applies essentially to one-dimensional deformations, but it can be extended to more general (three-dimensional) deformations by the introduction of linearly related stresses and strains (generalizations of σ and e) that account for shearing, twisting, and volume changes. The resulting generalized Hooke's law, upon which the linear theory of elasticity is based, provides a good description of the elastic properties of all materials, provided that the deformations correspond to extensions not exceeding about 5 percent. This theory is commonly applied in the analysis of engineering structures and of seismic disturbances.

The elastic limit is in principle different from the proportional limit, which marks the end of the kind of elastic behaviour that can be described by Hooke's law, namely, that in which the stress is proportional to the strain (relative deformation) or equivalently that in which the load is proportional to the displacement. The elastic limit nearly coincides with the proportional limit for some elastic materials, so that at times the two are not distinguished; whereas for other materials a region of nonproportional elasticity exists between the two.

The linear theory of elasticity is not adequate for the description of the large deformations that can occur in rubber or in soft human tissue such as skin. The elastic response of these materials is nonlinear except for very small deformations and, for simple tension, can be represented by the constitutive law $\sigma = f(e)$, where $f(e)$ is a mathematical function of e that depends on the material and that approximates to Ee when e is very small. The term nonlinear means that the graph of σ plotted against e is not a straight line, by contrast with the situation in the linear theory. The energy, $W(e)$, stored in the material under the action of the stress σ represents the area under the graph of $\sigma = f(e)$. It is available for transfer into other forms of energy—for example, into the kinetic energy of a projectile from a catapult.

The stored-energy function $W(e)$ can be determined by comparing the theoretical relation between σ and e with the results of experimental tension tests in which σ and e are measured. In this way, the elastic response of any solid in tension can be characterized by means of a stored-energy function. An important aspect of the theory of elasticity is the construction of specific forms of strain-energy function from the results of experiments involving three-dimensional deformations, generalizing the one-dimensional situation described above.

Strain-energy functions can be used to predict the behaviour of the material in circumstances in which a direct experimental test is impractical. In particular, they can be used in the design of components in engineering structures. For example, rubber is used in bridge bearings and engine mountings, where its elastic properties are important for the absorption of vibrations. Steel beams, plates, and shells are used in many structures; their elastic flexibility contributes to the support of large stresses without material damage or failure. The elasticity of skin is an important factor in the successful practice of skin grafting. Within the mathematical framework of the theory of elasticity, problems related to such applications are solved. The results predicted by the mathematics depend critically on the material properties incorporated in the strain-energy function, and a wide range of interesting phenomena can be modelled.

Gases and liquids also possess elastic properties since their volume changes under the action of pressure. For small volume changes, the bulk modulus, κ, of a gas, liquid, or solid is defined by the equation $P = -\kappa(V - V_0)/V_0$, where P is the pressure that reduces the volume V_0 of a fixed mass of material to V. Since gases can in general be compressed more easily than liquids or solids, the value of κ for a gas is very much less than that for a liquid or solid. By contrast with solids, fluids cannot support shearing stresses and have zero Young's modulus.

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

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elastomer, any member of a class of synthetic polymeric substances (giant molecules consisting of linked smaller molecules or monomers) possessing rubberlike qualities, especially the ability to regain shape after deformation; toughness; and resistance to weathering and chemical attack.

The chemical requirements for useful elastomers include high molecular weight, flexibility of the polymer chain, and a controlled degree of polarity and structural irregularity. These features impart cohesiveness and a lack of molecular order in the undeformed state, although natural and synthetic rubbers generally take on some aspects of crystallinity at very low temperatures or when they are highly extended.

Many important elastomers are copolymers in which the main molecular chain is composed of carbon atoms; they are usually based on butadiene and other organic compounds obtainable from petroleum: in Buna S, the second component is styrene; in Buna N, acrylonitrile. Butyl rubber, used in pneumatic inner tubes, is a copolymer of isobutylene and isoprene. Elastomeric materials in which the main polymer chain contains atoms other than carbon include the polysulfide rubbers (Thiokols) and the silicones.

Elat, also spelled ELATH, EILAT, or ELOTH, port city, southern extremity of Israel per the 1949 armistice accords, at the south tip of the Negev and at the head of the Gulf of Aqaba (Hebrew, Mifratz Elat), the eastern arm of the Red Sea. The city is referred to several times in the Bible. In I Kings 9 it is told that King Solomon's ships sailed to the land of Ophir from Ezion-Geber "near Eloth," bringing back a cargo of gold. The archaeologist Nelson Glueck, who excavated the site of ancient Ezion-Geber (1940 and following), concluded that it and Elat were one and the same; the ruins are in Jordan just east of modern Elat.

Elat was a southern outpost of the Limes Palestinae, the line of border fortresses established by the Romans and the Nabataeans (Semitic tribes of ancient Arabia). It was a place of refuge for Jews fleeing the Muslim conquest of the Arabian Peninsula (7th century). In 1116 the town, known as Aila, was taken by the crusaders. About 8½ mi (14 km) south is the islet of I Ha-Almuggim (Coral Island); also known as the Isle de Graye, it has ruins of a fortress marking the extreme southern extent of crusader rule. The area fell to Saladin in 1167 and thereafter declined.

At the end of the British Palestine mandate (May 15, 1948) there was nothing on Elat's site but an abandoned frontier outpost called Umm Rashrāsh. In early 1949 the Israeli army advanced over 150 mi from rear bases at Be'er Sheva' (Beersheba) across the then roadless Negev and reached Israel's Red Sea coast at the site of Elat on March 10, 1949. This was the last operation of the Arab–Israeli War of 1948–49.

Modern Elat, founded in 1949 and incorporated in 1959, is Israel's only outlet to the Red Sea, Indian Ocean, and Far East. A small port was opened in April 1951 and after the Sinai Campaign of 1956, when Egyptian control of the Strait of Tiran at the Gulf's entrance was broken, it was much enlarged. It was again cut off in May 1967, when Egypt blockaded the strait. This action was a principal cause of the Six-Day War of June 1967. When the Suez Canal was closed (1967–75), the strait was reopened to the commerce of all nations and Elat again expanded. A new oil jetty was built with a pipeline connection to Ashqelon on the Mediterranean, then north to Haifa. Due to the extreme heat and aridity of Elat, the Israeli government granted special incentives to settlers willing to live there. Twenty years after its founding, the population had increased 25 times. Elat is now linked with the more settled parts of Israel by improved highways and by regular air service. Its Red Sea coast, with clear waters, picturesque coral formations, and marine life, has been promoted as a tourist area; scuba diving is popular. Many of the city's residents find employment in the copper mines of nearby Timna'. Pop. (1982 est.) 19,500.

Elath (Israel): *see* Elat.

Elatinaceae, family of flowering plants, in the tea order (Theales), comprising two genera of mostly aquatic herbs. Members of the family have opposite or whorled leaves and small flowers with two to five overlapping petals. Waterwort (*Elatine hexandra*) and two similar species, *E. hydropiper* and *E. macropoda*, sometimes are grown in aquariums. These Eurasian plants tend to mat together as they grow. One species, *E. americana*, is widespread in northern North America. Species growing on bog edges or stream banks differ in form from those growing underwater.

The genus *Bergia*, with 25 tropical and tem-

perate species, also adapts to both aquatic and terrestrial situations. *B. capensis,* for example, has two types of roots—those on the aquatic form are green, contain chlorophyll, and float freely; those on the terrestrial form are white, stout, and branched.

Elaver River (France): *see* Allier River.

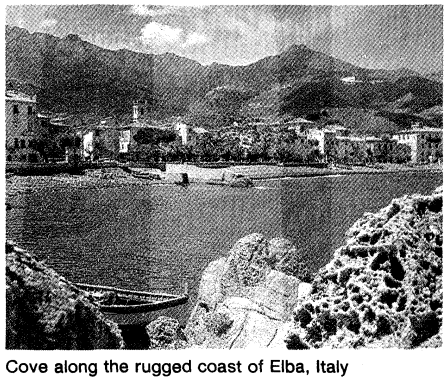
Elazığ, city, eastern Turkey. It lies at the foot of a plateau overlooking a fertile plain. Originally founded as an Ottoman military garrison and administrative centre after the mid-19th century, the city grew rapidly. Modern Elazığ, surrounded by vineyards and orchards, is an important trading centre for the crops and livestock of the area; it is noted also for its wine. It is the home of the Euphrates University, founded in 1975. Pop. (1980) city, 142,983.

Elba, Latin ILVA, largest (area 86 square miles [223 square km]) island of the Tuscan Archipelago, off the west coast of Italy, in the Tyrrhenian Sea. It is famous as Napoleon's place of exile in 1814–15. Administratively Elba is part of Livorno province. Its coast is precipitous and its interior mountainous, rising to Mount Capanne (3,343 feet [1,019 m]).

The Etruscans mined iron ore at Elba, then called Aethalia ("Smoky Place") by the Greeks, probably because of the smelting furnaces. The Romans, who called it Ilva, also mined iron ore and established a naval base on the island. Elba was ruled by Pisa in the early Middle Ages but passed to Genoa in 1290 and in 1399 to the dukes of Piombino, who ceded it to Cosimo I de Medici of Florence in 1548. In Spanish hands from 1596 until 1709, it was next ruled by Naples. In 1802 it was ceded to France; and when Napoleon I abdicated in 1814, he was exiled to Elba. He arrived there on May 4. The island was recognized as an independent principality with Napoleon as its ruler until Feb. 26, 1815, on which day he returned to France for the Hundred Days. Thereafter Elba was restored to Tuscany, with which it passed to unified Italy in 1860.

Napoleon's chief residence, the Mulini Palace, overlooks the sea near Portoferraio, Elba's chief town, on the north coast. His summer residence, Villa San Martino, lies 4 miles (6 km) southwest and contains a museum and a collection of paintings.

Elba's mild climate supports a varied vegetation of Mediterranean type, with rich olive groves and vineyards. There are important fisheries of anchovies, sardines, and tuna. In modern times iron ore has been mined on the east coast, but the reserves of accessible ore are nearing exhaustion, and deeper deposits seem unlikely to repay the increased costs of mining. Thus, tourism has assumed increasing importance. Popular summer resorts are Procchio, Marciana Marina, Marciana, and those on the Gulf of Biodola in the north, Marina di Campo on the south coast, and Porto Azzurro, with its great Spanish fort (1602; now a prison), facing the mainland. The island has bus services and is connected by passenger and car ferry services with Livorno and Portovecchio di Piombino on the mainland. Pop. (1984 est.) 28,907.

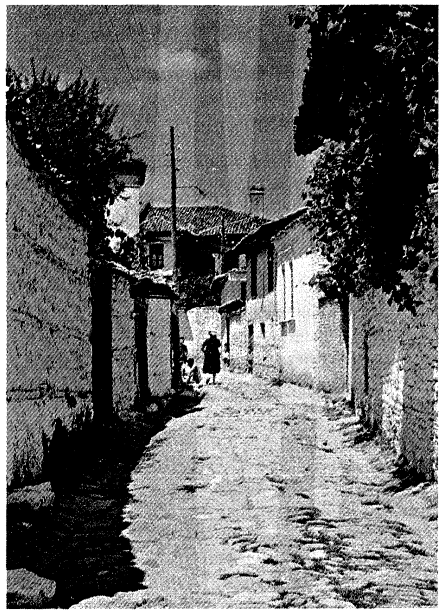


Cove along the rugged coast of Elba, Italy

G. Barone—Shostal/EB Inc.

Elbasan, city, central Albania. It lies on the north bank of the Shkumbin River, in the highlands at the eastern end of a fertile, well-watered plain. It was founded in 1466 by the Ottoman sultan Mehmed II, on the site of ancient Scampis, as a base for his military operations against the Albanian commander Skanderbeg. The town was a principal centre of Albanian nationalism during Ottoman rule. Until World War II about 85 percent of the populace was Muslim and most of the remainder Albanian Orthodox. Architectural remains of the former walled town are visible.

The trade centre of an olive-, corn- (maize-), and tobacco-growing region, Elbasan is linked by road and rail to the port of Durrës and other towns. The city's economic activities include timber processing and the production of cement, soap, and olive oil. In 1978 a large metallurgical combine began production, using iron-nickel ore mined in the surrounding area. Cërrik, a few miles to the southwest, has a petroleum refinery. Pop. (1983 est.) city, 69,900.



Cobbled street in Elbasan, Alb.

Paolo Koch from Rapho/Photo Researchers—EB Inc.

Elbe River, Czech LABE, river of central Europe and one of the continent's major waterways. It rises in the Krkonoše (Giant) Mountains on the border of Czechoslovakia and Poland and flows south and west in a wide arc across Bohemia; it then flows northwest across Germany and empties into the North Sea near Cuxhaven.

The following article is a brief treatment of the Elbe River. For full treatment, *see* MACROPAEDIA: Europe.

From 1945 to 1990 the Elbe River formed part of the boundary between East and West Germany. It is 724 miles (1,165 km) long, in places as wide as 9 miles (14 km), and has an average annual discharge of 25,074 cubic feet (710 cubic metres) per second. Its major left-bank tributaries are the Vltava (Moldau), Ohře (Eger), and Mulde, and its right-bank tributaries are the Iser, Black Elster, Havel, and Alster. The Elbe is connected by the Elbe–Lübeck Canal with the Baltic Sea, by the Elbe–Havel Canal with the Havel River and Berlin, and by the Mittelland Canal with the Ruhr industrial region and the Rhine River; the canal network is an important transport route for exports. The 55,620-square-mile (144,060-square-kilometre) drainage basin of the Elbe contains some of Germany's richest agricultural and industrial regions. The river is navigable for 1,000-ton barges as far as Ústí nad Labem in Bohemia and for smaller barges as far as Prague. The principal cities on the Elbe are Dresden, Magdeburg, Wittenburg, Hamburg, and Cuxhaven in Germany. Hamburg, located 55 miles (88 km) upstream from the mouth of the river, is one of the largest seaports on the continent of Europe.

Elbeuf, town, Seine-Maritime *département,* Haute-Normandie region, northwestern France. It lies on the left bank of the Seine River, 12 miles (19 km) south of Rouen. Wooded hills and high cliffs surround the town. Built on the site of a Roman city, it was occupied by the English during the Hundred Years' War (1337–1453) and then passed into the hands of the House of Lorraine. Raised to the rank of a duchy in the 16th century by Henry III of France, it kept that title until the French Revolution.

Elbeuf is one of the traditional centres of wool and cloth manufacture in France. Since World War II, chemical, electrical, rubber, and automobile industries have been established in the region. The town was badly damaged during World War II. The churches of Saint-Jean (16th century) and Saint-Étienne (16th and 17th centuries) contain notable stained-glass windows. Pop. (1982) 17,004.

Elbląg, German ELBING, *województwo* (province), northern Poland. Established in 1975, the province comprises an area of 2,356 square miles (6,103 square km). It is bordered on the north by the Baltic Sea and the U.S.S.R. and by the Polish provinces of Olsztyn on the east, Toruń on the south, Bydgoszcz on the southwest, and Gdańsk on the west. Located in Masury (Masuria), the area east of the Vistula River, Elbląg is one of the five provinces forming Poland's Baltic coastal zone (Pomerania).

Elbląg province has six seaports (Frombork, Tolkmicko, Katy, Krynica Morska, Elbląg city [German: Elbing], and Nowo Pasłęka), three large navigable rivers (the Vistula, the Nogat, and the Pasłęka), and many lakes set amid virgin forests. The 35-mile (56-kilometre) Elbląg Canal across the central part of the province enables oceangoing ships to travel from the Gulf of Danzig in the north to the inland port of Ostróda in neighbouring Olsztyn province in the southeast. Chemicals and electrical machinery are manufactured, food is processed, and there are thermoelectric plants in the province. Elbląg province has many old Baltic towns along the northern coast, such as Tolkmicko and Frombork, and others inland, such as Malbork and Elbląg, all from about the 12th century. Founded as part of Masury in the Middle Ages, the province remained under Polish influence and carried on a bitter struggle against the Teutonic Knights. Elbląg city, the provincial capital, is served by major railways and highways. Pop. (1987 est.) 469,600.

Elbląg, German ELBING, city, capital of Elbląg *województwo* (province), northern Poland. It lies along the Elbląg River near the Nogat, the eastern mouth of the Vistula River. Founded in 1237 by the Teutonic Knights, the castle and settlement were granted town rights in 1246, joining the Hanseatic League in the late 13th century. By 1580 it had become the chief East Prussian port in trade with England. Silting then obstructed Vistula Lagoon, reducing Elbląg to an inland port. In 1945 during World War II, a great deal of the town was destroyed by the Germans. Elbląg has subsequently been rebuilt and continues to be the commercial centre as well as the capital of Elbląg province.

Elbląg is a rail junction and port; its economy depends upon metallurgy, heavy-machinery manufacture (including turbines), sawmilling, brewing, and agriculture. The 99-mile- (159-kilometre-) long Elbląg Canal, completed in 1872, connects Elbląg with the inland port of Ostróda to the south. There is a branch of Gdańsk Technical University at nearby Zamech. Pop. (1987 est.) 119,600.

elbow, in human anatomy, hinge joint formed by the meeting of the humerus (bone of the upper arm) and the radius and ulna (bones of the forearm). The elbow allows the bending and extension of the forearm, and it also allows the rotational movements of the radius and ulna that enable the palm of the hand to be turned upward or downward.

The elbow forms from the expansion of the lower end of the humerus into two thick knobs, or condyles: the humerus' dome-shaped lateral condyle articulates with a shallow depression on the end of the radius, and the humerus' spool-shaped trochlea fits into a notch in the ulna. In addition, the edge of the radius' head fits into a shallow groove on the side of the ulna. The bending and extension of the elbow joint are achieved, respectively, by contractions of the biceps and triceps muscles. These movements chiefly involve only the humerus and ulna; rotation of the forearm involves the smaller radius bone as well.

The elbow is especially susceptible to stress injuries, although its surrounding capsule contains cushioning synovial membranes and is reinforced by ligaments. Thick lateral ligaments support the hinge action of the humerus–ulna junction, and a strong annular ligament around the upper part of the radius helps to hold that bone in place. These ligaments prevent the forward displacement of the forearm bones, but acute stresses can produce rearward dislocations of them. Attempts to force elbow movement past full extension of the arm (180 degrees) tear the joint's protective capsule, producing elbow sprains, while chronic and repeated stressful motions, such as the rotation of the forearm in some sports, can cause pain from overuse of the joint (tennis elbow).

Elbrus, Mount, Russian GORA ELBRUS, highest peak of the Caucasus mountains, southern U.S.S.R. It is an extinct volcano with twin cones reaching 18,510 feet (5,642 m) and 18,356 feet (5,595 m). The volcano was formed during the Upper Tertiary Period, more than 2,500,000 years ago. Sulfurous gases are still emitted on its eastern slopes, and there are many mineral springs along its descending streams. A total area of 53 square miles (138 square km) of Elbrus is covered by 22 glaciers, the waters and snow of which feed the Kuban River and some of the headwaters of the Terek. Elbrus is a major centre for mountaineering and tourism in the Caucasus region. In 1964 an extensive tourist and mountaineering base was opened, with large-scale sporting facilities.

Mount Elbrus, highest peak of the Caucasus mountains

Novosti Press Agency

Elburz Mountains, also spelled ALBORZ, ALBOURZ, ALBURZ, or ELBURS, Persian RESHTEH-YE KŪHHĀ-YE ALBORZ, major mountain range in northern Iran, 560 miles (900 km) long. The range, most broadly defined, extends in an arc eastward from the Soviet frontier southwest of the Caspian Sea to the Khorāsān region of northeastern Iran, southeast of the Caspian Sea, where the range merges into the Ālādāgh, the more southerly of the two principal ranges there. More commonly, however, the westernmost part of the range is called the Talish (Talysh, Talesh, or Tavālesh) Range, or the Bogrov Dāgh; the Elburz Range, in its strictest sense, forms part of the central stretch of the chain, which also includes Iran's two highest peaks, Mount Damāvand and Mount Alām. The Elburz mountain system traverses virtually all of the northernmost portions of Iran from east to west.

The Elburz chain is not as truly alpine (*i.e.,* resembling the European Alps) in its structure as is often suggested. On the one hand, continental conditions regarding sedimentation are reflected by thick Devonian sandstones (formed 345,000,000 to 395,000,000 years ago) and by Jurassic (136,000,000- to 190,000,000-year-old) shales containing coal seams. On the other hand, marine conditions are reflected by Permo-Carboniferous (225,000,000- to 345,000,000-year-old) strata that are composed mainly of limestones, as well as by very thick beds of green volcanic tuffs and lavas. Orogenic (mountain-building) phases of importance date from the younger Tertiary (Miocene and Pliocene epochs) Period (between 2,500,000 and 26,000,000 years ago). Over large areas they produced only a loose folding; but in the Central Elburz a number of folds were formed into blocks thrust mainly southward but in places northward, with cores made of Paleozoic rocks. Structurally and topographically, the Elburz system is less clearly defined on the southern than on the Caspian (northern) side of the chain, since various off-branching elements interconnect it on the southern side with the adjoining Iranian Plateau.

The Western Elburz Range runs south-southeastward for 125 miles (200 km). Varying in width from 15 to 20 miles (24 to 32 km), it consists of a single asymmetric ridge, the long slope facing the Caspian. Few of its peaks approach or exceed 10,000 feet (3,000 m) in height. There is a low pass west of Āstārā, near the Soviet frontier, 5,000 feet (1,500 m) above sea level. The Safīd River, formed by the junction of the Qezel Owzan (Qisil Uzun) and Shāhrūd rivers, is the only river to cross the whole width of the chain: its gorge, giving access to the low pass of Qazvīn, offers the best passage through the mountain chain, although by no means an easy one, between the Gīlān region on the shores of the Caspian and the inland plateau to the south.

The Central Elburz is 250 miles (400 km) long. East of the longitude of Tehrān, which lies to the south of the range, it reaches a width of 75 miles (120 km). Located among the longitudinal valleys and ridges of the range are some important centres of settlement, with the towns of Deylamān, Razan, Kojūr, and Namar located on the Caspian side and Emāmshahr (formerly Shāhrūd), Lār, Damāvand, and Fīrūzkūh on the southern side. There are likewise many gorges, by which the rivers find their way down one or another of the slopes. Only two passes allow a relatively easy crossing in a single ascent—these are the Kandevān Pass, between the Karaj and the Chālūs rivers, and the Gadūk Pass, between the Hableh and the Tālā rivers. The main divide runs generally south of the highest crest, which—with the exception of the towering and isolated cone of the extinct volcano Mount Damāvand (18,386 feet [5,604 m])—culminates in the glaciated massif of Takht-e Soleymān, which rises to more than 15,750 feet (4,800 m).

The Eastern, or Shāhkūh, Elburz runs about 185 miles (300 km) in a northeasterly direction. Since two ranges branch off on its southern side and no compensatory elements appear on the northern side, its width dwindles to less than 30 miles (48 km). With the exception of the Shāhkūh Range proper (which reaches an elevation of 12,359 feet [3,767 m]), the chain decreases in height toward the east. Longitudinal valleys are found less and less frequently east of the Shāhkūh. There are several passes at low elevations.

The Caspian and the inland, or southern, slopes of the Elburz differ markedly from each other in climatic and vegetational aspects. The Caspian slope has a distinctly humid climate, thanks to northerly air movements, enriched with moisture from the sea, which collide with the steep faces of the mountains to cause precipitation. This precipitation amounts to more than 40 inches (1,000 mm) annually in the lowlands of the Gīlān region and is even more plentiful at higher elevations. Although it decreases toward the east, it still suffices to nourish a humid forest for the whole length of the chain on the Caspian side, where the soils are mostly of the brown-forest type. The natural vegetation of this slope grows in distinct zones: the luxuriant Hyrcanian forest on the lowest levels; a beech forest in the middle zone; and a magnificent oak forest from the elevation of 5,500 feet (1,700 m) up to the levels where gaps in the divide allow the moist air to overflow into the inland basins. In some sheltered valleys there are extensive stands of wild cypress; sheltered valleys adjacent to the Safīd River constitute the only olive-growing areas of note in Iran.

The southern slope of the Elburz, by direct contrast, shares the arid character of the Iranian Plateau. Annual precipitation varies between 11 and 20 inches (280 and 500 mm) and is very irregular. The soils are mostly of the type associated with steppe (treeless, grassy, or shrubby) vegetation. The slope has become even more steppelike ever since the almost complete destruction of its original dry forest of junipers.

The Hyrcanian tigers for which the Caspian forests were famous are now very rare; but other wild cats, such as the leopard and the lynx, are still numerous in the Elburz. The bear, the wild boar, red and roe deer, the mouflon (wild mountain sheep), and the ibex are also present. Eagles and pheasants are notable among birds.

While large areas of the Elburz Mountains are almost uninhabited—some being occupied only by nomads and others having been depleted by Turkmen raids in the 19th century—there are still several well-settled districts, including Deylamān, Alāmut, Tālaqān, and Lārījān (at the foot of Mount Damāvand). The landscape of the Caspian slopes is characterized by forest clearings with shingle-roofed loghouse villages and by lush fields and pastures. The landscape of the inland slopes is of the oasis type. Extensive grain cultivation occurs on both slopes, and cattle raising occurs on the Caspian side. Alpine pastures, seasonally dotted with flocks of sheep, cover an extensive zone yet higher. The land-distribution pattern prevailing in the Elburz includes a high proportion of peasant ownership. The holdings often are much-fragmented.

Many of the traditional ways of livelihood of the mountaineers, including charcoal burning (now prohibited because of devastation of the forests), the transportation of goods (especially of rice and of charcoal for Tehrān) by pack animals, and the working of hundreds of small

coal mines, have been displaced by the 20th-century modernization of Iran.

Apart from the main line of the trans-Iranian railroad, which links Tehrān with Bandar-e Torkeman via the Gadūk Pass, there are several asphalted roads across parts of the Elburz. From west to east, these run between Ardebīl and Āstārā, between Qazvīn and Rasht, between Tehrān and Chālūs, between Tehrān and Āmol (via Damāvand); between Tehrān and Bābol (via Fīrūzkūh), and between Emāmshahr and Gorgān (via Kotal-e Zardāneh Pass).

The wild (natural or original) forests of the Elburz Mountains cover more than 8,000,000 ac (3,000,000 ha), of which some 3,000,000 ac can be exploited commercially for timber and other wood. There are also a few modern coal mines, as well as some deposits of iron and other ores. But most important is the water of the rivers, which is used for irrigation, for generating hydroelectric energy, and for supplying the fast-growing Tehrān. Spectacular dams have been built. These include the Safīd Rūd Dam, used for the irrigation of the Safīd Rūd Delta; the Karaj Dam and the Jajrūd Dam, used mainly for supplying water to Tehrān and partly for irrigation; and a series of dams on other rivers of the Māzandarān *ostān* also used for irrigation.

(H.B.)

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Elcano, Juan Sebastián de (b. *c.* 1476, Guetaria, Vizcaya, Castile—d. Aug. 4, 1526, at sea), Basque navigator who completed the first circumnavigation of the Earth.

In 1519 he sailed as master of the "Concepción," one of five vessels in Ferdinand Magellan's fleet. On Magellan's death, which occurred in the Philippines in April 1521, Elcano took command of the expedition and brought it safely home to Spain despite scurvy, starvation, and harassment by the Portuguese. Only one ship of the five, the "Vittoria," with 17 other Europeans and 4 Indians aboard, reached Spain in September 1522. In 1525 Elcano, together with García Jofre de Loaisa, was appointed to the command of a fleet of seven ships and sent to claim the Moluccas for Charles V of Spain. Elcano died while crossing the Pacific.

Elche, town, Alicante province, in the autonomous community (region) of Valencia, southeastern Spain, on the Río Vinalopó just south of Alicante city. Of Iberian origin, the site was inhabited by Greeks, Carthaginians, and Romans (who named the town Ilici). Under Arab domination, the name was changed to Elx, whence Elche. A well-known example of 5th-century BC Iberian art, a polychrome stone statue known as "La dama de Elche" ("The Lady of Elche"), was found on a nearby archaeological site in 1897; a mosaic floor with Latin inscriptions was also uncovered there in 1959. A local custom—declared a national artistic monument in 1931—is observed annually on August 14–15 in the 17th-century church of Santa María with performances of the medieval drama *Misterio de Elche,* representing the Assumption of the Virgin.

Primary economic activity is based on the nearby El Palmeral (Palm Grove), of Carthaginian origin; it produces dates and fronds for export. Other fruits grown include pomegranates, figs, and olives. Elche manufactures olive oil, soap, esparto fabrics, and hempen sandals (*alpargatas*). Pop. (1981) 162,873.

Elcho Island (Australia): *see* Galiwinku.

Elda, city, Alicante province, in the autonomous community (region) of Valencia, southeastern Spain, northwest of Alicante city. Of ancient origin, Elda was called Idella by the Iberians, early peoples of Spain. The city first achieved importance under the Moors, who occupied it in the 8th century and built a castle (ruins remain); it was re-Christianized by James I of Aragon in 1265. In the 18th century Elda was given the title Fidelísima ("most faithful") by Philip V for its loyalty to the crown during the War of the Spanish Succession. Elda, connected by rail with Almansa and Alicante, is the centre of a fertile grain and fruit-producing area. Its manufactures include shoes, paper, furniture, and esparto fibre. Pop. (1981) 52,185.

Eldad (BEN MAHLI) HA-DANI, English ELDAD THE DANITE (fl. late 9th century), Jewish traveller and philologist who was generally credited with the authorship of a fanciful geographical narrative that exerted an enduring influence throughout the Middle Ages. This possibly gave rise to the legend of Prester John, the mighty Oriental priest-potentate of fabulous wealth and power.

Probably originally from southern Arabia, Eldad visited Mesopotamia, Egypt, North Africa, and Spain and caused a stir by his account of the Ten Lost Tribes of Israel (*q.v.*). He himself claimed to be a descendant of the Danites, who, together with the tribes of Naphtali, Asher, and Gad, were said to have established a Jewish kingdom in Cush (Kush), variously interpreted as Ethiopia or, roughly, present-day Sudan. His veracity was challenged largely because the ritual prescriptions he described diverged from those of the Talmud, the rabbinical compendium of law, lore, and commentary. His Hebrew narrative, *Sefer Eldad,* established his reputation as a philologist whom leading medieval Jewish grammarians and lexicographers quoted as an authority on linguistic difficulties. It appeared in several languages and in widely deviating versions. The first edition was published at the Italian city of Mantua in 1480.

Eldegüzid DYNASTY, also spelled ILDIGÜZID, ILDEGÜZID, ILDEGIZID, or ILDENIZID, (1137–1225), Iranian *atabeg* dynasty of Turkish origin that ruled in Azerbaijan (now divided between Iran and the U.S.S.R.).

The founder of the dynasty was Shams ad-Dīn Eldegüz (reigned *c.* 1137–75), originally a Turkish slave of the Seljuq minister Kamāl al-Mulk Simīrumī. In 1137 the Seljuq sultan Mas'ūd I appointed Eldegüz ruler of the Seljuq provinces of Arrān and Azerbaijan. In 1161, shortly after he had married the widow of the Seljuq ruler Toghril II, Eldegüz was made *atabeg* (guardian) of his stepson, the infant Seljuq prince Arslan. During the next three decades the Eldegüzids, using their position as *atabeg*s of Seljuq princes, expanded their territories in Iran as far south as Isfahan and northward in the Caucasus to the borders of Shīrvān and Georgia. In 1191 the Seljuq sultan Toghril III defeated and subjugated Qutlugh Inanj (reigned 1191–95), the fourth Eldegüzid ruler. Qutlugh had to retreat to Azerbaijan, where the Eldegüzids held their position until 1225, when the Khwārezm-Shāh, Jalāl ad-Dīn Mingburnu, took over the administration of their territories.

elder, in Christianity, any of various church officers. In modern times the title of elder has been used notably in the Presbyterian and Reformed churches and in Mormonism.

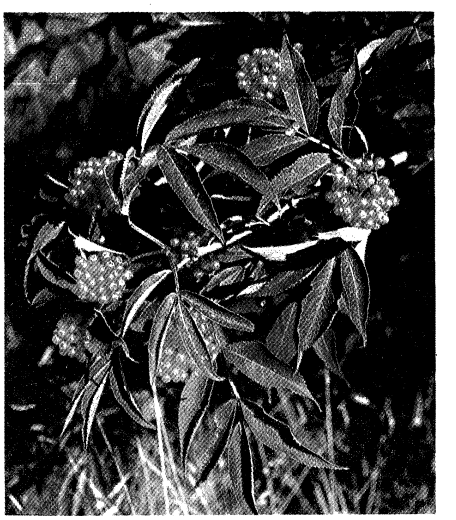
In the early Christian Church the term elder (Hebrew *zaken,* Greek *presbyteros*), though possibly influenced by the use of the title for secular magistrates in Asia Minor, was derived from the Israelites, who shared it with other Semitic peoples. Moses appointed 70 elders as intermediaries between himself and the people (Num. 11:16). In the New Testament, elders are mentioned together with bishops (*episcopoi*) as leaders of local churches; in some passages the two terms seem interchangeable. Later the word *presbyteros* came to mean "presbyter" (*i.e.,* priest). It is thus difficult to decide on its exact significance in the early church. After the threefold ministry of bishop, priest, and deacon became fully adopted in the 2nd and following centuries, the office of elder lapsed in the Roman Catholic Church.

During the Reformation in the 16th century the office of elder was revived by certain churches, notably the Presbyterians. According to Presbyterian theory of church government, there are two classes of elders: the teaching elders, called ministers, ordained and especially set apart to the pastoral office, and the ruling elders, who are lay persons chosen generally by the congregation and ordained to assist the minister in the oversight and government of the church.

In the Church of Jesus Christ of Latter-day Saints, or Mormonism, an elder is a male member aged 20 or over. In this church there are no distinctions between a lay person and a priest. At the age of 12, all worthy Mormon males become deacons; and before the age of 20 they become priests. At that age a man becomes an elder in the Melchizedek priesthood. In later life he may possibly rise to become a high priest, a member of the so-called seventy.

Among Methodists the term elder refers to a fully ordained minister. In the Lutheran Church the terms elder and deacon are often used interchangeably with reference to lay persons chosen by a congregation to assist the pastor in his official duties; they and the pastor form a board of elders, with advisory powers.

elder, any of about 20 to 30 species, mainly shrubs and small trees, comprising the genus *Sambucus* of the family Caprifoliaceae. Most are native to forested temperate or subtropical areas of both hemispheres. They are important as garden shrubs, as forest plants, and for their berries, which provide food for wildlife and are used to produce wines, jellies, pies, and medicines. An elder has divided leaves and flat, roundish clusters of tiny, yellowish-white, saucer-shaped flowers that are followed by small red, blue-black, black, or yellow berries.



European red elder (*Sambucus racemosa*)
A.J. Huxley

The American, or sweet, elder (*S. canadensis*), of North America is the most important species horticulturally. It grows to 2.4 metres (8 feet) tall and produces large clusters of

white flowers, succeeded by abundant clusters of fruit. This fruit, called elderberry, is sometimes collected from wild trees, but a number of cultivated varieties have been developed for home and commercial use. The berries may be mixed with grapes for jelly or combined with apples as a pie filling. In some areas, the juice is traditionally fermented into wine. The unopened flower buds are sometimes pickled as a substitute for capers. In folk medicine, the elderberry has been touted as a remedy for stomach upsets, as an eye lotion, as a salve for bruises, and as a diuretic.

Other species of elders include the European, or black, elder (*S. nigra*), which reaches 9 m (29 feet), and the blue, or Mexican, elder (*S. caerulea*), which grows to 15 m (48 feet). European red elder (*S. racemosa*), native from northern Europe to North China, has round clusters of scarlet berries and reaches 4 m (13 feet). Red-berried elder (*S. pubens*), with dark pith, is a similar North American species. Danewort (*S. ebulus*), widespread in Europe and North Africa, is a perennial with annually herbaceous growth to 1 m (3 feet). Its clusters of black berries were once a source of dye.

Elder, John (b. March 8, 1824, Glasgow, Scot.—d. Sept. 17, 1869, London), Scottish marine engineer whose introduction of the compound steam engine on ships cut fuel consumption and helped make practical long voyages on which refueling was impossible.

The son of an inventor, Elder served a five-year apprenticeship with a Glasgow firm and then worked in engine factories in England. On his return to Scotland he joined a firm of millwrights, which later, as Randolph, Elder, and Company, entered the marine-engineering field. In 1854 he developed the marine compound steam engine (using both high and low pressures), which enabled seagoing vessels to save 30 to 40 percent of the coal they had been burning. As a partner and subsequently as sole owner of the business, he was an enlightened employer with a far-sighted attitude toward management–labour relations. In 1869 he was elected president of the Institute of Engineers and Shipbuilders of Glasgow.

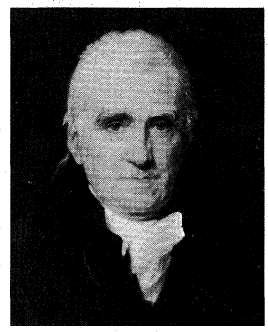
Elder, Kate, also called KATIE ELDER, or KATE FISHER, byname BIG NOSE KATE, or NOSEY KATE (fl. 1877–81), plainswoman and frontier prostitute of the old American West, companion and possible wife of Doc Holliday (*q.v.*).

Nothing is known of her background before she turned up in a Fort Griffin, Texas, saloon in the fall of 1877, working as a barroom prostitute. There she met Holliday, with whom she had an affair and whom she helped to escape the law after he had knifed and killed a man in a brawl. Early in 1878 they made their way to Dodge City, Kan., where they took rooms as Dr. and Mrs. John H. Holliday; they claimed to have married and may have done so, though no proof exists.

They later moved on to Tombstone, Ariz., where in July 1881 an intoxicated Elder signed a deposition to the effect that John H. Holliday had been one of the outlaws who had lately tried to hold up the Benson stagecoach. Holliday was later freed of the charge, but he straightaway abandoned Elder.

Her subsequent life is unknown, although a late story, probably apocryphal, has Elder turning up in Bisbee, Ariz., in 1884/85. There in the Brewery Gulch saloon she was reportedly slain by a stray bullet fired by a drunk.

Eldon, John Scott, 1st Earl of, VISCOUNT ENCOMBE OF ENCOMBE, BARON ELDON OF ELDON (b. June 4, 1751, Newcastle upon Tyne, Northumberland, Eng.—d. Jan. 13, 1838, Hamilton Place, Middlesex), lord chancellor of England for much of the period between 1801 and 1827. As chief equity judge, he granted the injunction as a remedy more often than earlier lords chancellor had generally done and settled the rules for its use. An inflexible conservative, he opposed Roman Catholic political emancipation, the



Eldon, detail of a portrait by Sir Thomas Lawrence; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

abolition of imprisonment as a punishment for debtors, the abolition of the slave trade, and the reform of the House of Commons.

Scott studied at University College, Oxford (B.A., 1770; M.A. 1773), and at the Middle Temple, London. Called to the bar in 1776, he entered the House of Commons in 1783. As attorney general from 1793, during the French revolutionary period, he was largely responsible for the measures that the ministry of William Pitt the Younger took to suppress political meetings and literature considered seditious. In 1799 he became chief justice of the Court of Common Pleas and was created Baron Eldon. Appointed lord chancellor by Prime Minister Henry Addington (afterward 1st Viscount Sidmouth), he served under five premiers from April 14, 1801, to April 12, 1827, except for 14 months in 1806–07. He resigned in protest against the Catholic Emancipation plan of George Canning, prime minister in 1827.

Always dilatory, the English chancery was thought to be at its worst in that respect during Eldon's tenure. He helped, however, to develop trademark law by issuing numerous injunctions against merchants who sold goods bearing the name of other traders. In 1821 King George IV created him Viscount Encombe and Earl of Eldon.

Eldorado (Spanish: "The Gilded One"), originally, the legendary ruler of an Indian town near Bogotá, who was believed to plaster his naked body with gold dust during festivals, then plunge into Lake Guatavita to wash off the dust after the ceremonies; his subjects threw jewels and golden objects into the lake. Spanish conquistadores heard the tale before 1530, and one of them reported that he had visited Eldorado himself in a city called Omagua. In 1538 Spaniards from Peru and Germans from Venezuela converged on the Bogotá highlands in search of the "gilded man." No trace of him was found, but the area remained under Spanish rule.

As the search continued into the Orinoco and Amazon valleys, Eldorado came to mean an entire fabulous country of gold, with legendary cities named Manoa and Omagua. In this quest, Gonzalo Pizarro crossed the Andes from Quito (1539), Francisco de Orellana sailed down the Napo and the Amazon (1541–42), and Gonzalo Jiménez de Quesada explored eastward from Bogotá (1569–72). Sir Walter Raleigh searched for Manoa in the Orinoco lowlands (1595), while Spaniards sought Omagua nearby. In 1603 the Portuguese Pêro Coelho de Sousa explored northward from Pernambuco, and the golden city of Eldorado was shown on maps of Brazil and the Guianas for years thereafter.

Eldorado was only one of the many mythical regions of great riches—Cíbola, Quivira, the City of the Caesars, and Otro Méiico being among the others. The search for these led to the rapid exploration and conquest of much of the Americas by Spaniards and others. Since then, Eldorado has come to mean any place where wealth can be quickly and easily gained. The name was given to towns in Latin America and the United States and to a California county. The story is often mentioned in literature, as in Milton's *Paradise Lost* and Voltaire's *Candide.*

Eldoret, town, western Kenya, eastern Africa, on the Uasin Gishu Plateau west of the Great Rift Valley. Situated at an elevation of 6,857 feet (2,090 m) above sea level, its healthful climate attracted many European settlers during the colonial period. It serves an agricultural area; chief crops are corn (maize), wheat, and pyrethum (a plant used in manufacturing insecticides). Cattle raising in the vicinity is important. Local industries include flour-milling and food-processing plants. Eldoret is a rail stop on the line running northwest into Uganda. It is the seat of a Roman Catholic bishopric. Pop. (1983 est.) 55,300.

Eldridge, (David) Roy, byname LITTLE JAZZ (b. Jan. 30, 1911, Pittsburgh, Pa., U.S.—d. Feb. 26, 1989, Valley Stream, N.Y.), American trumpeter, one of the great creative musicians of the 1930s.

A child prodigy, Eldridge began his professional career in 1917 when, on New Year's Eve, he played the drums in his elder brother's band. He went to New York City in 1930 and played in the trumpet sections of bands led by Cecil Scott, Elmer Snowden, and Teddy Hill. His style was influenced by that of saxophonist Coleman Hawkins. By the time he was playing with Hill at the Savoy Ballroom in New York City's Harlem, in 1935, Eldridge was developing into an improviser of magnificent power and invention. The following year he joined the Fletcher Henderson orchestra, then in its last days, and his recordings from that period show him to be one of the great creative musicians of the decade. He also appears on a few of the historic small-group recordings with the singer Billie Holiday, and from time to time he had bands of his own.

Eldridge's fame suddenly flowered in 1941 when he joined Gene Krupa's band, and it was further increased in 1944 when he joined Artie Shaw. Later, he toured with Jazz at the Philharmonic and other jazz concert groups all over the world, retiring in 1980. Stylistically he became one of the key figures of jazz trumpet playing, representing a link between the classical style of Louis Armstrong and the fierce departures of Dizzy Gillespie, who testified to Eldridge's influence upon him.

Eldridge broke away from the traditional conception involving figures that were most natural to the trumpet (arpeggiated lines and sustained tones) and generated a technically difficult approach resembling jazz saxophone improvisation: very fast, scalelike passages. In addition, he incorporated harmonically unorthodox choices of notes and leaps into the high register (he loved to hear a note squeal and crack), which provided the basis for Dizzy Gillespie's enormously influential modern jazz trumpet style.

Elea (Greek city-state): *see* Elis.

Elea, also spelled HYELE, Roman VELIA, ancient city in Lucania, Italy, about 25 miles southeast of Paestum; home of the Eleatic school of philosophers, including Parmenides and Zeno. The city was founded about 535 BC by Phocaean Greek refugees on land seized from the native Oenotrians. Unlike other Greek cities in Italy, Elea was never captured by the Lucanians; it became a Roman ally around 275 and a *municipium* in 90–89 BC. Elea, finally deserted in medieval times be-

cause of Arab raids, has extensive ruins that include sanctuaries, houses, the outline of the complete wall circuit, and a medical centre.

Eleanor OF AQUITAINE, also called ELEANOR OF GUYENNE, French ÉLÉONORE, or ALIÉNOR, D'AQUITAINE, or DE GUYENNE (b. *c.* 1122—d. April 1, 1204, Fontevrault, Anjou, Fr.), queen consort of both Louis VII of France (in 1137–52) and Henry II of England (in 1152–1204) and mother of Richard I the Lion-Heart and John of England. She was perhaps the most powerful woman in 12th-century Europe.

Eleanor was the daughter and heiress of William X, duke of Aquitaine and count of Poitiers, who possessed one of the largest domains in France—larger, in fact, than those held by the French king. Upon William's death in 1137 she inherited the Duchy of Aquitaine and in July 1137 married the heir to the French throne, who succeeded his father, Louis VI, the following month. Eleanor became queen of France, a title she held for the next 15 years. Beautiful, capricious, and adored by Louis, Eleanor exerted considerable influence over him, often goading him into undertaking perilous ventures.

From 1147 to 1149 Eleanor accompanied Louis on the Second Crusade to protect the fragile Latin kingdom of Jerusalem, founded after the First Crusade only 50 years before, from Turkish assault. Eleanor's conduct during this expedition, especially at the court of her uncle Raymond of Poitiers at Antioch, aroused Louis's jealousy and marked the beginning of their estrangement. After their return to France and a short-lived reconciliation, their marriage was annulled in March 1152. According to feudal customs, Eleanor then regained possession of Aquitaine, and two months later she married the grandson of Henry I of England, Henry Plantagenet, count of Anjou and duke of Normandy. In 1154 he became, as Henry II, king of England, with the result that England, Normandy, and the west of France were united under his rule. Eleanor had only two daughters by Louis VII; to her new husband she bore five sons and three daughters. The sons were William, who died at the age of three; Henry; Richard, the Lion-Heart; Geoffrey, duke of Brittany; and John, surnamed Lackland until, having outlived all his brothers, he inherited, in 1199, the crown of England. The daughters were Matilda, who married Henry the Lion, duke of Saxony and Bavaria; Eleanor, who married Alfonso VIII, king of Castile; and Joan, who married successively William II, king of Sicily, and Raymond VI, count of Toulouse. Eleanor would well have deserved to be named the "grandmother of Europe."

During her childbearing years, she participated actively in the administration of the realm and even more actively in the management of her own domains. She was instrumental in turning the court of Poitiers, then frequented by the most famous troubadours of the time, into a centre of poetry and a model of courtly life and manners. She was the great patron of the two dominant poetic movements of the time: the courtly love tradition, conveyed in the romantic songs of the troubadours, and the historical *matière de Bretagne*, or "legends of Britanny," which originated in Celtic traditions and in the *Historia regum Britanniae*, written by the chronicler Geoffrey of Monmouth some time between 1135 and 1139.

The revolt of her sons against her husband in 1173 put her cultural activities to a brutal end. Since Eleanor, 11 years her husband's senior, had long resented his infidelities, the revolt may have been instigated by her; in any case, she gave her sons considerable military support. The revolt failed, and Eleanor was captured while seeking refuge in the kingdom of her first husband, Louis VII. Her semi-imprisonment in England ended only with the death of Henry II in 1189. On her release, Eleanor played a greater political role than ever before. She actively prepared for Richard's coronation as king, was administrator of the realm during his crusade to the Holy Land, and, after his capture by the Duke of Austria on Richard's return from the east, collected his ransom and went in person to escort him to England. During Richard's absence, she succeeded in keeping his kingdom intact and in thwarting the intrigues of his brother John Lackland and Philip II Augustus, king of France, against him.

In 1199 Richard died without leaving an heir to the throne, and John was crowned king. Eleanor, nearly 80 years old, fearing the disintegration of the Plantagenet domain, crossed the Pyrenees in 1200 in order to fetch her granddaughter Blanche from the court of Castile and marry her to the son of the French king. By this marriage she hoped to insure peace between the Plantagenets of England and the Capetian kings of France. In the same year she helped to defend Anjou and Aquitaine against her grandson Arthur of Brittany, thus securing John's French possessions. In 1202 John was again in her debt for holding Mirebeau against Arthur, until John, coming to her relief, was able to take him prisoner. John's only victories on the Continent, therefore, were due to Eleanor.

She died in 1204 at the monastery at Fontevrault, Anjou, where she had retired after the campaign at Mirebeau. Her contribution to England extended beyond her own lifetime; after the loss of Normandy (1204), it was her own ancestral lands and not the old Norman territories that remained loyal to England. She has been misjudged by many French historians who have noted only her youthful frivolity, ignoring the tenacity, political wisdom, and energy that characterized the years of her maturity. "She was beautiful and just, imposing and modest, humble and elegant"; and, as the nuns of Fontevrault wrote in their necrology: a queen "who surpassed almost all the queens of the world."

(R.Pe.)

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Eleanor OF CASTILE, Spanish LEONOR DE CASTILLA (b. 1246—d. Nov. 28, 1290, Harby, Nottinghamshire, Eng.), queen consort of King Edward I of England (ruled 1272–1307). Her devotion to Edward helped bring out his better qualities; after her death, his rule became somewhat arbitrary. Eleanor was the daughter of King Ferdinand III of Castile and his wife, Joan of Ponthieu.

Eleanor of Castile, detail of an electrotype from an effigy in Westminster Abbey; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

In 1254 Eleanor was married to Lord Edward, son of England's King Henry III. In honour of the event, her half brother, Alfonso X of Castile, transferred to Edward his claims to Gascony. When Henry III's baronial opponents seized power in England in 1264, Eleanor was sent for safety to France; she returned in October 1265, after Edward had crushed the rebels.

Eleanor accompanied Edward on a crusade from 1270 to 1273. The story that she saved his life at Acre (now in Israel) by sucking poison from a dagger wound is evidently apocryphal. After Edward ascended the throne, Eleanor was criticized for allegedly mistreating the tenants on her lands. Upon her death, Edward erected the famous Eleanor Crosses—several of which still stand—at each place where her coffin rested on its way to London.

Eleanor OF PROVENCE, French ÉLÉONORE DE PROVENCE (b. 1223—d. June 25, 1291, Amesbury, Wiltshire, Eng.), queen consort of King Henry III of England (ruled 1216–72); her widespread unpopularity intensified the severe conflicts between the King and his barons.

Eleanor's father was Raymond Berengar IV, count of Provence, and her mother was the daughter of Thomas I, count of Savoy. The marriage of Eleanor and Henry (January 1236) was designed to further the King's continental ambitions. Eleanor soon alienated the barons by having her Savoyard and Provençal uncles installed in high offices in England.

After rebel barons captured Henry and took over the government in May 1264, Eleanor became the leader of the royalist exiles in France. She raised an invasion force, but her fleet was wrecked at Sluis, Flanders. Nevertheless, the rebels were crushed in August 1265, and Eleanor then returned to England. Upon the death of Henry and the accession of her son Edward I, she retired to a nunnery at Amesbury.

Eleaticism (from Elea, or Velia, a Greek colony in southern Italy), one of the principal schools of ancient Pre-Socratic philosophy, distinguished by its radical monism, according to which all that is really true is a static plenum of Being and nothing exists that stands either in contrast or in contradiction to it; and by its stress on the coalescence of existence, thought, and expression.

A brief treatment of Eleaticism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines.

As a result of Aristotle's systematizing, Xenophanes of Colophon has often been counted as the founder of the Eleatic school; but its chief tenets undoubtedly appear first in Parmenides. Zeno of Elea was the pupil of Parmenides; and Melissus was the third and last leader of the school.

A summary of certain features in Parmenides' doctrine will explain its outstanding importance to philosophy. It argues that reality is one undifferentiated whole; the "things" and their changes that we observe through our senses are mere appearances or names. He claimed that Being is one (Greek *hen*) and unique and that it is continuous, indivisible, and all that there is or ever will be (the Eleatic One). Aristotle further elaborated Parmenides' argument to assert that Being must be all there is—since other than Being there is only Not-Being—and Not-Being cannot divide Being from Being. It follows, therefore, that Being is whole, continuous, and "not divisible, since it is all alike."

In opposition to the Ionian natural philosophers who accepted the reality of change but looked for material stuff underlying it, Parmenides' position was reached by an abstract,

logical, or generalized analysis of what we mean by "to be." He was therefore correctly regarded as the founder of metaphysics. His use of the law of contradiction meant the introduction of logic as the prime method of philosophy.

Melissus defended him along the same lines, while Zeno's work forms a complement by defending him negatively or indirectly, through a *reductio ad absurdum* of his opponents' position. With Zeno, however, the analysis focusses less on Being than on the co-extensive term Unity. He may have intended to deal with the pluralism of Pythagoreans, whose materialization of numbers made them specially aware that plurality implied units. Here was the weak point of Eleaticism, and it was noticed by Gorgias and by Plato: the absurdities demonstrated in the alleged units of the pluralists had only to be turned against the unitary reality of the Eleatics.

By Plato's time the heirs of Zeno were so-called Megarian thinkers, who concentrated on logical puzzles involved in the notions of predication, contradiction, possibility, and motion; we can see how they compelled Plato to attend to purely logical matters in the *Euthydemus, Parmenides,* and *Sophist.* The influence of the Eleatic school was due, in fact, to the very generality of its analysis. Melissus' remark, that if there were a "many" these would have to be like the Eleatic One and not as they appear, was acceptable to Democritus and to Plato alike. The properties of the atom were almost certainly suggested by those of "the one." The Eleatic or monistic strand in Plato is conspicuous in the Neoplatonists and, through their medium, was to be consciously woven by Hegel into his objective idealism.

Eleazar ben Azariah (fl. late 1st and early 2nd centuries AD), Jewish rabbinic scholar, one of the Palestinian tannaim (those who compiled the Jewish Oral Law), whose practical maxims constitute some of the best known sayings of the Talmud.

Eleazar was a wealthy, learned, and highly esteemed resident of Jabneh who traced his descent through Ezra, the legendary spiritual leader of Palestine. He served for a short time as head of the local Sanhedrin (the Jewish legislative body) after the deposition from that post of Rabban Gamaliel II of Jabneh. Eleazar was an expert in the Scriptures and in all aspects of Jewish Law. He favoured a direct and literal interpretation of the Scriptures, and he formulated the principle that a biblical verse can be interpreted in the contect of the verses that precede or follow it.

Eleazar ben Judah OF WORMS, original name ELEAZAR BEN JUDAH BEN KALONYMOS, also called ELEAZAR ROKEAḤ (b. *c.* 1160, Mainz, Franconia, Holy Roman Empire—d. 1238, Worms), Jewish rabbi, mystic, Talmudist, and codifier.

Along with the *Sefer Ḥasidim* (1538; "Book of the Pious"), of which Eleazar was a coauthor, his voluminous works are the major extant documents of medieval German Ḥasidism (an ultrapious sect that stressed prayer and mysticism). He was a member of the eminent Kalonymos family, which gave medieval Germany many of its spiritual leaders and mystics; another member of that family, the semilegendary pietist Judah ben Samuel the Ḥasid of Regensburg, was his teacher and spiritual master.

Eleazar's wife conducted a business so that he could devote himself to his studies. In 1196 two Christian crusaders broke into his house and, before his eyes, murdered his wife and two daughters. In spite of this horrendous experience, he continued to teach a doctrine of love of humanity. He became a rabbi at Worms in 1201 and in 1223 took part in a synod at Mainz, which considered such questions as business relations with Christians and the inequitable exemptions of particularly favoured Jews from the tax imposed by the government.

Eleazar was a man of great erudition who did not compartmentalize his knowledge of Kabbalism (the influential body of Jewish mystical writings) and the Talmud (the rabbinical compendium of law, lore, and commentary); rather, he tried to unify these opposing aspects of Judaism in his writings, often with strange results.

His greatest work is his ethical code *Rokeaḥ* (1505; "Dealer in Spice"), for which he is sometimes known as Eleazar Rokeaḥ. The work is prefaced with a number of chapters dealing with the essential principles of Judaism, in which Eleazar attempts to explain mystic concepts, including the unity of God, in terms of Halakha (Law). The work itself, which is not complete, contains some 497 sections addressed to every aspect of Jewish life, from sabbath law, holiday rituals, and marriage ceremony to penance for sins, the latter a preoccupation of the German Ḥasidim, in common with medieval Christianity.

Eleazar was an angelologist, not only in his mystic theories of theurgy (the art of persuading or compelling supernatural beings to one's bidding) but also in his writings on the *kavod* ("divine glory"), a concept also shared by his master, Judah ben Samuel the Ḥasid, who wrote a mystic work, existing only in citations, on the subject. Eleazar believed that the *kavod,* a ruling angel, was an emanation from God and the knowable aspect of him, while God himself was infinitely transcendent and unknowable. Eleazar also wrote *tosafot* (commentaries) on a number of Talmudic tractates, as well as mystical commentaries on the five scrolls (Song of Solomon, Ruth, Lamentations, Ecclesiastes, and Esther) and on the Pentateuch (five books of Moses).

election, the formal process of selecting a person for public office or accepting or rejecting a political proposition, by voting.

A brief treatment of elections follows. For full treatment, *see* MACROPAEDIA: Political Systems.

An election is one of the means by which a society may organize itself and make specified formal decisions. Where voting is free, it acts simultaneously as a system for making certain decisions regarding the power relations in a society and as a method for seeking political obedience with a minimum of sacrifice of the individual's freedom. The essence of a democratic election is freedom of choice. Another characteristic of voting is that it can be regarded as a procedure having special authority within the group, organization, or state. Representatives are elected who become important decision-makers for the body politic. In some countries the individual may be asked to go through some of the formalities of casting a ballot, but this is a mock election, not a true one. In this type of election, the voter can merely ratify choices already made by the dictator or the ruling group.

With the increasing size of the electorate, the administrative problems of conducting elections have become more and more complicated. The aim of election administration is to safeguard the rights of the voters, to serve the convenience of the voters, to keep the expense of holding elections to a minimum, to provide the best method for translating votes into seats, and to prevent fraud. The devices to achieve these ends have been registration laws, ballot laws, laws governing the casting and counting of the votes, laws regarding the assignment of seats, and corrupt practices acts.

When an election is to be held, registration machinery must be set up to determine who is entitled to vote under the law and to safeguard against voting by persons who are not qualified to vote. Registration procedures should impose the least possible burden upon the voters that is consistent with the achievement of these objectives. They should also provide means for keeping the voter lists up to date. Proper identification of the voter is the key to a sound registration system. In some U.S. states and in the Philippines the signature of the voter is used as a means of identification. The voter signs his name at the time he registers and again when he applies to vote. The polling official compares the two signatures and establishes the identification. In India and parts of Africa, where illiteracy is more common, a fingerprint is used for the same purpose.

The time of the year when elections are held, the day of the week, how early the booths are opened and how late closed are important considerations. In agricultural countries elections (where there are fixed terms of the legislature) are sometimes fixed after the spring sowing or in autumn after the harvest. The day of the week is especially important in an industrial country, where work must proceed with regularity. Most European countries except Great Britain adopted a Sunday or a holiday as election day. In the United States, with most elections coming on Tuesday, some states have laws allowing voters to be absent from work for the time necessary to vote.

In the 19th century, great debates were waged in the legislatures of Western nations over the process of polling. Of primary concern were securing the freedom of the voter from outside influence, protecting against ballot tampering, and ensuring the honest counting of votes. The first of these was secured by the proper organization of the whole electoral procedure; the second by the institution of the secret ballot; and the third by associating the representatives of the contending parties with the supervising officer of the proceedings. The official in charge of local election adminstration is usually a public official, either of the central authority (the *préfet* in France) or of a local government authority (the town clerk in Great Britain).

elector, German KURFÜRST, prince of the Holy Roman Empire who had a right to participate in the election of the emperor (the German king). Beginning around 1273 and with the confirmation of the Golden Bull of 1356, there were seven electors: the archbishops of Trier, Mainz, and Cologne; the duke of Saxony; the count palatine of the Rhine; the margrave of Brandenburg; and the king of Bohemia. Other electorates were created later for Bavaria (1623–1778), Hanover (from 1708), and Hesse-Kassel (from 1803). The office disappeared with the abolition of the empire in 1806, though the ruler of Hesse-Kassel continued to use the title until later in the 19th century.

electoral college, in the United States, a group of electors chosen within each state to elect the president and vice president. Each state has as many presidential electors as it has representatives in both houses of Congress.

As originally planned by the framers of the Constitution, the electors actually choose the president. The framers preferred this to a direct popular election because, at a time when travel was difficult and there were no national party organizations, they feared that many regional candidates would divide the vote. Requiring a candidate to win a majority in the electoral college was a way of obtaining a national consensus.

Although the Constitution still allows electors to use their discretion, electors now are usually pledged to support a party's candidate. All the states, except Maine, hold a winner-take-all popular vote for electors. Whichever candidate wins a plurality in a state wins all the electoral votes in that state.

With the winner-take-all system, elected presidents receive a greater percentage of the electoral vote than of the popular vote. Two presidents, Rutherford B. Hayes in 1876 and Benjamin Harrison in 1888, won a majority of the electoral votes even though they received fewer popular votes than their principal opponents. In a very close election, it would again be possible for a popular-vote loser to be elected president. Opponents of the electoral system fear this would undermine the authority of the presidency. It is also feared that a regionally strong third-party candidate who could win even a few states could thwart the intention of the voters. He could throw his electoral votes to a candidate, who would not win otherwise, in exchange for political concessions.

Defenders of the system argue that in a direct popular vote the winner does not have to win a majority of anything—votes or states. Small states or states with a small population fear being overwhelmed by urban centres. Defenders claim a direct-vote system would encourage more splinter candidates.

Electoral Commission (1877), in U.S. history, commission created by Congress to resolve the disputed presidential election of 1876 between Republican Rutherford B. Hayes and Democrat Samuel J. Tilden. For the first time since before the Civil War the Democrats had polled a majority of the popular vote, and preliminary returns showed Tilden with 184 electoral votes of the 185 needed to win, while Hayes had 165. Three states were in doubt: Florida, Louisiana, and South Carolina, with 19 electoral votes among them. The status of one of Oregon's three electors—that had already been given to Tilden—was also in question. Hayes and most of his associates were ready to concede when a New Hampshire Republican leader, William E. Chandler, observed that if Hayes were awarded every one of the doubtful votes, he would defeat Tilden 185–184. Both parties claimed victory in all three Southern states and sent teams of observers and lawyers into all three in hopes of influencing the official canvass.

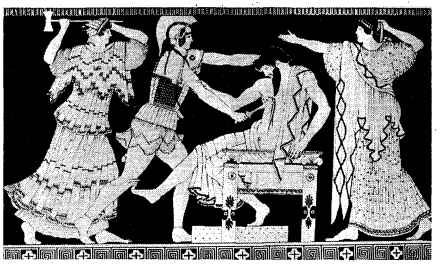
The responsibility for resolving the conflicting claims rested with Congress—which was more evenly divided between the parties than it had been in decades. The U.S. Constitution provided that each state send its electoral certificate to the president of the Senate, who "shall, in the presence of the Senate and House of Representatives, open all the certificates, and the votes shall then be counted." But it shed no light on whether Congress might, in a disputed election, go behind a state's certificate and review the acts of its certifying officials or even if it might examine the choice of electors. If it had such powers, might it delegate them to a commission?

The impasse continued on December 6, the appointed date for electors to meet in the states. When Congress convened the next day there were rival reports from the doubtful states. For more than six weeks maneuvering and acrimony prevailed in Congress and out, punctuated by threats of civil war. Finally, Congress created an Electoral Commission (Jan. 29, 1877) to pass on the contests. The Commission was given "the same powers, if any," possessed by Congress in the matter, and its decisions were to be final unless rejected by both houses.

The Commission was to have five members from the House of Representatives, five from the Senate, and four members from the Supreme Court. Congressional and court contingents were divided evenly between Republicans and Democrats, and the four associate justices were to name a fifth, tacitly but universally understood to be the noted independent from Illinois, David Davis. At this stage the Republican-controlled legislature of Illinois elected Davis to the state's vacant U.S. Senate seat, and he refused the commission appointment, although he stayed on the Supreme Court until March 3. Thereupon the four justices picked their colleague Joseph P. Bradley, a Republican whose record made him acceptable to the Democrats.

Bradley leaned toward Tilden's convincing claim to the Florida vote, the Commission's first action, but Republican pressures swayed him, and the Florida tally went to Hayes, who had almost certainly lost it in fact. Thenceforward all votes followed Florida, on a straight party-line 8–7 basis. (Hayes's claim to Oregon was clearly legitimate, and fraud and intimidation by both parties had been widespread in Louisiana and South Carolina.) The final vote was reported to Congress on February 23. After a week of ominous bluster, which Tilden did much to quiet among his aggrieved followers, a tumultuous session of Congress convened March 1 to count the electoral vote and after 4 AM the next day declared Hayes elected; he was sworn in on the following day. The verdict was received bitterly by Democrats in the North and philosophically by those in the South, who had been promised by Hayes's allies that federal troops would be removed promptly from the former Confederate states, as in fact they were before the end of April. The threats of violence that had recurred throughout the dispute came to naught, giving a welcome sense of assurance to both factions that, even so soon after the Civil War, self-government and domestic peace were not incompatible.

Electra (Greek: "Bright One"), in Greek legend, the daughter of Agamemnon and Clytemnestra, who saved the life of her young brother Orestes by sending him away when their father was murdered. When he later returned, she helped him to slay their mother and their mother's lover. Electra then married Orestes' friend Pylades. The plays of the same name written by Sophocles and Euripides and the *Choephoroi* by Aeschylus vary the theme in detail. Many other versions also exist, including Eugene O'Neill's play *Mourning Becomes Electra* (1931).



Electra and Orestes killing Aegisthus in the presence of their mother, Clytemnestra; detail of a Greek vase, 5th century BC

The Mansell Collection

electret, material that retains its electric polarization after being subjected to a strong electric field. The positive charge within the material becomes permanently displaced in the direction of the field, and the negative charge becomes permanently displaced in the direction opposite to the field. One end of the electret is somewhat positive, and the other is somewhat negative, though the net charge remains zero. Electrets are prepared from certain waxes, plastics, and ceramics, the individual molecules of which are permanently polarized but are randomly arranged before being subjected to an electric field so that there is no overall polarization in the material. The strong electric field (approximately 1,000,000 volts per metre) rotates the polar molecules into an alignment that persists when the external field is removed. Sometimes electrets are made by allowing a molten material to solidify in a strong electric field.

The behaviour of electrets in an electric field is analogous to that of permanent magnets in a magnetic field. An electret, for example, lines up in an electric field with its positive end pointing in the direction of the field. Electrets, discovered in 1925, have found applications in electrostatic microphones.

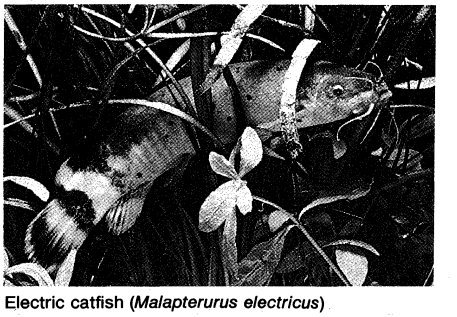
electric arc, continuous, high-density electric current between two separated conductors in a gas or vapour with a relatively low potential difference, or voltage, across the conductors. The high-intensity light and heat of arcs are utilized in welding, in carbon-arc lamps and arc furnaces that operate at ordinary air pressure, and in low-pressure sodium-arc and mercury-arc lamps.

electric automobile, battery-powered motor vehicle, originating in the late 1880s and used for private passenger, truck, and bus transportation.

Through the early period of the automotive industry until about 1920, electric automobiles were competitive with petroleum-fueled cars particularly as luxury cars for urban use and as trucks for deliveries at closely related points, for which the relatively low speed and limited range, until battery recharge, were not detrimental. Electrics, many of which were steered with a tiller rather than a wheel, were especially popular for their quietness and low maintenance costs. Ironically, the death knell of the electric car was first tolled by the Kettering electrical self-starter, first used in 1912 Cadillacs and then increasingly in other gasoline-engine cars. Mass production, led by Henry Ford, also reduced the cost of the non-electrics. Electric trucks and buses survived into the 1920s, later than passenger cars, especially in Europe.

Electric automobile prototypes reappeared in the 1960s when major U.S. manufacturers, faced with ultimate exhaustion of petroleum-based fuels and with immediate rising fuel costs from the domination of Arab petroleum producers, once again began to develop electrics. Both speed and range were increased, and newly developed fuel cells offered an alternative to batteries; but by the mid-1980s electric automobiles had not become a part of the automotive industry's output. Most industrial in-plant carrying and lifting vehicles, however, were electrically powered.

electric catfish (*Malapterurus electricus*), widely distributed freshwater catfish native to tropical Africa. The only member of the family Malapteruridae, it is a thickset fish with six mouth barbels and a single fin (the adipose fin) on its back, just anterior to the rounded tail fin. It is brownish or grayish, irregularly



Electric catfish (*Malapterurus electricus*)

Douglas Faulkner

spotted with black, and attains a length and weight of about 1.2 metres (4 feet) and 23 kilograms (51 pounds).

The electric catfish is capable of generating and controlling the discharge of up to 450 volts of electricity. It uses its power to defend itself and to capture prey. The electric organ

is composed of modified muscle tissue and forms a fine, gelatinous layer directly beneath the soft, naked skin of the fish. The electric catfish is hardy and, though pugnacious, is sometimes kept in home aquariums. It was pictured on tombs by the ancient Egyptians.

electric charge, quantity of electricity that flows in electric currents or that accumulates on the surfaces of dissimilar nonmetallic substances that are rubbed together vigorously. Electric charge, a basic property of matter, occurs in discrete natural units and is neither created nor destroyed.

Electric charges are of two general types: positive and negative. Two objects that have an excess of one type of charge exert a force of repulsion on each other when relatively close together. Two objects that have excess opposite charges, one positively charged and the other negatively charged, attract each other when relatively near. *See* Coulomb force.

Many fundamental, or subatomic, particles of matter have the property of electric charge. For example, electrons have negative charge and protons have positive charge, but neutrons have zero charge. The negative charge of each electron is found by experiment to have the same magnitude, which is also equal to that of the positive charge of each proton. Charge thus exists in natural units equal to the charge of an electron or a proton, a fundamental physical constant. A direct and convincing measurement of an electron's charge, as a natural unit of electric charge, was first made (1911) in the Millikan oil-drop experiment (*q.v.*). Atoms of matter are electrically neutral because their nuclei contain the same number of protons as there are electrons surrounding the nuclei. Electric current and charged objects involve the separation of some of the negative charge of neutral atoms. Current in metal wires consists of a drift of electrons of which one or two from each atom are more loosely bound than the rest. Some of the atoms in the surface layer of a glass rod positively charged by rubbing it with a silk cloth have lost electrons, leaving a net positive charge owing to the unneutralized protons of their nuclei. A negatively charged object has an excess of electrons on its surface.

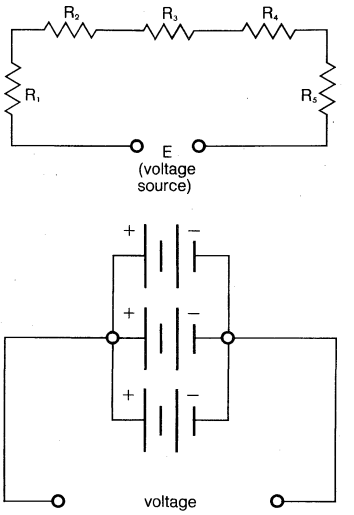
Electric charge is conserved: in any isolated system, in any chemical or nuclear reaction, the net electric charge is constant. The algebraic sum of the fundamental charges remains the same. *See* charge conservation.

The unit of electric charge in the metre–kilogram–second and SI systems is the coulomb, equivalent to the net amount of electric charge that flows through a cross section of a conductor in an electric circuit during each second when the current has a value of one ampere. One coulomb consists of 6.24×10^{18} natural units of electric charge, such as individual electrons or protons. One electron itself has a negative charge of $1.60217733 \times 10^{-19}$ coulomb. In the centimetre–gram–second system there are two units of electric charge: the electrostatic unit of charge, esu, or statcoulomb; and the electromagnetic unit of charge, emu, or abcoulomb. One coulomb of electric charge equals 3,000,000,000 esu, or one-tenth emu.

An electrochemical unit of charge, the faraday, is useful in describing electrolysis reactions, such as in metallic electroplating. One faraday equals 9.6485309×10^4 coulombs, the charge of a mole of electrons (that is, an Avogadro's number, 6.0221367×10^{23}, of electrons).

electric circuit, path for transmitting electric current. An electric circuit includes a device that gives energy to the charged particles constituting the current, such as a battery or a generator; devices that use current, such as lamps, electric motors, or electronic computers; and the connecting wires or transmission lines. Two of the basic laws that mathematically describe the performance of electric circuits are Ohm's law and Kirchhoff's circuit rules (*qq.v.*).

Electric circuits are classified in several ways. A direct-current circuit carries current that flows only in one direction. An alternating-current circuit carries current that pulsates back and forth many times each second, as in most household circuits. A series circuit



Representative circuit connections
(Top) Resistors connected in series; (bottom) batteries connected in parallel

comprises a path along which the whole current flows through each component (*see* illustration, top). A parallel circuit comprises branches so that the current divides and only part of it flows through any branch. The voltage, or potential difference, across each branch of a parallel circuit is the same, but the currents may vary. In a home electrical circuit, for instance, the same voltage is applied across each light or appliance, but each of these loads draws a different amount of current, according to its power requirements. A number of similar batteries connected in parallel (*see* illustration, bottom) provides greater current than a single battery, but the voltage is the same as for a single battery. *See also* integrated circuit; tuned circuit.

The network of transistors, transformers, capacitors, connecting wires, and other electronic components within a single device such as a radio is also an electric circuit. Such complex circuits may be made up of one or more branches in combinations of series and series-parallel arrangements.

electric current, any movement of electric charge carriers, such as subatomic charged particles (*e.g.*, electrons having negative charge, protons having positive charge), ions (atoms that have lost or gained one or more electrons), or holes (electron deficiencies that may be thought of as positive particles).

Electric current in a wire, where the charge carriers are electrons, is a measure of the quantity of charge passing any point of the wire per unit of time. In alternating current (*q.v.*) the motion of the electric charges is periodically reversed; in direct current (*q.v.*) it is not. In many contexts the direction of the current in electric circuits is taken as the direction of positive charge flow, the direction opposite to the actual electron drift. When so defined the current is called conventional current.

Current in gases and liquids generally consists of a flow of positive ions in one direction together with a flow of negative ions in the opposite direction. To treat the overall effect of the current, its direction is usually taken to be that of the positive charge carrier. A current of negative charge moving in the opposite direction is equivalent to a positive charge of the same magnitude moving in the conventional direction and must be included as a contribution to the total current. Current in semiconductors consists of the motion of holes in the conventional direction and electrons in the opposite direction.

Currents of many other kinds exist, such as beams of protons, positrons, or charged pions and muons in particle accelerators.

Electric current generates an accompanying magnetic field, as in electromagnets. When an electric current flows in an external magnetic field, it experiences a magnetic force, as in electric motors. The heat loss, or energy dissipated, by electric current in a conductor is proportional to the square of the current.

A common unit of electric current is the ampere, a flow of one coulomb of charge per second, or 6.2×10^{18} electrons per second. The centimetre–gram–second units of current are either the electrostatic unit of charge (esu) per second or the absolute electromagnetic unit (abamp). One abamp equals 10 amperes; one ampere equals 3×10^9 esu per second.

electric dipole, pair of equal and opposite electric charges the centres of which are not coincident. An atom in which the centre of the negative cloud of electrons has been shifted slightly away from the nucleus by an external electric field constitutes an induced electric dipole. When the external field is removed, the atom loses its dipolarity. A water molecule (H_2O), in which two hydrogen atoms stick out on one side and form together with the oxygen atom as vertex a 105° angle, constitutes a permanent electric dipole. The oxygen side of the molecule is always somewhat negative and the hydrogen side somewhat positive. An electric dipole may be large, too, such as a long straight wire used as a radio transmitting antenna on which electrons are impelled back and forth, making one end negative and the other positive with reversal of polarity every half cycle.

In an electric field a dipole undergoes a torque, tending to rotate so that its axis becomes aligned with the direction of the electric field. The amount of torque, greatest when the dipole is at right angles to the electric field, depends not only on the strength of the electric field but also on the separation of the two electric charges and their magnitude. If each charge has a magnitude q and the distance from the centre of the negative charge to that of the positive charge is d, the product qd is defined as the electric dipole moment. Its magnitude indicates the maximum torque exerted upon a given electric dipole per unit value of the surrounding electric field in a vacuum. The electric dipole moment, a vector, is directed along the line from negative charge toward positive charge. Dipole moments tend to point along the direction of the surrounding electric field.

Because electric dipole moment has dimensions of electric charge times displacement, its unit in the metre–kilogram–second system is the coulomb-metre; in the centimetre–gram–second system it is the esu-centimetre.

electric discharge lamp, also called VAPOUR LAMP, lighting device consisting of a transparent container within which a gas is energized by an applied voltage and thereby made to glow. The French astronomer Jean Picard observed (1675) a faint glow in a mercury-barometer tube when it was agitated, but the cause of the glow (static electricity) was not then understood. The Geissler tube of 1855, in which gas at low pressure glowed when subjected to an electrical voltage, demonstrated the principle of the electric discharge lamp. After practical generators were devised in the 19th century, many experimenters applied electric power to tubes of gas. From about 1900, practical electric discharge lamps were in use in Europe

and the United States. The French inventor Georges Claude was the first to use neon gas, about 1910. Mercury vapour in a neon lamp gives a bluish light; mercury is used also in fluorescent lamps and some ultraviolet lamps. Helium in amber glass glows gold; blue light in yellow glass shows green; combinations of gases give white light.

The sodium-vapour lamp, developed about 1931 in Europe, is a good illuminant if the yellow colour of its light is acceptable.

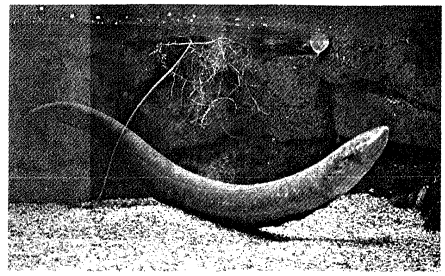
The glow lamp, used as an indicator or a night-light, contains a high-resistance filament in a small bulb. The voltage difference between plates at the ends of this filament causes the enclosed gas, usually neon or argon, to glow faintly. It uses little power and lasts a long time. Because the glow discharge tends to keep the voltage across the lamp constant, it is sometimes used as a voltage regulator. *See also* arc lamp; fluorescent lamp.

electric displacement, auxiliary electric field or electric vector that represents that aspect of an electric field associated solely with the presence of separated free electric charges, purposely excluding the contribution of any electric charges bound together in neutral atoms or molecules. If electric charge is transferred between two originally uncharged parallel metal plates, one becomes positively charged and the other negatively charged by the same amount, and an electric field exists between the plates. If a slab of insulating material is inserted between the charged plates, the bound electric charges comprising the internal structure of the insulation are displaced slightly, or polarized; bound negative charges (atomic electrons) shift a fraction of an atomic diameter toward the positive plate, and bound positive charges shift very slightly toward the negative. This shift of charge, or polarization, reduces the value of the electric field that was present before the insertion of the insulation. The actual average value of the electric field E, therefore, has a component P that depends on the bound polarization charges and a component D, electric displacement, that depends on the free separated charges on the plates. The relationship among the three vectors D, E, P in the metre–kilogram–second (mks) or SI system is: $D = \varepsilon_0 E + P$ (ε_0 is a constant, the permittivity of a vacuum). In the centimetre–gram–second (cgs) system the relationship is: $D = E + 4\pi P$.

The value of the electric displacement D may be thought of as equal to the amount of free charge on one plate divided by the area of the plate. From this point of view D is frequently called the electric flux density, or free charge surface density, because of the close relationship between electric flux and electric charge. The dimensions of electric displacement, or electric flux density, in the metre–kilogram–second system are charge per unit area, and the units are coulombs per square metre. In the centimetre–gram–second system the dimensions of D are the same as those of the primary electric field E, the units of which are dynes per electrostatic unit, or statvolts per centimetre.

electric eel (*Electrophorus electricus*), eel-shaped South American fish of the family Electrophoridae capable of producing an electric shock strong enough to stun a man. Despite its name, the fish is not a true eel but is related to characins in the order Cypriniformes. It is a sluggish creature, inhabiting slow, fresh water and periodically surfacing to gulp air from which it absorbs oxygen for respiration.

Long, cylindrical, scaleless, and gray-brown, the electric eel sometimes reaches a length and weight of 2.75 metres (9 feet) and 22 kilograms (49 pounds). Dorsal and caudal fins are

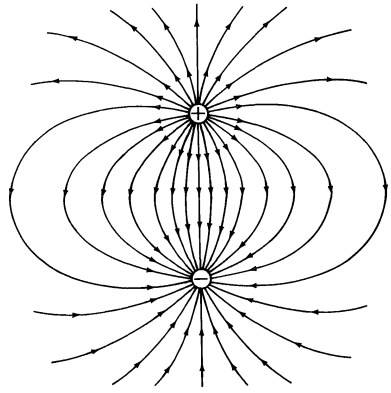


Electric eel (*Electrophorus electricus*)
Toni Angermayer

rudimentary, but the tail region, comprising about four-fifths the total length, is bordered below by a long anal fin, undulations of which enable the fish to move about. The tail region also contains the electric organs, which are derived from muscle tissue and innervated by spinal nerves. The shock is used mainly to immobilize fish and other prey; it can be discharged at will and can measure up to 650 volts.

electric eye: *see* photoelectric cell.

electric field, region around an electric charge in which an electric force is exerted on another charge. Instead of considering the electric force as a direct interaction of two electric charges at a distance from each other, one charge is considered the source of an electric field that extends outward into the surrounding space,



Electric field lines near equal but opposite charges
From R. Resnick and D. Halliday, *Physics, Parts I & II*, copyright 1966; by permission of John Wiley & Sons, Inc.

and the force exerted on a second charge in this space is considered as a direct interaction between the electric field and the second charge. The strength of an electric field E at any point may be defined as the electric force F exerted per unit positive electric charge q at that point, or simply $E = F/q$. If the second, or test, charge is twice as great, the resultant force is doubled; but their quotient, the measure of the electric field E, remains the same at any given point. The strength of the electric field depends on the source charge, not on the test charge. Strictly speaking, the introduction of a small test charge, which itself has an electric field, slightly modifies the existing field. The electric field may be thought of as the force per unit positive charge that would be exerted before the field is disturbed by the presence of the test charge.

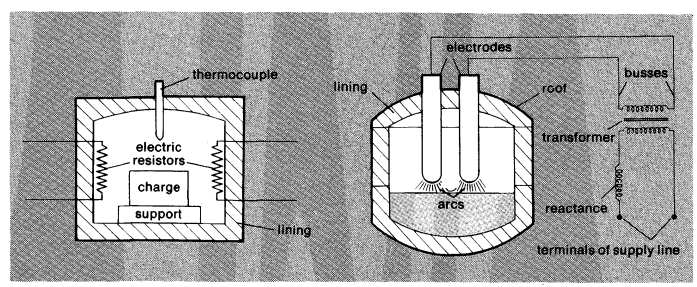
The direction of the force exerted on a negative charge is opposite that exerted on a positive charge. Because an electric field has both magnitude and direction, the direction of the force on a positive charge is chosen arbitrarily as the direction of the electric field. Because positive charges repel each other, the electric field around an isolated positive charge is oriented radially outward. When represented by lines of force, or field lines, electric fields are depicted as starting on positive charges and terminating on negative charges. The lines indicate the path a small positive test charge would take if placed in the field. A line tangent to a field line indicates the direction of the electric field at that point. Where the field lines are close together, the electric field is stronger than where they are farther apart. The magnitude of the electric field around an electric charge, considered as source of the electric field, depends on how the charge is distributed in space. For a charge concentrated nearly at a point, the electric field is directly proportional to the amount of charge; it is inversely proportional to the square of the distance radially away from the centre of the source charge, and depends also upon the nature of the medium. The presence of a material medium always diminishes the electric field below the value it has in a vacuum.

Thus, each point in space has an electric property associated with it, the magnitude and direction of which are expressed by the value of E, called electric field strength, or electric field intensity, or simply the electric field. Knowledge of the value of the electric field at a point without any specific knowledge of what produced the field is all that is needed to determine what will happen to electric charges close to that particular point.

At times the electric field itself may become detached from the source charge, as in the case of charges accelerating up and down the transmitting antenna of a television station. The electric field with an accompanying magnetic field is propagated through space as a radiated wave at the same speed as that of light. Such electromagnetic waves indicate that electric fields are generated not only from electric charges but also from changing magnetic fields.

The value of the electric field has dimensions of force per unit charge. In the metre–kilogram–second and SI systems, the appropriate units are newton per coulomb, equivalent to volt per metre. In the centimetre–gram–second system, the electric field is expressed in units of dyne per electrostatic unit, esu, equivalent to statvolt per centimetre.

electric furnace, heating chamber with electricity as the heat source for achieving very high temperatures to melt and alloy metals and refractories. Electricity has no electrochemical effect on the metal but simply heats it. Modern electric furnaces may be either induction furnaces or arc furnaces. A third type, the resistance furnace, still has use in



Electric furnaces
(Left) Resistor furnace, (right) open arc furnace

production of silicon carbides and electrolytic aluminum; in this type, the furnace charge (*i.e.,* the material to be heated) serves as the resistance element.

While electric furnaces produce about one-third of the steel produced in the United States, they are used to produce almost all the stainless steel, constructional alloys, tool steels, and special alloys required by the chemical, automotive, aircraft, machine tool, transportation, and food-processing industries. Electric furnaces are also used to supply short-term demands for steel because the start-up time is much shorter than for the open-hearth furnace or the more economical basic-oxygen-process furnace.

The German-born English inventor Sir William Siemens first demonstrated the arc furnace in 1879 at the Paris Exposition by melting iron in crucibles. In the arc furnace, carbon electrodes produce an electric arc above the container of metal in the production of alloy steels and cast iron.

In the modern Héroult arc furnace, the arcs strike directly into the metal bath from the electrodes. The three-phase type in general use has three arcs to produce the heat.

In the induction furnace, a coil carrying alternating electric current surrounds the container or chamber of metal; eddy currents are induced in the metal, or charge, the circulation of these currents producing extremely high temperatures for melting the metals and for making alloys of exact composition.

In one type of resistance furnace, the heat-producing current is introduced by electrodes buried in the metal. Heat may also be produced by resistance elements lining the interior of the furnace.

electric generator, also called DYNAMO, any machine that converts mechanical energy to electricity for transmission and distribution over electrical power networks or for use in trains, ships, aircraft, and automobiles.

A brief treatment of electric generators follows. For full treatment, *see* MACROPAEDIA: Energy Conversion.

Electric generators transform mechanical energy from various sources, as, for example, wind turbines, water turbines at dams, steam turbines driven by steam produced with heat from the combustion of fossil fuels or from nuclear fission, and internal-combustion engines (diesel engines and gas-turbine engines in particular). The construction and speed of generators vary according to the characteristics of the mechanical prime mover employed. The underlying principles of operation of an electric generator are the same as those for an electric motor—namely, Ampère's law and Faraday's law (*see also* electric motor). In an electric motor, the flow of energy is simply reversed, with electrical energy undergoing conversion to mechanical energy.

In most cases, generators that supply electrical power networks produce alternating current (AC), which reverses polarity at a fixed frequency (generally 50 or 60 cycles per second). Several generators are usually connected into a power network and must operate at the identical frequency for simultaneous power generation. Such machines are thus called synchronous generators or, in some cases, alternators.

The first practical electric generator was built by the French engineer and inventor Zénobe-Théophile Gramme during the late 1860s. This so-called Gramme dynamo contributed significantly to the general acceptance of electricity as a useful form of energy.

electric heater, device for heating rooms that converts electric current to heat by means of resistors that emit radiant energy. Resistors may be composed of metal-alloy wire, nonmetallic carbon compounds, or printed circuits. Heating elements may have exposed resistor coils mounted on insulators, metallic resistors embedded in refractory insulation and encased in protective metal, or a printed circuit encased in glass. Fins may be used to increase the area that dissipates the heat.

Electric heaters are also used for domestic central heating and for materials processing in industry (*see* heat pump; electric furnace).

In an electron tube, an electric heating element shaped in the form of a wire or ribbon is used to supply heat to a cathode; the element provides heat when a current is passed through it.

electric motor, any of a class of devices that convert electrical energy to mechanical energy usually employing electromagnetic phenomena such as the coupling between the electrical and mechanical systems.

A brief treatment of electric motors follows. For full treatment, *see* MACROPAEDIA: Energy Conversion.

The electric motor is the complement of the electric generator, a device that transforms mechanical energy into electrical energy (*see also* electric generator). In general, generators may function as motors, and, conversely, motors may function as generators; they differ only in some construction details and their auxiliary equipment.

The operation of an electric motor involves two general principles. The first, called Ampère's law after the French physicist, states that a conductor experiences a force if a component of an electric current in that conductor flows at right angles to a magnetic field. The second principle, Faraday's law, holds that a potential difference exists between the ends of a conductor if that conductor is given a component of motion perpendicular to the magnetic field.

Given these principles, every electric motor has to have two basic components—namely, a rotor and a stator. The rotor, which in most cases comprises the moving part, contains conductors to produce and shape magnetic fields that will interact with magnetic fields generated by the stator. In addition, the rotor has a contacting device (*e.g.,* slip rings) to connect it electrically with the external circuit, as well as various other mechanisms, including a drive shaft with which it transmits mechanical power to another machine. The stator is made up of similar magnetic materials and electrical conductors that serve to establish and shape magnetic fields.

Electric motors are commonly classified into two broad types, depending on the kind of electric current used—*i.e.,* direct or alternating. These general types may be subdivided into induction motors, synchronous motors, and commutator motors, based on the way in which the magnetic fields are controlled.

An induction motor typically has two sets of insulated wire windings: one, usually on the stator, is connected to an external power source; the other, on the rotor, consists of continuous wire loops. The magnetic field established when currents flow in these conductors is concentrated in a narrow air gap between the stator and the rotor. The purpose of the windings connected to the external energy source is to produce a rotating field that interacts with the induced currents in the rotor conductors, thereby establishing forces on those conductors. The revolving field can only be created if there are at least two windings that carry currents that are not in phase (*i.e.,* whose waves are not at maximum magnitude simultaneously).

Alternating-current induction motors basically are constant-speed devices and are most frequently used as such. They are the most widely employed electric motors because of their simple construction, efficiency, and low cost. Moreover, they are extremely rugged and in the smaller sizes (under 25 horsepower) can generally withstand a sudden application of full voltage at standstill without damage.

Like induction motors, synchronous devices operate on the principle of a rotating magnetic field. In most cases the stator produces this field. The rotor serves to generate a constant unidirectional field by energizing a direct-current winding from a direct-current source (usually of 125 or 250 volts). This field interacts with the rotating field. In small synchronous motors, it is possible to eliminate the need for a direct-current power source by constructing the stator from metals used for permanent magnets. In such a case, the stator is given a permanent residual magnetic field that locks in with the rotating field at synchronous speed. These so-called hysteresis motors have a lower power-to-weight ratio than motors energized by direct current, but they are especially useful in certain low-load applications where constant speeds are crucial—*e.g.,* gyro-spin motors employed in navigational equipment, in tape recorders, and in electric clocks.

Direct-current commutator motors, commonly regarded as forerunners of induction and synchronous devices, utilize a stationary field instead of a rotating field. Such a motor consists of a field magnet (stationary magnet), an armature (rotor coil), and a commutator, which is a mechanism that reverses the direction of the current in the armature. The armature turns between the poles of the field magnet until its own poles are next to the opposite poles of the magnet. At this point the direction of the current flowing through the armature is reversed, enabling the armature to make another half-turn. As the armature revolves, it produces torque, the turning force of the motor. One variety of direct-current commutator device, the series motor, is able to produce very high torque under heavy load, making it especially useful for traction applications.

The development of the electric motor can be traced back to the work of the Danish scientist Hans Christian Ørsted. During the early 19th century Ørsted discovered that electricity in motion generates a magnetic field. In seeking to demonstrate the converse of this finding, the English physicist and chemist Michael Faraday constructed a primitive model of the electric motor in 1821. By the early 1870s the Belgian-born electrical engineer Zénobe-Théophile Gramme developed the first commercially viable electric motor. In 1888 another electrical engineer, Nikola Tesla, invented the first alternating-current induction motor, a device generally considered the prototype of the modern electric motor.

Today, the electric motor has largely supplanted other motive power for industrial, business, transportation, and household applications. Not only are electric motors able to meet diverse service requirements, as, for example, accelerating, braking, and holding a load, but they also are available in a wide variety of sizes with output ranging from a fraction of a watt to thousands of horsepower.

electric organ (musical instrument): *see* electronic organ.

electric polarization, slight relative shift of positive and negative electric charge in opposite directions within an insulator, or dielectric, induced by an external electric field. Polarization occurs when an electric field distorts the negative cloud of electrons around positive atomic nuclei in a direction opposite the field. This slight separation of charge makes one side of the atom somewhat positive and the opposite side somewhat negative. In some materials whose molecules are permanently polarized by chemical forces, such as water molecules, some of the polarization is caused by molecules rotating into the same alignment under the influence of the electric

field. One of the measures of polarization is electric dipole moment, which equals the distance between the slightly shifted centres of positive and negative charge multiplied by the amount of one of the charges. Polarization P in its quantitative meaning is the amount of dipole moment p per unit volume V of a polarized material, $P = p/V$.

electric potential, specific description of an electric field, or the region around a distribution of electric charge, from the point of view of how much potential energy stored in the field may be associated with each point. Accordingly, electric potential, a property of each point of an electric field, is equal to the amount of work or energy per unit charge required to transport a small positive test charge to a specific point in the field from an arbitrary reference point, usually taken as any position beyond the influence of the charge that causes the electric field. In many electrical circuit problems the Earth is the reference point for computing potential. The potential at a given point is independent of the path taken by the test charge (unless the test charge traverses a changing magnetic field).

In the metre–kilogram–second–ampere system, in which work and energy have units of joules and electric charge has units of coulombs, electric potential is expressed in units of joules per coulomb, named simply volts. Thus, if the electric potential at a point is 4 volts, it would take 40 joules of work by an external force to move 10 coulombs of positive charge to that point from far away. If a negative charge, such as a quantity of electrons, were being moved to that point, the (positive) charge distribution itself would do 40 joules of work on negative 10 coulombs of charge, attracting it to the same point.

The electric potential close to a positive charge is higher than it is farther away. Around a positive point charge the potential falls off in direct proportion to the distance from the positive charge.

The concept of electric potential has far-reaching application in the understanding of basic electrical phenomena. The difference in the potential between two points of an electric field, or between two points of an electric circuit, however, is a more useful concept for practical applications.

electric power, energy generated through the conversion of other forms of energy, such as mechanical, thermal, or chemical energy. Electric energy is unrivalled for many uses, as for lighting, computer operation, motive power, and entertainment applications. For others it is competitive, as for many industrial heating applications, cooking, space heating, and railway traction.

A brief treatment of electric power follows. For full treatment, *see* MACROPAEDIA: Energy Conversion.

For statistical data on production and consumption of electrical energy, *see* BRITANNICA WORLD DATA in the current *Britannica Book of the Year*.

Electric power is the product of current and voltage. A given value of power can be produced by endless combinations of current and voltage values. If the current is direct, electrons progress always in the same direction through the device receiving power. If the current is alternating, electrons move back and forth in the device and in the wires connected to it. For many applications either type of current is suitable, but alternating current (ac) is customarily used because of the greater efficiency with which it can be generated and distributed. A direct current (dc) is required for certain industrial applications, such as electroplating and electrometallurgical processes.

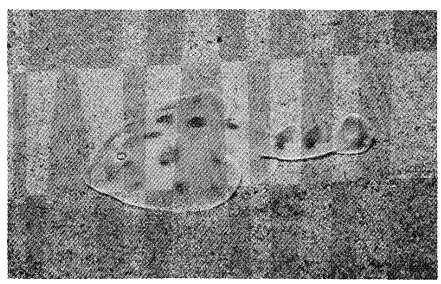
The wide-scale production and distribution of electric power was made possible by the development of the electric generator, a device that operates on the basis of the induction principle formulated in 1831 by Michael Faraday and Joseph Henry independently of one another. The first public power station employing an electric generator began operation in London in January 1882. A second such station opened later that same year in New York City. Both used dc systems, which proved inefficient for long-distance power transmission. By the early 1890s the first practical ac generator was built at the Lauffen power station in Germany, and service to Frankfurt am Main was initiated in 1891.

There are two primary sources for driving generators—hydro and thermal. Hydroelectric power is derived from generators turned by falling water. Most other electric energy is obtained from generators driven by steam produced either by a nuclear reactor (*q.v.*) or by burning fossil fuels—namely, coal, oil, and natural gas.

Until the 1930s hydroelectric power plants equipped with water-turbine generating units produced the largest percentage of electric energy because they were less expensive to operate than thermal power plants using steam-turbine units. Since that time, however, major technological advances have reduced the cost of thermal power generation to the extent that it has become more economical than hydroelectric power production. Moreover, in many industrially developed nations favourable hydro sites are gradually being exhausted. As a result, the proportion of thermally generated power to the total electric power output has increased annually in such countries. Thermal plants using nuclear energy to run steam-electric units have also contributed to this trend. Dwindling fossil fuel reserves, growing pollution problems, and an increasing concern over the potential hazards of accidental radioactive discharges from nuclear power plants, nonetheless, have promoted research into various alternative electric energy sources, including magnetohydrodynamic (MHD) generators, nuclear fusion reactors, solar batteries, and geothermal power stations.

Electric energy generated at a central power station is transmitted to bulk delivery points, or substations, from which it is distributed to consumers. Transmission is accomplished by an extensive network of high-voltage power lines, including overhead wires, underground and submarine cables, and microwave systems. Voltages higher than those produced by power plant generators are required when transferring alternating current over long distances, in order to reduce power losses that result from the resistance of transmission lines. Step-up transformers are employed at the generating station to increase the transmission voltage. At the substations other transformers step down the voltage to levels suitable for distribution systems.

electric ray, also called TORPEDO, TORPEDO FISH, NUMBFISH, or CRAMPFISH, any of the rays of the families Torpedinidae, Narkidae, and Temeridae, notable for their ability to produce electrical shocks. Electric rays are found throughout the world in warm and temperate waters.



Electric ray (*Narcine brasiliensis*)
Douglas Faulkner

There are numerous species of electric ray; most inhabit shallow water, but some (*Benthobatis*) live at depths of 1,000 metres (3,300 feet) and more. Slow-moving bottom dwellers, electric rays feed on fishes and invertebrates. They are harmless unless touched or stepped on and are of negligible commercial interest.

Electric rays range in length from under 30 centimetres (1 foot) to about 2 metres (6 feet). They are soft and smooth-skinned, with a circular or nearly circular body disk formed by the head and pectoral fins. The electric organs, composed of modified muscle tissue, are in the disk, one on each side of the head. The shock from these organs is used in defense and capturing prey; when produced by a large ray, it is strong enough to fell a human adult. In ancient Greece and Rome, the shocks of the species *Torpedo nobiliana* were used as a cure for gout, headache, and other maladies.

electric susceptibility, quantitative measure of the extent to which an electric field applied to a material causes polarization, or a slight separation of centres of positive and negative charge within the material. For most materials, the polarization $\boldsymbol{P}$ is directly proportional to the average electric field strength $\boldsymbol{E}$ so that the ratio of the two, $\boldsymbol{P}/\boldsymbol{E}$, is a constant that expresses an intrinsic property of the material. The electric susceptibility symbolized by the Greek letter chi with subscript e, χ_e, in the centimetre–gram–second (cgs) system, is defined by this ratio; that is, $\chi_e = \boldsymbol{P}/\boldsymbol{E}$. In the metre–kilogram–second (mks) system, electric susceptibility is defined slightly differently by including the constant permittivity of a vacuum, symbolized by the Greek letter epsilon with subscript 0, ε_0, in the expression; that is, $\chi_e = \boldsymbol{P}/(\varepsilon_0 \boldsymbol{E})$. In both systems the electric susceptibility is always a positive number without dimensions. Because of the slight difference in definition, the value of the electric susceptibility of a given material in the mks system is 4π times its value in the cgs system.

electric switch, device for opening and closing electrical circuits under normal load conditions, usually operated manually. There are many designs of switches; a common type, the knife switch, may be single- or multiple-pole, and single- or double-throw, and may have a capacity up to 20,000 amperes and 750 volts. The so-called mercury, or "silent," switch is used extensively for controlling home lighting circuits. The oil switch has its live parts immersed in oil to reduce arcing. The aggregate of switching or circuit-breaking equipment for a power station or a transforming station, often located in an outdoor yard (switchyard) beside the station, is usually spoken of as switchgear.

electrical and electronics engineering, branch of engineering concerned with the practical applications of electricity and with devices in which the motion of electrons and other charged particles is controlled.

A brief treatment of electrical and electronics engineering follows. For full treatment, *see* MACROPAEDIA: Electricity and Magnetism; Electronics; Energy Conversion; Engineering; Information Processing and Information Systems; Telecommunications Systems.

Although electrical phenomena had attracted notice as early as the 17th century, it was not until the 19th that any strides were made to develop the study of electricity into a discipline. In that century the basic laws of electricity were mathematically formulated and the first practical applications of electricity were invented (*e.g.*, the telephone and the incandescent lamp).

Great strides have been made in electrical engineering during the 20th century, and the profession can be broadly divided into two major areas—high-power electrical engineer-

ing and low-power, or electronic, engineering. High-power electrical engineering is centred around the ability to transmit high-power currents originating in a central station along wires or cables to more remote parts where it is needed. For example, a power station may be built which can supply all the forms of energy needed in a large metropolitan area, including the energy needed for lighting and heating homes, for powering factories, and for maintaining city services.

The major part of high-power electrical engineering involves the operation of power stations that use the burning of wood, coal, or oil to produce electrical energy or else make use of hydroelectric, nuclear, or geothermal energy. This power is then distributed by cables to the various centres where it is needed. In order to cope with the variations of power demand that will occur, and to cover times of breakdown and maintenance of power stations, cable networks or grids have been built so that the power need not always come from the local power station, but can be shunted from other power stations. There are three major areas of development in high-power electrical engineering—the power converter in the power station, the means of distributing electrical power, and the means of turning the power into a form suitable for heating, lighting, operating mechanical devices, etc.

In the 20th century the so-called low-current, or electronics, engineering has made extraordinary strides. One of the earliest areas of application was the telephone. The invention of the telephone was followed by the wireless telegraph and radio which enabled communication to be made by using electromagnetic waves. With further research and the development of new technology, the vacuum tube was developed, followed some years later by the semiconductor. The semiconductor supplanted the vacuum tube in radio transmission and reception and later in the amplification of audio and video signals for television. The semiconductor eventually came to be used in radar, sonar, and worldwide communications via satellite.

The most widespread use of semiconductors may be in computers. The first computers were large, but as semiconductor technology improved, minicomputers and finally microcomputers were developed.

The first semiconductor, the transistor, was invented in 1948; progressive miniaturization of such devices led to the development of the microchip, which can contain hundreds or thousands of transistors and other components and form a small, integrated circuit. This in turn has led to the production of highly compact and sophisticated computer devices.

Electrical and Electronics Engineers, Institute of (IEEE), international organization of engineers and scientists in electrical engineering, electronics, and allied fields, formed in 1963 by merger of the American Institute of Electrical Engineers (founded 1884) and the Institute of Radio Engineers (founded 1912). It publishes the monthly *Journal of Quantum Electronics* and other journals. Headquarters are in New York City.

electrical double layer, region of molecular dimension at the boundary of two substances across which an electrical field exists. The substances must each contain electrically charged particles, such as electrons, ions, or molecules with a separation of electrical charges (polar molecules). In the electrical double layer, oppositely charged particles attract each other and tend to collect at the surface of each substance but remain separated from one another by the finite size of each particle or by neutral molecules that surround the charged particles. The electrostatic attraction between the two opposite and separated charges causes an electrical field to be established across the interface.

The electrical field generated within an electrical double layer has a major influence on physical and chemical processes that occur at phase boundaries. For example, in electrochemical cells (apparatus used to generate electric current from a chemical reaction or vice versa) where the fundamental process involves the transfer of electrons between a metallic electrode and a solution, small changes in the electrical field strength across the interface produce large changes in the rate of flow of electrons (current). Consideration of the electrical field strength across the interface is also important in industrial processes in which it is desired to transfer a substance across an electrode–solution boundary, such as the deposition of metal from solution or the dissolution of a metal electrode. The concept of an electrical double layer is essential to the understanding of a large group of electrical phenomena associated with the movement of a solid in a liquid medium—*e.g.*, colloidal particles dispersed in solution—or the movement of a liquid along a fixed solid—*e.g.*, flow of liquid through a capillary tube.

electrical impedance, measure of the total opposition that a circuit or a part of a circuit presents to electric current. Impedance includes both resistance and reactance (*qq.v.*). The resistance component arises from collisions of the current-carrying charged particles with the internal structure of the conductor. The reactance component is an additional opposition to the movement of electric charge that arises from the changing magnetic and electric fields in circuits carrying alternating current. Impedance reduces to resistance in circuits carrying steady direct current.

The magnitude of the impedance Z of a circuit is equal to the maximum value of the potential difference, or voltage, V (volts) across the circuit, divided by the maximum value of the current I (amperes) through the circuit, or simply $Z = V/I$. The unit of impedance, like that of resistance, is the ohm. Depending on the nature of the reactance component of the impedance (whether predominantly inductive or capacitive), the alternating current either lags or leads the voltage. The reciprocal of the impedance, $1/Z$, is called the admittance and is expressed in terms of the unit of conductance, the mho unit (ohm spelled backward).

electrical shock, the perceptible and physical effect of an electrical current that enters the body. The shock may range from an unpleasant but harmless jolt of static electricity, received after one has walked over a thick carpet on a dry day, to a lethal discharge from a power line.

The great majority of deaths occur from alternating current at house-current frequencies of 60 hertz (cycles per second) in North America and 50 hertz in Europe. Most of the deaths occur from contact with conductors at less than 500 volts. That is not to say that high voltages are less dangerous, but they are generally present only on apparatus and supply lines operated by utility companies, which attempt to ensure that only trained and authorized persons have access to them.

The effects of electric shock on the human body depend on the current that flows—the amperage—rather than on the force of the current, or voltage. The electrical resistance of the human body is variable and may in fact alter considerably during the passage of an electric shock. Therefore, except in broad terms, applied voltage is not a consideration. This leads to difficulties in the investigation of accidents, for the electrical engineer is often able to state only the voltage applied, but the physician thinks in terms of the current that flowed.

Another important consideration is the path that the current takes through the body. Looked at as an electrical conductor, the body behaves as a solution of electrolytes in a leathery container. The greatest current density therefore occurs along the axis joining the two points of contact. As the distance perpendicular to the line of current flow increases, the density of current rapidly falls off. Thus, those organs most likely to be affected are those that lie close to the direct path of the current. As the great majority of electrical fatalities are due to currents passing between an arm (usually the right) and the legs, the current passes through the chest and affects the organs within it. Except in those extremely unusual accidents in which the head makes one of the points of contact, the brain does not lie on or near the pathway of the current.

An electric shock may directly cause death in three ways: paralysis of the breathing centre in the brain, paralysis of the heart, or ventricular fibrillation (uncontrolled, extremely rapid twitching of the heart muscle). It is generally believed that ventricular fibrillation is the most common cause of death in electric shock.

Cardiopulmonary resuscitation (CPR) is the best emergency first-aid treatment for victims of electrical shock. It is a highly effective technique when applied by a well-trained person and can, in many cases, provide adequate short-term life support until more sophisticated treatment is available.

Although the great majority of victims of electric shock, excluding those who have been burned, either die or recover completely, a very small number suffer from aftereffects, which may be temporary but are sometimes permanent. These may include cataract of the eye, a form of angina (attacks of pain beneath the breastbone), or various disorders of the nervous system. A variety of other conditions have been reported, but, in most cases, their exact relationship to the electrical accident is unclear or cannot be clinically substantiated.

electricity, the phenomenon associated with stationary or moving electric charges. Electric charge is a fundamental property of matter and is borne by elementary particles. In electricity the particle involved is the electron, which carries a charge designated, by convention, as negative. Thus, the various manifestations of electricity are the result of the accumulation or motion of numbers of electrons.

A brief treatment of electricity follows. For full treatment, *see* MACROPAEDIA: Electricity and Magnetism.

Among the earliest electrical phenomena to be studied were those produced by stationary charges, or static electricity. The Greeks discovered that amber, rubbed with fur, attracted light objects such as feathers, and the word electric comes from the Greek *ēlektron,* meaning amber. Serious study of electricity did not begin until the end of the 16th century, when William Gilbert investigated the relation of static electricity and magnetism. Benjamin Franklin proved the electrical nature of lightning in 1752 in his famous kite experiment, and he established the conventional use of negative and positive to distinguish kinds of charge. By the middle of the 18th century, two broad classes of electrical materials had been recognized: insulators, which acquired and retained a static positive or negative surface electric charge when rubbed, and conductors, mostly metals, which did not acquire a charge by rubbing but which were able to carry away the charge from an insulator. It was also found that a conducting body could store a charge if it was insulated from its surroundings. (The acquisition of surface charge by an insulator is now attributed to the ability of atoms either to lose an outer electron, and so exhibit a net positive charge, or to gain an outer electron

for a net negative charge.) In 1767 Joseph Priestley established that electric charges attract with a force inversely proportional to distance, just as Newton had found gravity to do. The science of electrostatics was polished by Henry Cavendish, Charles-Augustin de Coulomb, and Siméon Denis Poisson.

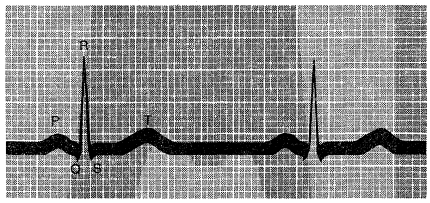
At the beginning of the 19th century, Count Alessandro Volta invented the electric pile, or battery, which was soon developed by others into a practical source of electric current. Within 20 years electric current and static electricity were shown to be manifestations of the same phenomenon. Sir Humphry Davy isolated the metal potassium in 1807 by passing an electric current through an electrolyte of fused potash; from these beginnings sprang electroplating, electrolytic refining, and other operations of the electrochemical industry. In 1808 Davy demonstrated that electricity could provide light or heat when he separated two charcoal electrodes that were carrying a current and drew an arc. In 1820 Hans Christian Ørsted observed the deflection of a compass needle when a nearby conductor carried an electric current and deduced that the current produced its own magnetic field in the space around the conductor. In 1831 Michael Faraday demonstrated the inverse action, whereby a magnetic field induces an electromotive force in a moving conductor. This discovery led to the development of the dynamo, the electric motor, and the transformer. The crowning achievement of 19th-century science was the set of field equations published by James Clerk Maxwell in 1864 that united electrical, magnetic, and optical phenomena in a single universal force, electromagnetism.

The application of what was once a laboratory curiosity to industry and everyday life began in earnest in the latter half of the 19th century. It was not until 1873 that Zenobe Théophile Gramme demonstrated that electric power could be transmitted efficiently from place to place by overhead conductors. After the invention of the incandescent lamp by Thomas A. Edison in 1879 and his construction of the first central power station and distribution system in New York City in 1881, electric power began to be introduced rapidly into the factory and the home. Electricity had by that time already been applied to communication in the form of the electric telegraph and the telephone.

The discovery of the electron by J.J. Thomson in the 1890s, followed quickly by the invention of the diode in 1904 and the triode in 1907, may be taken as marking the historical transition of the science of electricity into the science of electronics (*q.v.*).

electrocardiography, method of graphic tracing (electrocardiogram, or ECG) of the electric current generated by the heart muscle during a heartbeat. The tracing is recorded with an electrocardiograph (actually a relatively simple string galvanometer), and it provides information on the condition and performance of the heart. Electrocardiograms are made by applying electrodes to various parts of the body to lead off the tiny heart current to the recording instrument. The four extremities and the chest wall have become standard sites for applying the electrodes. After the electrodes are in place, held with a salt paste, a millivolt from a source outside the body is introduced so that the instrument can be calibrated. Standardizing electrocardiograms makes it possible to compare them as taken from person to person and from time to time from the same person. The normal electrocardiogram shows typical upward and downward deflections that reflect the alternate contraction of the atria (the two upper chambers) and of the ventricles (the two lower chambers) of the heart. The first upward deflection, P, is due to atrial contraction and is known as the atrial complex. The other deflections, Q, R, S, and T, are all due to the action of the ventricles and are known as the ventricular complexes. Any deviation from the norm in a particular electrocardiogram is indicative of a possible heart disorder. Information that can be obtained from an electrocardiogram includes whether the heart is enlarged and where the enlargement occurs, whether the heart action is irregular and where the irregularity originates, whether a coronary vessel is occluded and where the occlusion is located, and whether a slow rate is physiological or caused by heart block. The presence of high blood pressure, thyroid disease, and certain types of malnutrition may also be revealed by an electrocardiogram.

During the late 1960s, computerized ECG's came into use in many of the larger hospitals.



Two normal heartbeats recorded in a standard lead II electrocardiogram
Heavy horizontal lines are 5 millimetres apart; heavy vertical lines are 0.2 second apart; P wave records the beginning of auricular activity; Q, R, S, and T waves represent ventricular contraction

electrochemical reaction, any process either caused or accompanied by the passage of an electric current and involving in most cases the transfer of electrons between two substances—one a solid and the other a liquid.

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

The breadth of occurrence and application of electrochemical reactions is vast. Included are such major categories of activity as electrolysis, metallurgy, battery and fuel cell technology, electroplating, analytical chemistry, and biological research.

There are many spontaneously occurring chemical reactions which, when allowed to proceed under special circumstances, liberate electrical energy in the form of a current. A process of this type involves the direct conversion of the chemical energy, which is liberated in a reaction, to electrical energy. (An apparatus whereby such a process is brought about constitutes an electrical cell.) Conversely, the energy of an electric current can be utilized to produce many chemical reactions that do not occur spontaneously. In processes of this kind, electrical energy is directly converted into chemical energy, which is stored up in the products of the reactions. Electrolysis is such an electrochemical process.

Because of their chemical energy, the products of electrolysis have a tendency to react spontaneously with one another, reproducing the substances that were consumed during the electrolytic process. If this (reverse) reaction is allowed to occur under proper conditions a large proportion of the electrical energy used in electrolysis may be regenerated. This possibility is utilized in accumulators or storage cells, sets of which are known as storage batteries. Storage cells are often referred to as secondary cells to distinguish them from primary cells, which are not designed or constructed for recharging after their original supply of energy has been consumed. The charging of an accumulator is a process of electrolysis; a definite chemical change is produced by the electric current passing through it. In the discharge of the cell, the reverse chemical change occurs spontaneously; the accumulator is acting now as a cell that produces an electric current. The "storage" of electrical energy in a secondary cell thus involves its conversion into chemical energy, which can be reconverted into electrical energy when desired.

Substances that are reasonably good conductors of electricity may be divided into two groups: metallic, or electronic, conductors and electrolytic conductors. The metals and a few substances such as graphite, manganese dioxide, and lead sulfide exhibit metallic conductivity; the passage of an electric current through them produces heating and magnetic effects but no chemical changes. Electrolytic conductors or electrolytes comprise most acids, bases, and salts, either in the molten condition or in solution in water or other solvents. Plates or rods composed of a suitable metallic conductor dipping into the fluid electrolyte are employed to conduct the current into and out of the liquid; *i.e.,* to act as electrodes. When a current is passed through an electrolyte between suitable electrodes, not only are heating and magnetic effects produced, but also definite chemical changes occur at or in the neighbourhood of the electrodes, the process being one of electrolysis. At the negative electrode, or cathode, the chemical change may be either the deposition of a metal or the liberation of hydrogen and formation of a basic substance or some other chemical reduction process; whereas at the positive electrode, or anode, it may be either the dissolution of the anode itself, the liberation of a nonmetal, the production of oxygen and an acidic substance, or some other chemical oxidation process. In some cases, these primary products of electrolysis then react with the electrolyte or with the material of which the electrodes are composed, yielding secondary products.

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

electrochemistry, branch of chemistry concerned with the relation between electricity and chemical change. Many spontaneously occurring chemical reactions liberate electrical energy, and some of these reactions are used in batteries and fuel cells to produce electric power. Conversely, electric current can be utilized to bring about many chemical reactions that do not occur spontaneously. In the process called electrolysis, electrical energy is converted directly into chemical energy, which is stored in the products of the reaction. This process is applied in refining metals, in electroplating, and in producing hydrogen and oxygen from water. The passage of electricity through a gas generally causes chemical changes, and this subject forms a separate branch of electrochemistry.

electrocution, method of execution widely used in the United States, in which the condemned person is subjected to a heavy charge of electric current. The prisoner is made to sit in a wired chair, and electrodes are fastened to his head and one leg so that the current will flow through his body. Several shocks may be applied.

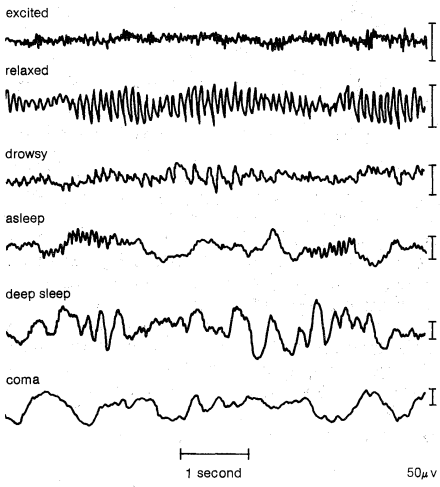
The electric chair was first used at Auburn State Prison, New York, on Aug. 6, 1890, and eventually became the preferred method of executing criminals in the United States. In 1915 Pennsylvania adopted the chair, and it came to be used in 24 states. It was also adopted in the Philippines and in the former Republic of China.

electrode, electric conductor, usually metal, used as either of the two terminals of an electrically conducting medium; it conducts current into and out of the medium, which may be an electrolytic solution as in a storage battery, or a solid, gas, or vacuum. The electrode from which electrons emerge is called the cathode and is designated as negative; the

electrode that receives electrons is called the anode and is designated as positive. In an electron tube, the anode is called the plate, and conducting elements that regulate the electron flow inside the tube are also called electrodes.

electrodynamic transducer (electronics): *see* transducer.

electroencephalography, technique for recording and interpreting the electrical activity of the brain. The nerve cells of the



Typical brain wave patterns from a state of excitement to one of deep coma

By courtesy of the Montreal Neurological Institute

brain generate electrical impulses that fluctuate rhythmically in distinct patterns. In 1929 Hans Berger of Germany developed an electroencephalograph, an instrument that measures and records these brain wave patterns. The recording produced by such an instrument is called an electroencephalogram, commonly abbreviated EEG.

To make an EEG, electrodes are placed in pairs on the scalp. Each pair of electrodes transmits a signal to one of several recording channels of the electroencephalograph. This signal consists of the difference in the voltage between the pair. The rhythmic fluctuation of this potential difference is shown as peaks and troughs on a line graph by the recording channel. The EEG of a normal adult in a fully conscious but relaxed state is made up of regularly recurring oscillating waves known as alpha waves. When a person is excited or startled, the alpha waves are replaced by low-voltage, rapid, irregular waves. During sleep, the brain waves become extremely slow. Such is also the case when a person is in a deep coma. Other abnormal conditions are associated with particular EEG patterns. Irregular slow waves known as delta waves, for example, arise from the vicinity of a localized area of brain damage.

Electroencephalography provides a means of studying how the brain works and of tracing connections between one part of the central nervous system and another. Its effectiveness as a research tool, however, is limited because it records only a small sample of electrical activity from the surface of the brain. Many of the more complex functions of the brain, such as those that underlie emotions and thought, cannot be related closely to EEG patterns. Electroencephalography has proved more useful as a diagnostic aid in cases of serious head injuries, brain tumours, cerebral infections, epilepsy, and various degenerative diseases of the nervous system.

electroforming, also called GALVANOPLASTY, making duplicates by electroplating metal onto a mold of an object, then removing the mold. Intricate surface details are exactly reproduced by this process, which is used to make masters for pressing phonograph records. Electroforming is also used for reproducing medals and for making tubing with precisely controlled dimensions. Electrotyping (*q.v.*) is an electroforming process for making duplicate printing plates.

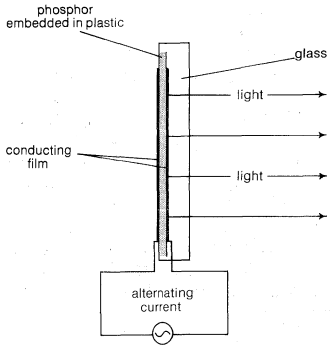
electrogalvanizing, electroplating of a zinc coating onto iron or steel. *See* galvanizing.

electrogasdynamics, study of the forces produced by the motion of electrically charged particles (ions) carried by an insulating gas flowing through an electric field. *See also* magnetohydrodynamic device.

electrojet, streaming movement of charged particles in the ionosphere. The term is limited by some to those flow patterns that contain a significant proportion of neutral gases, but highly concentrated, laterally limited, electric currents are also called electrojets. The latter circulate within the ionosphere at heights of 80 to 100 kilometres (50 to 60 miles) and complete their circuits in low latitudes and across the polar caps. They are associated with auroras and other magnetic disturbances. *See* aurora.

electroless plating, plating of metals and plastics to achieve relatively thick coatings by a process that relies on a controlled autocatalytic reduction. Discovered in 1944 by A. Brenner and G.E. Riddell, electroless plating involves deposition on the surface of a variety of materials in a chemical bath to produce copper, nickel, silver, gold, palladium, and other metallic surfaces. It is also used in mirroring, in which a clean surface of glass is dipped into an ammoniacal silver solution mixed with Roselle salt or with a nitric acid–cane-sugar alcohol solution. While all the problems associated with this process for the plating of plastics are not resolved, the major expansion of electroless plating has come in this area. A large number of consumer goods, ranging from ashtrays to typewriter parts, are coated by this method to create durable and attractive surfaces.

electroluminescence, production of light by the flow of electrons, as within certain crystals. Electroluminescence is one of the few



Electroluminescence

instances in which a direct conversion of electric energy into visible light takes place without the generation of heat, such as with the incandescent lamp.

There are two distinct mechanisms that can produce electroluminescence in crystals: pure or intrinsic (also called the Destriau effect, after Georges Destriau, a 20th-century French physicist) and charge injection. The principal differences between the two mechanisms are that in the first, no net current passes through the phosphor (electroluminescent material) and in the second, luminescence prevails during the passage of an electric current.

In Destriau electroluminescence, thermal activation and the electric field liberate atomic electrons (from donor levels) into the conduction band. Many of these conduction electrons are accelerated by the field until they collide with luminescent centres, ionizing them (*i.e.*, ejecting electrons from their atoms). Light is emitted in the normal way as soon as an electron recombines with an ionized atom of the centre. Because the effect dies away when constant voltage is applied, an alternating voltage may be used to create a sustained light emission. The Destriau effect may be extended over large areas so that electroluminescent cells may be made with which to panel walls and ceilings of a room for general illumination. The Figure shows a typical cell in which a phosphor, such as zinc sulfide, is embedded in a plastic sheet. The sheet is thin—a small fraction of a millimetre—so that 100–200 volts across it will produce an intense electric field. Electroluminescent cells can be fabricated to emit a particular colour of light by a suitable choice of phosphor and voltage frequency.

Electroluminescence can also result from charge injection, as when an electrode contacts a crystal to provide a flow of electrons or holes (electron extraction) or a voltage is applied to a *p–n* junction causing a current to flow; *i.e.*, electrons flow from the *n*-type material into the *p*-type material. In both cases, the electrons lose energy when recombining with centres or positive holes accompanied by the emission of light.

electrolysis, process by which electric current is passed through a substance to effect a chemical change. The chemical change is one in which the substance loses or gains an electron (oxidation or reduction). The process is carried out in an electrolytic cell (*q.v.*), an apparatus consisting of positive and negative electrodes held apart and dipped into a solution containing positively and negatively charged ions. The substance to be transformed may form the electrode, may constitute the solution, or may be dissolved in the solution. Electric current (*i.e.*, electrons) enters through the negatively charged electrode (cathode); positively charged components of the solution travel to this electrode, combine with the electrons, and are transformed to neutral elements or molecules. The negatively charged components of the solution travel to the other electrode (anode), give up their electrons, and are transformed into neutral elements or molecules. If the substance to be transformed is the electrode, the reaction is generally one in which the electrode dissolves by giving up electrons.

Electrolysis is used extensively in metallurgical processes, such as in extraction (electrowinning) or purification (electrorefining) of metals from ores or compounds and in deposition of metals from solution (electroplating). Metallic sodium and chlorine gas are produced by electrolysis of molten sodium chloride; electrolysis of an aqueous solution of sodium chloride yields sodium hydroxide and chlorine gas. Hydrogen and oxygen are produced by electrolysis of water.

electrolyte, in chemistry and physics, substance that conducts electric current as a result of a dissociation into positively and negatively charged particles called ions, which migrate toward and ordinarily are discharged at the negative and positive terminals (cathode and anode) of an electric circuit, respectively. The most familiar electrolytes are acids, bases, and salts, which ionize when dissolved in such solvents as water or alcohol. Many salts, such as sodium chloride, behave as electrolytes when melted in the absence of any solvent; and some, such as silver iodide, are electrolytes even in the solid state.

electrolytic cell, any device in which electrical energy is converted to chemical energy, or vice versa. Such a cell typically consists of two metallic or electronic conductors (electrodes)

held apart from each other and in contact with an electrolyte (*q.v.*), usually a dissolved or fused ionic compound. Connection of the electrodes to a source of direct electric current renders one of them negatively charged and the other positively charged. Positive ions in the electrolyte migrate to the negative electrode (cathode) and there combine with one or more electrons, losing part or all of their charge and becoming new ions having lower charge or neutral atoms or molecules; at the same time, negative ions migrate to the positive electrode (anode) and transfer one or more electrons to it, also becoming new ions or neutral particles. The overall effect of the two processes is the transfer of electrons from the negative ions to the positive ions, a chemical reaction (*see* oxidation-reduction reactions). An example is the electrolysis of sodium chloride (common salt), forming sodium metal and chlorine gas; the energy required to make the reaction proceed is supplied by the electric current. Other common applications of electrolysis include electrodeposition for refining or plating of metals and the production of caustic soda.

In the case of substances that generate energy, rather than consume it, when they react with each other, some or all of this energy can be converted to electricity if the reaction can be divided into an oxidation and a reduction that can be made to occur at separate electrodes. In the lead-acid storage battery, for example, lead dioxide, lead metal, and sulfuric acid react to form lead sulfate and water; the separate processes are the oxidation of lead to lead sulfate at one electrode and the reduction of lead dioxide to lead sulfate at the other while electric charge is transported through the electrolyte by the migration of hydrogen ions. These processes create a driving force (a voltage or electrical potential) that causes electricity to flow through an external circuit joining the two electrodes. Many other chemical combinations have been utilized in cells and batteries.

Other cells for generating electricity by means other than motion of a conductor in a magnetic field include solar cells, in which electron flow between semiconductors results from absorption of light, and fuel cells, in which a continuous supply of liquid or gaseous oxidizing agent, such as oxygen, removes electrons from the cathode as a reducing agent, such as hydrogen, supplies electrons to the anode.

electrolytic polishing: *see* electropolishing.

electromagnet, device consisting of a core of magnetic material surrounded by a coil through which an electric current is passed to magnetize the core. An electromagnet is used wherever controllable magnets are required, as in contrivances in which the magnetic flux is to be varied, reversed, or switched on and off.

The engineering design of electromagnets is systematized by means of the concept of the magnetic circuit. In the magnetic circuit a magnetomotive force *F*, or *F*m, is defined as the ampere-turns of the coil that generates the magnetic field to produce the magnetic flux in the circuit. Thus, if a coil of *n* turns per metre carries a current *i* amperes, the field inside the coil is *ni* amperes per metre and the magnetomotive force that it generates is *nil* ampere-turns, where *l* is the length of the coil. More conveniently, the magnetomotive force is *Ni*, where *N* is the total number of turns in the coil. The magnetic flux density *B* is the equivalent, in the magnetic circuit, of the current density in an electric circuit. In the magnetic circuit the magnetic equivalent to current is the total flux symbolized by the Greek letter phi, φ, given by *BA*, where *A* is the cross-sectional area of the magnetic circuit.

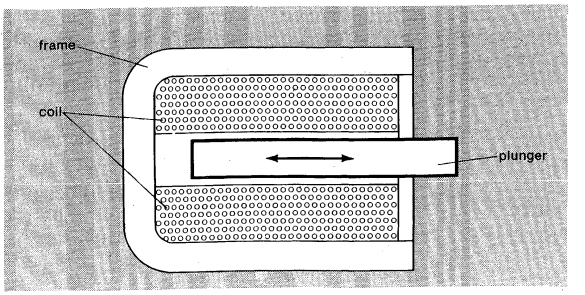


Figure 1: Elements of a solenoid

In an electric circuit the electromotive force (*E*) is related to the current, *i*, in the circuit by $E = Ri$, where *R* is the resistance of the circuit. In the magnetic circuit $F = r\varphi$, where *r* is the reluctance of the magnetic circuit and is equivalent to resistance in the electric circuit. Reluctance is obtained by dividing the length of the magnetic path *l* by the permeability times the cross-sectional area *A*; thus $r = l/\mu A$, the Greek letter mu, μ, symbolizing the permeability of the medium forming the magnetic circuit. The units of reluctance are ampere-turns per weber. These concepts can be employed to calculate the reluctance of a magnetic circuit and thus the current required through a coil to force the desired flux through this circuit.

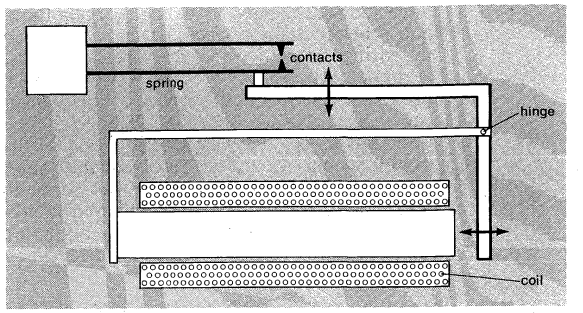


Figure 2: Elements of a relay

Several assumptions involved in this type of calculation, however, make it at best only an approximate guide to design. The effect of a permeable medium on a magnetic field can be visualized as being to crowd the magnetic lines of force into itself. Conversely, the lines of force passing from a region of high to one of low permeability tend to spread out, and this occurrence will take place at an air gap. Thus the flux density, which is proportional to the number of lines of force per unit area, will be reduced in the air gap by the lines bulging out, or fringing, at the sides of the gap. This effect will increase for longer gaps; rough corrections can be made for taking the fringing effect into account.

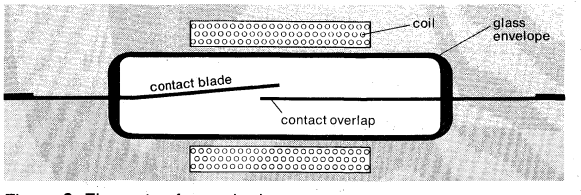


Figure 3: Elements of a reed relay

It has also been assumed that the magnetic field is entirely confined within the coil. In fact, there is always a certain amount of leakage flux, represented by magnetic lines of force around the outside of the coil, which does not contribute to the magnetization of the core. The leakage flux is generally small if the permeability of the magnetic core is relatively high.

In practice, the permeability of a magnetic material is a function of the flux density in it. Thus, the calculation can only be done for a real material if the actual magnetization curve, or, more usefully, a graph of μ against *B*, is available.

Finally, the design assumes that the magnetic core is not magnetized to saturation. If it were, the flux density could not be increased in the air gap in this design, no matter how much current were passed through the coil. These concepts are expanded further in following sections on specific devices.

Solenoids. A solenoid is generally a long coil through which current is flowing, establishing a magnetic field. More narrowly, the name has come to refer to an electromechanical device that produces a mechanical motion on being energized with an electric current. In its simplest form it consists of an iron frame enclosing the coil and a cylindrical plunger moving inside the coil, as shown in Figure 1. For an alternating current supply, the iron losses in a solid frame restrict the efficiency and a laminated frame is used, which is made up of a pile of thin sheets of iron cut to the appropriate shape and stacked with a layer of insulating varnish between each sheet. When the coil is energized, the plunger moves into the coil by virtue of the magnetic attraction between it and the frame until it makes contact with the frame.

Alternating-current solenoids tend to be more powerful in the fully open position than direct-current units. This occurs because the initial current, high because of the inductance of the coil, is lowered by the air gap between the plunger and frame. As the solenoid closes, this air gap decreases, the inductance of the coil increases, and the alternating current through it falls. If an alternating-current solenoid sticks in the open position the coil is likely to burn out.

When a solenoid is fully opened, it has a large air gap, and the high reluctance of this gap keeps the flux in the magnetic circuit low for

a given magnetomotive force, and the force on the plunger is correspondingly low. As the plunger closes, the reluctance falls and the flux increases so that the force increases progressively. Manufacturers of solenoids provide force-stroke curves so that users can select the proper unit for their purpose. The curve can be modified by spring loading the plunger so that the force provided throughout the stroke may be matched to the particular mechanical load.

Relays. A relay is a device in which the solenoid principle is applied to opening and closing light-current electrical circuits. The same device applied in heavy-current circuits is called a contactor, or circuit breaker.

Because the amount of mechanical movement required is generally small, the solenoid plunger is usually stationary, and part of the frame is hinged to give the necessary movement. This arrangement is illustrated schematically in Figure 2. When the coil is energized, the hinged part of the frame is attracted to the solid iron core in the coil; this attraction pushes the contacts together. When the energizing current is removed, the hinged part is forced back to the open position by the springiness of the contact.

With the appearance of transistorized switching circuits, which use remarkably low power, a need arose for a relay that would operate reliably with a power of 100 to 300 milliwatts, compared with 4 watts for the conventional relay. This need was met by the reed relay, or reed switch, shown in Figure 3. It consists of two flat blades of 50–50 nickel–iron alloy that overlap with a gap between them. When a magnetic field is applied along the length of the blades, opposite magnetic poles are induced in the overlapping parts, and they are attracted together, making electrical contact. On removal of the field, the springiness of the contact blade opens the contact. The overlap region is plated on each blade with gold to ensure good electrical contact, and the enclosing glass capsule is filled with dry nitrogen to prevent corrosion. The field required to operate the device is a function of the amount of overlap, and there is an optimum overlap corresponding to minimum required operating current.

Present reed switches used in telephone equipment are operated by up to 50 volts direct current. Typically, the reed closes at 58 ampere-turns and releases at 15 ampere-turns, the hold current being 27 ampere-turns. The contact closes to give a stable contact resistance in 2 milliseconds, releases in 100 microseconds, and has a lifetime of more than 50,000,000 operations. Using a 35,000 turn coil the coil resistance is typically 18,600 ohms so that the current at 50 volts is 2.7 milliamperes. The minimum operating condition requires only about 1.7 milliamperes, so that the relay can be worked satisfactorily at lower voltage.

By the use of small, external, permanent magnets, reed switches can be made into latching relays that remain closed when the energizing field is removed. They can also be designed with three blades to give changeover contacts.

Design of large electromagnets. Sooner or later almost every scientific research laboratory finds that it requires a facility for producing large magnetic fields. A number of advanced technologies likewise require large electromagnets. A cyclotron, for example, is a device used for scientific research in which subatomic charged particles are accelerated by an alternating electric field in a constant magnetic field. It uses a large magnet to produce moderate fields but with a pole diameter that may be several metres. Some industries make use of huge, high-powered electromagnets for lifting purposes.

The basic design principles of large electromagnets are those discussed earlier. The difficulties arise in trying to estimate the magnitude of the fringing flux across the air gap and the leakage flux around the coils. Their effects are minimized by using a tapered shape for the cores and pole caps; a typical laboratory magnet is shown in Figure 4. Because soft iron saturates at 2.16 webers per square m, flux densities in the air gap are generally limited to the region of 2.1 webers per square m with iron magnets.

When designed for lifting or load-carrying purposes, an electromagnet may be required to have a single exposed pole face to which the load to be carried will attach itself, and it will therefore have the shape of a bar magnet. The design is then dominated by the demagnetizing field. Suitably designed magnets can lift many times their own weight and are in general use in steelworks and scrapyards.

Principal applications. Electromagnets have a wide variety of uses. A summary of the principles of operation of some of the important devices in a few major areas of application—communications, research, electrical industry, and magnetic recording—is given below.

Modern telephone systems are based on the reed relay, together with solid-state circuits for complex routing of connections. The telephone receiver is basically an electromagnet with a U-shaped yoke having coils wound on each leg of the U. Passage of the electrical signal through the coils causes magnetic attraction of a soft-iron diaphragm supported a small distance from the ends of the U. The diaphragm is deflected by an amount proportional to the magnitude of the current in the coil and generates sound waves as it moves back and forth. Improvement in magnetic materials has increased the sensitivity of the telephone receiver, but the basic design has remained unchanged.

The loudspeaker performs the same function as the earphone of the telephone receiver but is required to displace a larger volume of air. The diaphragm comprises a flexible cone of large area carrying a coil of fine wire on a small ring located at its apex. The ring lies between the poles of a powerful cylindrically shaped permanent magnet. Audio-frequency current through the coil causes deflection of the diaphragm, as in the earphone. Modern loudspeakers are much more sensitive and efficient than their predecessors because of the improvement in permanent-magnet materials. The higher the flux density in the gap, the greater the sensitivity and the potential for fidelity of reproduction; modern loudspeakers use flux densities of up to one weber per square m. Alloy magnets are usually used.

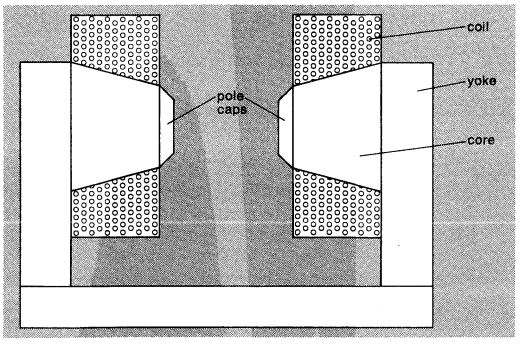


Figure 4: Elements of a typical electromagnet

Magnetic fields supply a powerful research tool without which modern physics could scarcely have grown to its present extent. A major area of application is in the interaction of magnetic fields and charged subatomic particles. A moving particle that carries a charge, such as an electron, can be regarded as an electric current and, like a current-carrying wire, experiences a force in a magnetic field. The direction of the force is perpendicular both to the direction of motion of the particle and to the magnetic field, so that the particle is deflected from its original path. This principle can be used to focus a stream of electrons into a narrow beam and to deflect the beam by creating suitable magnetic fields, either from permanent magnets or from electromagnets. Every television receiver contains just such focusing and deflection systems to scan the face of the television tube with an electron beam.

In scientific applications the same principle is used in the electron microscope, in which the beam of electrons is passed through a series of magnetic "lenses," just as light is passed through glass lenses in a conventional microscope.

As noted above, the cyclotron makes use of a magnetic field to cause charged particles to execute a circular path. On each traverse of the circle they are accelerated and finally acquire enormous kinetic energy (energy of motion). The cyclotron has been an important tool in nuclear research and in the production of radioactive isotopes.

The same principle may be used to analyze materials in the mass spectrometer. The actual deflection of a moving charged particle in a magnetic field is determined by its charge, mass, and velocity. In a mass spectrometer the material under investigation is in the form of a gas of ionized particles that are accelerated by a fixed electric field. In passing through the magnetic field the particles are deflected by an amount determined by their mass, providing they all carry the same charge. By recording their arrival position at a fixed target, the mass of the particles can be deduced.

The electrical industry is founded on the generation and exploitation of magnetic fields. The electric motor is based on the force generated on a current-carrying conductor; the generator is based on the inverse effect that a conductor moving in a magnetic field has a current induced in it. In general, high-flux densities are required in the magnetic circuits of motors and generators, and this requirement has led to the use of soft iron or silicon–iron electromagnets as the source of magnetic fields in them. With the advent of modern permanent-magnet materials, however, small direct-current motors, in which the field is provided by permanent magnets, are finding wide applications, particularly in the toy industry (*see* magnet).

The principle of magnetic recording is to induce a permanent magnetization in a material by means of the signal to be recorded. The induced magnetization must be proportional to the amplitude of the signal and must remain in the material when the signal is removed. Thus, a magnetic material is required that has a high permeability, so that it will magnetize readily in a small field; a high remanent magnetization, so that the stored information can be easily "read"; and not too high (but not too low) a coercive force, so that the stored

information can be erased without great difficulty.

The most common type of magnetic recorder makes use of a magnetic tape. This passes at constant speed close to a recording head that may consist of a U-shaped magnet yoke with coils wound on each limb. As the current in the coil varies in accordance with the audio-frequency signal to be recorded, a varying magnetization is induced in the tape. To play back the recorded information, the tape is passed through or near a coil so that the magnetic flux from the tape cuts the wires of the coil and induces an audio-frequency current in it. The tape may be erased by passing it through a recording head that carries a high-frequency signal, which has the effect of demagnetizing the tape.

Computer information is in a particularly simple form for magnetic storage because it consists of a chain of electrical pulses of standard amplitude. Material requirements for the tape are not so stringent as for audio recording, the important feature being only that the tape should not demagnetize spontaneously. Many computers have replaced tape storage by discs of magnetic alloy that rotate under the recording head. Information can be stored at a higher density (bits per unit area) than in tape, and access to the information can be made faster by traversing the "read" head in a radial direction across the discs. For information on other related magnetic recording devices, *see* magnetic recording.

electromagnetic field, a property of space caused by the motion of an electric charge. A stationary charge will produce only an electric field in the surrounding space. If the charge is moving, a magnetic field is also produced. An electric field can be produced also by a changing magnetic field. The mutual interaction of electric and magnetic fields produces an electromagnetic field, which is considered as having its own existence in space apart from the charges or currents (a stream of moving charges) with which it may be related. Under certain circumstances, this electromagnetic field can be described as a wave transporting electromagnetic energy.

electromagnetic radiation, energy that is propagated through free space or through a material medium in the form of electromagnetic waves, such as radio waves, visible light, and gamma rays. The term also refers to the emission and transmission of such radiant energy.

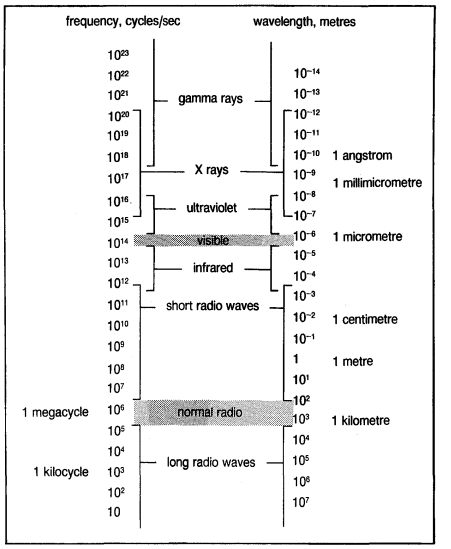
A brief treatment of electromagnetic radiation follows. For full treatment, *see* MACROPAEDIA: Electromagnetic Radiation; Light; Radiation.

The Scottish physicist James Clerk Maxwell was the first to predict the existence of electromagnetic waves. In 1864 he set forth his electromagnetic theory, proposing that light—including various other forms of radiant energy—is an electromagnetic disturbance in the form of waves. In 1887 Heinrich Hertz, a German physicist, provided experimental confirmation by producing the first man-made electromagnetic waves and investigating their properties. Subsequent studies resulted in a broader understanding of the nature and origin of radiant energy.

It has been established that time-varying electric fields can induce magnetic fields and that time-varying magnetic fields can in like manner induce electric fields. Because such electric and magnetic fields generate each other, they occur jointly, and together they propagate as electromagnetic waves. An electromagnetic wave is a transverse wave in that the electric field and the magnetic field at any point and time in the wave are perpendicular to each other as well as to the direction of propagation. In free space (*i.e.*, a space that is absolutely devoid of matter and that experiences no intrusion from other fields or forces), electromagnetic waves always propagate with the same speed—that of light (299,792,458 m per second, or 186,282 miles per second)—independent of the speed of the observer or of the source of the waves.

Electromagnetic radiation has properties in common with other forms of waves such as reflection, refraction, diffraction, and interference. Moreover, it may be characterized by the frequency with which it varies over time or by its wavelength. Electromagnetic radiation, however, has particle-like properties in addition to those associated with wave motion. It is quantized in that for a given frequency v, its energy occurs as an integer times hv, in which h is a fundamental constant of nature known as Planck's constant. A quantum of electromagnetic energy is called a photon. Visible light and other forms of electromagnetic radiation may be thought of as a stream of photons, with photon energy directly proportional to frequency.

Electromagnetic radiation spans an enormous range of frequencies or wavelengths, as is shown by the electromagnetic spectrum (*see* Figure). Customarily, it is designated by fields, waves, and particles in increasing magnitude of frequencies—radio waves, microwaves, infrared rays, visible light, ultraviolet light, X rays, and gamma rays. The corresponding wavelengths are inversely proportional, and both the frequency and wavelength scales are logarithmic.



The electromagnetic spectrum

From F. Bueche, *Principles of Physics* (1965); McGraw-Hill Book Company, publisher

Electromagnetic radiation of different frequencies interacts with matter differently. A vacuum is the only perfectly transparent medium, and all material media absorb strongly some regions of the electromagnetic spectrum. For example, molecular oxygen (O_2), ozone (O_3), and molecular nitrogen (N_2) in the Earth's atmosphere are almost perfectly transparent to infrared rays of all frequencies, but they strongly absorb ultraviolet light, X rays, and gamma rays. The frequency (or energy equal to hv) of X rays is substantially higher than that of visible light, and so X rays are able to penetrate many materials that do not transmit light. Moreover, absorption of X rays by a molecular system can cause chemical reactions to occur. When X rays are absorbed in a gas, for instance, they eject photoelectrons from the gas, which in turn ionize its molecules. If these processes occur in living tissue, the photoelectrons emitted from the organic molecules destroy the cells of the tissue. Gamma rays, though generally of somewhat higher frequency than X rays, have basically the same nature. When the energy of gamma rays is absorbed in matter, its effect is virtually indistinguishable from the effect produced by X rays.

There are many sources of electromagnetic radiation, both natural and man-made. Radio waves, for example, are produced by cosmic objects such as pulsars and quasars and by electronic circuits. Sources of ultraviolet radiation include mercury vapour lamps and high-intensity lights, as well as the Sun. The latter also generates X rays, as do certain types of particle accelerators and electronic devices.

electrometer, instrument designed to measure very small voltages and currents. The quadrant, Lindermann, Hoffman, and Wulf electrometers measure electrical potential between charged elements (*e.g.*, plates or fine quartz fibres) within the housings of the electrometer. The sensitivity of these instruments is about 0.01 volt.

A much more sensitive device is the vacuum-tube electrometer, a direct-current amplifier capable of measuring currents as minute as 10^{-15} amperes (about 10,000 electrons per second). This instrument, however, is subject to drift. A newer version of this type of electrometer replaces the electron tube with a matched pair of junction field-effect transistors. To aid in stabilizing the output-signal voltage, some of these devices are operated at temperatures approaching absolute zero (−459.67° F [−273.15° C]).

The vibrating-reed electrometer uses a capacitor that has a vibrating reed as one of its plates. Movement of the reed changes the voltage across the capacitor. The output of the electrometer (which is easily amplified without drift) is the current necessary to keep the meter's capacitance constant.

Uses of electrometers include studying the ionizing effects of cosmic rays, determining absorption spectra in chemical analysis, and counting ions in gas chromatography.

electromotive force, abbreviation E, or EMF, energy per unit electric charge that is imparted by an energy source, such as an electric generator or a battery. Energy is converted from one form to another in the generator or battery as the device does work on the electric charge being transferred within itself. One terminal of the device becomes positively charged, the other becomes negatively charged. The work done on a unit of electric charge, or the energy thereby gained per unit electric charge, is the electromotive force. Electromotive force is the characteristic of any energy source capable of driving electric charge around a circuit. It is abbreviated E in the international metric system but also, popularly, as emf.

A common unit of electromagnetic force is the volt, equivalent in the metre–kilogram–second system to one joule per coulomb of electric charge. In the electrostatic units of the centimetre–gram–second system, the unit of electromagnetic force is the statvolt, or one erg per electrostatic unit of charge.

electromotive series, listing of chemical species (atoms, molecules, and ions) in the order of their tendency to gain or lose electrons (be reduced or oxidized, respectively), expressed in volts and measured with reference to the hydrogen electrode, which is taken as a standard and arbitrarily assigned the voltage of zero. At the hydrogen electrode, an aqueous solution containing hydrogen in its oxidized form (the hydrogen ion, H^+) at a concentration of one mole per litre is maintained at 25° C (77° F) in equilibrium with hydrogen in its reduced form (hydrogen gas, H_2) at a pressure of one atmosphere. The reversible oxidation–reduction half reaction is expressed by the equation $2H^+ + 2e^- \rightleftharpoons H_2$, in which e^- represents an electron. The electrode potentials of several elements are shown in the Table.

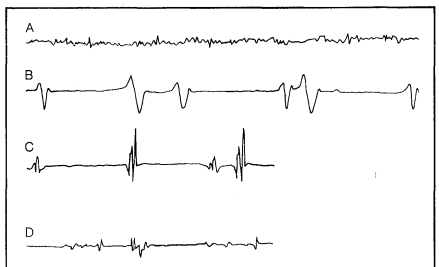
Electromotive series at 25° C

	ion	half reaction	electrode potential (volt)
metals			
lithium	Li^+	$Li = Li^+ + e^-$	−3.05
potassium	K^+	$K = K^+ + e^-$	−2.92
barium	Ba^{2+}	$Ba = Ba^{2+} + 2e^-$	−2.90
calcium	Ca^{2+}	$Ca = Ca^{2+} + 2e^-$	−2.87
sodium	Na^+	$Na = Na^+ + e^-$	−2.71
magnesium	Mg^{2+}	$Mg = Mg^{2+} + 2e^-$	−2.37
aluminum	Al^{3+}	$Al = Al^{3+} + 3e^-$	−1.66
zinc	Zn^{2+}	$Zn = Zn^{2+} + 2e^-$	−0.76
iron	Fe^{2+}	$Fe = Fe^{2+} + 2e^-$	−0.44
cadmium	Cd^{2+}	$Cd = Cd^{2+} + 2e^-$	−0.40
nickel	Ni^{2+}	$Ni = Ni^{2+} + 2e^-$	−0.25
tin	Sn^{2+}	$Sn = Sn^{2+} + 2e^-$	−0.14
lead	Pb^{2+}	$Pb = Pb^{2+} + 2e^-$	−0.13
hydrogen	H^+	$H_2 = 2H^+ + 2e^-$	0.00
copper	Cu^{2+}	$Cu = Cu^{2+} + 2e^-$	+0.34
mercury	Hg^{2+}	$2Hg = Hg_2^{2+} + 2e^-$	+0.79
silver	Ag^+	$Ag = Ag^+ + e^-$	+0.80
platinum	Pt^{2+}	$Pt = Pt^{2+} + 2e^-$	+1.20
gold	Au^{3+}	$Au = Au^{3+} + 3e^-$	+1.49
nonmetals			
sulfur	S^{2-}	$S^{2-} = S + 2e^-$	+0.48
iodine	I^-	$2I^- = I_2 + 2e^-$	+0.54
bromine	Br^-	$2Br^- = Br_2 + 2e^-$	+1.07
chlorine	Cl^-	$2Cl^- = Cl_2 + 2e^-$	+1.36
fluorine	F^-	$2F^- = F_2 + 2e^-$	+2.87

Conflicting conventions have been used for the signs of these potentials; those shown in the Table generally agree with the recommendations of an international conference in 1953.

By subtracting one half reaction (and its potential) from another, the tendency of the resulting complete chemical reaction to occur may be determined; for example, the half reactions for copper and zinc may be combined to show that the reaction $Cu^{2+} + Zn \rightleftharpoons Cu + Zn^{2+}$ has a potential of −1.10 volts. In conformity with the 1953 convention, the negative value of the voltage indicates that this reaction proceeds spontaneously from left to right as written; that is, metallic zinc dissolves in a solution of copper(II) ions to form metallic copper and to set free zinc(II) ions in the solution.

electromyography, process of graphically recording the electrical activity of muscle. Normal muscle is electrically silent when at rest, but when it is active, as during contraction or stimulation, an electrical current is generated, and the successive action potentials (impulses) can be registered on a cathode-ray



Electromyographic patterns
(A) Fibrillation; (B) fasciculation; (C) normal muscle; (D) muscular dystrophy

From Winthrobe *et al.* (eds.), *Harrison's Principles of Internal Medicine*, © 1970 by McGraw-Hill, Inc.; used by permission

oscilloscope screen in the form of continuous wavelike tracings. The visual recording, called an electromyogram, or EMG, is customarily accompanied by auditory monitoring with a loudspeaker. For diagnostic purposes, records of muscle electrical activity are usually obtained during muscle relaxation, during voluntary contraction when needle electrodes are inserted into the muscle under study, and during muscle activity evoked by the stimulation of its nerve. Weakness or wasting of muscle is generally caused either by impairment of the nerves supplying it (neuropathic disorders, such as amyotrophic lateral sclerosis and poliomyelitis) or by intrinsic muscle impairment or primary muscle disease (myopathy). In neuropathic disorders, there is usually increased spontaneous activity during muscle relaxation (fibrillation and fasciculation), together with reduced, altered, or absent normal muscle action potentials. In myopathies, there is frequently a reduction in the amplitude or duration of the muscle action potentials and an increase in the complexity of their wave form.

electron, lightest stable subatomic particle known. It carries a single negative charge and is considered the basic charge of electricity.

A brief treatment of electrons follows. For full treatment, *see* MACROPAEDIA: Atoms: Their Structure, Properties, and Component Particles.

An electron is nearly massless. It has a rest mass of 9.1×10^{-28} gram, which is only 0.0005 the mass of a proton. The electron is a fermion, a type of particle named after the Fermi-Dirac statistics that describe its behaviour. It has a half-integral spin—spin constitutes the property of intrinsic angular momentum in quantum-mechanical terms. Moreover, the electron reacts only by the electromagnetic, weak, and gravitational forces; it does not respond to the force of strong interactions, which is the short-range nuclear force that binds protons and neutrons in the atomic nucleus. The electron has an antimatter counterpart called the positron. This antiparticle has precisely identical properties except that it carries a positive charge. If it meets an electron, both are annihilated in a burst of energy. Positrons are rare on the Earth, being produced only in high-energy processes (*e.g.*, by cosmic rays) and live only for brief intervals of time before annihilation by electrons that abound everywhere.

The electron was the first subatomic particle discovered. It was identified in 1895 by the British physicist J.J. Thomson during an investigation of cathode rays. His discovery of electrons, which he initially called corpuscles, played a pivotal role in revolutionizing knowledge of atomic structure.

Under ordinary conditions, electrons are bound to the positively charged nuclei of atoms by the attraction between opposite electric charges. In a neutral atom the number of electrons is identical to the number of positive charges on the nucleus. Any atom, however, may have more or fewer electrons than positive charges and thus be negatively or positively charged as a whole; these charged atoms are known as ions. Not all electrons are associated with atoms. Some occur in a free state in a gas or a vacuum.

Within any given atom, electrons move about the nucleus in an orderly arrangement of orbitals, the attraction between electrons and nucleus overcoming repulsion among the electrons that would otherwise cause them to fly apart. These orbitals are organized in concentric shells proceeding outward from the nucleus with an increasing number of subshells. The electrons in orbitals closest to the nucleus are held most tightly; those in the outermost orbitals are shielded by intervening electrons and are the most loosely held by the nucleus. As the electrons move about within this structure, they form a diffuse cloud of negative charge that occupies nearly the entire volume of the atom. The arrangement of electrons therefore determines the size of individual atoms. It also affects the way they respond to other atoms, particles, and electromagnetic radiation.

electron affinity, in chemistry, the amount of energy liberated when an electron is added to a neutral atom to form a negatively charged ion. The electron affinities of atoms are difficult to measure, hence values are available for only a few chemical elements, chiefly the halogens. These values were obtained from measurements of heats of formation and lattice energies of ionic compounds of the elements. The electron affinity of an element is a measure of that element's tendency to act as an oxidizing agent (an electron acceptor) and is generally related to the nature of the chemical bonds the element forms with other elements.

electron beam, stream of electrons (as from a betatron) used chiefly in research, technology, and medical therapy to produce X rays and images on television, oscilloscope, and electron-microscope screens. Electrons may be collimated by holes and slits, and, because they are electrically charged, they may be deflected, focused, and energized by electric and magnetic fields.

electron capture, one of three processes of radioactive disintegration known as beta decay (*q.v.*).

electron charge (symbol *e*), fundamental physical constant expressing the naturally occurring unit of electric charge (*q.v.*), equal to $1.6021892 \times 10^{-19}$ coulomb, or 4.803250×10^{-10} electrostatic unit (esu, or statcoulomb). In addition to the electron, all charged subatomic particles thus far discovered have an electric charge equal to this value or some whole-number multiple of it.

electron diffraction, bending of a beam of electrons when passing near matter or through spacings in its submicroscopic structure that are comparable in size to the wavelength of an electron. According to the proposal (1924) of the French physicist Louis de Broglie, electrons and other particles have wavelengths that are inversely proportional to their momentum. Consequently, high-speed electrons have short wavelengths, a range of which are comparable to the spacings between atomic layers in crystals. A beam of such high-speed electrons should undergo diffraction, a characteristic wave effect, when directed through thin sheets of material or when reflected from the faces of crystals. Electron diffraction, in fact, was observed (1927) by C.J. Davisson and L.H. Germer in New York and by G.P. Thomson in Aberdeen, Scot., and the wave nature of electron beams was thereby experimentally established.

As an analytical method, electron diffraction is used to identify a substance chemically or to locate the position of atoms in a substance. This information can be read from the patterns that are formed when various portions of the diffracted electron beam cross each other and by interference make a regular arrangement of impact positions, some where many electrons reach and some where few or no electrons reach. Recorded photographically or otherwise, such a distribution is called a diffraction pattern, which when properly interpreted yields information about the nature and structure of the gas, liquid, or solid that caused the electron diffraction.

electron gun, electrode structure that produces and may control, focus, and deflect a beam of electrons, as in a television picture tube, where the beam produces a visual pattern on the tube's screen. At one end of the gun is the cathode, a flat metal support covered with oxides of barium and strontium. When heated by a coil behind the support, these oxides emit electrons, which are drawn toward a positively charged sleeve (first anode) and partially intercepted by a flat disk (the control electrode).

electron microscope, microscope that achieves extremely high resolution by using a beam of electrons instead of a beam of light to illuminate the object of study. *See* microscope.

electron optics, branch of physics that is concerned with beams of electrons, their deflection and focussing by electric and magnetic fields, their interference when crossing each other, and their diffraction or bending when passing very near matter or through the spacings in its submicroscopic structure. Electron optics is based on the wave properties of electrons (electrons were originally considered to be particles, but their wave behaviour was predicted and then experimentally established in the 1920s). Beams of electrons exhibit behaviour similar to those of light and X-rays, and all these are subject to the same mathematical descriptions. One of the applications of electron optics is the electron microscope.

electron paramagnetic resonance (EPR), also called ELECTRON SPIN RESONANCE (ESR), selective absorption of weak radio-frequency electromagnetic radiation (in the microwave region) by unpaired electrons in the atomic structure of certain materials that simultaneously are subjected to a constant, strong magnetic field. The unpaired electrons, because of their spin, behave like tiny magnets. When materials containing such electrons are subjected to a strong stationary magnetic field, the magnetic axes of the unpaired electrons, or elementary magnets, partially align themselves with the strong external field, and they precess in the field much as the axes of spinning tops often trace cone-shaped surfaces as they precess in the gravitational field of the Earth. Resonance is the absorption of energy from the weak alternating magnetic field of the microwave when its frequency corresponds to the natural frequency of precession of the elementary magnets.

When either the microwave frequency or the stationary field strength is varied and the other is kept fixed, the measurement of radiation absorbed as a function of the changing variable gives an electron paramagnetic resonance spectrum. Such a spectrum, typically a graph of microwave energy absorption versus applied stationary magnetic field, is used to identify paramagnetic substances and to investigate the nature of chemical bonds within molecules by identifying unpaired electrons and their interaction with the immediate surroundings.

electron scattering, random collisions of the charge carriers (electrons) with atoms in a crystalline solid (*e.g.,* metal, semiconductor, or insulator) that decreases the mobility of the carriers. The deflection of a beam of electrons by a target also is called electron scattering. The scattering of beams of electrons accelerated to more than 100 megaelectron volts has been used as a probe of the size and charge distribution of atomic nuclei. *See also* electron diffraction.

electron spectroscopy, method of determining the energy with which electrons are bound in chemical species by measuring the kinetic energies of the electrons emitted upon bombardment of the species with X-ray or ultraviolet radiation. Details of the structure may be inferred from the results because differences in the arrangements of the atoms affect the amount of energy required to eject electrons. *See also* Auger effect.

electron synchrotron, type of synchrotron designed to accelerate electrons to high energies (*see* synchrotron).

electron tube, also called VACUUM TUBE, or VALVE, device usually consisting of a sealed glass or metal enclosure that is used in electronic circuitry to control a flow of electrons. The control exerted by such a device may take the form of rectification of an alternating current, amplification of a weak current, or the generation of oscillations, of X-rays, or of images on a luminescent screen.

A brief treatment of electron tubes follows. For full treatment, *see* MACROPAEDIA: Electronics.

Thomas Edison was one of the first to observe a flow of current between two separated charged elements (for Edison, a heated filament and a positively charged plate) in an evacuated glass bulb. The Edison effect remained a curiosity until it was shown by Sir J.J. Thomson in 1897 that the discharge observed in the tube was in fact a flow of electrons. From that clue J.A. Fleming designed a two-element tube, called a diode, that, when incorporated into a circuit, acted as a valve by permitting current to flow in one direction only. It could thus rectify an alternating current and, more importantly, serve as a detector of radio waves.

In 1907 the U.S. engineer Lee De Forest built the first triode, or three-element tube, by inserting a grid between the emitting element (filament, later a cathode) and the collecting element (plate or anode). An electrical potential imposed on the grid could increase or decrease the flow of electrons between the other two elements and thus enable the tube to act as an amplifier. If the current supplied to the grid were a weak signal, the triode tube would produce as its output a strong signal current. The development of practical radio communications derived directly from De Forest's invention.

The typical electron tube consists of a glass or metal envelope from which air has been evacuated, a set of pins at the base by which connections are made to other circuit components, and the internal elements. These last consist of the cathode, usually of tungsten, which supplies electrons by the process of thermionic emission; a heater or filament, which serves to heat the cathode so that it will emit electrons; the plate or anode, which collects electrons; and one or more grids, including the basic control grid, a screen grid that increases the amplifying capacity of the tube, and a suppressor grid that controls secondary emission of electrons.

A great variety of tubes have been developed for special purposes. The photoelectric tube contains a cathode made of a material, such as cesium, that emits electrons when struck by light. Electron-gun tubes use an arrangement of internal or external devices to control a beam of electrons from the cathode to a luminescent screen that takes the place of the plate. Cathode-ray tubes and television tubes are among the many types of electron-gun tubes. Other varieties of tubes include the ignitron, used to rectify very large currents in industrial applications, the gas tube, in which ionized mercury vapour carries the current instead of thermionic electrons, the klystron, used to generate extremely high-frequency microwaves, and X-ray tubes, in which the electron beam strikes a target of heavy metal to produce penetrating X-rays.

For many applications the electron tube has been supplanted by the semiconductor device (*q.v.*).

electron volt, unit of energy commonly used in atomic and nuclear physics, equal to the energy gained by an electron (a charged particle carrying unit electronic charge when the electrical potential at the electron increases by one volt). The electron volt equals 1.602×10^{-12} erg. The abbreviation MeV indicates 10^6 (1,000,000) electron volts and BeV, 10^9 (1,000,000,000).

electronegativity, in chemistry, the ability of an atom to attract to itself an electron pair shared with another atom in a chemical bond.

The commonly used measure of the electronegativities of chemical elements is the electronegativity scale derived by Linus Pauling in 1932. In it the elements are tabulated in decreasing order of electronegativity, fluorine being the most electronegative and cesium the least. The scale was derived from a comparison of the energies associated with chemical bonds between various combinations of atoms. A scale very similar to Pauling's values has been obtained by measurements of atomic ionization potentials and electron affinities.

Elements differing greatly in electronegativity tend to form ionic compounds, composed of positively and negatively charged units called ions; those differing moderately in electronegativity form polar, covalent compounds, in which atoms are held together by chemical bonds, but which show some degree of ionization, while those elements with approximately equal electronegativities form nonpolar compounds, which show little charge separation.

electronic carillon, also called ELECTRONIC CHIME, ELECTROPHONIC CARILLON, or ELECTROACOUSTICAL CARILLON, 20th-century musical instrument in which the acoustical tone source—metal tubes, rods, or bars struck by hammers—is picked up electromagnetically or electrostatically and converted into electrical vibrations that are highly amplified and fed into loudspeakers placed in a belfry or other exterior site. It is played from an electric keyboard—sometimes an organ manual—activating solenoid (electromagnetic) switches, which throw small hammers against the tone source, resulting in a ringing sound suggestive of bells. Although generally considered an imitative instrument replacing cast bells, it more properly should be regarded as an independent instrument existing on its own merits. The electronic carillon ranges two to five octaves, the electronic chime less than two octaves.

The precursor of the electronic carillon, developed in the U.S. in 1916, was a set of sizable bronze tubes vertically suspended in a belfry and struck by hammers electrically activated from a keyboard located at will and connected by cable. Closed at one end, these tubes, known as tubular bells, resembled orchestral tubular bells, or chimes, except for size. The outdoor belfry device was an enlarged version of smaller organ chimes of brass tubes, which were introduced in 1888. In 1923 the tubes were given amplifications, and in 1926, automatic roll play.

In the 1930s small rods of brass or bronze were introduced as a tone source and proved more economical than tubes. With the rods, attempts were made to approximate more closely the sound of the cast bell. In "fixed-free" suspension (one end fastened and the other free) a rod produces two prominent partials a major sixth apart. To produce a given note, two rods are struck at selected points. Only the desired sound-wave frequencies are picked up and amplified, the electronic pickups being placed at nodal (nonvibrating) points in the vibration pattern of unwanted partials. When the composite sound is electronically modified, the result offers a reasonable imitation of bells in the upper register but a superficial one in the lower. Two elements are relevant: larger bells have a pronounced "strike tone"—a pitch sensation of sharper timbre at impact—that the rod does not reproduce; and the partials of a bell decay at independent rates, a behaviour characteristic of metal cast in the shape of Western flared-mouth bells and not duplicated in the vibrating rod.

Irrespective of musical considerations, the electronic carillon or chime possesses certain advantages in comparison with cast bells. It is generally less expensive, its equipment requires little space, and its loudspeakers can be mounted on a roof or other elevated area without need of a tower. It is also possible to include indoor speakers, thus giving more

listening flexibility, and the keyboard can be placed wherever desired. For variety some instruments include other types of musical sound, such as the harp or celesta; the appropriate timbres (tone colours) are produced by selective pickup of partials in the rods. In churches the rods can also be combined with the organ. Automatic roll play with clock control may also be used to operate the instrument.

Common locations of the electronic carillon include churches, educational institutions, cemeteries, public buildings, and campaniles in parks. Generally, its music is heard informally as background to other activity; formal recitals are rare. Most electronic carillons are in the U.S., though a few have been installed in other countries.

electronic configuration, also called ELECTRONIC STRUCTURE, in chemistry and physics, designation of the states of electrons in the region about an atomic nucleus. In terms of the older shell atomic model, electrons in normal atoms occupy several shells in succession from the first, or *K* shell, nearest the atomic nucleus, through the second, or *L* shell, up to the seventh, or *Q* shell, farthest from the nucleus. The electronic configuration of an atom of the metal tin (atomic number 50) on this basis may be expressed by stating the number of electrons in each shell beginning with the first: 2-8-18-18-4.

In this atom the *K, L,* and *M* shells are filled to their limits (2, 8, and 18 electrons, respectively); the 18 electrons in the *N* shell and the four in the *O* shell only partially saturate the capacities of 32 and 50, respectively.

In terms of a more refined, quantum-mechanical model, each of the shells of the former model is subdivided into a set of orbitals (*q.v.*), each of which can be occupied by no more than a pair of electrons. The two electrons that occupy the *K* shell of the shell model correspond to those that occupy the orbital designated 1*s*. The old *L* shell corresponds to four orbitals, one denoted 2*s* and three denoted 2*p;* electrons occupying 2*p* orbitals are bound with equal strength to the nucleus but less strongly than those in the 2*s* orbital. The old *M* shell is replaced by nine orbitals: one 3*s,* three 3*p,* and five 3*d* orbitals. Sixteen orbitals replace the old *N* shell: one 4*s,* three 4*p,* five 4*d,* and seven 4*f* orbitals. Orbitals in higher shells are designated similarly.

Electronic configuration is indicated by listing the occupied orbitals in succession together with the specific number of electrons in each orbital or cluster of similar orbitals as a superscript to the right of each. In this notation, the electronic configuration of tin is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^2$.

The similarities in chemical and spectroscopic properties that initially led to recognition of the members of the traditional groups in the periodic table are apparent from the electronic configurations of the elements. For example, the elements carbon, silicon, germanium, tin, and lead, which comprise Group IVa of the periodic table, all have electronic configurations showing that the four outermost (most loosely bound) electrons occupy *s* and *p* orbitals. These, the so-called valence electrons, are the ones responsible for the chemical properties of the elements.

Electronic configuration is often indicated more briefly by specifying the occupied orbitals in excess of the configuration for the noble gas that ends the previous period in the periodic table of the elements. Again in the case of tin, 14 electrons, the ten 4*d*, two 5*s*, and two 5*p* electrons, are in excess of the electronic configuration of the noble gas krypton (chemical symbol Kr, atomic number 36). The electronic configuration of tin, therefore, may be stated simply: $(Kr)4d^{10}5s^25p^2$.

electronic eavesdropping, the act of electronically intercepting conversations without the knowledge or consent of at least one of the participants. Historically, the most common form of electronic eavesdropping has been wiretapping, which monitors telephonic and telegraphic communication. It is legally prohibited in virtually all jurisdictions for commercial or private purposes.

Great controversy has evolved over the use of this technique to detect crime or to gather evidence for criminal prosecution. Opponents assert that the legitimate governmental interest in curtailing crime does not outweigh the great potential for infringing upon constitutional or fundamental guarantees of citizenship, such as individual privacy and freedom from unreasonable searches and seizures. Efforts to satisfactorily define the point at which a valid objective of law enforcement becomes an invasion of privacy have generally failed, and thus the controversy over wiretapping and all other types of electronic eavesdropping persists.

Wiretapping activities date back to the beginnings of telegraphic communication. In the United States, state statutes forbidding the interception of messages were enacted as early as 1862. The tapping of telephone lines began in the 1890s and was approved for use by police officials in the Supreme Court case of *Olmstead* v. *United States* (1928). Federal investigative authorities continue to engage in wiretapping, although in 1934 Congress enacted restraints that severely limited the use of intercepted material as admissible evidence in judicial proceedings. In the 1960s and 1970s the Supreme Court sought to protect individuals from "unreasonable searches and seizures" by circumscribing prosecution based on electronic surveillance. Some U.S. states prohibit wiretapping completely, whereas others authorize its use pursuant to a valid court order. With the adoption of the Crime Control Act of 1968, Congress authorized the use of electronic surveillance for a variety of serious crimes, subject to strict judicial control.

In England permission to employ a wiretap is granted only in cases of serious offense when interceptions are likely to result in conviction and other methods of investigation have failed. In most other jurisdictions wiretapping is authorized under prescribed circumstances at the request of judicial, prosecuting, or police officials. A court order is ordinarily required, but in some countries, such as Denmark and Sweden, exceptions are recognized in urgent cases.

The typically vague standards governing the use of wiretapping have also provoked controversy with regard to other listening devices. Transistors, microcircuits, and lasers, all products of space-age technology, have revolutionized the art of electronic eavesdropping. One group of the new investigative tools takes the shape of a ray gun. The ray is beamed at the object of the investigation from hundreds of feet away and can imperceptibly pick up a conversation and return it to the listener. The conversation is ordinarily carried by a radio beam, but modern application of a light beam, or laser, promises to simplify and improve upon this technique. The power necessary to transmit a light beam for carrying voices many miles is extremely small, and unlike a radio beam, a laser beam is practically impossible to detect by any means currently available.

The most efficient and least expensive form of listening device is a radio transmitter made out of integrated microcircuits. One hundred typical microcircuits can be made on a piece of material smaller and thinner than a postage stamp. A transmitter so constructed can be concealed in a playing card or behind wallpaper. Relatively low cost is another attribute of the transistor or microcircuit radio transmitter, and, as prices of snooper devices steadily decrease, more and more people will be able to obtain them. Critics warn that, as a consequence, the use of listening devices by the criminal and the just plain curious may increase drastically, thus presenting a threat not only to fundamental personal and civic rights of privacy but also jeopardizing the confidential nature of business and government transactions, already the major targets of electronic spying.

electronic game, any game operated by silicon-chip computer circuitry that provides a memory. The games fall into three classes: small, hand-held, battery-powered games; larger games displayed on a television screen or computer terminal; and the largest self-contained games played in arcades. The last two categories are usually called video games.

Electronic games originated late in the 1960s in the off-hour recreations of computer engineers who played games among themselves on computers. Hand-held games and video games first appeared in the early 1970s, and such early games included sports (table-tennis) and target games. Coin-operated games began in the mid-1970s. Battery-powered games came to be operable from house current by means of a jack connection to a rectifier. By the 1980s, nearly every competitive team or individual sport was represented—football, baseball, basketball, and soccer being dominant, as well as such games as Chess, Poker, Blackjack, and Backgammon. Word and number games were instructional for spelling and arithmetic, and quiz games challenged players in logic, strategy, and memory. Hand-held games grew to a size requiring many of them to be played on the floor or a table. Target games included Earth-bound military conflicts of all kinds and expanded into the intergalactic struggles.

By the 1980s, coin-operated electronic games had displaced the earlier pinball games in popularity. The display was usually vertical, and the games could be played by two players at once, as could most of the smaller games. The games were played, as pinball games had been, in drinking establishments, transportation centres, and amusement arcades, many of the latter devoted exclusively to electronic games.

By the 1980s, industry sales for home-use games exceeded $1,500,000,000 annually and sales of arcade machines exceeded $500,000,000. Much of the manufacturing industry was in the United States, but Japanese industry was not far behind.

electronic instrument, any musical instrument that produces or modifies sounds by electric, and usually electronic, means. The electronic element in such music is determined by the composer, and the sounds themselves are made or changed electronically.

A brief treatment of electronic instruments follows. For full treatment, *see* MACROPAEDIA: Musical Instruments.

The origins of electronic music go back to the 200-ton Telharmonium exhibited by Thaddeus Cahill in Massachusetts and New York in 1906. More manageable electronic instruments were subsequently built in the 1920s and '30s, most notably the Ondes Martenot of Maurice Martenot, which has an important place in the French composer Olivier Messiaen's *Turangalîla-Symphonie* (1946–48) and other works. Meanwhile other composers, including the Frenchman Edgard Varèse and the German Paul Hindemith, were exploring the possibilities of transforming sounds with the use of the phonograph, or gramophone: playing records at different speeds, backwards, and so on.

Work of this kind eventually bore fruit in the work of Pierre Schaeffer, who in 1948 created the first pieces using the phonograph as a medium of storage, alteration, and rerecording. Such techniques became much easier to use when tape recorders became avail-

able in about 1950, and Schaeffer's Paris studio for what he called *musique concrète* attracted the attention of several composers, notably Varèse, who worked there in 1954 on the tape for his *Déserts,* interweaving orchestral passages with electronic excursions. He used similar techniques of assembling purely electronic sounds with natural sounds (factory noises and music from instruments and voices) in his *Poème électronique* (1957–58), which exists entirely on tape.

Besides this kind of collage work, there were also in the 1950s attempts to produce music solely by electronic means of generation, deriving tones from oscillators, recording them on tape, perhaps modifying or editing them at will. The German composer Karlheinz Stockhausen's *Elektronische Studien* (1953–54) are essays of this kind, though in his next electronic work, *Gesang der Jünglinge* (1955–56; *Song of the Youths*), he combined electronic with vocal sounds, and in later tape compositions he has ranged still more widely. His *Telemusik* (1966) is a meeting of folk music from around the world, and in *Hymnen* (1966–67) his basic material is provided by national anthems.

Stockhausen has also played a leading part in the development of electronic music for live performance; indeed, few of his works do not have some electronic component. In *Kontakte* (1959–60) he created a world of "contacts" between purely electronic sounds and those of a live pianist and percussionist; in other works he has used electronic equipment to modify directly the sounds of other instruments and voices, whether an orchestra in *Mixtur* (1964), a single large tam-tam (rimless gong) played by four musicians in *Mikrophonie I* (1964), or a small chorus in *Mikrophonie II* (1965). Out of the ensemble for *Mikrophonie I* he developed a small group of players performing on electronic instruments—amplified viola, modified percussion, and so forth—with whom he worked on such pieces as *Kurzwellen* (1968; *Shortwaves*).

During the 1960s electronic music studios sprang up all over the world, attached to radio stations and universities. In the United States much important work was done at the Columbia–Princeton Electronic Music Center in New York City, where the American composer Milton Babbitt used a music synthesizer in his works, although employing the electronic medium for its fine rhythmic control and predictability of colour rather than its provision of new sounds. Other sorts of electronic sound synthesizers, associated originally with the name of Robert Moog, reduced the labour of electronic composition on tape when they began to appear in about 1965, but they have also contributed to a certain standardization of sound.

The main development of the 1970s, though initiated in the previous decade, was the growth of computer music, using digital techniques to control, in principle, every aspect of sound: pitch, colour, loudness, and the change of these qualities in time. Computer music has appealed to composers interested in a high degree of exact control (as exerted, for example, in Charles Dodge's tape pieces), but it has proved a suitable medium too for composers inclined, like John Cage in his various electronic works dating back to the 1930s, to use electronic imagery to stimulate a new kind of consciousness brought into being by the electronic age.

electronic organ, also called ELECTRIC ORGAN, or ELECTROPHONIC ORGAN, keyboard musical instrument in which tone is generated by electronic circuits and radiated by loudspeaker. This instrument, which emerged in the early 20th century, was designed as an economical and compact substitute for the much larger and more complex pipe organ.

The electronic organ resembles a spinet, or upright, piano in size and general shape. Most instruments of this general type rely upon electronic oscillators (circuits carrying an alternating current at a specific frequency) to produce their sound. If the instrument has multiple oscillators, it will be capable of reproducing music having multiple parts, such as a Bach fugue. If it has one oscillator, capable of frequency variation for different pitches but without assisting oscillators, the instrument is capable of reproducing only a single melodic line.

The first electronic organ was the 200-ton Telharmonium, made in 1904 by the American inventor Thaddeus Cahill. It was exhibited in New York in 1906 but lapsed into obscurity by World War I. Also notable were the inventions of the German inventor Jörg Mager, the Spherophone (1923) and Partiturophone (1935), but neither instrument was used extensively, and they were discontinued during World War II. Other more successful ventures were the Trautonium (1930), created by the German Friedrich Trautwein, and the Rangertone (1931), an invention by Captain Richard Ranger of the United States. In 1935 the Orgatron was introduced by F.A. Hoschke; in this organ, tone was generated by reeds that vibrated by electrically fan-blown air, with the vibrations picked up electrostatically and amplified.

Electronic organ
By courtesy of Hammond Organ Co.

One of the most important and well-known of the electronic organs is the Hammond organ, a sophisticated instrument having two manuals, or keyboards, and a set of pedals operated by the feet. It was patented by its inventor Laurens Hammond in 1934. Unlike most other instruments of its type, it produces its sound through a complex set of rotary, motor-driven generators. By means of a series of controls affecting the harmonics, or component tones, of the sound, a great variety of timbres (tone colours) can be reproduced that to some degree imitate the sound of other instruments, such as the violin, the flute, the oboe, and the orchestral percussion instruments.

By the 1960s organ manufacturers had expanded their technology, supplanting vacuum tubes with transistors and solid-state circuitry. Circuits and components designed to operate television and radio receivers and high-fidelity phonographs were adapted to produce music. In the 1970s digital microcircuitry was used to operate a computer organ. In this device, sounds are not created internally but have been pre-recorded and stored in the computer from which they can later be retrieved. Musical tones or shapes—recorded from conventional windblown pipe organs—are coded into digital form and may be re-created by a special computer at the touch of the keys and stops. Other devices have been used to control reverberation, pitch, and the attack or delay of a note.

electronic oven: *see* microwave oven.

electronic sound synthesizer: *see* music synthesizer.

electronic structure: *see* electronic configuration.

electronic work function, energy (or work) required to withdraw an electron completely from a metal surface. This energy is a measure of how tightly a particular metal holds its electrons—that is, of how much lower the electron's energy is when present within the metal than when completely free. The work function is of technological importance in applications involving electron emission from metals, as in photocells (electric eyes) and vacuum tubes.

The value of the work function for a particular material varies slightly depending upon the process of emission. For example, the energy required to boil an electron out of a heated platinum filament (thermionic work function) differs slightly from that required to eject an electron from platinum that is struck by light (photoelectric work function). Typical values for metals range from one to six electron volts.

When metals of different work functions are joined, electrons tend to leave the metal with the lower work function (where they are less tightly bound) and travel to the metal of higher work function. This effect must be considered whenever connections are made between dissimilar metals in certain electronic circuits.

Because some electrons in a material are held more tightly than others, a precise definition of work function specifies which electrons are involved, usually those most loosely bound.

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

electronics, scientific study and technology having to do with the motion of electrons and the control of that motion. Various scientific and technical disciplines, such as physics, chemistry, materials science, and electrical and electronics engineering, are concerned with different aspects of electronics.

A brief treatment of electronics follows. For full treatment, *see* MACROPAEDIA: Electronics.

The beginnings of electronics can be traced to various experiments with electricity. In the 1880s Thomas A. Edison and others observed the flow of current between elements in an evacuated glass tube. Edison, who was experimenting to improve his incandescent light bulb, added a second element near the filament in the tube. Under certain conditions, he noticed a bluish glow in the tube. This "Edison effect" remained unexplained and unexploited for some years. In 1897 the British physicist J.J. Thomson determined that the Edison effect was due to the emission and passage of particles that he called electrons from the negative to the positive electrode. A short time later the English engineer John A. Fleming constructed the so-called thermionic valve (a two-electrode vacuum tube) by which an electrical current could be restricted to flow only in one direction. This rectifying process, also known as detection and demodulation, produced an output current that could be used to operate a telephone receiver or recording device. Fleming's valve was greatly improved in 1907 by the American engineer Lee De Forest, who added a third element to the evacuated tube and produced the first triode, which could greatly amplify an electrical signal. From the triode the forms of the electron tube (*q.v.*) multiplied, giving rise to photomultiplier tubes, klystrons, magnetrons, and so forth.

In 1947 three scientists at Bell Laboratories—John Bardeen, William B. Shockley, and Walter H. Brattain—introduced the transistor, a simple device consisting of a small block of a semiconductor (*q.v.*) with three electrodes that could perform many of the functions of electron tubes. The invention of the transistor initiated a progressive miniaturization of electronic components that by the late 1980s resulted in the manufacture of solid-state devices that contained more than 3,000,000 transistors on a single tiny silicon chip. Such high-density microcircuits, called microprocessors, have led to tremendous advances in computer technology and in computer-based automated systems (*e.g.*, industrial robots and spacecraft-control systems). The availability of inexpensive microprocessors has also brought about the computerization of an enormous array of consumer products, ranging from self-focusing cameras and self-tuning televisions to programmable videocassette recorders and security systems. In addition, developments in optoelectronics (*i.e.*, an approach that makes use of both optical and electronic phenomena) have yielded efficient photodetectors and solar cells, as well as light-emitting diodes, semiconductor lasers, and optical fibres that are integral to many advanced communications systems.

electrophile, in chemistry, an atom or a molecule that in chemical reaction seeks an atom or molecule containing an electron pair available for bonding. Electrophilic substances are Lewis acids (compounds that accept electron pairs), and many of them are Brønsted acids (compounds that donate protons). Examples of electrophiles are hydronium ion (H_3O^+, from Brønsted acids), boron trifluoride (BF_3), aluminum chloride ($AlCl_3$), and the halogen molecules fluorine (F_2), chlorine (Cl_2), bromine (Br_2), and iodine (I_2). *Compare* nucleophile.

electrophone, any of a class of musical instruments in which the initial sound either is produced by electronic means or is conventionally produced (as by a vibrating string) and electronically amplified. Electronically amplified conventional instruments include guitars, pianos, and others.

Among instruments that use electronic means of generating sound are the theremin, the ondes martenot, electronic organs, and electronic music synthesizers. The vibraphone, or vibraharp, a metallophone that looks somewhat like the orchestral xylophone, makes use of electric fans at the upper ends of the vibrator tubes in order to produce a vibrato sound. *Compare* aerophone; chordophone; idiophone; membranophone.

electrophoresis, also called CATAPHORESIS, the movement of electrically charged particles in a fluid under the influence of an electric field. If the liquid rather than the particles is set in motion—*e.g.*, through a fixed diaphragm—the phenomenon is called electroosmosis.

Electrophoresis is used to analyze and separate colloids (*e.g.*, proteins) or to deposit coatings, as on elements used in electron tubes.

The Swedish chemist Arne Tiselius, in about 1930, introduced the use of electrophoresis as an analytic technique. Tiselius originated the moving-boundary method of observation, in which a layer of pure (*i.e.*, without particles) fluid is placed over a quantity of the same fluid containing colloidal particles; the boundary between two layers of fluid is visible and moves at the speed of electrophoresis of the particles.

electrophotography, any of several image-forming processes, principally xerography and the dielectric process, that rely on photoconductive substances whose electrical resistance decreases when light falls on them; it is the basis of the most widely used document-copying machines.

In xerography, a light exposure is made upon a uniformly charged metal plate, the selenium coating of which then selectively destroys the charge in conformity with the original. The image is made visible by dusting the plate with an oppositely charged pigmented powder; it is then transferred to paper electrostatically and fused with heat. Modern xerographic machines use a continuously rotating metal drum on which the various steps—charging, exposing, developing, and transferring—are carried out continuously.

A proprietary process known as Electrofax employs a photographic paper coated with a dielectric layer; the entire charging, exposure, and development process is thus effected directly on the paper itself.

electroplating, process of coating with metal by means of an electric current. Plating metal may be transferred to conductive surfaces (metals) or to nonconductive surfaces (plastics, wood, leather), after the latter have been rendered conductive by such processes as coating with graphite, conductive lacquer, electroless plate, or a vaporized coating.

Figure 1 shows a typical plating tank containing copper sulfate ($CuSO_4$) solution. A

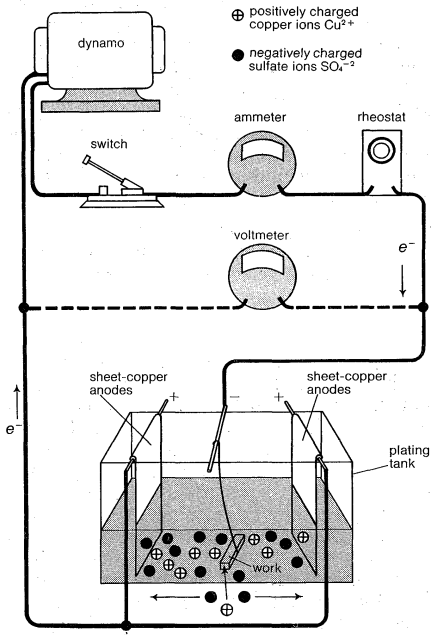


Figure 1: Electroplating circuit

dynamo supplies electric current which is controlled by a rheostat (*q.v.*). When the switch is closed, the cathode bar, which holds the work to be plated, is charged negatively. Some of the electrons from the cathode bar transfer to the positively charged copper ions (Cu^{++}), setting them free as atoms of copper metal. These copper atoms take their place on the cathode surface, copper plating it. Concurrently, as shown in the drawing, the same number of sulfate ions (SO_4^{--}) are discharged on the copper anodes, thereby completing the electrical circuit. In so doing, they form a new quantity of copper sulfate that dissolves in the solution and restores it to its original composition. This procedure is typical of nearly all ordinary electroplating processes; the current deposits a given amount of metal on the cathode and the anode dissolves to the same extent, maintaining the solution more or less uniformly. If this balance is perfect and there are no side reactions or losses, a 100 percent cathode efficiency and 100 percent anode efficiency could possibly be realized.

If the metal surface of the cathode is chemically and physically clean, the discharged atoms of copper are deposited within normal interatomic spacing of the atoms of the basis metal and attempt to become an integral part of it. In fact, if the basis metal is copper, the new copper atoms will frequently arrange themselves to continue the crystal structure of the basis metal, the plate becoming more or less indistinguishable from and inseparable from the basis metal.

If suitable solutions of different metals are mixed, it is possible to plate a wide variety of alloys of metals. By this means plated brass can be made more or less indistinguishable from cast brass. It is also possible, however, to deposit alloys or compounds of metals that cannot be produced by melting and casting them together. For example, tin–nickel alloy plate has been used commercially for its hardness and corrosion resistance, which are superior to that of either metal alone. The deposit consists of a tin–nickel compound (Sn-Ni) that cannot be produced in any other way.

Other common alloy plates include bronze and gold, with varying properties, such as different colours or hardnesses. Magnetic alloy plates of such metals as iron, cobalt, and nickel are used for memory drums in computers. Solder plate (Sn-Pb) is used in printed circuit work.

Development of electroplating. While some metal coating procedures date back to ancient times, modern electroplating started in 1800 with Alessandro Volta's discovery of the voltaic pile, or battery, which made noteworthy quantities of direct current electricity available. At about the same time, the battery was employed to deposit lead, copper, and silver. After a nodule of copper had been deposited on a silver cathode, the copper could not be removed. In the same year, zinc, copper, and silver were deposited on themselves and on a variety of basis metals (the metals on which the plating is applied), such as gold and iron.

Electroplating on a commercial scale was begun around 1840–41 and was accelerated by the discovery of cyanide solutions for plating silver, gold, copper, and brass. A cyanide–copper solution, for example, gave adherent deposits of copper directly on iron and steel. It is still used for this purpose and also for the initial plating on zinc die castings. The copper sulfate solution described above corrodes these metals, giving nonadherent deposits.

Electroplating has become a large and growing industry with sophisticated engineering

22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se
40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te
72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po

Figure 2: Periodic chart of metals readily plated

and equipment requirements. The metals that can be readily plated from aqueous solutions at high-current efficiencies near 100 percent can best be surveyed from Figure 2. It shows these metals in a single rectangle in their proper relationship to each other. The only metal shown outside of the rectangle that is in common use is chromium, which is commonly plated at low-current efficiencies of about 10–20 percent. Of the 27 metals inside the rectangle, about 15 are more or less common in plating, specifically, iron, cobalt, nickel, copper, zinc, ruthenium, rhodium, palladium, silver, cadmium, tin, iridium, platinum, gold, and lead. The others can be deposited easily but have not found much use in this way either owing to cost or availability or lack of useful properties.

A few metals shown outside of the rectangle are sometimes used for plating or electroforming purposes. Thus aluminum is frequently deposited in this way from organic or nonaqueous solutions and also fused (melted) salt baths. Some of the refractory metals (molybdenum, tungsten, tantalum, and niobium) have also been applied in this way by workers using fused salt baths.

The introduction of chromium plating in 1925 stimulated repercussions all through the plating industry. Chromium was essentially a bright plate and retained its brightness indefinitely. Chromium plate found a ready market in the automotive and appliance fields, in which the merits of the combination plate nickel–chromium or copper–nickel–chromium were soon proven. The requirements for closer control procedures in bath composition, temperature, and current density were reflected in better control and development of other processes.

The so-called hard-chromium plating likewise created a new way of improving wear resistance of machine parts and improved operation owing to good frictional and heat resistance properties. Worn or undersized parts were built up with chromium plate. The success of chromium plating increased the field for engineering applications of other metals such as nickel, copper, silver, and gold.

While nonmetallic materials have been plated since the mid-19th century, a period of rapid growth in the utilization of electroplated plastics began in 1963 with the introduction of ABS plastic (acrylonitrile–butadiene–styrene), which was readily plated. The plastic part is first etched chemically by a suitable process, such as dipping in a hot chromic acid–sulfuric acid mixture. It is next sensitized and activated by first dipping in stannous chloride solution and then in palladium chloride solution. It is then coated with electroless copper or nickel before further plating. A useful degree of adhesion is obtained (about 5 to 30 pounds per inch [1 to 6 kg per cm]) but is in no way comparable to the adhesion of metals to metals.

Principal applications. Copper plating is used extensively to prevent case hardening of steel on specified parts. The entire article may be copper plated and the plate ground off on the areas to be hardened. Silver plating is used on tableware and electrical contacts; it has also been used on engine bearings. The most extensive use of gold plating is on jewelry and watch cases. Zinc coatings prevent the corrosion of steel articles, while nickel and chromium plate are used on automobiles and household appliances.

electropolishing, also called ELECTROLYTIC POLISHING, electrochemical process of smoothing a metallic surface. The metallic object is made the anode in an electrolytic reaction so controlled that its high spots dissolve, until only a smooth surface remains. Electropolishing is the reverse of the process of electroplating.

electroscope, instrument for detecting the presence of an electric charge or of ionizing radiation, usually consisting of a pair of thin gold leaves suspended from an electrical conductor that leads to the outside of an insulating container. An electric charge brought near the conductor or in contact with it causes the leaves to stand apart at an angle. The like electric charge either induced in or transferred to each leaf causes them to repel each other. Radiation from radioactive materials introduced into a charged electroscope ionizes the gas within, permitting the charge on the leaves to leak off gradually. The rate at which the leaves of a charged electroscope converge to their parallel uncharged position is proportional to the intensity of radiation present.

electroshock therapy: *see* shock therapy.

electrostatic induction, modification in the distribution of electric charge on one material under the influence of a nearby second object that has an electric charge. Thus, because of the electric force between charged particles that constitute materials, a negatively charged object brought near an electrically neutral object induces a positive charge on the near side and a negative charge on the far side of the neutral object. The neutral object, furthermore, may sometimes become charged positively by induction, if its negative part is grounded momentarily to permit the negative charge to escape. Electrostatic induction occurs whenever any object is placed in an electric field. *See also* electric polarization.

electrostatic precipitation, method of removing certain impurities (either solid particles or liquid droplets) from air or other gas. It is widely used for removing particles from industrial-waste gases.

In 1824 M. Hohlfeld, a mathematics teacher in Leipzig, first described the precipitation of smoke particles by electricity. The first commercially successful process was developed in 1906 following experiments by F.G. Cottrell at the University of California, Berkeley.

When a discharge of electricity is fed into the air or gas, the particles it contains are ionized; *i.e.,* they become negatively charged from the gain of electrons on their surfaces. A large electrode surface of opposite charge then attracts these particles, and they are deposited there for removal by washing or scraping.

The earliest applications were to the smelting and sulfuric acid industries and at cement mills. Other important applications include removal of tar from coke-oven gases; cleaning the air in air conditioning systems; removal of acid fumes in petroleum refineries and chemical plants; recovery of such industrially valuable materials as the oxides of tin and copper; and removal of fly ash from stack gases of large coal-burning power plants.

electrostriction, property of all electrical nonconductors, or dielectrics, that manifests itself as a relatively slight change of shape, or mechanical deformation, under the application of an electric field. Reversal of the electric field does not reverse the direction of the deformation.

The converse piezoelectric effect occurs only in a particular class of nonconducting crystals and is characterized both by generally a much greater deformation for a given value of the electric field and by a reversal in the direction of deformation when the electric field is reversed. *See* piezoelectricity.

electrothermic process, metallurgical technique in which heat is generated by the passage of electricity through the material being heated. *See* electric furnace.

electrotyping, electroforming process for making duplicate plates for relief, or letterpress, printing. The process was first announced in 1838 by M.H. von Jacobi, a German working in St. Petersburg (now Leningrad). Thomas Spencer and C.J. Jordan of England and Joseph A. Adams of the United States produced similar results in the following year.

An electrotype, or electro, is made by electroplating a thin shell of copper or other metal onto a mold, usually wax, of the original cut or type form and then removing the mold and backing the shell with metal. More durable than type and cuts, electros are used instead of the original for long press runs, to avoid wear and damage to expensive type and halftones or linecuts. Electrotypes also can duplicate and replace linoleum cuts, woodcuts, and wood engravings.

electrovalent bond (chemistry): *see* ionic bond.

electrum, natural or artificial alloy of gold with at least 20 percent silver, which was used to make the first known coins in the Western world. Most natural electrum contains copper, iron, palladium, bismuth, and perhaps other metals. The colour varies from white-gold to brassy, depending on the percentages of the major constituents and copper. In the ancient world the chief source was Lydia, in Asia Minor, where the alloy was found in the area of the Pactolus River, a small tributary of the Hermus (modern Gediz Nehri, in Turkey). The first Occidental coinage, possibly begun by King Gyges (7th century BC) of Lydia, consisted of irregular ingots of electrum bearing his stamp as a guarantee of negotiability at a predetermined value. Various Greek states adopted electrum for coinage before the fall of the Lydian state (middle 6th century BC). Either Croesus, last king of Lydia, or his Persian successors abandoned electrum coinage in favour of a gold–silver bimetallism, with interchangeability at a fixed ratio. In western Europe, coins of artificial electrum were minted under the Merovingian dynasty because of the scarcity of gold.

elegy, meditative lyric poem lamenting the death of a public personage or of a friend or loved one; by extension, any reflective lyric on the broader theme of human mortality. In classical literature an elegy was simply any poem written in the elegiac metre (alternating lines of dactylic hexameter and pentameter) and was not restricted as to subject. In some modern literatures, such as German, in which the classical elegiac metre has been adapted to the language, the term elegy refers to this metre, rather than to the poem's content. Thus, Rainer Maria Rilke's famous *Duineser Elegien* (*Duino Elegies*) are not laments; they deal with the poet's search for spiritual values in an alien universe. But in English literature since the 16th century, an elegy has come to mean a poem of lamentation. It may be written in any metre the poet chooses.

A distinct kind of elegy is the pastoral elegy, which borrows the classical convention of representing its subject as an idealized shepherd in an idealized pastoral background and follows a rather formal pattern. It begins with an expression of grief and an invocation to the Muse to aid the poet in expressing his suffering. It usually contains a funeral procession, a description of sympathetic mourning throughout nature, and musings on the unkindness of death. It ends with acceptance, often a very affirmative justification, of nature's law. The outstanding example of the English pastoral elegy is Milton's "Lycidas" (1638), written on the death of Edward King, a college friend. Other notable pastoral elegies are Shelley's "Adonais" (1821), on the death of Keats, and Matthew Arnold's "Thyrsis" (1867), on the death of the poet Arthur Hugh Clough.

Other elegies observe no set patterns or conventions. In the 18th century the English

"graveyard school" of poets wrote generalized reflections on death and immortality combining gloomy, sometimes ghoulish imagery of human impermanence with philosophical speculation.

Representative works are Edward Young's *Night Thoughts* (1742–45) and Robert Blair's *Grave* (1743), but the best known of these poems is Thomas Gray's more tastefully subdued creation "An Elegy Written in a Country Church Yard" (1751), which pays tribute to the generations of humble and unknown villagers buried in the church cemetery. In the United States, a counterpart to the graveyard mode is found in William Cullen Bryant's "Thanatopsis" (1817). A wholly new treatment of the conventional pathetic fallacy of attributing grief to nature is achieved in Walt Whitman's "When Lilacs Last in the Dooryard Bloom'd" (1865–66).

In modern poetry the elegy remains a frequent and important poetic statement. Its range and variation can be seen in such poems as A.E. Housman's "To an Athlete Dying Young," W.H. Auden's "In Memory of W.B. Yeats," e.e. cummings' "my father moved through dooms of love," and John Peale Bishop's "Hours" (on F. Scott Fitzgerald).

Elektrostal, formerly (until 1938) ZATISHYE, city, Moscow *oblast* (province), Russian Soviet Federated Socialist Republic, 36 miles (58 km) east of Moscow city. The name, meaning "electric steel," derives from the high-quality-steel industry established there soon after the October Revolution in 1917. During World War II, parts of the heavy-machine-building industry were brought from the Ukraine, and Elektrostal is now a centre for the production of metallurgical equipment. Pop. (1987 est.) 150,000.

element, chemical: *see* chemical element.

element 106, an artificially produced radioactive element in Group VIb of the periodic table. In June 1974, Georgy N. Flerov of the Joint Institute for Nuclear Research at Dubna, Russian S.F.S.R., announced that his team of investigators had synthesized and identified element 106. In September of the same year, a group of American researchers headed by Albert Ghiorso at the Lawrence Radiation Laboratory (now Lawrence Berkeley Laboratory) of the University of California at Berkeley reported their synthesis of the identical element. Disagreement arose between the two groups over the results of their experiments, both having used different procedures to achieve the synthesis. The Soviet scientists had bombarded lead-207 and lead-208 with ions of chromium-54 to produce an isotope of element 106 having a mass number of 259 and decaying with a half-life of approximately 0.007 second. The American researchers, on the other hand, had bombarded a heavy radioactive target of californium-249 with projectile beams of oxygen-18 ions, which resulted in the creation of a different isotope of element 106—one with a mass number of 263 and a half-life of 0.9 second.

The results of both experiments have not yet been confirmed at other laboratories and no name has been proposed for the element. Based on its position in the periodic table, the element is thought to have chemical properties akin to those of tungsten.

element 107, a synthetic element in Group VIIb of the periodic table. It is thought to be chemically similar to the rare metal rhenium.

In 1976 Soviet scientists at the Joint Institute for Nuclear Research in Dubna announced that they had synthesized element 107 by bombarding a target of bismuth-209 with ions of chromium-54. The resultant collisions were reported to have produced an isotope of the element with a mass number of 261 and a half-life of one to two milliseconds. The existence of the element was confirmed by German physicists at the Institute for Heavy Ion Research (Gesellschaft für Schwerionenforschung [GSI]) in Darmstadt.

element 108, an artificially produced element belonging to the transuranium group. It was synthesized and identified in 1984 by German researchers at the Institute for Heavy Ion Research (Gesellschaft für Schwerionenforschung [GSI]) in Darmstadt, Ger. On the basis of its position in the periodic table of the elements, it is expected to have chemical properties similar to those of osmium.

The GSI research team, led by Peter Armbruster, produced an isotope of element 108 in a fusion reaction by irradiating lead-208 with ions of iron-58. The isotope, which has a mass number of 265, is exceedingly unstable and has a half-life of only two milliseconds. Experiments conducted by A.G. Demin and other Soviet researchers at the Joint Institute for Nuclear Research in Dubna have suggested the existence of two more isotopes of element 108 with mass numbers of 263 and 264.

element 109, the heaviest transuranium element for which a discovery claim has been made. It is predicted to have chemical properties resembling those of iridium.

In 1982 German physicists at the Institute for Heavy Ion Research (Gesellschaft für Schwerionenforschung [GSI]) in Darmstadt synthesized an isotope of element 109 with a mass number of 266. Using a high-energy linear accelerator, the GSI investigators, under the direction of Peter Armbruster, bombarded bismuth-209 targets with beams of iron-58 ions for roughly 10 days. The resultant fusion reaction between the bismuth and iron atoms yielded only a single nucleus of the new element; however, the sensitivity of the detection technique employed left little doubt as to the validity of the identification. Element 109 has an estimated half-life between 2 and 20 milliseconds.

elementary education, also called PRIMARY EDUCATION, the first stage traditionally found in formal education, beginning at about age 5 to 7 and ending at about age 11 to 13. In the United Kingdom and some other countries, the term primary is used instead of elementary. In the United States the term primary customarily refers to only the first three years of elementary education, *i.e.,* grades 1 to 3. Elementary education is often preceded by some form of preschool for children age 3 to 5 or 6 and is often followed by secondary education (*q.v.*).

Despite the many cultural and political differences among nations, the objectives and curriculum at least of elementary education tend to be similar. Nearly all nations are officially committed to mass education, which is viewed as eventually including a full elementary education for all. An increasing agreement may therefore be found among nations to the effect that preparation for citizenship is one of the major objectives of elementary education. In terms of curriculum, this objective suggests an emphasis on language competence, arithmetic skills, and basic social studies and science.

In the French system, which aims at the cultivation of reason and the intellect, children age 6 to 11 attend the *école primaire élémentaire.* The United States, which has a decentralized system of education, generally has nursery schools and kindergartens integrated with the elementary schools. The elementary-secondary sequence overall is 12 years long (not counting a one- or two-year kindergarten), but the subdivision of these years varies, including eight-four or six-six (elementary school and high school), six-three-three (elementary school, junior high school, and senior high school), and four-four-four (primary school, middle school, and high school), and some modifications of these patterns.

In India each state has a director of public education who, among his other tasks, is responsible for the inculcation of basic education through productive activity and local crafts to all children between the ages of 6 and 14. In the Indian curricular system, the student may begin an eight-year elementary school at the age of 6 and may possibly move on to a three-year secondary school and a three-year college, which constitute the higher scholastic organization. Other variations of the elementary school offer four- and six-year programs that are followed by a three-year junior secondary or middle school and a three-year secondary school.

In Canada the elementary school, depending upon the province, may be 8, 7, or 6 years in length. In Australia compulsory attendance begins at the age of 6 and extends to 15 in 5 states and to 16 in Tasmania. As a general rule, elementary and secondary education last six years each. Compulsory education in England begins at age 5 and continues to age 15. Formal school attendance begins with age 5, when the child enters the two-year infant school or department. Between the ages of 7 and 9, the student attends the junior school. The contemporary Japanese school system consists of a three-year kindergarten, a six-year elementary school, a three-year lower secondary school, and a three-year upper secondary school.

Elementary schools in most nations introduce the child first to the local environment and then systematically bring him into contact with larger environments. The way in which this is done, the relative emphasis on factual knowledge, the relative attention to the concept of culture, and the degree of pupil involvement in the design of the learning experiences may vary greatly from nation to nation or even between educational systems. Nevertheless, the principle that a child's learning should move from the immediate and familiar to the distant and unfamiliar appears to be widely accepted.

Great variation therefore exists within nations and internationally regarding such characteristics as the degree of stress placed on textbook learning, the degree of religious and ideological training, and the relationship between teachers and students. It should be noted that in some nations, such as Spain, Ireland, and some Muslim countries, religious and denominational influences control the school systems. In other countries (*e.g.,* the United States), ecclesiastical and other religious bodies maintain elementary, secondary, and higher schools separate from the public-school systems.

Viewed globally, several factors continue to be potent determinants of educational change. One factor is represented by the expansion of enrollments resulting from population growth and increased public desire for the fruits of schooling. A second factor is the social pressure for equalizing educational opportunity between social classes, ethnic and racial groups, rural and urban populations, and the sexes. Planning through the use of new managerial techniques, systems analyses, and operations research constitutes a third factor.

For international statistical data on elementary-school systems, *see* BRITANNICA WORLD DATA ANNUAL.

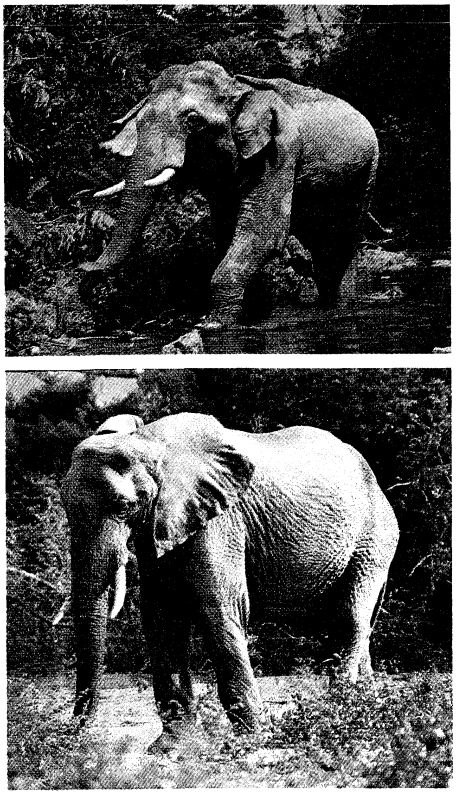
elementary family (kinship): *see* nuclear family.

elementary particle: *see* subatomic particle.

eleolite (mineral): *see* nepheline.

elephant, either of two species, *Elephas maximus,* the Indian elephant, and *Loxodonta africana,* the African elephant, of the family Elephantidae (order Proboscidea), character-

ized by their large size, long trunk (elongated nose), columnar legs, large ears (especially *L. africana*), and huge head. *See also* proboscidean.



(Top) Indian elephant (*Elephas maximus*), (bottom) African elephant (*Loxodonta africana*)

(Top) E.S. Ross, (bottom) Anthony Mercieca from Root Resources—EB Inc.

Elephants are grayish to brown, and their body hair is sparse and coarse. Both species have tusks and evergrowing upper incisors, but these are usually absent in the female Indian elephant (*E. maximus*). The nostrils are at the end of the dexterous muscular trunk, the tip of which has a small fingerlike projection that enables elephants to pick up small objects. Elephants drink by sucking water up into the trunk and then squirting it into the mouth. They eat by detaching grasses, leaves, and fruit with the tip of the trunk and using it to place this vegetation in the mouth.

The African elephant is the largest living land animal, weighing up to 7,500 kg (8.25 tons) and standing 3 to 4 m (10 to 13 feet) at the shoulder. The Indian elephant weighs about 5,500 kg (6 tons) with a shoulder height of 3 m (10 feet); its ears are considerably smaller than those of the African elephant. The molar teeth of elephants do not erupt all at once; rather, a new one grows forward as the existing tooth wears down. The sixth and final molar is worn down at about 60 years (*L. africana*), so few elephants live beyond this age.

E. maximus is native to the Indian subcontinent and southeastern Asia; *L. africana* is found in sub-Saharan Africa. So-called pygmy elephants, once considered a separate species, are now known to be young *L. africana*. Both species live in habitats ranging from thick jungle to savanna. They live in small family groups led by old cows; where food is plentiful the groups join in larger herds. Most bulls live in bachelor herds apart from the cows. Elephants migrate seasonally, according to the availability of food and water. They spend many hours eating and may consume more than 225 kg (500 pounds) of grasses and other vegetation in a day. Gestation averages 610 days for the Indian elephant and about two months longer for the African elephant. The former reaches breeding age between 8 and 12 years of age and the latter at about 14.

For many centuries the Indian elephant has been important as a ceremonial and draft animal. Commanded by its handler (or mahout), the elephant has been basic to Southeast Asian logging operations. African elephants are also used as draft animals, but not as extensively. Because an elephant must be at least 20 years old to do complex tasks, the species has never been truly domesticated; rather, young adults are captured wild and trained with the help of tame individuals. This practice puts an additional drain on the dwindling populations.

Elephants are in great danger from habitat destruction and human exploitation. The Indian elephant is considered an endangered species, and the African elephant is becoming vulnerable as its numbers decline. African elephants suffer particularly from poaching for the ivory trade. Overpopulation often occurs in wildlife reserves, resulting in further habitat loss. Conservation measures include protection from poaching and the creation of large reserves, including corridor areas to protect major migratory routes.

Elephant Man, byname of JOSEPH CAREY MERRICK (b. Aug. 5, 1862, Leicester, Leicestershire, Eng.—d. April 11, 1890, London), disfigured person who, after a brief career as a professional "freak," became the best-known resident patient of London Hospital from 1886 until his death. He is sometimes erroneously referred to as John Merrick.

Merrick's mother was slightly crippled, but otherwise his parents and brother seemed normal. He was apparently normal until about the age of five, when he began showing signs of a strange disorder that caused overgrowths over much of the skin and bone surfaces. His head became enormous (3 feet in circumference), with large bags of brownish spongy skin hanging from the back of his head and across his face; deformation of the jaws rendered him incapable of showing facial expression or speaking in more than a splutter difficult to understand. Although his left arm was normal, the right arm was discoloured and grotesque, ending in a 12-inch wrist and a finlike hand. The legs imitated the deformed arm, and a defective hip caused such lameness that he could walk only with the aid of a stick.

Merrick was confined to a workhouse at age 17, then escaped four years later to join a freak show (1883). While on exhibition, he was discovered by a London physician, Frederick Treves (1853–1923), and admitted to London Hospital (1886). He remained there until, at age 27, he died in his sleep of accidental suffocation.

The disorder from which Merrick suffered was long thought to be an extremely severe case of neurofibromatosis, but in the late 20th century researchers concluded that probably Merrick's remarkable deformities had been the result of an extremely rare disease known as the Proteus syndrome.

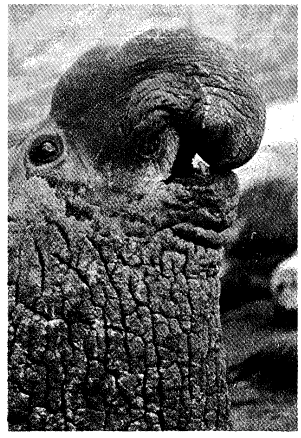
A touching and successful play about Merrick, *The Elephant Man,* by Bernard Pomerance, appeared in 1979; an unrelated motion picture based on Merrick's life was released in 1980.

Elephant Mountains (India): *see* Anaimalai Hills.

Elephant Mountains (Kampuchea): *see* Dâmrei Mountains.

elephant seal, also called SEA ELEPHANT, either of the two largest pinnipeds (aquatic mammals of the suborder Pinnipedia): the northern elephant seal (*Mirounga angustirostris*), now found mainly on coastal islands off California and Baja California; or the southern elephant seal (*M. leonina*), found throughout sub-Antarctic regions. Elephant seals are gregarious animals named for their size and for the male's inflatable, trunklike snout. They are in the family Phocidae.

The northern elephant seal is yellowish or gray-brown, and the southern is blue-gray.



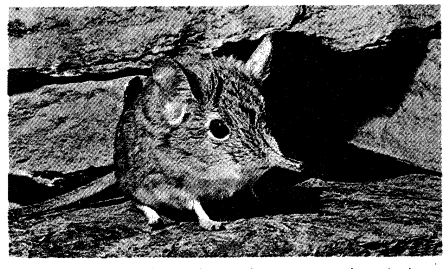
Elephant seal bull (*Mirounga*)

Anthony Mercieca—Root Resources

Males of both species attain a length of approximately 6.5 m (21 feet) and a weight of about 3,530 kg (7,770 pounds); females grow to 3.5 m (11.5 feet) and weigh 900 kg (2,000 pounds). Elephant seals feed on fish and on squid or other cephalopods. The northern species is nonmigratory; the southern elephant seal, like the northern form, breeds and molts on land, but it winters at sea, possibly near the pack ice. During the breeding season, elephant seals become aggressive toward each other. The bulls fight to establish territories along beaches and to acquire harems of from 13 to 30 cows. The cows produce single brownish black pups yearly. A few months after breeding has taken place, the seals molt, shedding large patches of coarse-haired skin. Both species have been hunted for their oil. The northern elephant seal was reduced almost to extinction; under protection, however, it has gradually increased in number.

elephant shrew, also called JUMPING SHREW, any of the 28 species of African mammals composing the family Macroscelididae of the order Insectivora (but sometimes separated as an order, Macroscelidea). Some authors unite them with tree shrews in an order Menotyphla. Elephant shrews are named for their elongated, flexible snouts. Their long hind legs, large ears and eyes, and long, thin tails give them the look of jerboas or kangaroo rats. They are 17 to 57 cm (7 to 22 inches) long, tail included. Their soft fur is yellowish to blackish, and most species have a pale eye-ring.

These active, swift animals occur mainly in dry, stony regions, where they hunt for insects. They bear one or two rather large young,



Forest elephant shrew (*Petrodromus tetradactylus*)

Russ Kinne—Photo Researchers/EB Inc.

which at birth are hairy and may be open-eyed.

The common, or black-eared, elephant shrew (*Macroscelides proboscideus*) is very

long-snouted. Widespread genera are *Elephantulus,* the 12 rock, or long-eared, elephant shrews, and *Petrodromus,* the 10 forest elephant shrews. The checkered-backed elephant shrew (*Rhynchocyon cirnei*) is the largest species, with a total length of 43 to 58 cm (17 to 23 inches).

Elephanta Island, island located in Bombay Harbour of the Arabian Sea, about 5 miles (8 km) east of Bombay city and island, and 2 miles (3 km) west of the mainland coast of Mahārāshtra state, western India. Elephanta Island has an area of 4–6 square miles (10–16 square km), varying with the tide. Its Hindi name, Ghārāpuri, derives from a small village in the south of the island. The Portuguese name refers to a large stone elephant that was later removed from the island and placed in Victoria Gardens (now called Jijāmāta Udyan), Bombay. Elephanta is famous for its 8th- and 9th-century cave temples. When it was ceded to the Portuguese by the kings of Ahmadābād, however, it ceased to be a place of worship, and the caves and sculptures were damaged by Portuguese soldiers. In the 1970s they were restored and preserved, and the island became a popular tourist resort. The most-celebrated of the sculptures is the Trimurtī, a three-headed bust, 20 feet (6 m) high, of the gods Śiva ("Destroyer"), Vishnu ("Preserver"), and Brahmā ("Creator").

The Trimurtī, a three-headed bust of the gods Śiva, Vishnu, and Brahmā, in one of the caves on Elephanta Island

Harrison Forman

elephantiasis, condition associated with the infectious diseases known collectively as filariasis (*q.v.*).

Elephantine, Arabic JAZĪRAT ASWĀN, island in the Nile opposite Aswān city in Aswān *muḥāfaẓah* (governorate), Upper Egypt. Elephantine is the Greek name for pharaonic Abu. There the 18th- and 19th-dynasty pharaohs built a large temple to Khnum, the ram god of the cataract region, to his consort, Sati, and to Anuket, goddess of nearby Sehel. To the north stands the Old and Middle Kingdom shrine. Numerous outstanding rock tombs of the Old and Middle Kingdom nobles of the city are situated high in the cliff on the west bank of the Nile. In the Old Kingdom (*c.* 2575–*c.* 2130 BC) Elephantine was known as the "door of the south," since it was the most southerly city in Egypt and the starting point for Sudanese trade. In the Middle Kingdom (1938–*c.* 1600? BC) it was an administrative centre for Egyptian-controlled Nubia. During the New Kingdom (1539–1075 BC), the region was part of the province of Nubia, but, from the Saite period (664–525 BC), it again became a frontier fortress. In modern times the island is the site of two Nubian villages.

elephant's-foot, also called HOTTENTOT-BREAD (*Dioscorea,* or *Testudinaria, elephantipes*), an odd-looking twining plant of the yam family (Dioscoreaceae), characterized by a large, woody, and partially exposed tuber. It is native to semiarid areas in southern Africa. The tubercle-covered tuber, resembling an elephant's foot or a tortoise shell, once served as a food for local peoples during famine (hence the name "Hottentot-bread"). The tuber can reach up to 1 m (3 feet) in diameter, and specimens weighing several hundred pounds have been reported. From such a root stock each year emerge thin climbing stems with small leaves. The plant is grown in desert gardens and conservatories as a curiosity.

elephant's tooth, also called ELEPHANT'S TUSK (marine mollusk): *see* tusk shell.

elephantsnout fish, any of certain mormyrid (*q.v.*) species.

Elets (Russian S.F.S.R.): *see* Yelets.

Eleusinia, ancient Greek festival in honour of Demeter (the goddess of agriculture), unconnected with the Eleusinian Mysteries despite the similarity of names. The Eleusinia, which included games and contests, was held every two years, probably in the month of Metageitnion (August–September). Every second festival had a particularly elaborate observance and was known as the Great Eleusinia. Its purpose was thanksgiving and sacrifice to Demeter for the gift of grain.

Eleusinian Mysteries, most famous of the secret religious rites of ancient Greece. According to the myth told in the Homeric *Hymn to Demeter,* the earth goddess Demeter (*q.v.*) went to Eleusis in search of her daughter Kore (Persephone), who had been abducted by Hades (Pluto), god of the underworld. Befriended by the royal family of Eleusis, she agreed to rear the queen's son. She was, however, prevented by the queen's fear from making the boy immortal and eternally young. After this occasion, she revealed her identity to the royal family and commanded that a temple be built for her into which she retired.

According to the *Hymn to Demeter,* the Mysteries at Eleusis originated in the two-fold story of Demeter's life—her separation from and reunion with her daughter and her failure to make the queen's son immortal. After Eleusis was incorporated, the city of Athens took responsibility for the festival, but the festival never lost its local associations.

The Mysteries began with the march of the *mystai* (initiates) in solemn procession from Athens to Eleusis. The rites that they then performed in the Telesterion, or Hall of Initiation, were and remain a secret. Something was recited, something was revealed, and acts were performed, but there is no sure evidence of what the rites actually were, though some garbled information was given by later, Christian writers who tried to condemn the Mysteries as pagan abominations. It is clear, however, that neophytes were initiated in stages and that the annual process began with purification rites at what were called the Lesser Mysteries held at Agrai (Agrae) on the stream of Ilissos, outside of Athens, in the month of Anthesterion (February–March). The Greater Mysteries at Eleusis was celebrated annually in the month of Boedromion (September–October). It included a ritual bath in the sea, three days of fasting, and completion of the still-mysterious central rite. These acts completed the initiation, and the initiate was promised benefits of some kind in the afterlife.

Eleusis, ancient Greek city famous as the site of the Eleusinian Mysteries. Situated in the fertile plain of Thria about 14 miles (23 km) west of Athens, opposite the island of Salamis, Eleusis was independent until the 7th century BC, when Athens annexed the city and made the Eleusinian Mysteries a major Athenian religious festival. After the Peloponnesian War, when the Thirty Tyrants were expelled from Athens and briefly occupied Eleusis, the city was again independent (403), but Athenian hegemony was restored within two years. The Gothic leader Alaric destroyed Eleusis in AD 395, and the site remained deserted until the 18th century, when it was revived as the modern town of Eleusis (Greek Lepsina), now an industrial suburb of Athens.

The Greek Archaeological Society, excavating the site after 1882, laid bare the whole of the sacred precinct, which included the Great Propylaea, a 2nd-century-AD copy of the central building of the Propylaea on the Acropolis of Athens. It also traced its extensions at various periods and revealed successive stages in the structure of the Telesterion, or Hall of Initiation, first built in late Mycenaean times, before 1000 BC.

Eleutherius, SAINT (b. Nicopolis, Epirus, Roman Empire [now in Greece]—d. May 24, 189, Rome; feast day May 26), pope from about 175 to 189. During his pontificate the church was involved in a controversy over Montanism, a movement that arose in Asia Minor among Christians who believed that new spiritual revelations could be achieved through the ecstatic trances of their prophets.

The early Christian writer St. Hegesippus says that Eleutherius was deacon of the Roman church under Pope St. Anicetus (*c.* 155–*c.* 166). He was pope in the reign of Commodus (Roman emperor 180–192 and coruler with his father, Marcus Aurelius, 176–180), who was relatively tolerant of the Christians. Eleutherius had been devoting close attention to the Montanist controversy when, in 177, Christians in the Lyon area wrote him expressing their opinion of the teachings of the prophet Montanus. Although the letter has been lost, it is believed to have asked Eleutherius to show mercy but not to compromise with followers of the movement. The churches of Lyon and Vienne, Fr., sent the letter by Bishop St. Irenaeus of Lyon, who was delegated to advise Eleutherius.

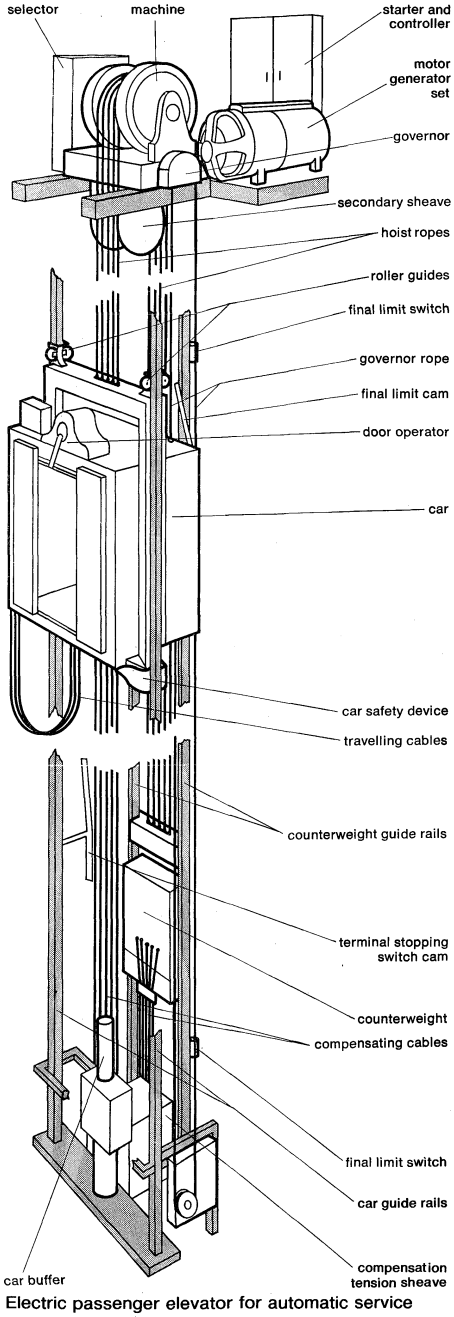
The opposition of Eleutherius to the Montanist movement has been noted, but the nature of his mediation in the dispute is not known. Modern historians agree in rejecting the legend that a king of Britain named Lucius wrote Eleutherius asking the pope to send missionaries.

elevated transit line, railroad line, usually electric, raised above the ground or street level, usually on a trestle, for local transit in urban areas. By the mid-19th century it was evident that surface vehicles were inadequate for carrying the traffic of large cities. The first elevated was successfully operated in New York City in 1871, using steam power. Because steam power had many disadvantages, the lines were later electrified. In 1895 Chicago acquired the first electric line. An extensive network of elevated lines built in New York City was in service for many years but was systematically eliminated because of aesthetic shortcomings and because it contributed to traffic congestion. Chicago developed an extensive elevated system. Many cities in Europe—Berlin, Stockholm, Madrid, and others—have had one or more elevated lines.

elevator, also called LIFT, car that moves in a vertical shaft to carry passengers or freight between the levels of a multistory building.

Most modern elevators are propelled by electric motors, with the aid of a counterweight, through a system of cables and sheaves (pulleys). By opening the way to higher buildings, the elevator played a decisive role in creating the characteristic urban geography of many modern cities, especially in the United States, and promises to fill an indispensable role in future city development.

The practice of lifting loads by mechanical means during building operations goes back at least to Roman times; the Roman architect-engineer Vitruvius in the 1st century BC described lifting platforms that used pulleys and capstans, or windlasses, operated by human, animal, or water power. Steam power was applied to such devices in England by 1800. In the early 19th century a hydraulic lift was introduced, in which the platform was attached to a plunger in a cylinder sunk in the ground below the shaft to a depth equal to the shaft's height. Pressure was applied to the fluid in the cylinder by a steam pump. Later a combination of sheaves was used to multiply the car's motion and reduce the depth of the plunger. All these devices employed counterweights to balance the weight of the car, requiring only enough power to raise the load.



Electric passenger elevator for automatic service

By courtesy of Otis Elevator Co.

Prior to the mid-1850s, these principles were primarily applied to freight hoists. The poor reliability of the ropes (generally hemp) used at that time made such lifting platforms unsatisfactory for passenger use. When an American, Elisha Graves Otis, introduced a safety device in 1853, he made the passenger elevator possible. Otis' device, demonstrated at the Crystal Palace Exposition in New York, incorporated a clamping arrangement that gripped the guide rails on which the car moved when tension was released from the hoist rope. The first passenger elevator was put into service in the Haughwout Department Store in New York City in 1857; driven by steam power, it climbed five stories in less than a minute and was a pronounced success.

Improved versions of the steam-driven elevator appeared in the next three decades, but no significant advance took place until the introduction of the electric motor for elevator operation in the mid-1880s and the first commercial installation of an electric passenger elevator in 1889. This installation, in the Demarest Building in New York City, utilized an electric motor to drive a winding drum in the building's basement. The introduction of electricity led to two further advances: in 1894 push-button controls were introduced, and in 1895 a hoisting apparatus was demonstrated in England that applied the power to the sheave (pulley) at the top of the shaft; the weights of the car and counterweight sufficed to guarantee traction. By removing the limitations imposed by the winding drum, the traction-drive mechanism made possible taller shafts and greater speeds. In 1904 a "gearless" feature was added by attaching the drive sheave directly to the armature of the electric motor, making speed virtually unlimited.

With the safety, speed, and height problems overcome, attention was turned to convenience and economy. In 1915 so-called automatic levelling was introduced in the form of automatic controls at each floor that took over when the operator shut off his manual control within a certain distance from the floor level and guided the car to a precisely positioned stop. Power control of doors was added. With increased building heights, elevator speeds increased to 1,200 feet (365 metres) per minute in such express installations as those for the upper levels of the Empire State Building (1931) and reached 1,800 feet (549 metres) per minute in the John Hancock Center, Chicago, in 1970.

Automatic operation, widely popular in hospitals and apartment buildings because of its economy, was improved by the introduction of collective operation, by which an elevator or group of elevators answered calls in sequence from top to bottom or vice versa. The basic safety feature of all elevator installations was the hoistway door interlock that required the outer (shaft) door to be closed and locked before the car could move. By 1950 automatic group-supervisory systems were in service, eliminating the need for elevator operators and starters.

An early attempt to minimize the sacrifice of floor space in elevator installations in tall buildings was the basis of the idea of the double-deck elevator, first tried in 1932. Each elevator consisted of two cars, one mounted above the other and operating as a unit, serving two floors at each stop. The technique is being increasingly adopted. Automatic double-deck elevators in the Time-Life Building, Chicago, were operating in 1971, and installations in the John Hancock Tower, Boston; the Standard Oil Company (Indiana) building, Chicago; and the Canadian Imperial Bank of Commerce, Toronto, were under construction in 1971.

Modern elevators are made in a variety of types for many purposes; in addition to ordinary freight and passenger operations they are used in ships, dams, and such specialized structures as rocket launchers. Heavy-lift, rapid-descent elevators are employed in high-rise construction operations. Practically all are electrically propelled, either by cables, sheave and counterweight, by a winding-drum mechanism (still used in many low-rise freight elevators), or by an electro-hydraulic combination. Multiple cables (three or more) increase both the traction surface with the sheave and the safety factor; cable failure is rare.

The drive motor usually operates on alternating current for slower speeds and direct current for higher speeds. With the direct-current motor, the speed is changed by varying the field strength of a direct-current generator, and by adjusting the direct connection of the armature of the generator with the armature of the drive motor. For high-speed elevators, a gearless arrangement is used, usually with the cables wrapped twice around the sheave. The traction elevator may have an unlimited rise, however, rises exceeding 100 feet require compensating ropes—*i.e.,* ropes from the bottom of the car to the bottom of the counterweight; as the car rises, the compensating rope weight is transferred to the car, and as it descends, more is transferred to the counterweight, keeping the load on the drive machine nearly constant (see illustration).

Hydraulic cylinders and plungers are used for low-rise passenger elevators and for heavy duty freight elevators. The plunger pushes the platform from below by the action of pressurized oil in the cylinder. A high-speed electric pump develops the pressure needed to raise the elevator; the car is lowered by the action of electrically operated valves which release the oil into a storage tank. Specialized types of hydraulic cylinder and plunger arrangements, including horizontally placed elements, are used for unusual applications. For instance, the roped, or "geared," type of hydraulic elevator common around 1900, with plunger and cylinder fitted with sheaves at each end, is employed on aircraft-carrier elevators to lift heavy loads short distances. As pressure is applied to the plunger, the distance between the sheaves increases, and the ropes wrapped around the sheaves pull up the elevator.

Elevators lifted by hoisting ropes are required to have platform "safeties," devices designed to clamp onto the steel guide rails upon activation, quickly braking the elevator to a halt. The safety, usually mounted below the car platform, is actuated by a speed governor through a rope. The rope pulls the safety to the on position in the event of excessive downward motion of the car. The device first cuts off elevator power; if excessive speed continues, it applies the safety brake.

Most modern elevators are automatic, using various control systems to operate elevators individually or in groups. The earliest automatic control system, single-automatic-push-button, gives a rider exclusive use of the car for a trip. It is used in small apartment buildings and for freight elevators.

Collective operation is popular for use with a single elevator in a building. The car answers all calls in one direction in sequence and then reverses and answers all calls in the opposite direction. It is used in larger apartments, hospitals, and small office buildings. A variation, called two-car or duplex collective, permits two cars to operate together and share calls between them.

Group-automatic operation controls two or more cars as a group, keeping them timed to operate within a specified operating interval. Group-automatic operation is used if traffic is heavy and two or more elevators are operating as in hospitals, department stores, and offices.

Separate outer doors and car doors are essential parts of modern elevator systems. The two usually employ the same type of operation—*e.g.*, centre-opening, two-leaf, single-slide. Doors are opened and closed by an electric motor on the car. Door speed in closing is regulated to avoid injury to persons caught in the closure. A sensor electrically reverses the door if it strikes an object in closing. Photoelectric controls and electronic proximity devices are also employed to control door reversal. Hoistway doors are designed so that they are always closed before the elevator can operate.

For freight elevators, vertically sliding, biparting doors are common. Such doors consist of an upper and lower leaf, mechanically linked so that the bottom half drops to floor level while the top half rises above the cab roof. A protective inner gate is often required.

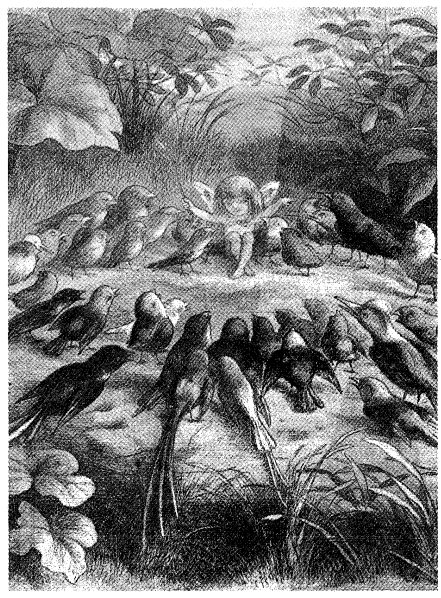
In isolated locations, especially in private residences, a telephone to an outside exchange is often required by law. In many buildings, elevators have intercommunication systems in case of mechanical failures. Alarm buttons, emergency lighting, and emergency power are often provided.

Automatic loading and unloading devices have been incorporated into modern freight elevators. A call button activates the automatic pickup; the elevator arrives, the load is pulled into the car, the car moves to the proper floor, and the load is discharged.

eleven-plus, in England, competitive examination given between primary and secondary school at about age 11. It evolved after 1944 as a means of determining in which of the three types of secondary school—grammar, technical, or modern—a child should continue his education. Originally the eleven-plus excluded unsuccessful contenders from grammar school, which would prepare them for university entrance. After the emergence in some areas of unselective comprehensive schools during the 1950s and 1960s, the importance of the eleven-plus in determining who could eventually enter universities declined. Provision was also made for pupils to transfer from secondary modern to grammar schools at the age of 13, if their progress merited such a change, or to take a further two-year course in preparation for the university matriculation examinations.

The eleven-plus has been sharply criticized for determining at age 11 a child's scholastic future, a decisive factor in his vocational prospects. It also has been charged with replacing the social barrier of fee paying with one that tends to create an educational elite. Others counter, however, that the practice of streaming in the comprehensive schools has a similar elitist tendency. The most damaging criticism of the eleven-plus emerged after surveys were conducted that demonstrated that it was inefficient and placed a large proportion of the school population in the wrong type of school.

elf, plural ELVES, in Germanic folklore, originally, a spirit of any kind, later specialized into a diminutive creature, usually in tiny human form. In the *Prose,* or *Younger, Edda,* elves were classified as light elves (who were fair) and dark elves (who were darker than pitch); these classifications are roughly equivalent to the Scottish seelie court and unseelie court. The notable characteristics of elves were mischief and volatility. They were believed at various times and in various regions to cause diseases in humans and cattle, to sit upon the breast of a sleeper and give him bad dreams (the German word for nightmare is *Alpdrücken,* or "elf-pressure"), and to steal human children and substitute changelings (deformed or weak elf or fairy children). In the British Isles, flint implements called elf-bolts, elf-arrows, or elf-shot (which are now known to be prehistoric tools used by the aboriginal Irish and the early Scots) were believed to be the weapons with which elves injured cattle. Elves occasionally also were benevolent and helpful. The second edition of *Encyclopædia Britannica,* which was published in 1777–84, calls the word elf obsolete but reports that belief in such creatures "still subsists in many parts of our own country. . . In the Highlands of Scotland, newborn children are watched till the christening is over, lest they should be stolen or changed by some of these phantastical existences." In time, elves came to be indistinct from fairies, though both older classics—such as Johann Wolfgang von Goethe's poem "Der Erlkönig"



A musical elf teaching the birds to sing, colour print by Richard Doyle
The Mansell Collection

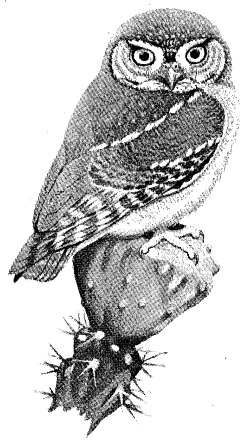
("The Elf King")—and such modern classics as J.R.R. Tolkien's *Lord of the Rings* (1954–55) still treat elves as a distinct type.

Elf Aquitaine, in full SOCIÉTÉ NATIONALE ELF AQUITAINE (French: "Elf Aquitaine National Society"), French corporate group formed on Sept. 1, 1976, in the reorganization and consolidation of petrochemical, mining, and several other industries. A 70-percent interest is owned by a French-government company, the Enterprise de Recherches et d'Activités Pétrolières (ERAP; "Enterprise for Petroleum Search and Activity"), known by its oil trademark Elf. Headquarters are in Paris.

Ever since enactment of its oil law of 1928, France had exercised a considerably greater degree of state supervision over its oil companies than have other countries in western Europe. Government agencies issued licenses and regulations for extraction and refining in France and Algeria and, later, in other countries, controlling not only small concerns but also such giants as the Société Nationale des Pétroles d'Aquitaine (SNPA), which was formed in 1941. On Jan. 1, 1966, two major government regulatory agencies were merged to form ERAP, which became a state holding company for all previously created French oil companies, including SNPA.

The Elf Aquitaine group engages not only in the development, marketing, and shipping of petrochemicals (those made from natural gas and crude oil) but also in the mining of such ores as nickel and coal in France, North America, Africa, and Australia. It also has diversified into such industrial activities as pharmaceuticals, cosmetics, health care, plastics, geothermal and solar energy, and data processing. The group obtained a major interest in the U.S. mining industry through a merger with Texasgulf Inc. in 1981.

elf owl (*Micrathene whitneyi*), tiny (sparrow-sized) bird of prey of the family Strigidae



Elf owl (*Micrathene whitneyi*)
Painting by Albert E. Gilbert

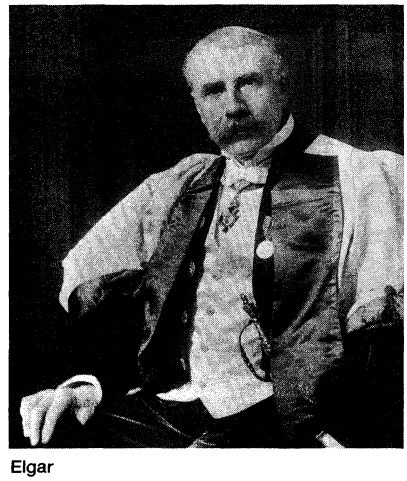
(order Strigiformes) of Mexico and the southwestern United States. It is the smallest owl. In the cactus deserts, elf owls are among the most common birds, but they also inhabit forested areas, dry grasslands, and wet savanna. They nest in holes in cacti or trees and hunt insects at night. Elf owls have round heads, which are large in proportion to the body, and big yellow eyes.

elfin-gold (plant): *see* luminous moss.

elfin woodland, a stunted forest at high elevations in warm, moist areas. It is characterized by low, gnarled trees heavily draped with air plants and by a forest floor cushioned by mosses and other primitive plants. Elfinwood, or Krummholz, is a similar stunted forest characteristic of most Alpine regions. *See also* cloud forest.

Elgar, Sir Edward (William) (b. June 2, 1857, Broadheath, Worcestershire, Eng.—d. Feb. 23, 1934, Worcester, Worcestershire), English composer whose works in the orchestral idiom of late 19th-century Romanticism—characterized by bold tunes, striking colour effects, and mastery of large forms—stimulated a renascence of English music.

The son of an organist and music dealer, Elgar left school at 15 and worked briefly in a lawyer's office. He was an excellent violinist, played the bassoon, and spent periods as a bandmaster and church organist. He had no formal training in composition. After working in London (1889–91), he went to Malvern, Worcestershire, and began to establish a rep-



Elgar
EB Inc.

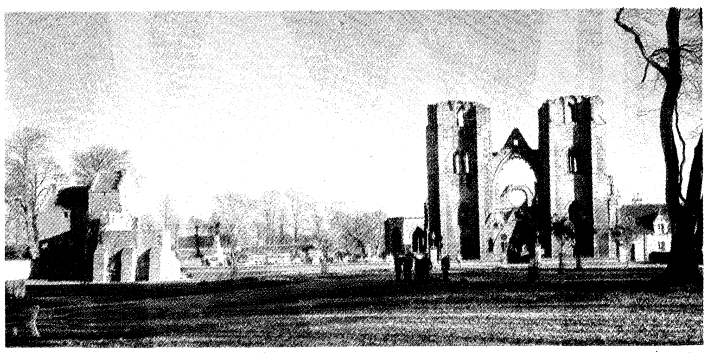
utation as a composer. He produced several large choral works, notably the oratorio *Lux Christi* (1896; *The Light of Life*), before composing in 1896 the popular *Enigma Variations* for orchestra. The variations are based on the countermelody to an unheard theme, which Elgar said was a well-known tune he would not identify—hence the enigma. Repeated attempts to discover it have been unsuccessful. All but the last of the 14 variations refer cryptically to friends of Elgar, the exception being his own musical self-portrait. This work, highly esteemed by Hans Richter, who conducted the first performance in 1899, brought Elgar recognition as a leading composer and became his most frequently performed composition. In 1900 there followed another major work, the oratorio *The Dream of Gerontius,* which many consider his masterpiece. Based on a poem by John Henry Cardinal Newman, it dispensed with the traditional admixture of recitatives, arias, and choruses, using instead a continuous musical texture as in the musical dramas of Wagner. The work was not well received at its first performance in Birmingham, but after it was acclaimed in Germany, it won British favour.

Elgar, a Roman Catholic, planned to continue with a trilogy of religious oratorios, but he completed only two: *The Apostles* (1903) and *The Kingdom* (1906). In these less successful works, representative themes are interwoven in the manner of the leitmotivs of Wagner. Other vocal works include the choral cantata, *Caractacus* (1898), and the song cycle for contralto, *Sea Pictures* (1900).

In 1904 Elgar was knighted, and from 1905 to 1908 he was the University of Birmingham's first professor of music. During World War I he wrote occasional patriotic pieces. After the death of his wife in 1920, he curtailed his music writing severely, and in 1929 he returned to Worcestershire. Friendship with Bernard Shaw eventually stimulated Elgar to further composition, and at his death he left unfinished a third symphony, a piano concerto, and an opera.

Elgar's principal works of a programmatic nature are the overture *Cockaigne,* or *In London Town* (1901), and the "symphonic study" *Falstaff* (1913). Of his five *Pomp and Circumstance* marches (1901–07; 1930), the first became particularly famous. Also highly esteemed are his two symphonies (1908 and 1911), the *Introduction and Allegro* for strings (1905), and his *Violin Concerto* (1910) and *Cello Concerto* (1919).

The first English composer of international stature since Henry Purcell (1659–95), Elgar liberated his country's music from its insularity. He left to younger composers the rich harmonic resources of late Romanticism and stimulated the subsequent national school of English music. His own idiom was cosmopolitan, yet his interest in the oratorio is grounded in the English musical tradition. Especially in England, Elgar is esteemed both for his own music and for his role in heralding the 20th-century English musical renascence.



Cathedral of Moray at Elgin, Moray
A.F. Kersting

Elgin, royal burgh (1234) and city, in Moray district, Grampian region, Scotland, situated in the fertile plain of Moray (of which it is the market town) on the River Lossie.

On a hill to the west stood the 12th-century castle that, in 1291, marked the northern limit of the English occupation of Scotland. The castle was destroyed after the Battle of Bannockburn (1314), which regained Scottish independence. The once-splendid cathedral of Moray, now a ruin, was founded in 1224. Twice destroyed by fire during the Middle Ages, it was rebuilt in the form of a Jerusalem cross and on a scale that made it one of the finest churches in Scotland.

The 18th century, which saw the final ruination of the cathedral, was also the great period of Scottish town architecture, and much of the High Street was lined with fine stone houses.

Elgin now serves as an educational and market centre for a wide area. Its industries include whisky distilling and wool milling.

The internationally famous Gordonstoun School, which lies 6 mi (10 km) to the north, was founded in 1934 by the German educator Kurt Hahn as a boys' school that would emphasize, in Spartan conditions, the development of character as well as academic training. Pop. (1981) 18,907.

Elgin, city, Cook and Kane counties, northeastern Illinois, U.S., on the Fox River. Founded in 1835, its name derived from the Scottish hymn "The Song of Elgin." It is located in the centre of a dairying region where Gail Borden developed condensed milk (patented 1856). Industrial growth began in 1837 with the building of a millrace and dam on the river. Diversified manufactures now include machine tools, hobby supplies, caskets, street sweepers, and electronic, rubber, and plastic products. The Elgin Watch Company, established in 1864, was an important economic asset until its transfer out of the state (1970). Elgin Academy was established in 1856, Judson College (Baptist) in 1963, and Elgin Community College in 1949. Inc. village, 1847; city, 1854. Pop. (1980) 63,798.

Elgin, EARLS OF, titled Scottish nobility in the family Bruce, grouped below chronologically and indicated by the symbol •.

• **Elgin, Thomas Bruce, 7th earl of,** 11TH EARL OF KINCARDINE (b. July 20, 1766—d. Nov. 14, 1841, Paris), British diplomatist and art collector, famous for his acquisition of the Greek sculptures now known as the "Elgin Marbles" (*q.v.*).

Third son of Charles Bruce, the 5th earl (1732–71), he succeeded his brother William Robert, the 6th earl, in 1771 at the age of five. Entering the army in 1785 and rising later to the rank of major general, Elgin began his diplomatic career in 1790. Envoy at Brussels in 1792 and at Berlin in 1795 during the first phase of the war against revolutionary France, he was appointed envoy extraordinary at Constantinople in 1799, retaining the post until 1803. Detained in France on his way home through the rupture of the Treaty of Amiens, Elgin did not reach England until 1806 and found his reputation under heavy attack. Though serving as a Scottish representative peer between 1790 and 1840, he took little further part in public life.

Keenly interested in classical art, Elgin secured permission from the Turks after his arrival in Constantinople to record and remove Greek antiquities, fearing their destruction in the ongoing conflict between the Greeks and the Turks. Between 1803 and 1812 his great collection of sculptures, taken chiefly from the Parthenon at Athens, then under Turkish domination, was brought to England, the first shipment being lost at sea. In the violent controversy generated by the removal, Elgin was denounced as a dishonest and rapacious vandal, notably by the poet Lord Byron, while the quality of his acquisitions, later regarded as exceptional, was questioned. In 1810 he published a *Memorandum* defending his actions and judgment. On the recommendation of a parliamentary committee, which also vindicated Elgin's conduct, the "Marbles" were bought by Great Britain in 1816 for £35,000, considerably below their cost to Elgin, and deposited in the British Museum, where they remain on view.

• **Elgin, James Bruce, 8th earl of,** 12TH EARL OF KINCARDINE (b. July 20, 1811, London—d. Nov. 20, 1863, Dharmsāla, India), British statesman and governor general of British North America in 1847–54 who effected responsible, or cabinet, government in Canada and whose conduct in office defined the role for his successors.

Bruce was elected to the British House of Commons for Southampton as a liberal Tory in 1841, but later that year he inherited his father's title (Scottish peerage) and left the Commons. In 1842 he was appointed governor of Jamaica. In 1846 he was named governor general of British North America and given the task of implementing the policy of responsible government recommended by his father-in-law, John George Lambton, 1st earl of Durham. He worked with the existing administration of the union of Canada East and Canada West until its defeat in the 1848 general election, when he supported the next administration's Rebellion Losses Act (1849), which compensated all Canadians for losses incurred during an 1837 rebellion in Lower Canada. His stand attracted strong Tory opposition; Elgin himself was stoned (though uninjured) by a mob, and Parliament buildings in Montreal were burned.

Elgin maintained good relations with the two subsequent administrations. In 1849 he was created Baron Elgin (United Kingdom peerage) and was made a privy councillor. He negotiated the Reciprocity Treaty (1854) between the Canadian colonies and the U.S. He also worked on the Canadian educational system and abolished seigneurial tenure. In 1857–59 and 1860–61 he served as special commissioner to China, and in 1858 he made an official visit to Japan. In England he served as postmaster general (1859–60) in Lord Palmerston's Cabinet, before undertaking his last post as viceroy of India in 1862.

• **Elgin, Victor Alexander Bruce, 9th earl of** (b. May 16, 1849, near Montreal—d. Jan. 18, 1917, Dunfermline, Fifeshire, Scot.), British viceroy of India from 1894 to 1899.

He was the son of the 8th earl and was educated at Eton and at Balliol College, Oxford. In politics a Liberal of right-wing tendencies, Elgin was first commissioner of works under William Gladstone in 1886. Emulating his fa-

ther, whom he succeeded in 1863, he became viceroy of India in 1894. His viceroyalty was a period of economic stringency and Indian unrest, further complicated by frontier wars. Upon relinquishing his appointment and returning to England in 1899, Elgin was made Knight of the Garter. During 1902–03 he acted as chairman of the royal commission that investigated the conduct of the South African War. From 1905 until 1908, when he retired from public life, Elgin served as secretary of state for the colonies in Sir Henry Campbell-Bannerman's administration.

Modest and retiring, disliking the requisite pomp, Elgin was not regarded as a successful or effective viceroy of India. His tenure of the colonial office saw the generous and much-praised settlement with the Boers in South Africa. This was, however, primarily the work of the prime minister, Sir Henry Campbell-Bannerman; and Elgin, by temperament a Whig, had little sympathy for his colleagues' more radical innovations in imperial government, being particularly opposed to proposals for Indian reform.

Elgin Marbles, collection of ancient Greek sculptures and architectural details in the British Museum, London. The objects were removed from the Parthenon at Athens and from other ancient buildings and shipped to England by arrangement of Thomas Bruce, 7th Lord Elgin, who was British ambassador to the Ottoman Empire (1799–1803). The removal created a storm of controversy in England that led to an investigation by Parliament.

Elgin, a lover of art and antiquities, was concerned about damage being done to important artworks in the temples of Greece, then under Ottoman sway. Fearing that they would eventually be destroyed because of Turkish indifference, he asked permission of the Sublime Porte to have artists measure, sketch, and copy important pieces of sculpture and architectural detail for posterity. At length the request was granted—along with the unsought authority "to take away any pieces of stone with old inscriptions or figures thereon."

Elgin then began selecting a vast store of the treasures for safekeeping in England. Among these were friezes, pediment sculptures, and fragmented statues from the cella (interior chamber) walls of the Parthenon; the northeast column, an anta capital, blocks of wall crown including architrave and cornice, and a caryatid from the Erechtheum (a temple of Athena); and various other antiquities from Athens, Attica, and other sites.

A series of shipments took the treasures to England in 1802–12 with but one mishap—the HMS *Mentor* sank in a storm off the Greek isle of Cythera in 1804, but the entire cargo was recovered. Elgin left the embassy in 1803 and arrived in England in 1806. Despite Elgin's wishes to the contrary, the collection remained private for the next 10 years.

An outcry arose over the affair, and Elgin was assailed for rapacity, vandalism, and dishonesty in hauling the Grecian treasures to London. Lord Byron directed an extravagant attack at him in the poem "The Curse of Minerva." Others suggested that the sculpture was mere junk, and in response Elgin opened it to public display. Critics at once conceded that it was indeed a treasure of the highest order. A select committee of Parliament was established to examine the sculpture and the possibility of acquiring it for the nation.

In 1810 Elgin published a defense of his actions that silenced most of his detractors. The final shipment of 80 cases of the Elgin Marbles reached London in 1812, and in 1816 the entire collection was acquired by the crown for the sum of £35,000. Elgin had spent somewhat more than twice that amount in unearthing, shipping, and salvaging it.

In 1983 the Greek government demanded the return of the marbles, but the British Museum—claiming among other reasons that it had saved the marbles from certain damage and deterioration—did not accede, and the issue remained controversial.

Elgon, Mount, extinct volcano on the Kenya–Uganda boundary. Its crater, about 5 mi (8 km) in diameter, contains several peaks, of which Wagagai (14,140 ft [4,310 m]) is the highest. Its extrusions cover about 1,250 sq mi (3,200 sq km) and consist largely of fragmental rocks and only a smattering of lavas. The mountain slope is gentle and the outline unimpressive. On the east and southeast at about 6,200 ft its relief merges with the Uasin Gishu Plateau, but in the west and northwest spectacular cliffs dominate the 3,600-ft plains of eastern Uganda. In the summit zone, moraines provide ample evidence of former glaciation. On the caldera's uneven floor there are considerable swamps, tapped by the Suam and Turkwell rivers. Other streams furrow the slopes. The moorland zone, containing tree heaths, giant groundsels, and lobelias, extends down to 10,000 ft, where it is succeeded by bamboo forest. Below 8,300 ft is a temperate deciduous forest.

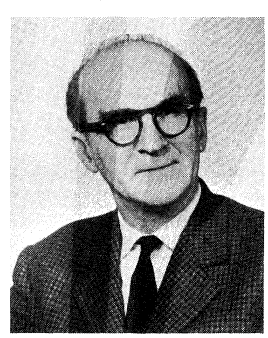
The Bantu-speaking Gisu, cultivators of coffee, bananas, millet, and corn (maize), occupy the western slopes. Elgonyi was the Masai name for the mountain. The Scottish explorer Joseph Thomson visited the southern side of Elgon in 1883; in 1890 Frederick (later Sir Frederick) Jackson and Ernest Gedge traversed the caldera from north to south.

Elhuyar (y de Suvisa), Fausto (d') (b. Oct. 11, 1755, Logroño, Spain—d. Feb. 6, 1833, Madrid), Spanish chemist and mineralogist who in partnership with his brother Juan José was the first to isolate tungsten, or wolfram (1783), though not the first to recognize its elemental nature.

After teaching at Vergara, in Spain (1781–85), Fausto accompanied his brother to several European colleges, including the Freiberg (Saxony) School of Mining and the University of Uppsala in Sweden. In 1788 he was appointed supervisor of the Mexican mining industry; his work was ended by the revolutionary movement early in the 19th century. On his return to Spain he was named director-general of mines and minister of state. He wrote several volumes on mineralogy and coining.

Eliade, Mircea (b. March 9, 1907, Bucharest—d. April 22, 1986, Chicago), historian of religions and man of letters, distinguished for his researches in the symbolic language used by various religious traditions and for his attempt to reduce their meaning to underlying primordial myths that provide the basis for mystical phenomena.

Eliade took an M.A. in philosophy from the University of Bucharest in 1928. He studied Sanskrit and Indian philosophy at the University of Calcutta (1928–31) and then lived for six months in the ashram (hermitage) of Rishikesh, Himalaya. Returning to Romania, he earned his Ph.D. in 1933 with the dissertation *Yoga: Essai sur les origines de la mystique indienne* ("Yoga: Essay on the Origins of Indian Mysticism") and was named assistant professor at Bucharest, where he taught the history of religions and Indian philosophy (1933–39). In 1945 he went to Paris as a visiting professor at the École des Hautes Études of the Sorbonne. In 1956 he became professor of the history of religions at the University of Chicago, where he remained. In 1961 he founded the international journal *History of Religions.*



Eliade
By courtesy of the University of Chicago

Fundamentally, Eliade considered religious experience in traditional and contemporary societies as credible phenomena that he termed hierophanies (*i.e.,* manifestations of the sacred in the world). His researches traced the forms that these hierophanies have taken throughout the world and through time. Eliade's essential interpretation of traditional religious cultures and his analysis of the forms of mystical experience characterize his major works: *Traité d'histoire des religions* (1949; *Patterns of Comparative Religion*); *Le Mythe de l'éternel retour* (1949; *The Myth of the Eternal Return*); and *Le Chamanisme et les techniques archaïques de l'extase* (1951; *Shamanism: Archaic Techniques of Ecstasy*). He also expressed his views in works of fiction, notably the novels *Forêt interdite* (1955; *The Forbidden Forest*) and *The Old Man and the Bureaucrats* (1979). Among his later works are two collections of essays, *The Quest: History and Meaning in Religion* (1969) and *Occultism, Witchcraft, and Cultural Fashion: Essays in Comparative Religion* (1976). He also wrote a three-volume work entitled *A History of Religious Ideas* (1978–85).

Elias, also spelled ELIA (Hebrew prophet): *see* Elijah.

Elias OF CORTONA (b. *c.* 1180, near Assisi, Duchy of Spoleto—d. April 22, 1253, Cortona, Duchy of Tuscany), disciple of St. Francis of Assisi and a leading figure in the early history of the Franciscan Order, which he twice governed.

In 1217 Elias headed the new Franciscan mission to the Holy Land as first minister provincial of Syria. He visited holy places in Palestine with Francis, returning with him to Italy in 1220. Vicar of the Franciscans from 1221, he governed the order from Francis' death (1226) until 1227, when John Parenti was elected in his stead. Later Elias was commissioned by Pope Gregory IX to build the Basilica of Assisi as a memorial to St. Francis.

Elected general of the order in 1232, Elias met with opposition from those who wanted strict observance of Francis' rule of poverty; they thought Elias too worldly and too dictatorial. He was deposed in 1239 and withdrew ultimately to Cortona with a few followers. Supporting the antipapal policy of Frederick II, Holy Roman emperor, he was excommunicated in 1240 by Gregory and again in 1244 by Pope Innocent IV when Frederick made him ambassador to Nicaea and Constantinople. In 1245 he built a church and cloister at Cortona in honour of St. Francis. He became reconciled with the church before his death.

Elías Piña, formerly LA ESTRELLETA, or SAN RAFAEL, province, western Dominican Republic, bounded on the west by Haiti. It was created as San Rafael in 1942 from the western part of Benefactor province under a plan to develop the frontier regions along the Haitian border; the name was changed to La Estrelleta in 1965 and to Elías Piña in the early 1970s. The territory of 690 sq mi (1,788 sq km) is an upland plain lying between the mountains of Cordillera Central to the north and the Sierra de Neiba on the south. Peanuts

(groundnuts), corn (maize), bananas, and coffee are the principal crops; livestock raising and lumbering are also important. The department is traversed by secondary highways; Comendador (*q.v.*) is the provincial capital. Pop. (1981) 65,384.

Elías Piña (city, Dominican Republic): *see* Comendador.

Élie de Beaumont, (Jean-Baptiste-Armand-Louis-Léonce): *see* Beaumont, (Jean-Baptiste-Armand-Louis-Léonce) Élie de.

Eliezer, Israel ben (Jewish mystic): *see* Ba'al Shem Ṭov.

Elihu, also spelled ELIU, in the Book of Job (chapters 32–37), was a comforter of Job, who is a biblical prototype of undeserved suffering. Because Elihu's speech differs in style from the rest of the work and because he is not mentioned elsewhere in it, as the other three comforters are, scholars consider his section to be a later addition.

Elihu's insights diverge from those of Zophar, Eliphaz, and Bildad, the three main comforters of Job, in that Elihu, for the most part, does not stress the old Hebrew idea that suffering is a punishment for sinful actions. Rather, he concentrates on Job's sinful reaction to his undeserved suffering. Job, he says, reacts by questioning the justice of God's ways and, indeed, takes a perverse pride in so doing. Instead, Job should recognize his suffering as a charitable discipline leading to reconciliation with God. In a statement that is unique for the comforters, Elihu also refers to a superhuman intermediary who will help restore Job to God. Elihu ends his arguments by stressing God's omnipotence and justice.

Elijah, also spelled ELIAS, or ELIA, Hebrew ELIYYAHU (fl. 9th century BC), Hebrew prophet, who ranks with Moses in saving the Yahweh religion from corruption by nature worship of Baal. Elijah proclaimed that there was no reality except the God of Israel, stressing monotheism to the people with possibly unprecedented emphasis. Elijah was also a pioneer in teaching God's transcendence and the idea of salvation being bestowed on a purified "remnant" of the people. His work underlined a faith linked with reason and morality rather than induced through sensual frenzy and ecstasy. He is commemorated by Christians on July 20 and is recognized as a prophet by Islām.

According to tradition, Elijah appeared in the reign of King Ahab, whose Phoenician wife, Jezebel, promoted Baal worship at Yahweh's expense; Elijah proclaimed a drought in punishment for the foreign cult. He later met 450 prophets of Baal in a contest on Mt. Carmel and vanquished them, simultaneously announcing the end of the drought. Though later disheartened in his struggle, Elijah's strength was renewed, and he upheld the moral law in denouncing Ahab's judicial murder of Naboth and confiscation of his vineyard. Elijah was finally taken to heaven in a whirlwind, thus showing Israel the possibility of a life beyond that on earth.

Elijah ben Solomon, in full ELIJAH BEN SOLOMON ZALMAN, also called by the acronym HA-GRA, from HA-GAON RABBI ELIYA-HU, also called ELIJAH GAON (b. April 23, 1720, Sielec, Lithuania—d. Oct. 9, 1797, Vilna, Russian Empire), the Gaon (Excellency) of Vilna, the outstanding authority in Jewish religious and cultural life in 18th-century Lithuania. Widely educated in philosophy, grammar, and folk medicine, as well as Jewish tradition, he vigorously opposed Ḥasidism, the pietistic mystic movement of his day, as superstitious and unscholarly and joined in a manifesto excommunicating its adherents. Although he wrote

Elijah ben Solomon, engraving

Picture from the photographic archive of the Jewish Theological Seminary of America, New York, Frank J. Darmstaedter

no works, more than 40 volumes were compiled from his students' notes and from his own marginal notes to texts.

Elijah was born into a long line of scholars. He became famous in early childhood for prodigious feats of rapid learning and an unusually retentive memory, intellectual gifts he retained to his last day. Married at approximately 18, he settled in Vilna (Vilnius, Wilno), leaving it only for the penitential *galut* ("exile") journey through Jewish communities in Poland, Lithuania, and Germany and returning in 1748. The rest of his life, Elijah was a central public figure in Vilna—the cultural centre of eastern European Jewry—leading the Jewish community through a combination of a life devoted to study, prayer, vision, and meditation and of teaching a chosen circle of devoted pupils. The Vilna community supported him with a stipend that came largely from funds bestowed by one of Elijah's ancestors for the support of scholars from his family. It added its own funds and also gave Elijah a rent-free apartment. Thus, the community gave him a monthly payment higher than the salary of the communal rabbi, though he had no explicit function; it did so because of his exemplary life and voluntary leadership.

Elijah's view of man and his struggle for self-realization throughout history was based on the assumption that for every individual there exists a peculiar path, "according to the specific roots of his soul and the particular nature of his body." In the first era of history, prophets revealed to each man his own path. In the following era, when prophecy had ended, one had to turn inward and discover one's way for oneself. Elijah held that, theoretically, this could be still done even in the present era of decline; but temptation and deception are ripe and active. Spiritual safety lies, therefore, in following the uniform Torah—the divine guidance or law.

Individual strength and guiding authority marked Elijah's spiritual life. He steadily and systematically restrained his extraordinarily quick perception and compelled himself to constant analysis and repetition, an intellectual self-discipline that he called "grinding." He rejected his own active dream life, which was full of scholarly insights and visions. Indeed, he resented the knowledge imparted to him in sleep, for he sought to worship through conscious intellectual labour; gifts from on high—even through the intermediary of heavenly angels and heralds—were seen as misleading. His many visions were even more suspect to him, for he feared evil forces that might have lurked within them.

Elijah's vast knowledge in all fields of traditional Jewish learning in Talmud and Midrash (the traditional interpretative and commentative literature) and in biblical exegesis, as well as in mystical literature and lore, was combined with a deep interest in and knowledge of philosophy, grammar, and folk medicine. He studied day and night not only as the best way to worship God but also as the true method of exercising proper leadership, which he believed should be the emanation of a scholar overflowing with learning. Elijah's metaphor for this is that of a large central vessel filling itself up to overflowing into smaller vessels—the pupils—who in their turn overflow into groups around them; thus does the central teacher influence the whole people.

Elijah put this theory in practice and drew a small circle of very able and influential pupils to him, most of whom were already rabbis or preachers. Outstanding among them were Ḥayyim ben Issac, rabbi of Volozhin, the founder of a new type of Lithuanian yeshiva (Talmudic academy) and Elijah's successor as leader of Lithuanian Jewry; and Jacob ben Wolf Kranz, an itinerant preacher of great renown, who created a new school and style of preaching.

Elijah usually avoided public activities and engaged actively in certain causes only as an extraordinary form of his unceasing leadership and teaching from his study. The most conspicuous and sustained of his public activities was his implacable fight against Ḥasidism, which lasted from 1772 until his last day. He feared and despised it as an "idolatrous," superstitious, vulgar, and antischolarly movement and participated in a manifesto excommunicating its adherents. Ḥasidic admiration for miracles and visions, adulation of their group leader (the *tzaddiq*), and striving for collective joy, with the aid of alcoholic liquor and dancing, were to him the propagation of all he rejected for himself. Moreover, Ḥasidic stress on prayer was to him an attack on the supremacy of Torah study, which he held sacred.

As a result of his concentrated devotion to incessant, wakeful learning and direct, oral teaching, as well as his concern with minute textual criticism and emendation and the urgent tempo of his intellectual work, all that is extant from him are notes of his teachings kept by his pupils and his own short manuscript notes written in the margins of basic texts. These have been combined and edited into more than 40 volumes now in print in all fields of his interest, yet some material still remains in manuscript. Lately, there has been ascribed to him a prophetic work, *Kol hator* ("Voice of the Turtledove") foretelling the success of Zionism, but it is, in its main elements, probably a modern forgery.

Elijah's main contribution to posterity was to provide an example of the intellectual love of God in the traditional mode when Jewish modernity was in its infancy. (H.H.B.-S)

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Elijah's cup, in Judaism, the fifth ceremonial cup of wine poured during the family Seder dinner on Passover (Pesaḥ). It is left untouched in honour of Elijah, who, according to tradition, will arrive one day as an unknown guest to herald the advent of the Mes-

Elijah's cup, Polish, 18th century

Picture from the photographic archives of the Jewish Theological Seminary of America, New York; Frank J. Darmstaedter

siah. During the Seder dinner, biblical verses are read while the door is briefly opened to welcome Elijah, who, it is further said, will resolve all controversial questions connected with the Law. In this way the Seder dinner not only commemorates the historical redemption from Egyptian bondage of the Jewish people but also calls to mind their future redemption when Elijah and the Messiah shall appear.

Elimelech OF LIZHENSK (b. 1717—d. 1787, Lizhensk, Galicia), Jewish teacher and author, one of the founders of Ḥasidism (a Jewish pietistic movement) in Galicia.

Elimelech was a disciple of Ṭov Baer, one of the early Ḥasidic leaders, and after Baer's death he settled in Lizhensk, which subsequently became an important Ḥasidic centre. Elimelech emphasized the importance of the leader (zaddik, meaning "righteous one"), who, he believed, is mediator between God and the people and possesses authority not only in the spiritual sphere but in all areas of life. Although the zaddik belongs to a higher world, he descends to the level of the community to redeem it, and his capacity to sin is a necessary part of his mission of transforming evil into good. Elimelech's ideas are set forth in his treatise *No'am Elimelekh,* which was published after his death by his son Eleazar.

Elion, Gertrude Belle (b. Jan. 23, 1918, New York, N.Y., U.S.), American pharmacologist who, along with George H. Hitchings and Sir James W. Black, received the Nobel Prize for Physiology or Medicine in 1988 for their development of drugs used to treat several major diseases.

Elion graduated from Hunter College with a degree in biochemistry in 1937. Finding it difficult to obtain a research position because she was a woman, she taught chemistry in high school until joining the Burroughs Wellcome Laboratories in 1944. There she was first the assistant and then the colleague of Hitchings, with whom she worked for the next four decades.

The two scientists developed an array of new drugs that were effective against leukemia, autoimmune disorders, urinary-tract infections, gout, malaria, and viral herpes. Their success was due primarily to their innovative research methods, which marked a radical departure from the trial-and-error approach taken by previous pharmacologists. Elion and Hitchings pointedly examined the difference between the biochemistry of normal human cells and those of cancer cells, bacteria, viruses, and other pathogens (disease-causing agents). They then used this information to formulate drugs that could kill or inhibit the reproduction of a particular pathogen, leaving the human host's normal cells undamaged. The two reseachers' new emphasis on understanding basic biochemical and physiological processes enabled them to eliminate much guesswork and wasted effort typical previously in developing new therapeutic drugs.

Eliot, Sir Charles (Norton Edgecumbe) (b. Jan. 8, 1862, Sibford Gower, Oxfordshire, Eng.—d. March 16, 1931, at sea, in the Strait of Malacca), diplomat and colonial administrator who initiated the policy of white supremacy in the British East Africa Protectorate (now Kenya).

A scholar and linguist, Eliot had served in diplomatic posts in Russia (1885), Morocco (1892), Turkey (1893), and Washington, D.C. (1899), when in 1900 he was knighted and appointed commissioner and consul general for the East African Protectorate. He collaborated with the farmers there (notably Lord Delamere, to whom he ceded 100,000 acres [40,500 hectares] of land) and encouraged European immigration by the wholesale award of land concessions to European settlers.

By 1903 he was encountering opposition from the Colonial Office, which felt he was proceeding too rapidly. In 1904, after being criticized for granting a concession on land previously reserved for the Masai, he resigned his position. Following his resignation, he took no other diplomatic posts until 1920, when he became ambassador to Japan. He retired in 1926, continuing to live in Japan.

Eliot, Charles William (b. March 20, 1834, Boston, Mass., U.S.—d. Aug. 22, 1926, Northeast Harbor, Maine), educator, leader in public affairs, president of Harvard University for 40 years, and editor of the 50-volume *Harvard Classics* (1909–10).

Eliot graduated from Harvard in 1853 and was appointed assistant professor of mathematics and chemistry there in 1858. In 1867 he sailed for Europe, where he made a study of European educational systems. His published observations (in *The Atlantic Monthly,* 1869) brought his name to the attention of the directors of Harvard, who were looking for a new president. Eliot was inaugurated in October 1869. When he retired in 1909 he had elevated Harvard into an institution of world renown.

Contending that higher learning in the United States needed to be "broadened, deepened, and invigorated," Eliot demanded a place for the sciences as well as the humanities in any sound program of liberal education. To counter the rigidity of the Harvard curriculum—which, following what was then general practice, was then almost totally prescribed—Eliot eliminated required courses. Under his successor, A. Lawrence Lowell, a balance was struck between required and elective courses.

Eliot's influence reached into secondary education. During his presidency Harvard raised its entrance requirements, and other major colleges did likewise. This, in turn, effected a corresponding rise in secondary-school standards. In the report of a national committee on secondary education (1892), he urged the introduction of foreign languages and mathematics during the student's seventh school year. The idea was embodied later (1910) by the introduction of junior high schools in the United States.

Charles William Eliot

By courtesy of Harvard University

Eliot's writings include *Educational Reform: Essays and Addresses 1869–1897* (1898) and *University Administration* (1908).

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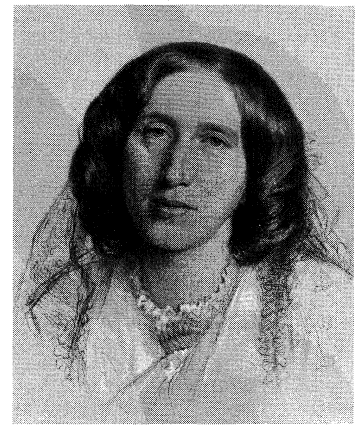
Eliot, George, pseudonym of MARY ANN, or MARIAN, CROSS, *née* EVANS (b. Nov. 22, 1819, Chilvers Coton, Warwickshire, Eng.—d. Dec. 22, 1880, London), Victorian novelist who developed the method of psychological analysis characteristic of modern fiction. Her major works include *Adam Bede* (1859), *The Mill on the Floss* (1860), *Silas Marner* (1861), *Middlemarch* (1871–72), and *Daniel Deronda* (1876).



George Eliot, chalk drawing by F.W. Burton, 1865; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Evans was born on an estate of her father's employer. Her command of England's Midland dialects is not strange; she heard little else until she went as a boarder to Mrs. Wallington's School at Nuneaton (1828–32). There she came under the influence of Maria Lewis, the principal governess, who inculcated both formal Johnsonian diction and a strong evangelical piety in the young girl. At her last school (1832–35), conducted by the daughters of the Baptist minister at Coventry, her religious ardour increased. She dressed severely and engaged earnestly in good works. The school gave her a reading knowledge of French and Italian, and, after her mother's death had compelled her to return home to keep house for her father, he let her have lessons in Latin and German. In 1841 she moved with her father to Coventry.

There she became acquainted with a prosperous ribbon manufacturer, Charles Bray (1811–84), a self-taught freethinker who campaigned for radical causes. His brother-in-law, Charles Hennell, was the author of *An Inquiry Concerning the Origin of Christianity* (1838), a book that precipitated Evans' break with orthodoxy that had been long in preparation. Various books on the relation between the Bible and science had instilled in her keen mind the very doubts they were written to dispel. In 1842 she told her father that she could no longer go to church. The ensuing storm raged for several months before they reached a compromise, leaving her free to think what she pleased so long as she appeared respectably at church, and she lived with him until his death in 1849.

The Brays and the Hennells quickly drew her from extreme provincialism, introducing her to many ideas in violent disagreement with her Tory father's religious and political views. When Charles Hennell married in 1843, she took over from his wife the translating of D.F. Strauss's *Das Leben Jesu kritisch bearbeitet,* which was published anonymously as *The Life of Jesus Critically Examined,* 3 vol. (1846), and had a profound influence on English rationalism. After the wedding Mrs. Hennell's father, R.H. Brabant, invited Evans to visit at Devizes. A rather silly man, he had worked for years on a book (never completed), which was to dispose of the supernatural elements in religion. They read German and Greek together and discussed theology on long walks; soon Mrs. Brabant became jealous of their intimacy, and, before the term of her visit, Evans was forced to leave. Mrs. Hennell felt that her father had acted ungenerously. Out of the humiliation of this episode George Eliot drew the horrible vividness of Mr. Casaubon in *Middlemarch.*

She spent the winter of 1849–50 at Geneva, reading extensively while living with the family of François d'Albert Durade, who painted a portrait of her. Like those by Mrs. Bray (1842) and Sir Frederic Burton (1865), all in the National Portrait Gallery, it shows her with light brown hair, gray-blue eyes, and a very fair complexion. Returning to Coventry, she spent the rest of 1850 with the Brays, pondering how to live on the £100 a year left by her father. After John Chapman, the publisher of *The Life of Jesus Critically Examined,* got her a chance to review R.W. Mackay's *The Progress of the Intellect* in *The Westminster Review* (January 1851), she decided to settle in London as a free-lance writer, and in January 1851 she went to board with the Chapmans at 142, Strand.

Soon after her arrival Mrs. Chapman and the children's governess, who was also Chapman's mistress, became jealous of Marian, as she now signed her name, and after 10 weeks she returned to Coventry in tears. Doubtless her feelings were strongly attracted to the magnetic Chapman, whose diary supplies this information, but there is no evidence that she was ever his mistress. A few months later he bought *The Westminster Review,* and Evans, contrite at the domestic complications she had unwittingly caused, returned to London. For three years, until 1854, she served as subeditor of *The Westminster,* which under her influence enjoyed its most brilliant run since the days of John Stuart Mill. At the Chapmans' evening parties she met many notable literary figures in an atmosphere of political and religious radicalism. Across the Strand lived the subeditor of *The Economist,* Herbert Spencer, whose *Social Statics* (1851) Chapman had just published. Evans shared many of Spencer's interests and saw so much of him that it was soon rumoured that they were engaged. Though he did not become her husband, he introduced her to the two men who did.

George Henry Lewes was the most versatile of Victorian journalists. In 1841 he had married Agnes Jervis, by whom he had four sons. In 1850 Lewes and a friend, the journalist Thornton Leigh Hunt, founded a radical weekly called *The Leader,* for which he wrote the literary and theatrical sections. In April 1850, two weeks after the first number appeared, Agnes Lewes gave birth to a son whose father was Thornton Hunt. Lewes, being a man of liberal views, had the child registered as Edmund Lewes and remained on friendly terms with his wife and Hunt. But after she bore Hunt a second child in October 1851, Lewes ceased to regard her as his wife, though, having condoned the adultery, he was precluded from suing for divorce. At this moment of dejection, his home hopelessly broken, he met Marian Evans. They consulted about articles and went to plays and operas that Lewes reviewed for *The Leader.* Convinced that his break with Agnes was irrevocable, Evans determined to live openly with Lewes as his wife. In July 1854, after the publication of her translation of Feuerbach's *Essence of Christianity,* they went to Germany together. In all but the legal form it was a marriage, and it continued happily until Lewes' death in 1878. "Women who are content with light and easily broken ties," she told Mrs. Bray, "do *not* act as I have done. They obtain what they desire and are still invited to dinner."

At Weimar and Berlin she wrote some of her best essays for *The Westminster* and translated Spinoza's *Ethics* (still unpublished), while Lewes worked on his groundbreaking life of Goethe. By his pen alone he had to support his three surviving sons at school in Switzerland as well as Agnes, whom he gave £100 a year, which was continued until her death in 1902. She had four children by Hunt, the last born in 1857, all registered under Lewes' name. The few friends who knew the facts agreed that toward Agnes his conduct was more than generous, but there was a good deal of malicious gossip about the "strong-minded woman" who had "run off with" her husband. Evans' deepest regret was that her act isolated her from her family in Warwickshire. She turned to early memories and, encouraged by Lewes, wrote a story about a childhood episode in Chilvers Coton parish. Published in *Blackwood's Magazine* (1857) as "The Sad Fortunes of the Reverend Amos Barton," it was an instant success. Two more tales, "Mr. Gilfil's Love-Story" and "Janet's Repentance," also based on local events, appeared serially in the same year, and Blackwood republished all three as *Scenes of Clerical Life,* 2 vol. (1858) under the pseudonym George Eliot.

Adam Bede, 3 vol. (1859), her first long novel, she described as "a country story—full of the breath of cows and the scent of hay." Its masterly realism—"the faithful representing of commonplace things"—brought to English fiction the same truthful observation of minute detail that Ruskin was commending in the Pre-Raphaelites. The book is rich in humour. The germ of the plot was an anecdote her Methodist aunt told of visiting a girl condemned for child murder. The dialect of the Bedes she had heard in the conversations of her Derbyshire uncles with her father, some of whose early experiences she assigned to Adam. But what was new in English fiction was the combination of deep human sympathy and rigorous moral judgment. *Adam Bede* went through eight printings within a year, and Blackwood doubled the £800 paid for it and returned the copyright.

In *The Mill on the Floss,* 3 vol. (1860), she returned again to the scenes of her early life. The first half of the book, with its remarkable portrayal of childhood, is irresistibly appealing, and throughout there are scenes that reach a new level of psychological subtlety.

At this time historical novels were in vogue, and during their visit to Florence in 1860 Lewes suggested Savonarola as a good subject, George Eliot grasped it enthusiastically and began to plan *Romola* (1862–63). First, however, she wrote *Silas Marner* (1861), which had thrust itself between her and the Italian material. Its brevity and perfection of form made this story of the weaver whose lost gold is replaced by a strayed child the best known of her books, though it has suffered unfairly from being forced on generations of schoolchildren. *Romola* was planned as a serial for *Blackwood's,* until an offer of £10,000 from *The Cornhill Magazine* induced George Eliot to desert her old publisher; but rather than divide the book into the 16 installments the editor wanted, she accepted £3,000 less, an evidence of artistic integrity few writers would have shown. Details of Florentine history, setting, costume, and dialogue were scrupulously studied at the British Museum and during a second trip to Italy in 1861. It was published in 14 parts between July 1862 and August 1863. Though the book lacks the spontaneity of the English stories, it has been unduly disparaged.

George Eliot's next two novels are laid in England at the time of agitation for passage of the Reform Bill. In *Felix Holt, the Radical,* 3 vol. (1866), she drew the election riot from recollection of one she saw at Nuneaton in December 1832. The initial impulse of the book was not the political theme but the tragic character of Mrs. Transome, who was one of her greatest triumphs. The intricate plot popular taste then demanded now tells against the novel. *Middlemarch* (8 parts, 1871–72) is by general consent George Eliot's masterpiece. Under her hand the novel had developed from a mere entertainment into a highly intellectual form of art. Every class of Middlemarch society is depicted from the landed gentry and clergy to the manufacturers and professional men, the shopkeepers, publicans, farmers, and labourers. Several strands of plot are interwoven to reinforce each other by contrast and parallel. Yet the story depends not on close-knit intrigue but on showing the incalculably diffusive effect of the unhistoric acts of those who "lived faithfully a hidden life and rest in unvisited tombs."

Daniel Deronda (8 parts, 1876), in which George Eliot comes nearest the contemporary scene, is built on the contrast between Mirah Cohen, a poor Jewish girl, and the upper class Gwendolen Harleth, who marries for money and regrets it. The less convincingly realized hero, Daniel, after discovering that he is Jewish, marries Mirah and departs for Palestine to establish a home for his nation. The picture of the Cohen family evoked grateful praise from Jewish readers. But the best part of *Daniel Deronda* is the keen analysis of Gwendolen's character, which seems to many critics the peak of George Eliot's achievement.

In 1863 the Leweses bought the Priory, 21, North Bank, Regent's Park, where their Sunday afternoons became a brilliant feature of Victorian life. There on Nov. 30, 1878, Lewes died. For nearly 25 years he had fostered her genius and managed all the practical details of life, which now fell upon her. Most of all she missed the encouragement that alone made it possible for her to write. For months she saw no one but his son Charles Lee Lewes; she devoted herself to completing the last volume of his *Problems of Life and Mind* (1873–79) and founded the George Henry Lewes Studentship in Physiology at Cambridge. For some years her investments had been in the hands of John Walter Cross (1840–1924), a banker introduced to the Leweses by Herbert Spencer. Cross's mother had died a week after Lewes. Drawn by sympathy and the need for advice, George Eliot soon began to lean on him for affection too. On May 6, 1880, they were married in St. George's, Hanover Square. Cross was 40; she was in her 61st year. After a wedding trip in Italy they returned to her country house at Witley before moving to 4, Cheyne Walk, Chelsea, where she died in December. She was buried at Highgate Cemetery.

(G.S.Ha.)

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in blank verse; *The Legend of Jubal and Other Poems* (1874), which ends with, "Oh, May I Join the Choir Invisible"; *Impressions of Theophrastus Such* (1879), a collection of moral essays; *Essays and Leaves from a Note-Book,* ed. by C.L. Lewes (1884), mostly reprinted from journals.

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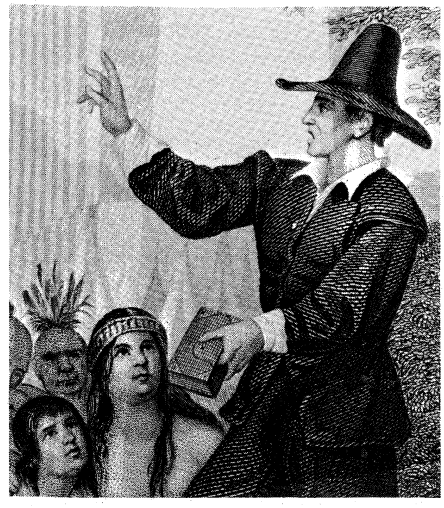
Eliot, Jared (b. Nov. 7, 1685, Guilford, Conn.—d. April 22, 1763, Killingworth, Conn.), American colonial clergyman, physician, and agronomist. Eliot, the grandson of John Eliot, noted New England missionary, was graduated from the Collegiate School of Connecticut (Yale College) in 1706. He taught for two years and then received a call as pastor of the Congregational Church in Killingworth (Clinton), Conn. He served as minister of the congregation until his death. He also acted as the town's physician.

Eliot achieved some notice through his scientific research and writing. He investigated the mineral qualities of Connecticut lands and in 1762 published an *Essay on the Invention, or Art of Making Very Good, if not the Best Iron, from Black Sea Soil.* The essay won recognition from the Royal Society in London. Eliot also worked with Yale's president, Ezra Stiles, on implementing silk production in Connecticut.

Eliot's major scientific contributions, however, were in the field of agronomy. He studied agricultural practices in Connecticut for several years and used his own lands for particular experiments. From that extensive research, he compiled his *Essays upon Field-Husbandry,* which was published in six parts from 1748 to 1759. Those essays became the most popular and prominent works on agronomy published in the English colonies before the American Revolution. Eliot sought to advance scientific techniques of agriculture, to improve farm production, and also to restore seemingly exhausted soils and to promote the planting of cover and forage crops.

Eliot, John (b. 1604, Widford, Hertfordshire, Eng.—d. May 21, 1690, Roxbury, Massachusetts Bay Colony), Puritan missionary to the Indians of Massachusetts Bay Colony whose translation of the Bible was the first Bible printed in North America.



John Eliot preaching to the Massachusets Indians, detail from an engraving by John Chester Buttre, *c.* 1856, after a drawing by Johannes Adam Simon Oertel, 19th century

By courtesy of the Library of Congress, Washington, D.C.

Eliot graduated from Jesus College, Cambridge, in 1622 and emigrated to Boston in 1631. From 1632 to his death he was pastor of the church at nearby Roxbury. With the support of his congregation and fellow ministers, he began a mission to the Indians, preaching at Nonantun (Newton) and at other towns. Groups of "praying Indians" soon arose, and by 1674 there were 14 villages with 4,000 converts. The following year, however, the communities suffered serious setbacks from persecutions that occurred during King Philip's War, and the villages never fully recovered.

Eliot's work was financed chiefly from England, where his activities inspired the creation of the Company for Propagating the Gospel in New England and Parts Adjacent in North America (1649). This was the first genuine missionary society. Eliot's methods set the pattern of subsequent Indian missions for almost two centuries. Civilization, he believed, was closely bound up with evangelization. His converts were gathered into Christian towns, governed by a biblical code of laws, and gradually introduced to the English manner of life. Each village had a school where the Indians were taught English and the handicrafts by which they could support themselves. After severe testing, believers were organized by covenant into a Puritan "church-state," and native teachers and evangelists were trained. Eliot himself, called the "Apostle to the Indians," produced the needed literature in the Massachusets Algonkian language, beginning with his primer or catechism of 1654. His translation of the New Testament appeared in 1661, the Old Testament in 1663. Among his other works are *The Christian Commonwealth* (1659) and *The Harmony of the Gospels* (1678).

Eliot, Sir John (b. April 11, 1592, St. Germans, Cornwall, Eng.—d. Nov. 28, 1632, London), English Puritan and Parliamentarian who, with his brilliant oratory, played a leading role in the early conflicts between King Charles I and Parliament. His death during his imprisonment for opposing the crown made him a martyr to the Parliamentary cause.

The son of a wealthy landowner, he was first elected to Parliament in 1614 and was knighted four years later. In 1622 his friend George Villiers, earl (later duke) of Buckingham, the royal favourite, appointed him vice admiral of Devon. In 1623 Eliot succeeded in arresting a well-known pirate, Capt. John Nutt, who thereupon used his political connections to have Eliot imprisoned for bribery. Six months later Buckingham stepped in to obtain his release.

Elected to the Parliament of 1624, Eliot won a reputation as an orator for his addresses defending freedom of speech for members of the House of Commons. He lost confidence in Buckingham after witnessing the mistakes and extravagances of Buckingham's foreign policy, and in the Parliament of 1626 he helped manage impeachment proceedings against the Duke.

Charles I thereupon saved Buckingham by imprisoning Eliot (May 11–19, 1626) and dissolving Parliament. Eliot was suspended from his vice admiralty, and in June 1627 he was thrown into prison along with 74 other prominent gentry for refusing to contribute a forced loan to the crown.

Released in January 1628, he became the opposition leader in the Parliament that convened in March. There he made speeches against arbitrary taxation and in favour of preservation of English Protestantism from what he considered the Roman Catholic leanings of the archbishops. With Edward Coke and Peter Wentworth he urged passage of the

Sir John Eliot, detail of an oil painting by an unknown artist, 1632; in the collection of the Earl of St. Germans

Country Life

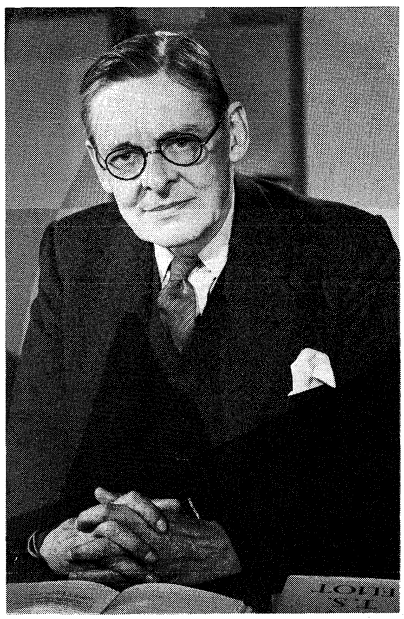
Petition of Right. In the Parliament of 1629, Eliot went further by drawing up three resolutions that vigorously condemned Charles's religious policy and his customs levies. Although Charles ordered Parliament to adjourn, Eliot had the speaker of the House of Commons held down in his chair until the resolutions were passed. The King had Eliot and eight others arrested. Imprisoned in the Tower of London, Eliot wrote several books on politics and ethics, including *An Apology for Socrates* and *The Monarchie of Man.* But his close confinement undermined his health; contracting tuberculosis, he died in the Tower. See Harold Hulme, *The Life of Sir John Eliot* (1957).

Eliot, T(homas) S(tearns) (b. Sept. 26, 1888, St. Louis, Mo., U.S.—d. Jan. 4, 1965, London), American–English poet, playwright, and literary critic, a leader of the modernist movement in poetry in such poems as *The Waste Land* (1922) and such poetic dramas as *Murder in the Cathedral* (1935), and *The Cocktail Party* (1950). A hit musical, *Cats,* based on his *Old Possum's Book of Practical Cats* (1939), opened in London in 1981 and in New York City in 1982.

As poet, dramatist, literary critic, and editor, T.S. Eliot exercised a strong influence on 20th-century culture in the period between World Wars I and II; his experiments in diction, style, and versification revitalized English poetry, and in a series of critical essays he shattered old orthodoxies and erected new. He pronounced on social and cultural questions, and as director of the publishers Faber & Faber Ltd. he was a generous and discrimi-

nating patron of young poets. The publication of *Four Quartets,* during World War II, led to his recognition as the greatest living English poet and man of letters with the award in 1948 of the Order of Merit and the Nobel Prize for Literature.

Family background and early years. Eliot's first American paternal ancestor, Andrew Eliot, a shoemaker of East Coker, Somerset, Eng., arrived in Boston in 1670. The poet's grandfather, the Rev. William Greenleaf Eliot, migrated from Boston to St. Louis immediately after his graduation from Harvard in 1834. A fervent Unionist, Unitarian, and anti-slavery man in a slave state, he was a founder of Washington University, which would have been named for him but for his objection; he became its chancellor in 1872. The poet's father, Henry Ware Eliot, broke with family tradition and went into business; his mother, Charlotte Champe Stearns, was a prolific poet of some reputation, author of a life of her father-in-law and of a poetic drama on the martyrdom of the 15th-century Italian religious reformer Savonarola, to which her son wrote an introduction in 1926. At the time of the poet's birth, the Eliots had been in Missouri 54 years; yet they retained, against Southern and Western influences, the New England political and theological culture. Late in life the poet said that he was glad to have



T.S. Eliot, 1954
Angus McBean

been born in St. Louis instead of Boston or New York or London. He was, nevertheless, a New Englander to the end.

Eliot's family background is important for an understanding of his career, for he was allowed the widest education available in his time, with no influence from his father to be "practical" and to go into business. From Smith Academy in St. Louis he went to Milton, in Massachusetts; from Milton he entered Harvard in 1906; he was graduated B.A. in 1909, after three instead of the usual four years. The men who influenced him at Harvard were George Santayana, the philosopher and poet, and the critic Irving Babbitt. From Babbitt he derived an anti-Romantic attitude that, amplified by his later reading of British philosophers F.H. Bradley and T.E. Hulme, lasted through his life. In the academic year 1909–10 he was an assistant in philosophy at Harvard.

The year 1910–11 was crucial for the man who was to become one of two or three great poets of the first half of the 20th century. He spent the year in France, attending Henri Bergson's lectures in philosophy at the Sorbonne and reading poetry with Alain-Fournier, whose "lessons" gave Eliot a mastery not only of the French language but of Symbolist poetry from Charles Baudelaire through Jules Laforgue to Stéphane Mallarmé. In 1914 he first met Ezra Pound. In 1946 he was to publish in *Poetry: A Magazine of Verse* a defense of Pound's literary career (ignoring Pound's politics) in which he described the arid literary milieu of young American poets in the decade before World War I. Both Eliot and Pound turned to poets in other languages—Pound to the troubadours and the early Renaissance poets of Italy, Eliot to Laforgue and Dante, who even more than John Webster and John Donne helped Eliot to find his own style. From 1911 to 1914 he was back at Harvard reading Indian philosophy and studying Sanskrit under the distinguished scholar Charles Lanman. In 1913 he read Bradley's *Appearance and Reality;* by 1916 he had finished, in Europe, a dissertation entitled *Knowledge and Experience in the Philosophy of F.H. Bradley* (not published until 1964); but World War I had intervened, and he never returned to Harvard to take the final oral examination for the Ph.D. degree.

Early publications. Eliot was to pursue four careers: editor, dramatist, literary critic, and philosophical poet. He was probably the most erudite poet of his time in the English language. His undergraduate poems were "literary" and conventional. His first important publication, and the first masterpiece of "modernism" in English, was "The Love Song of J. Alfred Prufrock."

> Let us go then, you and I,
> When the evening is spread out against the sky
> Like a patient etherized upon a table. . . .

Eliot had given a copy of the poem to his friend Conrad Aiken, who passed it on to Ezra Pound, who in turn sent it to Harriet Monroe, editor of *Poetry,* where it languished more than a year because Monroe was not sure it was poetry. Although Pound had printed privately a small book, *A lume spento,* as early as 1908, "Prufrock" was the first poem by either of these literary revolutionists to go beyond experiment to achieve perfection. It represented a break with the immediate past as radical as that of Samuel Taylor Coleridge and William Wordsworth in *Lyrical Ballads* (1798). From the appearance of Eliot's first volume, *Prufrock and Other Observations,* in 1917, one may conveniently date the maturity of the 20th-century poetic revolution; for, in addition to the title poem, the book contained "Preludes" and "Portrait of a Lady"—both mature works; and the revolution had come of age. The significance of the revolution is still disputed, but the striking similarity to the Romantic revolution of Coleridge and Wordsworth is obvious: Eliot and Pound, like their 18th-century counterparts, set about reforming poetic diction. Whereas Wordsworth thought he was going back to the "real language of men," Eliot sought a diction that might be spoken by an educated person, being "neither pedantic nor vulgar." (He wrote of Swinburne: "For the first time in verse of such eminence, sound exists without sense.")

For a year he taught French and Latin at the Highgate School; in 1917 he began his brief career as a bank clerk in Lloyds Bank Ltd. Meanwhile he was also a prolific reviewer and essayist in both literary criticism and technical philosophy. In 1919 he published *Poems,* which contained the poem "Gerontion," a meditative interior monologue in blank verse: nothing like this poem had appeared in English.

The Waste Land and criticism. With the publication in 1922 of *The Waste Land,* Eliot won an international reputation. This poem, in five parts, proceeds on a principle of "rhetorical discontinuity" that reflects the fragmented experience of the 20th-century sensibility of the great modern cities of the West. For Eliot is the poet of the secularized city, the decay of *urbs aeterna* (the "eternal city"). This is the ultimate theme of *The Waste Land,* concretized by the constant rhetorical shifts, the juxtapositions of contrasting styles. But it is not, as his early critics supposed, a simple contrast of the heroic past with the degraded present; it is rather a timeless, simultaneous awareness of moral grandeur and moral evil. The original manuscript of about 800 lines was cut down to 433 at the suggestion of Ezra Pound. *The Waste Land* is not Eliot's greatest poem, though it is his most famous.

Eliot has said that the poet-critic must inevitably write "programmatic criticism"—that is, criticism that expresses the poet's own interests as a poet, quite different from historical scholarship, which stops at placing the poet in his background. Consciously intended or not, this kind of criticism creates an atmosphere in which the poet-critic's own poetry will be better understood and appreciated than if it had to appear in a literary milieu dominated by the standards of the preceding age. Eliot's essay "Tradition and the Individual Talent," appearing in his first critical volume, *The Sacred Wood* (1920), is historically analogous to and as historically important as Wordsworth's "Preface." Tradition, according to Eliot, must be earned by the poet; it is not a repetition of the work of the immediate past ("novelty is better than repetition," he said); it comprises the whole of European literature from Homer to the present. The poet writing in English may therefore make his own tradition by using materials from any past period, in any language. This point of view is "programmatic" in the sense that it disposes the reader to accept the revolutionary novelty of Eliot's polyglot quotations and serious parodies of other poets' styles in *The Waste Land.* Also in *The Sacred Wood,* "Hamlet and His Problems" sets forth Eliot's theory of the objective correlative:

> The only way of expressing emotion in the form of art is by finding an "objective correlative"; in other words, a set of objects, a situation, a chain of events which shall be the formula for that particular emotion; such that, when the external facts, which must terminate in sensory experience, are given, the emotion is immediately evoked.

Eliot adapted the phrase from either Santayana or from the U.S. painter and author Washington Allston and placed it in the context of his impersonal theory of poetry; it thus had an immense influence toward correcting the vagueness of late Victorian rhetoric by insisting on a correspondence of word and object. Two other essays, first published the year after *The Sacred Wood,* almost complete the Eliot critical canon: "The Metaphysical Poets" and "Andrew Marvell," published in *Selected Essays, 1917–32* (1932). In these essays he effects a new historical perspective on the hierarchy of English poetry, putting at the top the Metaphysical poets of the 17th century and lowering poets of the 18th and 19th centuries. Eliot's second famous phrase appears here—"dissociation of sensibility," invented to explain the change that came over English poetry after Donne and Marvell. This change seems to him to consist in a loss of the union of thought and feeling. The phrase has been attacked, yet the historical fact that gave rise to it cannot be denied, and with the poetry of Eliot and Pound it had a strong influence in reviving interest in certain 17th-century poets. The first, or programmatic, phase of Eliot's criticism ended with *The Use of Poetry and the Use of Criticism* (1933)—his Charles Eliot Norton lectures at Harvard.

Shortly before this his interests had broadened into theology and sociology; three short books, or long essays, were the result: *Thoughts After Lambeth* (1931), *The Idea of a Christian Society* (1939), and *Notes Towards the Definition of Culture* (1948). These book-essays, along with his *Dante* (1929), an indubitable masterpiece, broadened the base of literature into theology and philosophy—whether a work is poetry must be decided by literary standards; whether it is great poetry must be decided by standards higher than the literary.

The criticism and the poetry are so interwoven, so much the product of a unified mind and sensibility, that it is difficult to discuss them separately. The great essay on Dante appeared two years after Eliot had become an Anglo-Catholic (1927); in that year he also became a British subject. The first long poem after his conversion was "Ash Wednesday" (1930), a religious meditation in a style entirely different from that of any of the earlier poems. Indeed, Eliot never repeated himself, though every poem is unmistakably his. "Ash Wednesday" was not well received in an era that held that poetry, though autonomous, is strictly secular in its outlook; it was misinterpreted, typically by the critic Edmund Wilson, as an expression of personal disillusion.

Later career and influence. Eliot's masterpiece is *Four Quartets,* taken as a single work, though each "quartet" is a complete poem. The four parts, published at intervals between 1935 and 1941, were issued as a book in 1943. This led to the award to Eliot, in 1948, of the Nobel Prize for Literature.

The plays, which begin with *Sweeney Agonistes* (published 1926; first performed in 1934) and end with *The Elder Statesman* (first performed 1958; published 1959), are, with the exception of *Murder in the Cathedral* (published and performed 1935), inferior to the lyric and meditative poetry. Eliot's belief that even secular drama attracts people who unconsciously seek a religion, that in fact all drama has a religious structure of progress toward self-knowledge, reconciliation, or purification, led him to put drama above all other forms of poetry. All his plays are in a blank verse of his own invention, in which the metrical effect is not apprehended apart from the sense; thus he brought "poetic drama" back to the popular stage. *The Family Reunion* (1939) and *Murder in the Cathedral* are Christian tragedies, the former a tragedy of revenge, the latter of the sin of pride. The other plays are comedies in which the plots are derived from Greek drama. The most successful of these plays is *The Cocktail Party* (first performed 1949; published 1950), based upon the *Alcestis* of Euripides.

Eliot's career as editor was ancillary to his main interests, but his quarterly review, *The Criterion* (1922–39), was the most distinguished international critical journal of the period. He was a "director," or working editor, of the publishing firm of Faber & Faber Ltd. from the early 1920s until his death.

Eliot's posthumous volume of criticism, *To Criticize the Critic, and Other Writings* (1965), contains two essays of great value: the title essay is a review and a severe but not falsely modest evaluation of his literary criticism; "American Literature and the American Language" deals with the chauvinist myth of American English as a separate language and with equal conviction treats British and American literature as branches of one literature. The first half of the 20th century will probably be known to historians as the age of Eliot, as the mid-18th century was the age of Johnson. But Samuel Johnson came at the end of the Neoclassical period and summed it up, whereas Eliot, as critic and poet, created his age. He always kept his private life rigorously in the background. In 1915 he married Vivian Haigh-Wood; after 1933 she was mentally ill, and they lived apart; she died in 1947. In January 1957 he married Valerie Fletcher, with whom he lived happily until his death.

(A.Ta.)

MAJOR WORKS. *Poetry. Prufrock and Other Observations* (1917); *Poems* (1919); *Ara Vos Prec* (1920), incorporates *Prufrock* and *Poems* with additional verse, including "Gerontion"; *The Waste Land* (1922); *Poems, 1909–* (1925), incorporates *Ara Vos Prec, The Waste Land,* and "The Hollow Men"; *Journey of the Magi* (1927); "Ash Wednesday" (1930); *Collected Poems, 1909–35* (1936), incorporates *Poems, 1909–25,* "Ash Wednesday," chorus from *The Rock,* "Burnt Norton," and others; *Old Possum's Book of Practical Cats* (1939); *Four Quartets* (1943), each of the four issued as a separate pamphlet: "Burnt Norton" (1941); "East Coker" (1940); "The Dry Salvages" (1941); "Little Gidding" (1942); *Collected Poems, 1909–62* (1963).

Plays. Sweeney Agonistes: Fragments of an Aristophanic Melodrama (pub. in *Criterion,* 1926; pub. separately 1932); *The Rock* (1934); *Murder in the Cathedral* (1935; film script, 1951); *The Family Reunion* (1939); *The Cocktail Party* (1950); *The Confidential Clerk* (1954); *The Elder Statesman* (1959).

Criticism. Ezra Pound: His Metric and Poetry (1917); *The Sacred Wood: Essays on Poetry and Criticism* (1920); *Homage to John Dryden* (1924), contains "John Dryden," "The Metaphysical Poets," and "Andrew Marvel"; *For Lancelot Andrewes: Essays on Style and Order* (1928); *Dante* (1929); *John Dryden: The Poet, the Dramatist, the Critic* (1932); *Selected Essays, 1917–32* (1932, rev. ed. 1951); *The Use of Poetry and the Use of Criticism* (1933); *Elizabethan Essays* (1934); *Essays Ancient and Modern* (1936); *The Music of Poetry* (1942); *The Classics and the Man of Letters* (1942); *What Is a Classic?* (1945); *Milton* (1947); *Poetry and Drama* (1951); *The Three Voices of Poetry* (1954); *On Poetry and Poets* (1957); *To Criticize the Critic and Other Writings* (1965).

Other prose work (sociology and church politics). *Thoughts After Lambeth* (1931); *After Strange Gods—A Primer of Modern Heresy* (1934); *The Idea of a Christian Society* (1939); *Reunion by Destruction* (1943); *Notes Towards the Definition of Culture* (1948).

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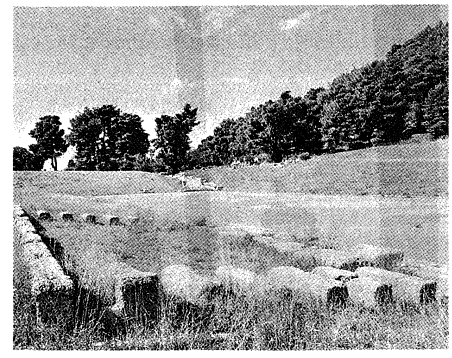
BIBLIOGRAPHY. Three distinguished works on Eliot are Elizabeth Drew, *T.S. Eliot: The Design of His Poetry* (1949), a Jungian interpretation of Eliot's symbolism; F.O. Matthiessen, *The Achievement of T.S. Eliot,* 3rd ed. (1958), with a supplementary chapter by C.L. Barber covering the works written after Matthiessen's death in 1950; and Helen Gardner, *The Art of T.S. Eliot* (1949), a brilliantly perceptive study. Other valuable long studies are Hugh Kenner, *The Invisible Poet* (1959); Grover C. Smith, *T.S. Eliot's Poetry and Plays* (1956); and Leonard Unger, *T.S. Eliot: Moments and Patterns* (1967), an essay on the influence of Joseph Conrad. Studies of the plays are David Jones, *The Plays of T.S. Eliot* (1960); and E. Martin Browne, *The Making of T.S. Eliot's Plays* (1969), a work indispensable to the understanding of Eliot's methods of dramatic composition, since Browne produced and directed all the plays and was to that extent a collaborator. The first symposium on Eliot, and still valuable, is Leonard Unger (ed.), *T.S. Eliot: A Selected Critique* (1948). Others are B. Rajan (ed.), *T.S. Eliot: A Study of His Writings by Several Hands* (1948); Tambimuttu and Richard March (eds.), *T.S. Eliot: A Symposium* (1948); Neville Braybrooke (ed.), *T.S. Eliot: A Symposium for His Seventieth Birthday* (1958); and Hugh Kenner (ed.), *T.S. Eliot: A Collection of Critical Essays* (1962). These symposia represent cumulative insights of permanent value. The symposium, Allen Tate (ed.), *T.S. Eliot: The Man and His Work* (1966), published a year after Eliot's death, is retrospective in emphasis, including personal reminiscence and criticism by I.A. Richards, Herbert Read, Conrad Aiken, F.V. Morley, Bonamy Dobrée, Helen Gardner, John Crowe Ransom, G. Wilson Knight, E. Martin Browne, Austin Warren, and 16 other critics. Cleanth Brooks, *Modern Poetry and the Tradition* (1939), contains the most perceptive analytical commentary on *The Waste Land.* Conrad Aiken, *Collected Criticism* (1968), contains a review of *The Waste Land.* See also Valerie Eliot (ed.), *The Waste Land: A Facsimile and Transcript of the Original Drafts Including the Annotations of Ezra Pound* (1971). Lewis Freed, *T.S. Eliot: The Critic as Philosopher* (1979), studies the relation of Eliot's thought to Bradley's. Two general surveys of Eliot's career—including his family background, education, public life, philosophy, and social and political ideas—contain as much relevant information as one may reasonably expect to find until Mrs. Eliot authorizes an official biography: Herbert Howarth, *Notes on Some Figures Behind T.S. Eliot* (1964); and Russell Kirk, *Eliot and His Age* (1971).

Eliphaz THE TEMANITE, in the Old Testament Book of Job, (chapters 4, 5, 15, 22), one of three friends who sought to console Job, who is a biblical archetype of unmerited suffering. The word Temanite probably indicates that he was an Edomite, or member of a Palestinian people descended from Esau.

In three speeches of increasing severity, Eliphaz attempts to reconcile Job to God and induce him to repent. In the first speech he recounts a mystic vision that informed him of the universal sinfulness of man—proof that suffering is never unmerited. In the second speech he belittles Job's self-justifications by describing the uncaring transcendence of God. In the third and last speech he reflects the old Hebrew idea that suffering always implies sinful actions by accusing Job of specific unethical deeds. In the epilogue he and his friends are reproved by God for not speaking the truth about him.

Consult the INDEX *first*

Elis, also called ELEA, modern ILIÁ, ancient Greek city-state in the northwestern corner of the Peloponnese, well known for its horse breeding and for the Olympic Games, which were allegedly founded there in 776 BC. The city of Elis, having gained control of the entire region by 580, briefly joined Sparta in an anti-



Remains of the seating at the stadium, Olympia
Starfoto—ZEFA

Persian alliance (479), then broke with Sparta, adopted a democratic constitution (*c.* 471), and became the administrative centre of a union of smaller townships. During the Peloponnesian War, Elis again allied with Sparta, though in 420 it temporarily joined Athens, Argos, and Mantineia. By adroit diplomacy and by emphasizing its neutrality as president of the Olympic Games, the city retained its territory and its independence until the fall of the Roman Empire. One of the major archaeological sites in modern Greece is in ancient Elis, at Olympia, scene of the games.

Elisabeta (Romanian personal name): *see under* Elizabeth.

Elisabeth (personal name): *see under* Elizabeth; Isabella.

Élisabethville (Zaire): *see* Lubumbashi.

Elisabetta (Italian personal name): *see under* Elizabeth; Isabella.

Elisha, also spelled ELISAIOS, or ELISEUS, in the Old Testament, Israelite prophet, the pupil of Elijah, and also his successor (*c.* 851). He instigated and directed Jehu's revolt against the house of Omri, which was marked by the bloodbath at Jezreel.

The popular traditions about Elisha (II Kings 2–13) sketch a charismatic, quasi-ecstatic figure, very similar to Elijah. Like his mentor, Elisha was a passionate exponent of the ancient religious and cultural traditions of Israel, which both felt to be threatened by the acculturation going on in Canaan, and especially by the dynasty of Omri, in alliance with Phoenicia. As a prophet Elisha was a political activist and revolutionary. He led a "holy war" that extinguished the house of Omri in Jerusalem as well as in Samaria (II Kings 9–10); its bloody violence was denounced by the prophet Hosea a century later (Hos. 1:4ff.).

Though Elisha recruited Jehu, it was Elijah who was instructed to anoint him (I Kings 19:16). This is characteristic of their relationship; in popular estimation Elisha always remains partly in the shadow of his master. The story of the beginning of his apprenticeship (I Kings 19:19–21) and the account in which he becomes Elijah's heir and successor (II Kings 2:8–18) both feature the prophetic "mantle." In the first Elijah casts it upon his pupil; in the second, Elisha picks it up. The mantle, cultic garment of the prophet, carries connotations of power and authority.

Elisha ben Abuyah, byname AḤER (fl. *c.* AD 100), Jewish scholar who renounced his faith. He came to be regarded in later ages as a prototype of the heretic whose intellectual pride leads him to infidelity to Jewish laws and morals. In the Talmud, Elisha is not mentioned by name but is usually referred to as Aḥer ("the Other," or "Another"). His renunciation of Judaism was considered doubly heinous because he was a tanna (scholar), one of a group of some 200 masters of the Oral Law that flourished in Palestine during the 1st and 2nd centuries AD.

The son of a rich Jew, Elisha was educated from childhood to be a scholar. Although he became a tanna, he lost faith in rabbinic authority and flouted Jewish law by such actions as openly riding through the streets on the most sacred Jewish holiday, Yom Kippur (the Day of Atonement). More seriously, the Talmud relates that Elisha betrayed Jews during persecution by the Roman emperor Hadrian (AD 76–138).

Different versions of the Talmud contain cryptic references to Elisha's heretical acts and the reason for his renunciation of Judaism. According to one tradition he became so interested in Greek culture and philosophy that he abandoned his heritage; another relates an incident that implies Elisha's belief in two gods. Later scholars, studying these passages, offered different, and sometimes contradictory, interpretations. Some concluded that Elisha was a follower of Philo of Alexandria, a philosopher whose theological views were considered heretical by contemporary Jews. Others saw Elisha variously as a convert to Christianity, a member of a Gnostic sect, or a Sadducee. Whatever the reason for his apostasy, Elisha's story became the subject of later literary works, among them the Hebrew drama *Ben Abuyah.*

Elísio, Filinto: *see* Nascimento, Francisco Manuel do.

elision (Latin: "striking out"), in prosody, the slurring or omission of a final unstressed vowel that precedes either another vowel or a weak consonant sound, as in the word *heav'n.* It may also be the dropping of a consonant between vowels, as in the word *o'er* for *over.* Elision is used to fit words into a metrical scheme, to smooth the rhythm of a poem, or to ease the pronunciation of words. In classical Greek poetry, an apostrophe (') is substituted for an elided letter, as is frequently the case in English verse. In Latin, however, the elided vowel or consonant remains, but it is ignored in scanning the line.

Elissa (Greek mythology): *see* Dido.

Elista, formerly (1944–57) STEPNOY, city and capital of the Kalmyk Autonomous Soviet Socialist Republic, southwestern Russian S.F.S.R. It was founded in 1865 and became a city in 1930. In 1944, when the Kalmyks were exiled for their alleged collaboration with the Germans, the republic was dissolved and the city became known as Stepnoy ("Steppe"). The Kalmyk A.S.S.R. and the name Elista were restored in 1957. Agriculture employs the most workers, though Elista also has administrative, trade, and cultural services for its surrounding rural area. Kalmyk University and teacher-training and medical colleges are located there. The city is connected by road to Astrakhan. Pop. (1987 est.) 85,000.

elixir, in alchemy, substance thought to be capable of changing base metals into gold. The same term, more fully *elixir vitae,* "elixir of life," was given to the substance that would indefinitely prolong life—a liquid that was believed to be allied with the philosopher's stone. Chinese Taoists not only sought the "pill of immortality" but developed techniques (meditation, breathing exercises, diet) that were thought to confer immortality by internal alchemy.

In pharmacy an elixir is usually defined as a sweetened hydroalcoholic solution containing flavouring materials and usually medicinal substances.

Elizabeth (personal name): *see under* Isabella, except as below.

Elizabeth, name of rulers grouped below by country and indicated by the symbol •.

Foreign-language equivalents:

German	Elisabeth
Russian	Yelizaveta, or Elizaveta
Spanish	Isabel

ENGLAND AND THE UNITED KINGDOM

• **Elizabeth I,** byname THE VIRGIN QUEEN, or GOOD QUEEN BESS (b. Sept. 7, 1533, Greenwich, near London—d. March 24, 1603, Richmond, Surrey, Eng.), queen of England (1558–1603) during a period, often called the Elizabethan Age, when England asserted itself vigorously as a major European power in politics, commerce, and the arts.

A brief treatment of Elizabeth I follows. For full treatment, *see* MACROPAEDIA: Elizabeth I of England.

Elizabeth's childhood was marked by dangers from political and religious intrigue, and in the reign of her half sister, Mary, daughter of Henry VIII's first wife, Catherine of Aragon, she was for a time imprisoned in the Tower of London. She became queen upon Mary's death (1558) and in the first 12 years of her reign established her popularity with the people. Her religious settlement of 1559 enforced the Protestant religion by law but was not unduly harsh to the Roman Catholics. This compromise, however, was shattered in 1570 by the interdict of Pope Pius V against Elizabeth, and thereafter the treatment of English Catholics became increasingly severe.

Despite various marriage plans designed to accommodate state interests—especially the crucial interest of securing the succession—and in spite of speculation about her friendships with several men, including Lord Robert Dudley, Elizabeth never married. Elizabeth's claim to the throne was threatened by Mary, Queen of Scots, a descendant of Henry VIII's sister Margaret; Mary's claim to the English throne was based on the questionable legality of Henry's second marriage to Anne Boleyn, Elizabeth's mother. The queen finally had Mary executed (1587). In 1588 the Spanish Armada was destroyed by the English fleet that Elizabeth had built.

The last years of her reign saw an economic decline and a series of disastrous military efforts to subdue the Irish. Public morale deteriorated. Elizabeth, who had outlived her most trusted friends and advisers, including Lord Burghley and Francis Walsingham, was left with more personally ambitious men, including Robert Devereux, Earl of Essex, who was executed for high treason in 1601. Elizabeth reportedly acknowledged James VI of Scotland as her successor on her deathbed.

• **Elizabeth II,** in full ELIZABETH ALEXANDRA MARY (b. April 21, 1926, London), queen of the United Kingdom of Great Britain and Northern Ireland. Her official title is "Elizabeth II, By the Grace of God, of the United Kingdom of Great Britain and Northern Ireland and of Her Other Realms and Territories Queen, Head of the Commonwealth, Defender of the Faith." She succeeded her father, King George VI, on Feb. 6, 1952, and was crowned on June 2, 1953.

Elizabeth II, 1952

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As the first child of a younger son of King George V, Princess Elizabeth had little prospect of acceding to the throne until her uncle, Edward VIII (afterward Duke of Windsor), abdicated in her father's favour on Dec. 11, 1936, at which time she became heir presumptive. She was educated privately and concentrated on the subjects of history, languages, and music.

On July 9, 1947, the king and queen announced the engagement of Princess Elizabeth to her distant cousin Lieutenant Philip Mountbatten of the Royal Navy, formerly Prince Philip of Greece and Denmark. The marriage took place in Westminster Abbey on Nov. 20, 1947, the day after George VI had created the bridegroom Duke of Edinburgh. Their first child, Prince Charles Philip Arthur George, was born Nov. 14, 1948 (created Prince of Wales in 1969); he was followed by Princess Anne Elizabeth Alice Louise (b. Aug. 15, 1950; from 1973, Mrs. Mark Phillips), Prince Andrew Albert Christian Edward (b. Feb. 19, 1960; created Duke of York in 1986), and Prince Edward Anthony Richard Louis (b. March 10, 1964). All these children have the surname "of Windsor," but in 1960 Elizabeth decided to prefix the name of Mountbatten to her own surname of

Windsor for descendants not styled prince or princess and royal highness.

In 1951 Princess Elizabeth began to represent King George VI, whose health was failing, on various state occasions. She and the Duke were at Sagana, Kenya, on their way to Australia and New Zealand, when news of the King's death and her accession reached them. Much of her reign was devoted to ceremonial functions and to tours of the Commonwealth countries and other nations.

Russia

• **Elizabeth,** Russian in full YELIZAVETA PETROVNA (b. Dec. 29 [Dec. 18, old style], 1709, Kolomenskoye, near Moscow—d. Jan. 5, 1762 [Dec. 25, 1761, O.S.], St. Petersburg), empress of Russia from 1741 to 1762 (1761, O.S.).

The daughter of Peter I the Great (ruled 1682–1725) and Catherine I (ruled 1725–27), Elizabeth grew up to be a beautiful, charming, intelligent, and vivacious young woman. Despite her talents and popularity, particularly among the guards, she played only a minor political role during the reigns of Peter II (ruled 1727–30) and Empress Anna (ruled 1730–40). But when Anna Leopoldovna assumed the regency for her son Ivan VI (1740–41) and threatened Elizabeth with banishment to a convent, the young princess allowed herself to be influenced by the French ambassador and other members of the Russian court who hoped to reduce German domination over Russian affairs and reverse Russia's pro-Austrian, anti-French foreign policy. On the night of Dec. 5–6, 1741, she staged a coup d'état, arresting the infant emperor, his mother, and their chief advisers; after summoning all the civil and ecclesiastical notables of St. Petersburg, Elizabeth was proclaimed empress of Russia.

Elizabeth, empress of Russia, detail of a portrait by an unknown artist, 18th century; in the collection of Mrs. Merriweather Post, Hillwood, Washington, D.C.

By courtesy of Mrs. Merriweather Post, Hillwood, Washington, D.C.

Upon ascending the throne, Elizabeth abolished the Cabinet council system of government that had been employed by her predecessors and formally reconstituted the Senate as it had been created by her father. As a result of this and similar measures, her reign has been generally characterized as a return to the principles and traditions of Peter the Great. In fact, Elizabeth's restoration of the Senate as the chief governing body was only nominal (the country really being ruled by her private chancery), and the Empress actually abolished some of her father's major reforms. Furthermore, rather than assume a dominant role in government as Peter had done, Elizabeth occupied herself with splendid court and church activities and the purchase of stylish Western clothing. She also encouraged the development of education and art, founding Russia's first university (in Moscow) and the Academy of Arts (in St. Petersburg) and building the extravagant Winter Palace (also in St. Petersburg). She left control of most state affairs to her advisers and favourites, under whose leadership the effectiveness of Russia's government was handicapped by continual court intrigues; the country's financial situation deteriorated; and the gentry acquired broad privileges at the expense of the peasantry.

Simultaneously, however, Russia's prestige as a major European power grew; guided by Aleksey Bestuzhev-Ryumin, who enjoyed Elizabeth's complete confidence, the country firmly adhered to a pro-Austrian, anti-Prussian foreign policy, annexed a portion of southern Finland after fighting a war with Sweden (1741–43), improved its relations with Great Britain, and successfully conducted hostilities against Prussia during the Seven Years' War (1756–63).

Before Russia and its allies, France and Austria, could force Prussia's collapse, however, Elizabeth died, leaving her throne to her nephew Peter III, who was a great admirer of Frederick II the Great of Prussia and who withdrew Russia from the war.

Spain

• **Elizabeth I–II:** *see* Isabella I–II.

Elizabeth (b. Dec. 24, 1837, Munich—d. Sept. 10, 1898, Geneva), empress consort of Austria from April 24, 1854, when she married the emperor Francis Joseph I. She was also queen of Hungary (crowned June 8, 1867) after the Austro-Hungarian *Ausgleich,* or Compromise. Her assassination brought her rather unsettled life to a tragic end.

Elizabeth of Austria, detail from a portrait by Leopold Horowitz

By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

She was the daughter of the Bavarian duke Maximilian Joseph. In August 1853 she met her cousin Francis Joseph, then aged 23, who quickly fell in love with the 15-year-old Elizabeth, who was regarded as the most beautiful princess in Europe. Soon after their marriage she showed a neurotic restlessness that may have been derived from her Wittelsbach ancestors. Generally popular with her subjects, she offended Viennese high society by her impatience with the rigid etiquette of the court.

The Hungarians admired her, especially for her endeavors in bringing about the Compromise of 1867. She spent much time at Gödöllő, north of Budapest. Her enthusiasm for Hungary, however, affronted German sentiment within Austria. She partly assuaged Austrian feelings by her care for the wounded in the Seven Weeks' War of 1866.

The suicide of her only son, the crown prince Rudolf, in 1889, was a shock from which Elizabeth never fully recovered. It was during a visit to Switzerland that she was mortally stabbed by an Italian anarchist, Luigi Luccheni.

Elizabeth, in full ELIZABETH ANGELA MARGUERITE, *née* BOWES-LYON, also called (1923–36) DUCHESS OF YORK (b. Aug. 4, 1900, St. Paul's Waldenbury, Hitchin, Hertfordshire, Eng.), queen consort of the United Kingdom of Great Britain and Ireland (1936–52), wife of King George VI.

The Lady Elizabeth Bowes-Lyon was the youngest daughter of Claude George Bowes-Lyon, 14th earl of Strathmore and Kinghorne (d. 1944); the Bowes-Lyon family could claim descent from Robert the Bruce, king of Scotland. On April 26, 1923, Elizabeth was married to Albert, duke of York, second son of King George V. This marriage was a popular departure from the long-standing practice of an English prince marrying into a foreign royal family. On Dec. 11, 1936, upon the abdication of Edward VIII and the accession of her husband as George VI, Elizabeth became queen consort. She never forgave Edward, afterward duke of Windsor, for having abandoned the throne to George, without the latter's adequate anticipation or preparation.

She bore two daughters, Elizabeth Alexandra Mary, the future queen Elizabeth II (b. 1926; *see* Elizabeth II *under* Elizabeth [England and Great Britain]), and Princess Margaret Rose, the future countess of Snowden (b. Aug. 21, 1930). After her husband's death in 1952 and the accession of Elizabeth II, she became known officially as Her Majesty Queen Elizabeth, the Queen Mother. She remained one of the most popular and admired members of the royal family.

Elizabeth, city, seat (1857) of Union County, northeastern New Jersey, U.S., on Newark Bay and Arthur Kill (connected by bridge to Staten Island, N.Y.), adjacent to Newark. Settlement began in 1664 with the purchase of land from the Delaware Indians. It was named Elizabethtown to honour the wife of Sir George Carteret, one of the colony's first proprietors. The first colonial assembly met there from 1668 to 1682. In 1740 it was chartered as the "free borough and town of Elizabeth." Elizabeth suffered severely during the American Revolution and was the scene of four military engagements. In the 1830s the Port of Staten Island was developed, which, together with the coming of the railroads, assured Elizabeth's steady growth. The city is highly industrialized, with important shipping operations including the Elizabeth-Port Authority Marine Terminal, with facilities for containerized shipping. Manufactures include sewing machines (the Singer Company relocated there in 1873), textiles, chemicals, automobiles, and machinery. Princeton University originated (1746) in Elizabeth as the College

Elizabeth-Port Authority Marine Terminal, Elizabeth, N.J.

By courtesy of the Port Authority of New York and New Jersey

of New Jersey. Boxwood Hall, now a state historic site, was the home of Elias Boudinot, president (1783) of the Continental Congress. Alexander Hamilton and Aaron Burr both attended the old academy (burned by the British in 1780) situated where the city's First Presbyterian Church parish house now stands. Inc. city, 1855. Pop. (1980) 106,201.

Elizabeth OF BAVARIA: *see* Isabella of Bavaria.

Elizabeth OF FRANCE, French ÉLISABETH DE FRANCE, in full ÉLISABETH-PHILIPPINE-MARIE-HÉLÈNE, byname MADAME ÉLISABETH (b. May 3, 1764, Versailles, Fr.—d. May 10, 1794, Paris), French princess, Louis XVI's sister, noted for her courage and fidelity during the Revolution, which sacrificed her to the guillotine.

She was the youngest daughter of the dauphin Louis (d. 1765) and Maria Josepha of Saxony. Whereas her aunt and two of her brothers (the future Louis XVIII and Charles X) emigrated early enough, Madame Élisabeth refused to leave Louis XVI and Marie-Antoinette at grips with the Revolution. She was imprisoned with them in the Temple after the suspension of the monarchy on Aug. 10, 1792, and shared all the hardships that this involved. She was sentenced to death by the Revolutionary tribunal. The fortitude and patience with which she bore her trials won lasting respect, especially in Catholic and royalist circles.

The *Mémoires de Madame Élisabeth,* edited by F. de Barghon Fort-Rion (1858), are of doubtful authenticity; and the *Correspondance de Madame Élisabeth de France,* edited by F. Feuillet de Conches (1868), should be consulted only with caution. There are English versions of some of the letters by K.P. Wormeley, *The Life and Letters of Madame Élisabeth de France* (1902).

Elizabeth OF HUNGARY, SAINT, German SANKT ELISABETH VON UNGARN (b. 1207, probably Pressburg, Hungary—d. Nov. 17, 1231, Marburg, Thuringia; canonized 1235; feast day November 17), princess of Hungary whose devotion to the poor (for whom she relinquished her wealth) made her an enduring symbol of Christian charity. The daughter of King Andrew II of Hungary, she was betrothed in infancy to Louis IV, son of Hermann I, landgrave of Thuringia, at whose court she was brought up. The marriage, which occurred when Louis succeeded his father (1221), proved to be ideal but brief. Louis died (1227) of plague at Otranto, Italy, en route to the Sixth Crusade. When his brother Henry assumed the regency, Elizabeth left and took refuge with her uncle, Bishop Eckbert of Bamberg. No longer caring for position or wealth, she joined the Third Order of St. Francis, a lay Franciscan group. At Marburg she built a hospice for the poor and sick, to whose service she devoted the rest of her life. She put herself under the spiritual direction of the incredibly severe ascetic Konrad von Marburg and lived in extreme poverty. Konrad has subsequently been judged too harsh in his treatment of her and unfit for his role.

Among the best known legends about Elizabeth is the one often depicted in art showing her meeting her husband unexpectedly on one of her charitable errands; the loaves of bread she was carrying were miraculously changed into roses. This transformation convinced him of the worthiness of her kind endeavours, about which he had been chiding her.

Elizabeth OF PORTUGAL, SAINT, byname THE PEACEMAKER, or THE HOLY QUEEN, Portuguese SANTA ISABEL DE PORTUGAL, or A PACIFICADORA, or A RAINHA SANTA (b. *c.* 1271—d. July 4, 1336, Estremoz, Port.; canonized 1625; feast day July 8), daughter of Peter III of Aragon, wife of King Dinis (Denis) of Portugal. She was named for her great-aunt St. Elizabeth of Hungary and received a strict and pious education. In 1282 she was married to Dinis, a good ruler but an unfaithful husband. Despite the corrupt court life, Elizabeth maintained her devout habits, helped the sick and the poor, and founded charitable establishments. When her son Afonso rebelled against his father, Elizabeth rode between the two armies and reconciled father and son. She also helped settle disputes among other royal relatives. After Dinis died in 1325, she lived at Coimbra, Port., near a Poor Clare convent that she had founded, and devoted herself to people in need. She died on her way to the battlefield to make peace between her son, then King Afonso IV, and Alfonso XI of Castile.

Elizabeth STUART (b. Aug. 19, 1596, Falkland Palace, Fifeshire, Scot.—d. Feb. 13, 1662, Westminster, London), British princess who from 1619 was titular queen of Bohemia.

The daughter of James VI of Scotland (later James I of Great Britain) and Anne of Denmark, in 1606 she came to the British royal court, where her beauty and charm attracted much attention and where she soon became a favourite subject of the poets. Gustavus Adolphus of Sweden, Philip III of Spain, and Frederick V, the Elector Palatine, all sought her hand. Her mother actively favoured the Spanish match, but her father, hoping to strengthen his ties with the German Protestant rulers, chose Frederick. After the wedding (February 1613), the couple left for Heidelberg. Their first child, Frederick Henry, was born in January 1614; their most famous son, Prince Rupert (*q.v.*), was born in December 1619.

In 1619 the Bohemians, in defiance of their Habsburg king Ferdinand, offered the crown of Bohemia to Frederick. In November 1619 he was crowned king (as Frederick I), but in November 1620 the Bohemian forces were defeated by the Catholic League acting for Ferdinand (then Holy Roman emperor). Elizabeth and Frederick fled, ultimately finding refuge at The Hague with Prince Maurice of Orange.

Elizabeth spent the ensuing 40 years in exile. Her eldest son died in 1629 and her husband in 1632. When in 1648 her second son, Charles Louis, was restored to the Palatinate, he ignored her pleas to join him, and in 1650 a pension from the House of Orange ceased. Help from England stopped owing to the Civil War (1642–51) between supporters of Elizabeth's brother, Charles I, and the Parliamentarians. In 1661 her nephew Charles II grudgingly allowed her to return to England.

Queen Elizabeth's letters were published in 1953, edited by L.M. Baker.

Elizabeth City, city, seat (1799) of Pasquotank County, northeastern North Carolina, U.S. It lies on the Pasquotank River, at the southern end of Dismal Swamp Canal on the Atlantic Intracoastal Waterway. It was founded and incorporated as Redding in 1793 but was renamed probably for Elizabeth, wife of Adam Tooley, the original landholder. Its excellent harbour was developed after the canal (completed 1828) stimulated trade with the West Indies. A port of entry, it ships local products and has lumberyards, shipyards, textile mills, and diversified industries. Elizabeth City State University was founded in 1891 and College of the Albemarle in 1960. Nearby are U.S. Coast Guard installations, Kitty Hawk (where the Wright brothers made their first flight, 1903), and the Outer Banks (on the Atlantic Flyway, a rendezvous for wildfowl hunters and fishermen). The International Cup Regatta and the Rockfish Rodeo are annual fall events. Halls Creek, near the city, was the site of the first Grand Assembly of Carolina (1665), and Enfield Farm was the scene (1677–79) of Culpeper's Rebellion (*q.v.*). Pop. (1980) 13,784.

Elizabeth Islands, chain of small islands extending southwest for 16 mi (26 km) from the tip of Cape Cod, southeastern Massachusetts, U.S., between Buzzards Bay and Vineyard Sound. Administratively a part of Dukes County, they constitute Gosnold town (a township area settled in 1641 and incorporated in 1864) and include Naushon, Pasque, Nashawena, and Cuttyhunk. The islands (named for Princess Elizabeth, daughter of James I) were visited in 1602 by the English navigator Bartholomew Gosnold, who built a fort and established a short-lived (three-week) colony on Cuttyhunk (the westernmost island) 18 years before the arrival of the "Mayflower" pilgrims at Plymouth. The name Cuttyhunk may be a distortion of a Wampanoag Indian term meaning "a thing that lies out in the great water." Naushon, the largest island, was a British naval base during the War of 1812. The islands are low-lying, cover an area of about 14 sq mi (36 sq km), are mostly privately owned, and may be reached only by boat and charter aircraft. Cuttyhunk is a popular base for sports fishing. Pop. (1980) 63.

Elizabethan literature, body of works written during the reign of Elizabeth I of England (1558–1603), probably the most splendid age in the history of English literature, during which such writers as Sir Philip Sidney, Edmund Spenser, Roger Ascham, Bishop Richard Hooker, Christopher Marlowe, and William Shakespeare flourished. The epithet Elizabethan can do no more than suggest the immense vitality and richness of English literature produced in the late 16th and early 17th centuries and does not describe any special characteristic of the writing. The Elizabethan age saw the flowering of poetry (the sonnet, the Spenserian stanza, dramatic blank verse), was a golden age of drama (especially for the plays of Shakespeare), and inspired a wide variety of splendid prose (from historical chronicles, versions of the Holy Scriptures, pamphlets, and literary criticism, to the first English novels). From about the beginning of the 17th century a sudden darkening of tone became noticeable in most forms of literary expression, especially in drama, and the change more or less coincided with the death of Elizabeth. English literature from 1603 to 1625 is properly called Jacobean, after the new monarch, James I. But, insofar as 16th-century themes and patterns were carried over into the 17th century, the writing from the earlier part of his reign, at least, is sometimes referred to as "Jacobethan."

Elizabethton, city, seat (1796) of Carter County, northeastern Tennessee, U.S., at the confluence of the Doe and Watauga rivers, in the southern Appalachian Mountains and the Unaka Division of the Cherokee National Forest, just east of Johnson City. Situated in Happy Valley, it is one of the region's oldest settlements, where a compact for self-government (the Watauga Association) was made in 1772. The community was named for Elizabeth (wife of Landon Carter, an early settler, for whom the county was named). From nearby Sycamore Shoals (now a state historic area) Revolutionary War patriots marched to the Battle of Kings Mountain (1780) in South Carolina. Pres. Andrew Johnson died at Stover House, on the banks of the Watauga.

The city's varied manufactures include synthetic yarns, twine, clothing, corrugated boxes, piano strings, and furniture. Milligan College (1881) is 5 mi (8 km) east. Nearby Watauga and Boone lakes are impounded by Tennessee Valley Authority dams and provide recreational facilities. Inc. 1905. Pop. (1980) 12,431.

Elizabethtown, city, seat of Hardin County, central Kentucky, U.S., 48 mi (77 km) south

of Louisville. Settled as Severns Valley Station (1779–80), it was laid out in 1793 by Colonel Andrew Hynes and named for his wife when it was officially established in 1797. Abraham Lincoln's father, Thomas, lived for a time in Elizabethtown in the early 1800s. The Abraham Lincoln Birthplace National Historic Site is 13 miles (21 km) southeast of the city. During the American Civil War the town was bombarded by the forces of the Confederate general John Morgan.

Elizabethtown developed as a trading centre for agricultural produce, tobacco, and spirits and after World War II acquired diversified industry. The Elizabethtown Community College, a branch of the state university, was opened in 1964. My Old Kentucky Home State Shrine, the Patton (Armor) Museum, and Fort Knox with its gold vaults are in the vicinity. Inc. city, 1893. Pop. (1987 est.) 16,393.

Elizaveta (Russian personal name): *see under* Elizabeth.

Elizavetgrad (Ukrainian S.S.R.): *see* Kirovograd.

elk, in Europe, a member of *Alces alces,* large-hoofed mammals known in North America as the moose (*q.v.*). The name is also used for several large deer of the genus *Cervus,* notably the red deer of Europe, the Kashmir stag and the Himalayan shou, as well as the North American deer more correctly called wapiti (*q.v.*). The name is also applied to the extinct Irish elk (*q.v.*).

elk, American: *see* wapiti.

Elk City, city, Beckham county, western Oklahoma, U.S., on Elk Creek. Laid out in 1901, the town was first called Busch. It is now the service centre for an agricultural, oil, and livestock area and has industries that include oil refining, gas recycling, cotton-gin equipment, furniture manufacturing, and feed production. The Sandstone Creek Project, concerned with upstream flood control of the Washita River, is 5 miles (8 km) northwest, and the Red Moon Indian Reservation, the Washita National Wildlife Refuge, and Foss Reservoir State Park are nearby. Old Town Museum at the city's western edge is a replica of an early Western town. Inc. 1907. Pop. (1988 est.) 10,910.

Elk Hills Scandal (U.S. history): *see* Teapot Dome Scandal.

Elk Island National Park, park in central Alberta, Canada, 20 miles (32 km) east of Edmonton. Established in 1906 as a game preserve, it is one of Canada's smaller national parks, with an area of 75 square miles (194 square km). The park is mostly forested but has facilities for prairie grazing. Tawayik Lake and its numerous islands form the chief resort area. The park is fenced and protects a large herd of buffalo, as well as wapiti, deer, and moose.

Elk Mountains, segment of the southern Rockies, extending for 50 miles (80 km) through Pitkin and Gunnison counties, west-central Colorado, U.S. Several peaks surpass 14,000 feet (4,300 m), including Pyramid, Snowmass, Capitol, and Maroon peaks, with Mount Carbon (14,259 feet [4,346 m]) being the highest. Mount Gunnison (12,714 feet [3,875 m]) is the high point in the West Elk Mountains, a southwesterly extension. Embraced by the Gunnison and White River national forests, the mountains are noted for their mineral deposits and recreational appeal.

Elk River, river rising as Bradley Creek in the Cumberland Mountains, Grundy county, southern Tennessee, U.S. The river meanders approximately 200 miles (320 km) southwestward through Franklin and Lincoln counties, past Fayetteville, across the southeastern corner of Giles county, and into Alabama. There it enters the Tennessee River 6 miles (10 km) east of Wheeler Dam, where it forms part of Wheeler Reservoir.

Elkesaite, also spelled ELKASAITE, member of a Jewish sect that arose in the vicinity of Trans-Jordanic Palestine around 100 AD. The sect was most noted for its practice of ritual baptism. Named after either a visionary leader named Elkesai or the book of revelation that bore his name, the group followed most Jewish laws, believed in the power of total-immersion baptism to remit sins, and may have practiced a form of communion with bread and salt.

Elkesaism drew followers from the Essene sect of Judaism and from among the Aramaic Jewish-Christians in the region of the Dead Sea. In later years, by 220 AD, the group adopted a Christological doctrine, apparently in an attempt to attract Greek-speaking Christians, but had virtually died out by 400 AD.

Elkhart, city, Elkhart county, northern Indiana, U.S. It lies at the confluence of the St. Joseph and Elkhart rivers, just west of South Bend. Elkhart was laid out in 1832 at the junction of Indian trails and derives its name from an island at the confluence of the rivers which Indians said was shaped like an elk's heart. The location there of repair shops for the Michigan Southern Railroad stimulated development of the town, which also became a division point for the New York Central Railroad. The manufacture of brass cornets was begun there in 1875 by Charles G. Conn; his company (now one of the world's largest makers of wind instruments), followed by others, has made Elkhart the band instrument centre of the country. The city's pharmaceutical industry (Miles Laboratories, Inc.) was established by Dr. Franklin Miles in 1884. Other manufactures now include mobile homes, furniture, electrical components, and machinery. Elkhart is also an agricultural marketing centre (livestock, dairy products, soybeans, and grains). Inc. 1877. Pop. (1988 est.) 45,531.

Elkhorn Tavern, Battle of (American Civil War): *see* Pea Ridge, Battle of.

Elkins, city, seat (1898) of Randolph county, eastern West Virginia, U.S. It lies along the Tygart Valley River, 35 miles (56 km) southeast of Clarksburg. A rural settlement known as Leadsville before 1889, the town was laid out after the arrival of the Western Maryland Railway and was renamed (1890) to honour the U.S. senator Stephen Benton Elkins. A trade and shipping centre for nearby timber, agricultural, and coal regions, the city also has light manufactures. Elkins is the home of Davis and Elkins College (1903) and is the headquarters of the Monongahela National Forest. The Mountain State Forest Festival is held there annually in October. The Bowden National Fish Hatchery and Stuart Recreation Area are nearby. Inc. 1890. Pop. (1986 est.) 8,020.

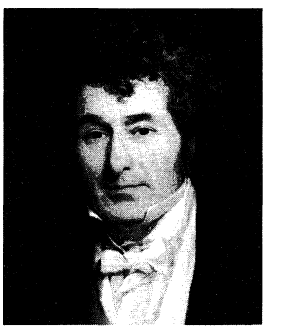
Elko, city, seat (1869) of Elko county, northeastern Nevada, U.S., in the Humboldt River valley. It originated in 1868 as a construction camp along the Central Pacific Railroad. Elko (a common railroad name of uncertain origin) developed as a transportation and communications centre. The present economy of the city is based on the raising of livestock (cattle and sheep), some mining (gold, silver, and copper), freight handling, and tourism. Northern Nevada Community College was established there in 1967. Elko is surrounded by segments of the Humboldt National Forest, which is headquartered in the city. Inc. 1917. Pop. (1986 est.) 11,660.

Elkton, town, seat (1786) of Cecil county, northeastern Maryland, U.S. It lies near the Delaware state line, 19 miles (31 km) west-southwest of Wilmington. Patented as Friendship in 1681, it was later known as Head of the Elk (for its location at the head of navigation on the Elk River), and it became an outlet for shipping wheat. In August 1777 during the American Revolution, the British under General Sir William Howe landed on Elk Neck (a promontory just southwest of Elkton) prior to an attack on Philadelphia.

A British naval squadron attacked the town during the War of 1812 but was repulsed. Elkton was known as the "Gretna Green of the East" and conducted a lucrative business in quick marriages until a 1938 state law stipulated a 48-hour waiting period; the town still has its wedding chapels and remains a popular destination of eloping couples.

Several buildings survive from the colonial period, including Gilpin Manor and Partridge Hill. Elk Neck State Park with Turkey Point Lighthouse (1834) is nearby. A large automobile plant at Newark, Del., immediately northeast, is important to Elkton's economy, which also depends on boatbuilding and the manufacture of explosives, propellants, plastics, rubber products, and clothing. Pop. (1986 est.) 7,180.

Ellenborough, Edward Law, Earl of, VISCOUNT SOUTHAM OF SOUTHAM, BARON ELLENBOROUGH OF ELLENBOROUGH (b. Sept. 8, 1790, London, Eng.—d. Dec. 22, 1871, Southam Delabere, Gloucestershire), British governor-general of India (1842–44), who also served four times as president of the board of control for India and was first lord of the British Admiralty. He was recalled from India for being out of control and later resigned another office under pressure.



Earl of Ellenborough, detail of an oil painting by F.R. Say, *c.* 1845; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Educated at Eton and at St. John's College, Cambridge, he entered the House of Commons in 1813 and the House of Lords as a baron following his father's death in 1818. He served as lord privy seal in 1828 and was president of the board of control for India in 1828–30 and for brief periods in 1834–35 and 1841. In the latter year Ellenborough was appointed governor-general of India. He had opposed since 1839 the costly intervention in Afghanistan, and after the First Afghan War he decided to make the Indus River his frontier, retaining only those strong-points upon it which ensured free navigation. However, rash opportunism led him to acquiesce in actions of Sir Charles James Napier (*q.v.*), his governor in Sind, which drove the Sindhi emirs (rulers) into war and defeat (1843).

Ellenborough then pursued his plans to promote trade by ending tolls and duties throughout Sind, Bahāwalpur, the North Western Provinces, Madras, and Bombay. But a war with Gwalior in December 1843, designed to keep its large army out of hostile hands, frustrated these plans, and the directors, exasperated by Ellenborough's arrogant self-will, resolved, in April 1844, to recall him. On his return he was created an earl and viscount.

Ellenborough served under Sir Robert Peel as first lord of the Admiralty in 1846 and under Lord Derby at the Board of Control in 1858. There he drafted the new plan for the government of India, which the Indian Mutiny had rendered necessary; but, by making public a caustic dispatch censuring Lord Canning's Oudh proclamation, which Ellenborough thought betrayed a desire for indiscriminate vengeance, he roused such opposition that he chose to resign. He never held office again.

Ellensburg, former ROBBER'S ROOST, city, seat (1883) of Kittitas county, central Washington, U.S., on the Yakima River, 28 miles (45 km) north of Yakima. The first white man settled there in 1867, and in 1870 the valley's first trading post was opened. In 1875 John Shoudy platted a townsite, naming it for his wife. Growth of the community was given impetus in 1887 by the building of the Northern Pacific Railway through to Puget Sound. Central Washington State College, opened there as a teacher college in 1891, provides a major source of employment. Ellensburg cherishes a Wild West tradition and is the site of the state's major rodeo (Labor Day weekend); the area is known for its dude ranches. Sheep and cattle are raised, and hay, small grain, and potatoes are grown on land irrigated through the Yakima Reclamation Project. Ginkgo Petrified Forest State Park (with numerous species of agatized wood and, at 7,184 acres [2,887 hectares], one of the world's largest petrified forests) is 28 miles (45 km) east. Inc. town, 1883; city, 1886. Pop. (1987 est.) 11,430.

Ellerman, Annie Winifred (British writer): *see* Bryher.

Ellesmere, Lake, coastal lagoon, eastern South Island, New Zealand, just west of Banks Peninsula. It measures 14 by 8 miles (23 by 13 km) and is 70 square miles (180 square km) in area. Receiving runoff from a 745-square-mile (1,930-square-kilometre) basin through several streams, principal of which is the Selwyn (entering through a delta from the north), Lake Ellesmere is brackish and is no deeper than 7 feet (2 m). It is isolated from the Pacific by the Kaitorete Spit, a gravel formation created by materials eroded from the Canterbury Plain and carried north by shore currents. There is no natural channel through the spit, but, to prevent rising waters from inundating market-gardening areas on reclaimed sections of the swampy shore, an opening has been dug at Taumutu in the southwest. The lake is host to great flocks of waterfowl. Its Maori name, Waihora, means "wide waters."

Ellesmere, Thomas Egerton, Baron: *see* Brackley, Thomas Egerton, Viscount.

Ellesmere Island, largest island of the Queen Elizabeth Islands, Baffin region, Northwest Territories, Canada. Off the northwest coast of Greenland, the island is believed to have been visited by Vikings in the 10th century. It was seen in 1616 by the explorer William Baffin and was named in 1852 by Sir Edward A. Inglefield's Expedition (which navigated the coast in the *Isabel*) after Francis Egerton, 1st Earl of Ellesmere. The island, roughly 300 miles wide by 500 miles long (500 km wide by 800 km long) and covering an area of 75,767 square miles (196,236 square km), is the most rugged in the Canadian Arctic Archipelago, with towering mountains (up to 8,583 feet [2,616 m]), vast ice fields, and a deeply indented coastline. Cape Columbia, at 83°07′ N, is the most northerly point of Canada. Settlements, all quite small, include Eureka, Craig Harbour, and Alert, the northernmost community in North America. Oil deposits have been discovered on the island.

Ellesmere Port and Neston, district (borough), county of Cheshire, England, extending from the River Mersey to the River Dee at the southern end of the Wirral Peninsula. Ellesmere Port is very much a 20th-century creation. The building of the Ellesmere Canal in 1795 saw the beginnings of industrial development, but it was the opening of the Manchester Ship Canal in 1894 that marked the emergence of Ellesmere Port as a major industrial centre. Petroleum refining began after World War I. After World War II, as refining and chemical industries expanded at Stanlow, the town grew rapidly. Other industries followed, including motor-vehicle manufacturing. In the west of the borough are the residential communities of Neston and Parkgate, the latter was an 18th-century port for ships from Ireland. The borough, covering 32 square miles (82 square km), also includes a number of villages. Pop. (1986 est.) 80,200.

Ellet, Charles (b. Jan. 1, 1810, Penn's Manor, Pa., U.S.—d. June 21, 1862, Cairo, Ill.), American engineer who built the first wire-cable suspension bridge in America.

After working for three years as a surveyor and assistant engineer, he studied at the École des Ponts et Chaussées, Paris, and traveled in France, Switzerland, and Great Britain, studying engineering works. After he returned to the United States in 1832, he proposed to Congress a 1,000-foot (305-metre) suspension bridge over the Potomac River at Washington, D.C. Like several of his early projects, this plan was too advanced for its time and was generally discouraged. In 1842 Ellet completed his wire-cable suspension bridge over the Schuylkill River at Philadelphia. Supported by five wire cables on each side, the bridge had a span of 358 feet (109 m).

Ellet designed and built (1846–49) for the Baltimore & Ohio Railway the world's first long-span wire-cable suspension bridge over the Ohio River at Wheeling, Va. The central span of 1,010 feet (308 m) was then the longest ever built.

In 1847 Ellet contracted to build a bridge over the Niagara River, 2 miles (3 km) below the falls. A light suspension span was built as a service bridge, and over it Ellet became the first man to ride across the Niagara Gorge. A dispute over money led Ellet to resign in 1848, leaving the bridge uncompleted.

After the outbreak of the American Civil War, Ellet devised a steam-powered ram that played a role in winning domination of the Mississippi River by the Union. He personally led a fleet of nine rams in the Battle of Memphis on June 6, 1862. Union forces were victorious, but Ellet was mortally wounded.

Ellice Islands (Pacific Ocean): *see* Tuvalu.

Ellington, Duke, byname of EDWARD KENNEDY ELLINGTON (b. April 29, 1899, Washington, D.C.—d. May 24, 1974, New York City), American composer, bandleader, and pianist who is among the most significant figures in jazz history and, along with Fletcher Henderson and Don Redman, was one of the founders of big-band jazz, which led to the swing era.

Ellington
down beat magazine

Ellington studied piano from age seven and in his teens was influenced by ragtime pianists; at 17 he began to play professionally. The following year he renounced the fine arts, toward which his parents had oriented him, to devote himself to jazz.

In about 1923, at the Kentucky Club in New York City, he led a small group that was later the core of his large band. In this period, the group contained Harry Carney, Sonny Greer, and, above all, Bubber Miley and Tricky Sam Nanton. Their tense or piercing sonorities constituted the essential element of the "jungle style" that asserted itself in pieces such as "Black and Tan Fantasy."

Almost without interruption from then until his death, Ellington led a band that was his laboratory for composition, orchestration, and the unique blend of improvisation and orchestration that he mastered with instrumentalists who spent most of their careers with him. He capitalized on the unique personal sounds of outstanding players such as trumpeter Cootie Williams, saxophonist Johnny Hodges, and bassist Jimmy Blanton, using each as a separate tone colour and writing ensemble parts suited to each player rather than writing just for the tone quality traditionally identified with the instrument. Especially characteristic of Ellington was the plunger-muted growl style of trombonist Nanton and trumpeter Miley. Ellington artfully employed wordless female vocals as another tone colour. Unlike his contemporaries, Ellington often broke away from the standard practice of grouping instruments of a kind and writing passages that pitted them against each other (*e.g.*, saxophones versus brass). He instead drew instruments from different sections of the band and voiced them together as a unit, thereby generating rich and unusual sounds such as the well-known "Mood Indigo" voicing of bass clarinet, muted trumpet, and trombone.

More than 1,000 orchestrations were crafted by Ellington, including not only brief big-band pieces but ones for film scores, operas, ballets, Broadway shows, and church services, many involving symphony orchestra, choruses, and dancers. The Ellington tunes most frequently performed by others include "Satin Doll," "Sophisticated Lady," "Don't Get Around Much Anymore," "Do Nothin' Til You Hear from Me," and "In a Sentimental Mood." His best-known longer works include *Black, Brown, and Beige* and *Reminiscing in Tempo.* Some pieces associated with Ellington were written by his musicians: pianist-arranger Billy Strayhorn wrote "Take the 'A' Train" and "Lush Life"; trombonist Juan Tizol wrote "Perdido" and "Caravan."

As a pianist, Ellington drew from the East Coast stride style of James P. Johnson and Willie the Lion Smith, streamlining it into the swinging and sprightly embroidery style that he used as accompaniment for his improvising soloists and as an additional orchestral colour. The piano style influenced Thelonious Monk, a leading modern-jazz composer-pianist, while Ellington's arranging concepts were assimilated by Gil Evans, Thad Jones, George Russell, Clare Fischer, Charles Mingus, Sun Ra, and other significant modern composers. In part owing to the showcase Ellington provided for them, several of his musicians had strong impact on jazz styles for their particular instruments: Hodges' approach to alto saxophone ballad interpretation, Blanton's method of hornlike solo lines played pizzicato on bass, and Ben Webster's tenor saxophone approach.

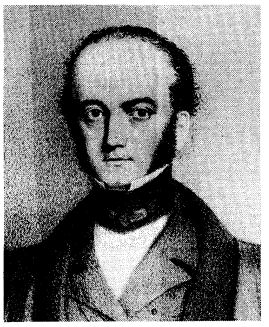
It is generally agreed that Ellington's masterpieces include a group of lesser-known works done between 1939 and 1942, which show a remarkably compatible matching of improvisations and prewritten passages: "Harlem Air Shaft," "Jack the Bear," "Concerto for Cootie," "Ko-ko," and "Cotton Tail." *The World*

of Duke Ellington by Stanley Dance contains interviews with the bandleader and his musicians and was published in 1970. An autobiography, *Music Is My Mistress,* appeared in 1973, and a biography by Ellington's son Mercer, *Duke Ellington in Person,* was published in 1978. James Lincoln Collier's *Duke Ellington* appeared in 1987.

Elliot (-Murray-Kynynmound), Gilbert: *see* Minto, Gilbert Elliot (-Murray-Kynynmound), 1st Earl of; Minto, Gilbert (John) Elliot (-Murray-Kynynmound), 4th Earl of.

Elliot Lake, town, Algoma district, south-central Ontario, Canada. It lies along the Elliot and Horne lakes, midway between Sault Ste. Marie and Sudbury and about 15 miles (25 km) north of Lake Huron's North Channel. Established in 1954 as a planned community when uranium ore was discovered in the vicinity, Elliot Lake grew rapidly to serve one of the world's largest uranium-producing districts and is the site of a mining and nuclear museum. It is now also a base for summer and winter sports, hunting, and fishing. Inc. 1966. Pop. (1986) 17,984.

Elliotson, John (b. Oct. 29, 1791, Southwark, London, Eng.—d. July 29, 1868, London), English physician who advocated the use of hypnosis in therapy, and who in 1849 founded a mesmeric hospital. He was one



Elliotson, detail of a lithograph

BBC Hulton Picture Library

of the first teachers in London to emphasize clinical lecturing and was one of the earliest of British physicians to urge use of the stethoscope.

After studying medicine at the University of Edinburgh, at the University of Cambridge, and in London hospitals, Elliotson taught at London University, and in 1834 became physician to the University College Hospital, where his interest in hypnosis led to conflicts with the hospital's medical committee and his resignation in 1838.

Elliott, Herb, byname of HERBERT JAMES ELLIOTT (b. Feb. 25, 1938, Perth, W.Aus., Australia), Australian middle-distance runner who was record holder in the 1,500-metre (metric-mile) race (1958–67) and the mile race (1958–62). As a senior runner he never lost a mile or a 1,500-metre race.

Elliott began running competitively at the age of eight. He ran his first sub-four-minute mile in 1958; and in that year he set a new world record with a 3 min 54.5 sec mile and in the 1,500-metre race with a time of 3 min 36 sec. Elliott ran the mile in less than four minutes 10 times in 1958 and 17 times during his career. In the 1960 Olympic Games at Rome, he won the gold medal in the 1,500-metre race, leading the second runner by 20 yards and setting a new record of 3 min 35.6 sec. He retired from competition in 1962.

ellipse, a closed curve, the intersection of a right circular cone (*see* cone) and a plane that is not parallel to the base, the axis, or an element of the cone. It may be defined as the path of a point moving in a plane so that the ratio of its distances from a fixed point (the focus) and a fixed straight line (the directrix) is a constant less than one. Any such path has this same property with respect to a second fixed point and a second fixed line, and ellipses often are regarded as having two foci and two directrixes. The ratio of distances, called the eccentricity, is the discriminant (*q.v.;* of a general equation that represents all the conic sections [*see* conic section]). Another definition of an ellipse is that it is the locus of points for which the sum of their distances from two fixed points (the foci) is constant. The smaller the distance between the foci, the smaller is the eccentricity and the more closely the ellipse resembles a circle.

A straight line drawn through the foci and extended to the curve in either direction is the major diameter (or major axis) of the ellipse. Perpendicular to the major axis through the centre, at the point on the major axis equidistant from the foci, is the minor axis. A line drawn through either focus parallel to the minor axis is a latus rectum (literally, straight side).

The ellipse is symmetric about both its axes. The curve when rotated about either axis forms the surface called the ellipsoid (*q.v.*) of revolution, or a spheroid.

The path of a heavenly body moving around another in a closed orbit in accordance with Newton's gravitational law is an ellipse (*see* Kepler's laws of planetary motion). In the solar system one focus of such a path about the Sun is the Sun itself.

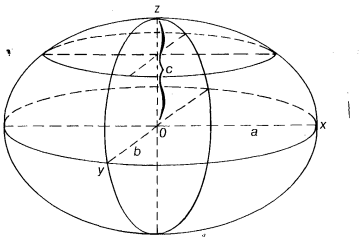
For an ellipse the centre of which is at the origin and the axes of which are coincident with the x and y axes, the equation is $x^2/a^2 + y^2/b^2 = 1$. The length of the major diameter is $2a$; the length of the minor diameter is $2b$. If c is taken as the distance from the origin to the focus, then $c^2 = a^2 - b^2$, and the foci of the curve may be located when the major and minor diameters are known. The problem of finding an exact expression for the perimeter of an ellipse led to the development of elliptic functions, an important topic in mathematics and physics.

ellipsoid, closed surface of which all plane sections are either ellipses or circles. An ellipsoid is symmetrical about three mutually perpendicular axes that intersect at the centre.

If a, b, and c are the principal semiaxes, the general equation of such an ellipsoid is $x^2/a^2 + y^2/b^2 + z^2/c^2 = 1$. A special case arises when $a = b = c$; then the surface is a sphere, and the intersection with any plane passing through it is a circle. If two axes are equal, say $a = b$, and different from the third, c, then the ellipsoid is an ellipsoid of revolution, or spheroid, the figure formed by revolving an ellipse (*q.v.*) about one of its axes. If a and b are greater than c, the spheroid is oblate; if less, the surface is a prolate spheroid.

An oblate spheroid is formed by revolving an ellipse about its major axis; a prolate, about its minor axis. In either case, intersections of the surface by planes parallel to the axis of revolution are ellipses, while intersections by planes perpendicular to that axis are circles.

Often an ellipsoid of revolution (called the reference ellipsoid) is used to represent the Earth in geodetic calculations, because such calculations are simpler than those with more complicated mathematical models. For this ellipsoid, the difference between the equatorial radius and the polar radius (the semimajor and semiminor axes, respectively) is about 21 km (13 miles) and the flattening is about 1 part in 300.



Ellipsoid

elliptic equation, any of a class of partial differential equations describing phenomena that do not change from moment to moment, as when a flow of heat or fluid takes place within a medium with no accumulations. The Laplace equation, $u_{xx} + u_{yy} = 0$, is the simplest such equation describing this condition in two dimensions. In addition to satisfying a differential equation within the region, the elliptic equation is also determined by its values (boundary values) along the boundary of the region, which represents the effect from outside the region. These conditions can be either those of a fixed temperature distribution at points of the boundary (Dirichlet problem) or those in which heat is being supplied or removed across the boundary in such a way as to maintain a constant temperature distribution throughout (Neumann problem).

If the highest order terms of a second-order partial differential equation with constant coefficients are linear and if the coefficients a, b, c of the u_{xx}, u_{xy}, u_{yy} terms satisfy the inequality $b^2 - 4ac < 0$, then, by a change of coordinates, the principal part (highest order terms) can be written as the Laplacian $u_{xx} + u_{yy}$. Because the properties of a physical system are independent of the coordinate system used to formulate the problem, it is expected that the properties of the solutions of these elliptic equations should be similar to the properties of the solutions of Laplace's equation (*see* harmonic function). If the coefficients a, b, c are not constant, but depend on x and y, then the equation is called elliptic in a given region if $b^2 - 4ac < 0$ at all points in the region. The functions $x^2 - y^2$ and $e^x \cos y$ satisfy the Laplace equation, but the solutions to this equation are usually more complicated because of the boundary conditions that must be satisfied as well.

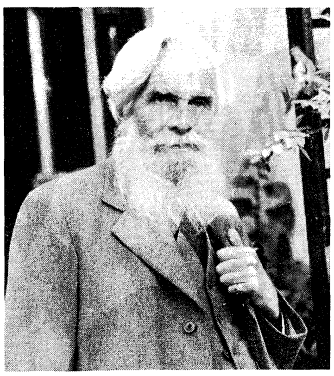
elliptic geometry (mathematics): *see* Riemannian geometry.

Ellis, (Henry) Havelock (b. Feb. 2, 1859, Croydon, Surrey, Eng.—d. July 8, 1939, Washbrook, Suffolk), English essayist and physician who studied human sexual behaviour and challenged Victorian taboos against public discussion of the subject.

The son of a sea captain, Ellis was educated at private schools in South London. After spending four years in Australia as a teacher, he returned to England in 1879 and entered St. Thomas' Hospital, London, in 1881 to study medicine. Ellis met George Bernard Shaw and Arthur Symons at meetings of the Fellowship of the New Life and became editor in 1887 of the "Mermaid Series of Old Dramatists," designed to bring 17th-century dramas to a wider public. Ellis also proposed and edited the "Contemporary Science Series," which included his first book, *The Criminal* (1890). The researches begun for *Man and Woman* (1894) led to his major work, the seven-volume *Studies in the Psychology of Sex* (1897–1928). Publication of the first volume resulted in a trial during which the judge hearing the case called claims for the book's scientific value "a pretence, adopted for the purpose of selling a filthy publication." Other volumes of the work were published in the United States and until 1935 were legally available only to the medical profession.

Ellis' *Studies in the Psychology of Sex* is a comprehensive and groundbreaking encyclopaedia of human sexual biology, behaviour, and attitudes. In separate volumes he examined such topics as homosexuality, masturba-

tion, and the physiology of sexual behaviour. Ellis viewed sexual activity as the healthy and natural expression of love, and he sought to dissipate the fear and ignorance that characterized many people's attitudes toward human

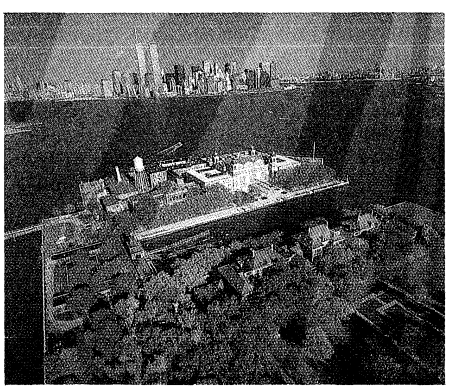


Havelock Ellis
The Mansell Collection

sexuality. His work helped to foster the open discussion of sexual problems, and he became known as a champion of women's rights and of sex education.

Ellis Island, island in Upper New York Bay that was the United States' principal immigration reception centre from 1892 to 1943. The island lies about 1 mile (1.6 km) southwest of the Battery of Manhattan, New York City, and about 1,300 feet (400 m) east of the New Jersey shore. It has an area of about 27 acres (11 hectares).

The island was named for Samuel Ellis, who owned it in the 1770s. For a time, ships' ballast was dumped there. In 1808 the state of New York sold the island to the federal gov-



Ellis Island, with the skyline of Manhattan in the background
Emmet Gowin

ernment for $10,000, and it was used for a fort and powder magazine. It served as the nation's major immigration station from 1892 to 1943; an estimated 17 million immigrants passed through Ellis Island, were processed there by immigration authorities, and obtained permission to enter the United States. After immigration reception was moved to New York City proper in 1943, Ellis Island continued to serve as a detention station for aliens and deportees until 1954. It became part of the Statue of Liberty National Monument in 1965 and was reopened to sightseers in 1976 by the National Park Service. The Main Building and other structures on the island were restored in the 1980s and opened in 1990 as the Ellis Island Immigration Museum, with displays chronicling America's immigrants.

Ellison, Ralph (Waldo) (b. March 11, 1914, Oklahoma City, Okla., U.S.), American teacher and writer who won eminence with his first and only novel, *Invisible Man* (1952). The story tells of a naive and idealistic Southern black youth who goes to Harlem, joins the fight against white oppression, and ends up ignored by his fellow blacks as well as by whites.

A shoeshine boy, jazz musician, and freelance photographer, Ellison left Tuskegee Institute (Alabama) in 1936 after three years' study of music and joined the Federal Writers' Project in New York City. In 1939 he began contributing short stories, reviews, and essays to various periodicals, and his novel *Invisible Man* won the 1953 National Book Award for fiction. After his novel appeared, Ellison published only a collection of essays, *Shadow and Act* (1964), but lectured widely on black culture, folklore, and creative writing and taught at various American colleges and universities.

Ellmann, Richard (David) (b. March 15, 1918, Highland Park, Mich., U.S.—d. May 13, 1987, Oxford, Oxfordshire, Eng.), American literary critic and scholar, an expert on the life and works of James Joyce, William Butler Yeats, Oscar Wilde, and other modern British and Irish writers.

Ellmann was graduated from Yale University (Ph.D., 1947) and taught at Northwestern University, Evanston, Ill., from 1951 to 1968, at Yale University from 1968 to 1970, and at the University of Oxford from 1970 to 1984. His book *Yeats: The Man and the Masks* (1948; reprinted 1978) is a study of one of Yeats's intense conflicts, the dichotomy between the self of everyday life and the self of fantasy. The book revealed Yeats as a timid and confused man behind a facade of arrogance. Ellmann's definitive biography of *James Joyce* (1959; new and rev. ed., 1982) explored in detail aspects of Joyce's life and thought; his work on this biography led to his editing Joyce's letters (1966) and other works on Joyce. His later works include *The Artist as Critic: Critical Writings of Oscar Wilde* and, as editor, *Oscar Wilde: A Collection of Critical Essays* (1970) and *New Oxford Book of American Verse* (1976). Ellmann's biography of *Oscar Wilde* appeared posthumously in 1988.

Ellora Caves, series of magnificent rock-cut temples of the Gupta period (6th–8th century AD), near the village of Ellora, central Mahārāshtra state, western India, 18 miles (29 km) northeast of Aurangābād town. The temples are excavated out of rock cliffs overlooking a plain and are of Buddhist, Hindu, and Jaina origins. The most remarkable of the monuments is the monolithic Kailāsanātha Temple, 165 feet (50 m) long and 96 feet (29 m) high, cut from a single outcropping of rock. It is extensively carved with exceptionally vigorous sculptures of Hindu divinities and mythological figures, many in erotic and voluptuous poses. The temple, dedicated to the Hindu god Śiva (Shiva), was built in the 8th century during the reign of the Rāṣṭrakūṭas. Ellora attracts many thousands of tourists annually.

Ellore (India): *see* Elūru.

Ellsworth, city, seat (1789) of Hancock county, southern Maine, U.S. It lies at the falls of the Union River, just south of Graham Lake, 26 miles (42 km) southeast of Bangor. It was settled in 1763, and its early development as a centre of lumber operations and shipbuilding was spurred by cheap waterpower. The city's light industries produce wood products, boats, and woolen goods. Nearby are Lamoine State Park and the Stanwood Museum and Birdsacre Sanctuary. Inc. town, 1800; city, 1869. Pop. (1986 est.) 5,460.

Ellsworth, Lincoln, original name WILLIAM LINN ELLSWORTH (b. May 12, 1880, Chicago, Ill., U.S.—d. May 26, 1951, New York, N.Y.), American explorer, engineer, and scientist

Lincoln Ellsworth
By courtesy of the American Geographical Society

who led the first trans-Arctic (1926) and trans-Antarctic (1935) air crossings.

A wealthy adventurer, Ellsworth was a surveyor and engineer in Canada for five years (1903–08), worked for three years with the U.S. Biological Survey, and served in the U.S. Army in World War I, training as an aviator. In 1924 he led the Johns Hopkins University (Baltimore) trans-Andean topographic survey from the Amazon River basin to the Pacific shores of Peru.

Fascinated with polar air exploration, he financed and accompanied two such expeditions with the Norwegian explorer Roald Amundsen. On the first (1925) they reached latitude 87°44′ N in two amphibian planes; an emergency landing without radio caused them to be given up for lost. After 30 days of grim effort, they carved out a takeoff field on the rough polar ice pack, after which one plane, overloaded with the total party of six, returned to Spitsbergen (now Svalbard), off northern Norway. The following year Ellsworth and the Italian explorer Umberto Nobile made the first crossing of the North Polar Basin in the dirigible *Norge*—a 3,393-mile (5,463-kilometre) journey from Spitsbergen to Alaska that won worldwide acclaim. In 1931 Ellsworth made an 800-mile (1,300-kilometre) canoe trip through central Labrador and later that year, for the American Geographical Society, made flights over Franz Josef Land and Novaya Zemlya—Arctic islands north of the Soviet Union.

In 1935, on the third of four private expeditions to the Antarctic, he flew across the continent from the Antarctic Peninsula to the Bay of Whales. The area he covered, including Sentinel and Eternity mountains, is now named Ellsworth Land. In 1939 he again flew over Antarctica and named the American Highland in the Indian Ocean quadrant, bringing the Antarctic terrain he claimed for the United States to 300,000 square miles (777,000 square km).

Ellsworth, Oliver (b. April 29, 1745, Windsor, Conn. [U.S.]—d. Nov. 26, 1807, Windsor), American lawyer, politician, and diplomat and third chief justice of the United States

Oliver Ellsworth, oil painting on wood by John Trumbull, 1792; in the Yale University Art Gallery
By courtesy of the Yale University Art Gallery

(1796–1800), who is best-remembered as the coauthor (with Roger Sherman) of the Connecticut Compromise (1787), concerning representation in the two houses of Congress, and as the chief author of the Judiciary Act of 1789, establishing the federal court system.

From 1775 he built a practice in Hartford, Conn. (The future lexicographer Noah Webster read law in his office.) He served in the Continental Congress (1777–83), on the Connecticut governor's council (1780–84), and on the state Superior Court (1784–89).

In 1789 Ellsworth became one of Connecticut's first two U.S. senators and the acknowledged Federalist leader in the Senate. He was a principal draftsman of the conference report on the first 12 proposed amendments to the Constitution (accepted by Congress in September 1789; 10 amendments—the Bill of Rights—were ratified by the states and became effective in December 1791).

Ellsworth was commissioned as chief justice on March 4, 1796. While presiding over the U.S. Circuit Court for Connecticut, he ruled, in *United States* v. *Isaac Williams* (1799), that a U.S. citizen could not expatriate himself without the consent of the government. He resigned late in 1800 because his health had been permanently impaired on an arduous trip to France to negotiate a treaty.

Ellsworth Land, formerly ELLSWORTH HIGHLAND, region in Antarctica at the base of the Antarctic Peninsula, between Ronne Ice Shelf and the Bellingshausen Sea, east of Marie Byrd Land. It embraces several mountain ranges, including the Ellsworth Mountains, the tallest peak of which, Vinson Massif (16,864 feet [5,140 m] above sea level), is the highest in Antarctica. The rugged, ice-covered area was discovered in 1935 by the American explorer Lincoln Ellsworth and his pilot Herbert Hollick-Kenyon during their aerial crossing of the continent and was named for the explorer's father. Claimed in part by Argentina, Chile, and the United Kingdom, Ellsworth Land is still largely unexplored.

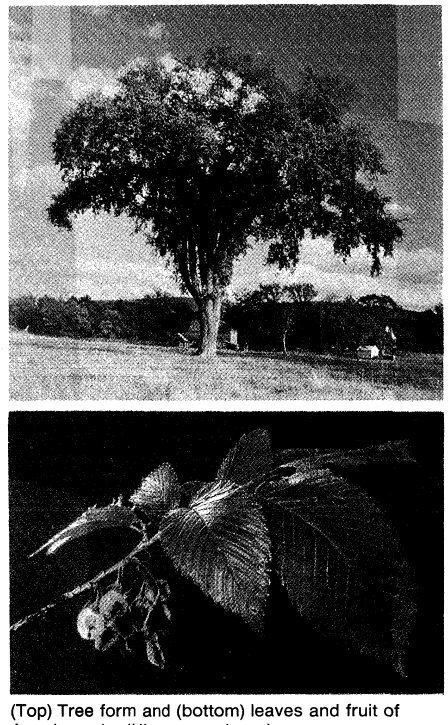
Ellul, Jacques (César) (b. Jan. 6, 1912, Bordeaux, Fr.), French political and social scientist and philosopher of technology, best-known for his antitechnological views, as expressed in his masterwork *La Technique: ou, L'enjeu du siècle* (1954; *The Technological Society*).

Ellul attended the universities of Bordeaux and Paris. From 1947 he was a professor of social history at the University of Bordeaux, having lectured at the universities of Montpellier (1937–38) and Strasbourg (1938–40). From 1944 to 1947 he was deputy mayor of Bordeaux.

Ellul's early works include *Le Fondement théologique du droit* (1946; *The Theological Foundation of Law*) and *Présence au monde moderne* (1948; *The Presence of the Kingdom*). The books for which he is best-known, however, are *La Technique, Propagandes* (1962; *Propaganda; The Formation of Men's Attitudes*), and *L'Illusion politique* (1964; *The Political Illusion*), all of which warn the reader of the dangers of human loss of control over the state, technology, and the modern world. Apart from these works, Ellul's canon is chiefly theological in nature and Christian in perspective.

elm, any of several forest and ornamental shade trees in the genus *Ulmus,* with about 18 species, in the family Ulmaceae native primarily to North Temperate areas. Many are cultivated for their height and attractive foliage. Elm leaves are doubly toothed and often lopsided at the base. The petalless flowers appear before the leaves and are borne in clusters on jointed stems. The nutlike fruit, surrounded by a flat, sometimes hairy, winglike structure, is called a samara.

The vase-shaped American elm (*U. americana*), of eastern North America, may grow 24 to 30 m (about 80 to 100 feet) tall. It has dark-gray, ridged bark and elliptical leaves. Slippery, or red, elm (*U. rubra*), a shorter species with a similar but smaller distribution, has a gluelike substance in the inner bark, which was formerly steeped in water as a remedy for throat ailments, powdered for use in poultices, and chewed as a thirst-quencher. Rock, or cork, elm (*U. thomasii*) has hard wood and twigs that often develop corky ridges.



(Top) Tree form and (bottom) leaves and fruit of American elm (*Ulmus americana*)

(Top) Russ Kinne—Photo Researchers/EB Inc., (bottom) Kitty Kohout from Root Resources—EB Inc.

Introduced species planted as ornamentals include Chinese elm (*U. parvifolia*), a small-leaved species with interesting mottled bark; English elm (*U. procera*), with a compact crown and deeply fissured bark; Wych elm (*U. glabra*), with smoother bark; and Camperdown elm (*U. glabra camperdownii*), a variety of Wych elm also known as umbrella elm because of its drooping branches. The fast-growing Siberian elm (*U. pumila*), a brittle-twigged, weak-wooded tree, is sometimes planted for quick shade and for windbreaks.

Many elm species are susceptible to Dutch elm disease (a fungoid disease) and to elm phloem necrosis. Resistant strains are preferred for planting. Elm wood is commercially important for boats and farm buildings because it is durable under water; it also is used for furniture.

elm bark beetle, any of several species of insect pests in the insect family Scolytidae (order Coleoptera). Examples are the American dark elm bark beetle (*Hylurgopinus rufipes*) and the greater and lesser European elm bark beetles (*Scolytus scolytus* and *S. multistriatus*). Pairs of the adult beetles bore into elm tree trunks and excavate a "nuptial chamber" on the layer of sapwood below the bark. The female goes on to make a vertical cleft, the mother gallery, in which eggs are placed at intervals. After hatching, the larvae burrow away at right angles to the mother gallery, their tunnels widening as they progress. After pupation and hatching, the new adults bore out through the bark and disperse. When bark is removed from affected trees the arrangement of the galleries can be seen on the wood surface. Each species of elm bark beetle produces a distinctive gallery pattern. A virulent parasitic fungus, the cause of Dutch elm disease (*q.v.*), is carried by elm bark beetles.

Elman, Mischa (b. Jan. 20, 1891, Talnoye, Ukraine, Russian Empire [now in Ukrainian S.S.R.]—d. April 5, 1967, New York City), violin virtuoso in the Romantic tradition, one of the foremost violinists of the 20th century.

A celebrated child prodigy, Elman studied violin from the age of four. In 1902 he became a tuition-free pupil of the famed violinist and teacher Leopold Auer at the St. Petersburg Conservatory. He made his professional debut in 1904 in Berlin, quickly establishing himself as one of the leading European violinists. From 1908 he toured the United States frequently. Subsequent tours took him throughout Europe and to the Far East. A U.S. citizen from 1923, he celebrated his 50th anniversary in the United States with an anniversary concert at Carnegie Hall in New York City. Elman's tone was considered to be resonant and voluptuous. His repertory was extensive. He composed several short violin pieces and arranged works by other composers for violin and piano.

Elmbridge, district (borough), county of Surrey, England. With an area of 37 square miles (97 square km), the borough comprises the former urban districts of Esher, and Walton and Weybridge. At the southwestern edge of the Greater London metropolitan area, the district is largely residential. It includes the Sandown Park racecourse (1875) and Claremont Park, rebuilt by Lancelot ("Capability") Brown in the Palladian style for Robert Clive of India. There is some light engineering and a large aircraft works at Brooklands. Pop. (1986 est.) 110,300.

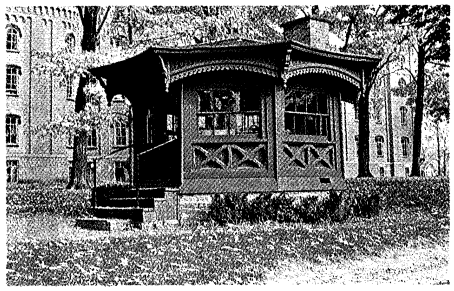
Elmen, Gustav Waldemar (b. Dec. 22, 1876, Stockholm—d. Dec. 10, 1957, Englewood, N.J., U.S.), American electrical engineer and metallurgist who developed permalloys, metallic alloys with a high magnetic permeability. This property enables the alloy to be easily magnetized and demagnetized, and such alloys are important for use in electrical equipment.

Elmen immigrated to the United States in 1893 and was naturalized in 1918. He worked as an electrical engineer with General Electric (1904–06) and Western Electric (1906–25) corporations and with Bell Telephone Laboratories, Inc. (1925–41). Elmen founded and directed (1941–56) the magnetism laboratory of the Naval Ordnance Laboratory, Washington, D.C. About 1920 the importance of his newly discovered permalloys (iron–nickel and iron–cobalt alloys) for telephone and other communications systems was recognized. His discovery made possible deep-sea telegraph cables of large message-carrying capacity.

Elmhurst, city, Du Page county, western suburb of Chicago, northeastern Illinois, U.S. First settled in 1837, it was originally called Cottage Hill for the Hill Cottage, an inn built in 1843 midway between Chicago and the Fox Valley settlement. In 1869 it was renamed Elmhurst (compound of "elm" and the German cognate of "forest"). The population increased when the Chicago and North Western Railway arrived (1849), and German labourers were brought in to saw logs from nearby groves for the wood-burning engines. Elmhurst developed as a residential suburb of Chicago and has some light manufacturing. Elmhurst College, affiliated with the United Church of Christ, was founded in 1871. The city's Lizzadro Museum of Lapidary Art displays gems, minerals, and art objects. Inc. village, 1881; city, 1910. Pop. (1986 est.) 43,805.

Elmira, city, seat (1836) of Chemung county, southern New York, U.S., on the Chemung

River, near the Pennsylvania border, 60 mi (97 km) west of Binghamton. The first white settlement (1788) was incorporated as the village of Newtown in 1815. Renamed Elmira



Mark Twain's study, Elmira College campus, Elmira, N.Y.
Milt and Joan Mann from CameraMann

in 1828 for the daughter of an early settler, Nathan Teall, it grew after the completion in 1832 of the Chemung Canal to Seneca Lake (15 mi north) and developed industrially after the arrival of the Erie Railroad in 1849. Manufactures now include machine tools, valves, office machines, glass, fire-fighting equipment, automobile and aircraft parts, fabricated steel, and electronic tubes.

The city's Woodlawn National Cemetery contains the graves of nearly 3,000 Confederate prisoners who died in the Elmira prison camp. Elmira Reformatory (now Correctional Facility) was opened in 1876; it has been a trendsetter in prison reform. Mark Twain spent summers at nearby Quarry Farm from 1870 until his death and did much of his writing there; he is buried in the Woodlawn Cemetery along with his son-in-law, pianist-conductor Ossip Gabrilowitsch. Elmira College, founded in 1855, and one of the earliest institutions of higher learning for women in the U.S., was opened to men in 1969; Mark Twain's Study, fashioned in the style of a Mississippi riverboat pilothouse, is preserved on its campus. Since 1930 nearby Harris Hill (859 ft [262 m] above the valley floor) has been the scene of glider contests and is the site of the National Soaring Museum. The Arnot Art Museum is in the city as is the Elmira Business Institute.

The Battle of Newtown (Aug. 29, 1779), at which Gen. John Sullivan defeated a combined British and Indian force led by Sir John Johnson and Chief Joseph Brant, was fought 5 mi (8 km) southeast. More than 5,000 homes were destroyed when floodwaters ravaged the area in June 1972. Inc. city, 1864. Pop. (1980) 35,327.

Elmira system, American penal system named after Elmira Reformatory, in New York. In 1876 Zebulon R. Brockway became an innovator in the reformatory movement by establishing Elmira Reformatory for young felons. Brockway was much influenced by the mark system, developed in Australia by Alexander Maconochie, whereby credits, or marks, were awarded for good behaviour, a certain number of marks being required for release. To this system Brockway added a new regimen of moral, physical, and vocational training. The Elmira system classified and separated various types of prisoners, gave them individualized treatment emphasizing vocational training and industrial employment, used indeterminate sentences, rewarded good behaviour, and paroled inmates under supervision.

Elmira Reformatory gave the reformatory movement two important philosophical tenets: first, the importance of specialized care for youthful offenders, recognizing both the individuality of prisoners and their similarity; second, the recognition that up to a certain age every criminal ought to be regarded as potentially a good citizen. This reformatory ideology gradually entered the U.S. prison system and also affected European correctional practices. *See also* mark system.

Elmo, SAINT: *see* Erasmus, Saint.

Elmore, Francis Edward and Alexander Stanley (respectively b. Nov. 9, 1864, Liverpool—d. July 26, 1932, Boxmoor, Hertfordshire, Eng.; b. Jan. 1, 1867, Liverpool—d. March 4, 1944, Boxmoor), British technologists, joint developers of flotation processes by which valuable ore, such as that of copper, is separated from the worthless material (gangue) with which it is usually extracted from the Earth.

In their early days the brothers, with their father, were engaged in the electrolytic refining of copper and in the production of copper tubes. The "bulk oil process," the first flotation process commercially employed, was invented by Francis, patented in 1898, and brought into use by his brother. In this process the ore was ground, suspended in water, and brought in contact with oil. As the oil floated up through the slurry, it wetted the particles of the mineral in preference to those of the gangue and carried them out of the mixture. Subsequently, the brothers developed an improved process (Elmore vacuum process) that required less oil and became widely used in the concentration of low-grade ores during the 20th century.

Elmslie, George Grant (b. Feb. 20, 1871, Huntly, Aberdeen, Scot.—d. April 23, 1952, Chicago), architect whose importance in the Prairie school of U.S. architecture in the first two decades of the 20th century was second only to that of Frank Lloyd Wright.

Elmslie was apprenticed to Adler and Sullivan during Wright's tenure with that Chicago firm and was associated with Louis Sullivan as a designer from 1895 to 1910. He may have had considerable influence on the design of Sullivan's series of small banks in the Middle West. His most notable works were designed during his partnership with William Gray Purcell and George Feick, Jr. (1910–12), and with Purcell only (1912–20), in Minneapolis, Minn. Among these are the Bradley residence, Woods Hole, Mass. (1911); the Edison Building, Chicago (1912); and the Woodbury County Courthouse, Sioux City, Iowa (1915–17). After 1920 Elmslie practiced independently in Chicago.

Elodea, genus of submerged aquatic plants useful in aquariums and in laboratory demonstrations of cellular activities. Elodea comprises 12 species in the frog's-bit family (Hydrocharitaceae), native to the New World. The common names waterweed and ditch moss reflect their weedy character in ponds and quiet waterways.

Several species are grown in schools as an experimental plant for demonstrating chloroplasts (green bodies in cells in which photosynthesis takes place), cell nuclei, cyclosis (movement of cellular contents), and oxygen production during photosynthesis. They are also important occasionally outside their natural range (North America) as an obstacle to lake navigation. In Europe, for example, the Canadian waterweed (*Elodea canadensis*) exists as an escaped population of female plants only, which reproduce vegetatively by breaking up.

Elohim, singular ELOAH (Hebrew: God), the God of Israel in the Old Testament. A plural of majesty, the term Elohim—though sometimes used for other deities, such as the Moabite god Chemosh, the Sidonian goddess Astarte, and also for other majestic beings such as angels, kings, judges (the Old Testament *shofeṭim*), and the Messiah—is usually employed in the Old Testament for the one and only God of Israel, whose personal name was revealed to Moses as YHWH, or Yahweh (*q.v.*). When referring to Yahweh, *elohim* very often is accompanied by the article *ha-*, to mean, in combination, "the God," and sometimes with a further identification *Elohim ḥayyim,* meaning "the living God."

Though Elohim is plural in form, it is understood in the singular sense. Thus, in Genesis the words, "In the beginning God (Elohim) created the heavens and the earth," Elohim is monotheistic in connotation, though its grammatical structure seems polytheistic. The Israelites probably borrowed the Canaanite plural noun Elohim and made it singular in meaning in their cultic practices and theological reflections.

Elohist source, also called E SOURCE, biblical source and one of four that, according to the documentary hypothesis, comprise the original literary constituents of the Pentateuch, the first five books of the Bible. It is so called because of its use of the Hebrew term Elohim for God, and hence labelled E, in contrast with another discerned source that uses the term YHWH and is labelled J (after the German transliteration of YHWH). *See also* biblical sources.

elongation, in astronomy, the angular distance in celestial longitude separating the Moon or a planet from the Sun. The greatest elongation possible for the two inferior planets (those closer than the Earth to the Sun) is about 48° in the case of Venus and about 28° in that of Mercury. Elongation may also refer to the angular distance of any celestial body from another around which it revolves or from a particular point in the sky; *e.g.,* the extreme east or west position of a star with reference to the north celestial pole.

elopiform, any member of the order Elopiformes, a group of fishes considered to be the most primitive of living bony fishes. Members of this order, which contains more extinct forms than living species, include the bonefish, tarpon, and ladyfish.

A brief treatment of elopiforms follows. For full treatment, *see* MACROPAEDIA: Fishes.

Living elopiforms range in size from the small bonefishes, which reach only 70 centimetres (28 inches) and weigh about 6.5 kilograms (14.5 pounds), to the 2.5-metre (8-foot) Atlantic tarpon, which may tip the scales at about 150 kg. The body is typically long, although not eel-like, and the tail is large and forked. In these fishes there is an open connection to the swim bladder, allowing air to be taken in at the mouth and passed directly into the swim bladder. In tarpons the swim bladder is highly vascularized and lunglike; these fish are air breathers and will drown if they cannot surface for air. Although adult tarpons inhabit well-oxygenated waters, the juveniles develop in stagnant tidal pools where this alternative mode of respiration enhances their survival.

Elopiform fishes, except for the gisu, dwell in coastal waters as adults and are able to move into brackish or freshwater areas. The Atlantic tarpon is well known for its great leaps out of the water, and both the Pacific tarpon and the ladyfish exhibit a similar rolling behaviour at the surface; these behaviours are probably related to taking in air. Tarpons and ladyfish are fast-swimming coastal predators that feed mainly on other fish. Bonefish are bottom feeders, following the tide in to root for worms and shellfish; they crush the latter with their rounded palatal teeth. The gisu is a deepwater bottom feeder and lives mainly on worms.

The elopiforms are highly fecund; one large female Atlantic tarpon contained an estimated 12,000,000 eggs, about seven times as many as the proverbially prolific codfish. These eggs are shed and fertilized in shallow waters, where they drop to the bottom. They hatch into rib-

bonlike larvae (leptocephalus) and are carried out to sea by currents; only those that remain in inshore waters undergo metamorphosis. Following metamorphosis the juveniles, or postlarvae, migrate into brackish pools or creeks where they eat small crustaceans and larval insects; they return to the sea as young adults. Gisu larvae, however, do not undergo a postlarval stage in brackish waters; hatching, larval life, and metamorphosis all take place in the deepwater environment that they share with the adults.

Eloth (Israel): *see* Elat.

Elphege, SAINT: *see* Aelfheah, Saint.

Elphinstone, Mountstuart (b. Oct. 6, 1779, Dunbartonshire, Scot.—d. Nov. 20, 1859, Hookwood, near Limpsfield, Surrey, Eng.), British official in India who was an enlightened administrator and who did much to promote popular education and local administration of laws.

Elphinstone entered the civil service in Calcutta with the East India Company in 1795. A few years later he barely escaped death when followers of the deposed prince of Oudh, Wazir Ali, raided British offices at the Benares residency and massacred all within their reach. Elphinstone transferred to the diplomatic service in 1801 as assistant to the resident at Poona; he was stationed at the court of Peshwa Bājī Rāo II, titular head of the Marāthā confederacy. He won distinction in 1803 as political agent and aide-de-camp to Col. Arthur Wellesley (brother of the governor general; later duke of Wellington) in the Marāthā War.

Elphinstone was appointed resident at Nāgpur in 1804, then was transferred to the Marāthā court at Gwalior in 1807; in 1808 he was sent to negotiate an alliance with the Afghan ruler Shāh Shojāʿ to prevent a Napoleonic advance upon India. Returning to Poona as resident in 1811, he kept the Marāthās disunited and used the murder of an envoy from Baroda to force a treaty on the Peshwa. Elphinstone defeated the Peshwa and ended the latter's efforts against British rule at the Battle of Kirkee (November 1817), though the residency at Poona and Elphinstone's notes for future literary works were burned.

Elphinstone was largely responsible for the creation of a British administrative system in the Marāthā territories annexed in 1818, first as Deccan commissioner and then, from 1819 to 1827, as governor of Bombay. Disliking the Anglicized system of government there, he sought to preserve the good in Marāthā institutions and to make allowance for Marāthā sentiment. To the raja of Sātāra he restored a kingdom; to the great territorial magnates he returned lands, privileges, and judicial powers; to the Brahmans he gave back temple lands and provided awards for learning. He tried to maintain the authority and usefulness of the village headmen and of the tribunals, wherein village elders could administer the law locally. He was a pioneer of state education, and he persisted at a time when others were horrified at the idea of educating the indigenous peoples. Spurred on by his advanced views, the wealthy native inhabitants of Bombay founded by public subscriptions the Elphinstone College in his honour.

Elphinstone travelled in Europe from 1827 to 1829; he later twice refused the governor generalship of India. He thereafter concentrated on writing his two-volume *History of India* (1841) and on advising the British government on Indian affairs.

Elsass: *see* Alsace.

Elsass-Lothringen: *see* Alsace-Lorraine.

Elsasser, Walter M(aurice) (b. March 20, 1904, Mannheim, Ger.), German-born American physicist notable for the variety of his contributions to science.

Elsasser received the Ph.D. from Göttingen in 1927, then accepted teaching appointments at Frankfurt, Paris, and the California Institute of Technology. He became a U.S. citizen in 1940 and engaged in research for the U.S. Army Signal Corps and the Radio Corporation of America before returning to academic life, holding successive positions at the universities of Pennsylvania, Utah, and California; the Scripps Institution of Oceanography; and Princeton, Maryland, and Johns Hopkins universities.

While Elsasser was a graduate student he correctly predicted that a beam of electrons would be diffracted by a crystalline material; after the neutron was discovered, he predicted the same behaviour for neutrons. Independently of Nobel Prize winner Hans Bethe, Elsasser carried out important work on the likelihood of certain interactions between neutrons and atomic nuclei.

Elsasser formulated what is known as the dynamo model, a model of the structure of the Earth to account for the origin and properties of its magnetic field. He suggested that convection within the core, driven by the energy of radioactive decay, generates electric currents that interact with concentric spherical shells of the Earth's mantle, which are rotating at different speeds, and that the Coriolis effect produces eddies at the boundaries of these shells.

He also investigated the applicability of contemporary theoretical concepts of physics, especially quantum mechanics, to the biological sciences, presenting his views in *The Physical Foundation of Biology* (1958), *Atom and Organism* (1966), and *The Chief Abstractions of Biology* (1975).

Elsene (Belgium): *see* Ixelles.

Elsevier FAMILY (Dutch publishing family): *see* Elzevir family.

Elsheimer, Adam, Elsheimer also spelled EHLSHEIMER (christened March 18, 1578, Frankfurt am Main—d. December 1610, Rome), German painter and printmaker recognized as an important figure in the development of 17th-century landscape painting, noted especially for his atmospheric use of light.

Elsheimer studied with Philipp Uffenbach in Frankfurt, where he learned the basic techniques of German Renaissance art. He also was influenced by the works of several Dutch landscape painters. Elsheimer travelled to Munich and later to Venice, where he was inspired by the work of Tintoretto. His works of this period explore the expressive, often mysterious effects of light. When he went to Rome in 1600, Elsheimer joined a group of artists that included Rubens and Paul Brill and he began to produce paintings of Italian Classical subjects and landscapes with small figures, often overpowered by massive foliage. His interest in lighting increased after he studied the works of Caravaggio, who had exploited the dramatic effects of chiaroscuro.

Elsheimer produced small and intricate paintings on copper and many larger, more vigorous drawings. His frequent depiction of illumination by firelight and candlelight was unusual for the period. "Flight Into Egypt" (1609, Louvre) is one of the first nocturnal landscape paintings in which the Moon and the stars are the principal sources of light. Elsheimer greatly influenced the Dutch and Italian schools, and particularly Rembrandt and Claude Lorrain. His early death had a disturbing effect on other artists of his time.

Elsinore (Denmark): *see* Helsingør.

Elskamp, Max (b. May 5, 1862, Antwerp—d. Dec. 10, 1931, Antwerp), one of the outstanding Belgian Symbolist poets, whose material was the everyday life and folklore of his native city. He was a sincere Catholic, and his poems often reflect his religious sentiments. Of a well-to-do family, Elskamp was also something of a dilettante and illustrated his works with his own woodcuts. Like most Belgian poets of his generation, he was deeply influenced by literary developments in France; he had personal contacts with both Verlaine and Mallarmé. Nevertheless, his religious themes are genuinely Belgian in inspiration. He repeatedly recalls the simple yet colourful religious experiences of his fellow Catholic countrymen and their daily life. He used a poetic idiom in harmony with these subjects, simple, sometimes even disingenuously naive, and interspersed with archaic turns of phrase. He knew, too, what effect could be gained by echoing the rhythms of the litanies and liturgies of the church. In his later years Elskamp became melancholic and withdrawn, but the spirit of his most characteristic and successful work is summed up by the title of one of his finest collections, *La Louange de la vie* (1898; "The Praise of Life").

Elsonian orogeny, a Precambrian thermal event that has been dated at 1,370,000,000 years ago (± 150,000,000 years) on the Canadian Shield. Although only the Western Nain Province in Labrador provides dates falling in this time period, large areas of Precambrian rocks that are located in central and southwestern portions of the United States yield dates falling in this time period and are considered by some authorities to represent the Elsonian event.

Elsschot, Willem, pseudonym of ALFONS DE RIDDER (b. May 7, 1882, Antwerp—d. June 1, 1960, Antwerp), Flemish novelist and poet whose mordant irony and sympathetic reflections on middle-class life won him lasting popularity.

Elsschot's first work, *Villa des roses* (1913), is an exercise in the naturalism of the period. The novel deals with the middle-class world, recounting events in a French boarding house. Elsschot's two subsequent novels, *De verlossing* (1921; "The Deliverance") and *Lijmen* (1924; *Soft Soap,* 1965), went virtually unnoticed during World War I; discouraged, he ceased writing until the 1930s. *Kaas* ("Cheese") was published in 1933, followed by *Tsjip* ("Cheep") in 1934. *Kaas*'s protagonist, Laarmans, was introduced in *Lijmen* and reappears in subsequent novels: *Pensioen* (1937; "Pension"), *De leeuwentemmer* (1940; "The Lion Tamer"), and Elsschot's masterpiece, *Het dwaallicht* (1946; "Will-o'-the-wisp"). Laarmans is a sensitive person who repeatedly fails in business because of his honesty and sympathy for his customers. Elsschot's novels are caustic views of social realities, but a beam of sympathy penetrates the ironic tone. He has no particular thesis to present; instead, what attracts attention is the drama latent in apparently ordinary situations. His poetry was published as *Verzen van vroeger* (1934; "Early Verse") and *Verzen* (3rd ed. 1947).

Elssler, Fanny (b. June 23, 1810, Vienna—d. Nov. 27, 1884, Vienna), Austrian ballerina who introduced theatricalized folk dance (character dance) into ballet. She was celebrated for her spirited, spectacular dancing and for her technique, especially her point work.

Daughter of a valet and copyist for the composer Franz Joseph Haydn, she studied under Jean-Pierre Aumer and made childhood appearances at the Kärntnerthor Theatre with her sister Theresa, also a dancer. Engagements in Naples, Berlin, and London brought her international fame. After three months of intensive study with Auguste Vestris, she made her Paris Opéra debut in 1834 in Jean Co-

alli's ballet *La Tempête*, derived from Shakespeare's *The Tempest*. Her immediate success divided Parisian balletomanes into two camps, since the warmth and spontaneity of her dancing was in marked contrast to the ethereal lightness of her greatest rival, Marie Taglioni. Théophile Gautier called Elssler "the Spaniard from the north." In *La Gypsy* (1839), made famous by her performance of the cracovienne, a Polish folk dance, and in *La Tarentule* (1839) she revealed extraordinary pantomimic ability. Her sensational success in *Le Diable boiteux* (1836), in which she introduced the Spanish cachucha, challenged Taglioni's supremacy. To unseat her rival, still called the greatest classical ballerina, she made one attempt in Taglioni's favourite ballet, *La Sylphide;* it was most unsuccessful, since she lacked Taglioni's lightness and elevation.

Between 1840 and 1842 Elssler toured the United States, winning extravagant adulation

Fanny Elssler in *La Chatte métamorphosée en femme*, lithograph by M. Alophe, *c.* 1837

By courtesy of the Dance Collection, New York Public Library, Astor, Lenox and Tilden Foundation

and earning enormous sums. She had broken her contract with the Paris Opéra in order to extend her American tour and could not return there, but she danced with continuing success in England, Germany, Italy, and Russia until her retirement in 1851.

Elsterian Glacial Stage, major division of Pleistocene deposits and time in northern Europe (the Pleistocene epoch began about 1,600,000 years ago and ended about 10,000 years ago). The Elsterian followed the Cromerian Interglacial Stage and preceded the Holstein Interglacial Stage, both, in contrast to the Elsterian, periods of relatively moderate climatic conditions. The Elsterian is equated with the Mindel Glacial Stage of classical European usage in the Alpine region, and the Kansan Glacial Stage of North America. The Elsterian was named for the Elster River of eastern Germany.

In Germany the deposits of the Elsterian are poorly exposed; they are covered by deposits of later ice advances. In Poland the Elsterian deposits are known as the Krakow, and eastward in the Soviet Union they are termed the Oka Glacial Stage; all the names refer essentially to the same geological unit. It has been inferred that the Elsterian sediments record at least two expansions of the glacial ice, termed Elster I and Elster II. During the Elsterian Stage, Poland was essentially treeless tundra, as is indicated by the study of fossil pollen.

Eltinge, Julian, original name WILLIAM DALTON (b. May 14, 1883, Newtonville, Mass., U.S.—d. March 7, 1941, New York City), U.S. vaudeville star, often called the greatest female impersonator in theatrical history.

Eltinge played his first female role at the age of 10. A graduate of Harvard, he entered vaudeville in 1904, soon commanding one of the highest salaries in show business. During

Eltinge

Culver Pictures

a successful tour of the United States and Europe in 1907, he gave a command performance for King Edward VII. His stage successes include *The Fascinating Widow* (1911), written for him, in which he played the dual role of Mrs. Monte and Hal Blake; *The Crinoline Girl* (1914); and *Cousin Lucy* (1915). He also starred in several silent motion pictures.

Elton, Charles (Sutherland) (b. March 29, 1900, Liverpool), English biologist credited with framing the basic principles of modern animal ecology.

Early influences. Elton was educated first at Liverpool College and then at New College, Oxford, from which he graduated with first class honours in zoology in 1922. Like many others, Elton rebelled against the strong emphasis on comparative anatomy in zoology at that time. Although most of his contemporaries turned to the physical and chemical analysis of animal mechanisms in the laboratory, Elton, at heart a naturalist, went in the opposite direction—to use the scientific method to study the lives of animals in their natural habitats and interrelationships with their surroundings. He set out to turn natural history into science—the science of ecology. The naturalists are the pioneer observers preparing the ground for the ecologists, who follow with their more quantitative and experimental studies. When Elton began his work, he described it as "the sociology and economics of animals."

The great naturalists of the past had a marked influence on Elton's outlook. He wrote of Alexander von Humboldt as "perhaps the first ecologist" in that he "created a stirring picture of the plant and animal world as a whole, with its majestic settings and its complex interplay of forces." Moreover, Elton recalled that "Humboldt's writings in turn inspired Charles Darwin, who went further than most of his generation in grasping the tremendous intricacy and importance of plant and animal interrelationships." Elton was particularly impressed by the methodology of the U.S. ecologist Victor Ernest Shelford in his book *Animal Communities in Temperate America as Illustrated in the Chicago Region* (1913). He had an opportunity to apply Shelford's ideas in 1921, when, still an undergraduate, he acted as assistant to Julian Huxley on the Oxford University expedition to Spitsbergen; at this time he was given a free hand in making an ecological survey of local animal life. He continued this project on three subsequent expeditions to the Arctic, in 1923, 1924, and 1930. Just as Darwin had been much influenced by the *Essay on the Principle of Population,* of Thomas Malthus, so was Elton influenced by *The Population Problem* (1922) of Alexander Carr-Saunders, who was also a member of the Oxford University expedition to Spitsbergen and who provided Elton with a first-hand introduction to his ideas.

Establishment of ecology. Elton's first book, *Animal Ecology,* published in 1927, was a landmark not only for his brilliant treatment of animal communities but also for the fact that the main features of his discussion have remained as leading principles of the subject ever since: food chains and the food cycle, the size of food, niches, and the "pyramid of numbers." He also developed more comprehensive ideas about the factors that govern animal numbers. As a result of his Arctic experience, Elton had become a biological consultant to the Hudson's Bay Company, a position that allowed him to make his important studies of the fluctuations in the populations of various furbearing mammals revealed in the trappers' records, which date from 1736. This study in turn led to his research on the fluctuations in Britain's mouse and vole populations as they were affected by their changing environmental conditions.

In 1930 appeared his provocative book *Animal Ecology and Evolution,* in which he says that "The balance of nature does not exist and perhaps never has existed." Moreover, "in periods of stress it is a common thing for animals to change their habitats and usually this change involves migration." And again, "we are face to face with a process which may be called the *selection of the environment by the animal,* as opposed to the *natural selection of the animal* by the environment." Unfortunately, his increasing concern with population numbers and their fluctuations did not allow him to pursue these exciting evolutionary ideas.

In 1932 Elton established his Bureau of Animal Population at Oxford. It became both a world centre for the collection of data on variations in animal numbers and a research institute in terrestrial ecology. It attracted workers from many countries, providing training for younger men who carried the Elton tradition to distant places, such as California and British Columbia in one hemisphere and Australia and New Zealand in the other. In the same year he became editor of the new *Journal of Animal Ecology,* which was launched by the British Ecological Society largely under his influence. In 1936 Oxford appointed Elton reader in animal ecology, and Corpus Christi College elected him a senior research fellow.

Elton's extensive work on mice and voles enabled him to assign his bureau at the outbreak of World War II the task of finding practical methods of controlling rodent pests, a study that saved his country much loss of food during those critical years. The methods he and his colleagues developed and the results they achieved are described in *The Control of Rats and Mice* (1954), which has become the model for such work all over the world. In 1942

he published his study on *Voles, Mice and Lemmings,* and in 1958 he discussed in *The Ecology of Invasions of Animals and Plants* the effects produced by the spread of organisms introduced into an area by both natural and human agencies. After World War II, Elton was engaged primarily in habitat studies; these studies formed the basis of his important volume *The Pattern of Animal Communities* (1966). This work gives more general principles, particularly the inverse pyramid of habitats, which corresponds to his pyramid of numbers.

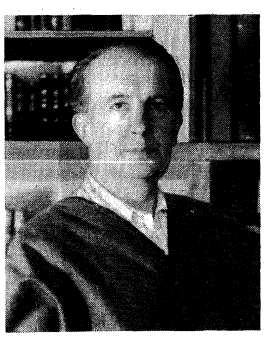
Elton was elected a fellow of the Royal Society of London in 1953 and foreign member of the American Academy of Arts and Sciences and was awarded the Gold Medal of the Linnean Society in 1967 and the Royal Society's Darwin Medal in 1970. He retired in 1967.

Elton perceived and stated more clearly than anyone else had yet done the outstanding principles governing the complex interplay between different animals and plants in any community, as well as their relations with their habitat. Moreover, he promoted these principles by his inspiration of many students at his Bureau of Animal Population at Oxford. He was widely acclaimed as the ecologist par excellence. (A.C.Ha.)

BIBLIOGRAPHY. Sir Alister Hardy, "Charles Elton's Influence in Ecology," *J. Anim. Ecol.,* 37:1–8 (1968), is a short general review of Elton's contributions to animal ecology.

Elton, Lake, highly saline lake, Volgograd *oblast* (administrative region), Russian Soviet Federated Socialist Republic, near the Kazakh S.S.R. border. The lake occupies an area of 59 sq mi (152 sq km) and is only 1–2 ft (0.3–0.6 m) deep. It is 60 ft below ocean level. Salt, extracted from the lake since the early 18th century, is used for the production of magnesium chloride. Other minerals are located nearby.

Éluard, Paul, pseudonym of EUGÈNE GRINDEL (b. Dec. 14, 1895, Saint-Denis, Paris—d. Nov. 18, 1952, Charenton-le-Pont, Fr.), French poet, one of the founders of the Surrealist movement and one of the important lyrical poets of the 20th century. His works emerge from his life experiences: World Wars I and II, the Spanish Civil War, the German occupation, the Resistance, the struggles of the Communist Party, romances, and the daily tide of events, encounters, friendships, and dreams.



Éluard, 1947
H. Roger-Viollet

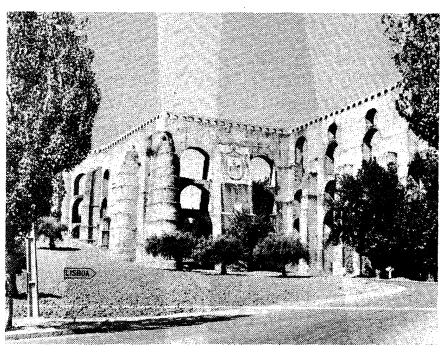
In 1919 Éluard made the acquaintance of the Surrealist poets André Breton, Philippe Soupault, and Louis Aragon, with whom he remained in close association until 1938. Experiments with new verbal techniques, theories on the relation between dream and reality, and the free expression of thought processes produced *Capitale de la douleur* (1926; "Capital of Sorrow"), his first important work, which was followed by *La Rose publique* (1934; "The Public Rose") and *Les Yeux fertiles* (1936; "The Fertile Eyes"). The poems in these volumes are generally considered the best to have come out of the Surrealist movement. At this time Éluard also explored, with André Breton, the paths of mental disorders in *L'Immaculée Conception* (1930).

After the Spanish Civil War he abandoned Surrealist experimentations. His late work reflects his political militance and a deepening of his underlying attitudes: the rejection of tyranny, the search for happiness. In 1942 he joined the Communist Party. His poems dealing with the sufferings and brotherhood of man, *Poésie et vérité* (1942; "Poetry and Truth"), *Au rendez-vous allemand* (1944; "To the German Rendezvous"), and *Dignes de vivre* (1944; "Worthy of Living"), were circulated clandestinely during World War II and served to strengthen the morale of the Resistance. After the war, his *Tout dire* (1951; "Say Everything") and *Le Phénix* (1951) added, in simple language and vivid imagery, to the great body of French popular lyrical poetry.

Consult the INDEX *first*

Elūru, also called ELLORE, town, administrative headquarters of West Godāvari district, northeastern Andhra Pradesh state, southern India, at the junction of the Godāvari and Krishna canal systems. The name was changed to its present form in 1949. Mainly a manufacturing town, Elūru produces textiles and leather products but is most noted for its pile carpets. It is also a centre for trade in rice, oilseeds, tobacco, and sugar. The town has a college affiliated with Andhra University in Waltair. Buddhist archaeological remains are at the nearby village of Pedda Vegi. Pop. (1981) 168,154.

Elvas, town and *concelho* (municipality), Portalegre district, east central Portugal, on a hill overlooking a plain. The town originated as the Roman Alpesa and during its long history was a border fortress besieged by the Moors, Spanish, and French. Main fortifications are a Moorish castle on Roman foundations, seven bastions, and (on adjoining hills) the forts of Santa Lúzia (1641) and Nossa Senhora da Graça (1763). Elvas was ceded to Portugal by the French at the Convention of Sintra (1808). The town's late Gothic cathedral has three naves, and the Aqueduct of Amoreiras (built 1498–1622) still brings water to the town; both are national monuments. Elvas is primarily an agricultural processing centre specializing in plums. Pop. (1981) town, 13,507; *concelho,* 25,528.



Aqueduct of Amoreiras, built between 1498 and 1622, Elvas, Port.
Josef Muench

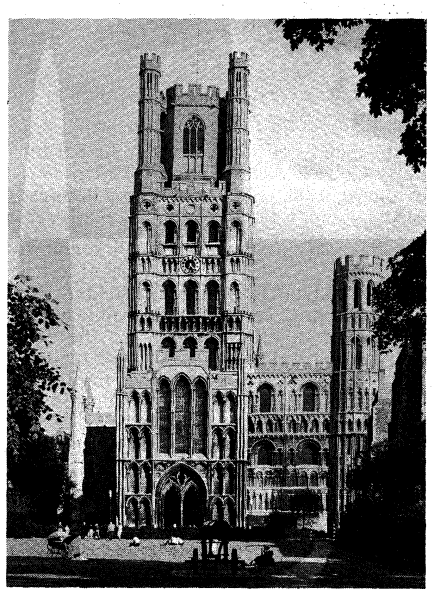
Elvas, William Carr Beresford, duque de (duke of): *see* Beresford, William Carr Beresford, Viscount.

Elvira, Council of, the first known council of the Christian Church in Spain, held early in the 4th century at Elvira, near modern Granada. It is the first council of which the canons have survived, and they provide the earliest reliable information on the Spanish Church. The exact date is disputed, but some scholars believe it was held either *c.* 300–303 or in 309.

Nineteen bishops and 24 priests, primarily from southern Spain, assembled with the intention of restoring order and discipline in the church. The 81 canons that were adopted reflect the internal life and external relations of the Spanish Church in the 4th century. In general, the canons were severe and imposed rigorous discipline for various sins. No reconciliation with the church was allowed for certain sins, which included idolatry, repeated adultery, divorce, and incest. The punishment for lesser sins was exclusion from Holy Communion, sometimes for as long as 10 years. Members of the clergy were expected to lead pure and holy lives.

Subsequently, some of the canons were included in the canons of later councils, including the Council of Nicaea (325).

Ely, city, East Cambridgeshire district, county of Cambridgeshire, England. It lies on an "island" of rock that rises above the alluvial Fens and, prior to their draining (1630–52), was a place of refuge. The Isle of Ely is 7 mi (11 km) long and 4 mi wide. The city itself is situated on the Isle's eastern side on the west bank of the River Ouse.



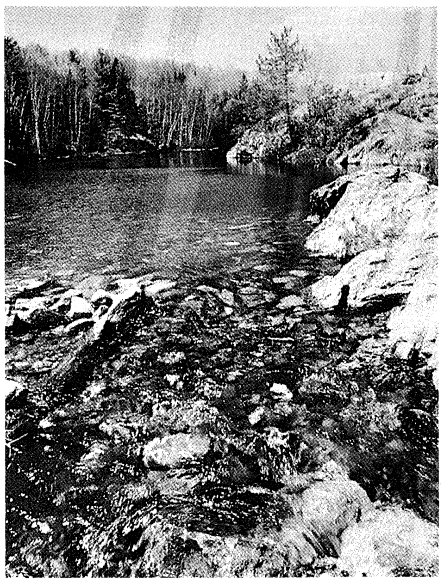
Cathedral church of the Holy and Undivided Trinity, Ely, Cambridgeshire
A.F. Kersting

In the 7th century AD Etheldreda, the daughter of Anna, king of East Anglia, founded a convent there. This was destroyed by the Danes in 870, and a Benedictine monastery was built on the ruins in 970. The Isle of Ely was the scene, in the 11th century, of Hereward the Wake's stand against William I the Conqueror. Shortly afterward, the foundations of the present cathedral were laid by the first Norman abbot of Ely, Simeon (1081–94). The cathedral dominates both the city of Ely and the surrounding countryside. The nave, the western tower (215 ft [66 m] high), and the transept are Norman.

Modern Ely remains a small locality, catering to tourists and visitors from nearby Cambridge. Pop. (1981 prelim.) 10,268.

Ely, city, St. Louis County, northeastern Minnesota, U.S., on Shagawa Lake, at the east end of the Vermilion Iron Range. Settled in 1885 as Florence, it was renamed for Samuel P. Ely, a Michigan mining man. Iron ore, discovered there in 1863, has been depleted and the last underground mine closed in 1967.

The logging industry has also declined, and Ely's economy now depends chiefly on the tourist trade. Ely lies in the heart of Superior National Forest and is the starting point for trips into the vast Boundary Waters Canoe Area. The Hidden Valley Winter Sports Area



Boundary Waters Canoe Area near Ely, Minn.
Milt and Joan Mann from CameraMann

is immediately east. Vermilion State Community College was founded in Ely in 1922. Inc. village, 1888; city, 1891. Pop. (1986 est.) 4,240.

Ely, city, seat (1886) of White Pine county, east-central Nevada, U.S. It is adjacent to East Ely, near the Utah border. Established in 1868 as a gold-mining camp and probably named for John Ely, a mining promoter, the community developed after 1907 with large-scale copper mining. Copper and other mining industries in the area underwent a major decline in the 1970s and early '80s, however. There is extensive ranching in the locality. Ely is a base for tourists attracted by the region's many mining ghost towns and recreational facilities (camping, hunting, fishing, and skiing). Parts of Humboldt National Forest are nearby. To the southeast is the Lehman Caves National Monument and to the south, the Ward Charcoal Ovens Historic State Monument, the site of stone beehive ovens used to produce charcoal for smelting in the 1870s. Inc. 1907. Pop. (1986 est.) 4,760.

Ely, Isle of, former county of England, since 1965 part of the county of Cambridgeshire. The Isle of Ely consists of a hill about 7 miles (11 km) long and 4 miles (6 km) wide that rises above the surrounding fens (low-lying lands that were partly covered by water). The Isle of Ely is the highest point in these fenlands and was formerly an island surrounded by marshes and swamps; it could only be reached by boat or causeway. This inaccessible location became the scene of Hereward the Wake's resistance to William I the Conqueror about 1070. In the 17th and 18th centuries, however, the surrounding fens were drained, and the Isle of Ely is now simply a hill in the midst of a low, flat plain whose rich soils provide highly productive farmlands.

The city of Ely (*q.v.*) lies on the northeast portion of the Isle of Ely and is dominated by a magnificent cathedral that dates mostly from the 11th and 12th centuries. The town has been the seat of a diocese since 1108, and until the Reformation its bishops held palatine jurisdiction over the entire Isle of Ely. Oliver Cromwell lived in a house in Ely from 1636 to 1647 while holding the post of farmer of the cathedral tithes.

The Isle of Ely was a separate administrative county until its amalgamation with Cambridgeshire in 1965 to form the county of Cambridgeshire and Isle of Ely. This county was renamed simply Cambridgeshire in the administrative reorganization of 1974.

Ely, Richard Theodore (b. April 13, 1854, Ripley, N.Y., U.S.—d. Oct. 4, 1943, Old Lyme, Conn.), American economist who was noted for his concern with social problems and the role of economists in solving them.

Ely was educated at Columbia University, graduating in philosophy in 1876, and in Germany, receiving his Ph.D. from the University of Heidelberg in 1879. He was professor of political economy at Johns Hopkins University (1881–92), where his advocacy of greater academic freedom and his then-controversial historical account of the labour movement aroused the indignation of conservative elements, causing him to resign. He then became head of the department of economics at the University of Wisconsin (1892–1925).

Ely combined a strong political commitment with a belief in the need for an ethical approach to economics. An early influence on his beliefs was John Stuart Mill's emphasis on the importance of institutional forces in affecting distribution. This led Ely to a concern with labour unrest and with agricultural economics and the problems of rural poverty.

Among the many civic organizations and institutions he founded or helped to create are the American Economic Association, the American Association for Labor Legislation, and the American Association for Agricultural Legislation. Ely's concern with social-reform legislation and his association with the progressive state government of Wisconsin made him one of the most influential American economists of his time. He wrote a highly successful textbook, *Introduction to Political Economy* (1889), as well as many other books and articles.

Elyot, Sir Thomas (b. *c.* 1490—d. March 26, 1546, Carleton, Cambridgeshire, Eng.), English author and administrator, memorable for his championship and use of English prose for subjects then customarily treated in Latin. Both as a philosopher and as a lexicographer, he endeavoured to "augment our Englysshe tongue" as a medium for ideas.

He was clerk to the Privy Council (1523–30) and was knighted in 1530. A member of Sir Thomas More's circle, Elyot was suspected of being out of sympathy with Henry VIII's plan to divorce Catherine of Aragon and probably owed his lack of advancement to his friendship with More. In 1531 he published *The Boke*

Elyot, drawing by Hans Holbein the Younger; in the Royal Library, Windsor Castle, Berkshire
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Named the Governour, dedicated to the king, and that autumn went as the king's envoy to the court of the Holy Roman emperor Charles V.

Elyot's very popular *Governour,* a plan for the upbringing of gentlemen's sons who were to bear authority in the realm, was the first important treatise on education in English and did much to form the later English ideal of the gentleman. His *Castel of Helth* was a popular regimen of health that, written in the vernacular and by a layman (although he had received some instruction in medicine), incurred censure but was widely read. His *Dictionary* (Latin into English), the first of its scope, was published in 1538. The aim of all Elyot's works was usefulness: he brought classics and Italian authors to the general public through his translations, he provided practical instruction in his own writings, and he added many new words to the English language.

Elyria, city, seat (1823) of Lorain county, northern Ohio, U.S. It lies along the Black River, just west of Cleveland and south of the city of Lorain. The site was settled in 1817 by Heman Ely, who built a log house, dam, gristmill, and sawmill. The city is now a diversified industrial community that manufactures alloy castings, auto parts, plastics, rivets, tools, screw-machine and foundry products, and electric motors. Caves, waterfalls, and a forest tract make Cascade and Elywood parks local beauty spots. Lorain County Community College was established in the city in 1963. Inc. village, 1833; city, 1892. Pop. (1988 est.) 57,065.

Elysium, also called ELYSIAN FIELDS, or ELYSIAN PLAIN, in Greek mythology, originally the paradise to which heroes on whom the gods conferred immortality were sent. It probably was retained from Minoan religion. In Homer's writings the Elysian Plain was a land of perfect happiness at the end of the earth, on the banks of the Oceanus River. A similar description was given by Hesiod of the Isles of the Blessed. In the earlier authors, only those specially favoured by the gods entered Elysium and were made immortal. By the time of Hesiod, however, Elysium was a place for the blessed dead, and, from Pindar on, entrance was gained by a righteous life.

Elytis, Odysseus also spelled ODYSSEAS ELYTĒS, original surname ALEPOUDHELIS (b. Nov. 2, 1911, Iráklion, Crete), Greek poet and winner of the 1979 Nobel Prize for Literature. Born the scion of a prosperous Cretan family, he abandoned the family name as a young man in order to dissociate his work from the family soap business.

Elytis studied law at Athens University and periodically worked in the family business. Intrigued by French Surrealism, and particularly by the poet Paul Éluard, he began publishing verse in the 1930s, notably in *Nea Grammata.* This avant-garde magazine was a prime vehicle for the "Generation of the '30s," an influential school that included George Seferis, who in 1963 became the first Greek Nobel laureate for literature. Elytis' earliest poems exhibited a strong individuality of tone and setting within the Surrealist mode. The volume *Prosanatolismoi* ("Orientations"), published in 1940, is a collection of his works to that date.

When Nazi Germany occupied Greece in 1941, Elytis joined the antifascist resistance to the Italians in Albania. He became something of a bard among young Greeks; one of his poems, *Asma hērōiko kai penthimo gia ton chameno anthypolochago tēs Alvanias* ("Heroic and Elegiac Song for the Lost Second Lieutenant of the Albanian Campaign"), was regarded as an anthem to the cause of freedom. After the war he lapsed into literary silence for almost 15 years, returning to print in 1959 with *To Axion Esti* (*The Axion Esti,*

1974), a long poem reminiscent of Whitman's *Song of Myself.*

Elytis lived in Paris after the Greek military coup of 1967. His later works include *Ho hēlios ho hēliatoras* (1971; *The Sovereign Sun,* 1974) and *Ta eterothalē* (1974; "The Stepchildren").

Elzevir FAMILY, also spelled ELSEVIER, a family of Dutch booksellers, publishers, and printers, 15 members of which were in business between 1581 and 1712. Louis (1546?–1617), son of a printer of Louvain, settled in Leiden as a Protestant *émigré* (*c.* 1581), set himself up as a bookbinder and bookseller, published more than 100 books, and began the family specialization in learned books. The business in Leiden enjoyed its greatest success between 1622 and 1652 under the management of his son Bonaventure (1583–1652) and grandson Abraham (1592–1652), during which time they became printers to the university (an office held by their successors until 1712). Two notable and widely imitated series were their *Petites Républiques,* 35 volumes concerned with different countries and published between 1625 and 1649, and their literary classics. The Leiden bookshop was closed in 1659, but publishing and printing continued, although in declining quantity and quality, until 1712. Members of the family operated branches under the Elzevirs' name at The Hague (*c.* 1590–1665), Utrecht (*c.* 1603–75), and Amsterdam (1638–81).

After having enjoyed an almost legendary reputation among bibliophiles for excellence of typography and design, the Elzevirs' work is now regarded only as typical of the high quality that prevailed in their day in Holland. Among their four chief typographical devices, the "solitary," consisting of an elm tree, a fruitful vine, and a man alone, with a motto *Non solus* ("Not alone"), is perhaps the best known.

emaki, also called EMAKIMONO, Japanese illustrated text, or narrative picture scroll. The *makimono,* or horizontal hand-scroll, format was used, and most often the text and illustrations appear on the same scroll.

The earliest extant example of *emaki* was painted in 735. Among the most famous *emaki* is the *Genji monogatari emaki* ("Illustrated Tale of Genji"), painted in the late 11th and early 12th centuries and preserved in the Tokugawa Reimeikai Foundation and the Gotō Art Museum, both in Tokyo.

emanationism, philosophical and theological theory that sees all of creation as an unwilled, necessary, and spontaneous outflow of contingent beings of descending perfection—from an infinite, undiminished, unchanged primary substance. Typically, light is used as an analogy: it communicates itself continually, remains unchanged, and shares its brightness in proportion to the nearness of its object. Emanationism precludes creation out of nothingness. Some scholars classify emanationism with pantheism despite their dissimilarities; however, emanationism does not hold that God is immanent in the finite world.

Hints of this doctrine occur in the first two centuries AD in the writings of Philo, a Hellenistic Jewish philosopher, and of Basilides and Valentinus, both founders of Gnostic schools (stressing esoteric knowledge); but its classic formulation is found in Neoplatonists such as Plotinus and Proclus. It played a prominent role in Gnostic religion. Early Christian writers modified the concept to explain the Trinity of divine Persons. The Jewish Kabbala, a system of mysticism, theosophy, and miracle working, explicates the doctrine; and logicians of the 16th and 17th centuries also employed it. After Gottfried Wilhelm Leibniz, however, the doctrine lost adherents; and today it has been displaced by theories of evolution.

Emancipation Manifesto (March 3 [Feb. 19, old style], 1861), manifesto issued by the Russian emperor Alexander II, which accompanied 17 legislative acts that freed the serfs of the Russian Empire. (The acts were collectively called Statutes Concerning Peasants Leaving Serf Dependence, or *Polozheniya o Krestyanakh Vykhodyashchikh iz Krepostnoy Zavisimosty.*)

Defeat in the Crimean War, a perceptible change in public opinion, and the increasing number and violence of peasant revolts had shown Alexander, who became tsar during the war, that only a thorough reform of Russia's antiquated social structure would put the nation on an equal footing with the Western powers. Abolition of serfdom, he decided, was the first priority. In April 1856, in a speech to a group of noblemen, he revealed his intention. The following January he appointed a secret committee to investigate the problems. When the committee, composed primarily of conservative landowners, failed to draw pertinent conclusions, Alexander publicly authorized the formation of provincial committees of noblemen to formulate plans for emancipating the serfs (December 1857).

By the end of 1859 the committees had sent their proposals to the "editorial commissions," which evaluated them and drafted the preliminary statutes for emancipation (October 1860). These were revised by the Chief Committee (formerly the secret committee) and by the State Council (January 1861) and were signed by the Tsar on Feb. 19, 1861, and published on March 5. The final edict, or ukase, was a compromise between the plans of the liberals, the conservatives, the government bureaucrats, and the landed nobility. It fully satisfied no one, particularly the group directly involved: the peasants.

According to the act, the serfs were immediately granted personal liberties and promised land. But the process by which they were to acquire the land was slow, complex, and expensive. They were required to serve their landlords while inventories of all the land were taken, land allotments calculated, and payment calculated, since, legally, the land belonged to the landlord. Peasants, with the government loans, had to "redeem" their land allotments from the landlords and make "redemption payments" to the government for the next 49 years.

By 1881 about 85 percent of the peasants had received their land; redemption was then made compulsory. The land allotments were adequate to support the families living on them and to yield enough for them to meet their redemption payments. But the large population growth that occurred in Russia between emancipation and the Revolution of 1905 made it increasingly difficult for the former serfs to get by economically.

Emancipation had been intended to cure Russia's most basic social weakness, the backwardness and want into which serfdom cast the nation's peasantry. In fact, though an important class of well-to-do peasants did emerge in time, most remained poor and land-hungry, crushed by huge redemption payments. It was not until the revolutionary year of 1905 that the government terminated these payments. By then, the peasant loyalty that the emancipation was intended to create could no longer be achieved.

Emancipation of Labour (Russian revolutionary organization): *see* Liberation of Labour.

Emancipation Proclamation, edict issued by U.S. Pres. Abraham Lincoln on Jan. 1, 1863, that freed the slaves of the Confederate states in rebellion against the Union.

Before the start of the Civil War many people and leaders of the North had been primarily concerned merely with stopping the extension of slavery into western territories that would eventually achieve statehood within the Union. With the secession of the Southern states and the consequent start of the Civil War, however, the continued tolerance of Southern slavery by Northerners seemed no longer to serve any constructive political purpose. Emancipation thus quickly changed from a distant possibility to an imminent and feasible eventuality. Lincoln had declared that he meant to save the Union as best he could—by preserving slavery, by destroying it, or by destroying part and preserving part. Just after the Battle of Antietam (Sept. 17, 1862) he issued his proclamation calling on the revolted states to return to their allegiance before the next year, otherwise their slaves would be declared free men. No state returned and the threatened declaration was issued on Jan. 1, 1863.

As president, Lincoln could issue no such declaration; as commander in chief of the armies and navies of the United States he could issue directions only as to the territory within his lines; but the Emancipation Proclamation applied only to territory outside of his lines. It has therefore been debated whether the proclamation was in reality of any force. It may fairly be taken as an announcement of the policy that was to guide the army and as a declaration of freedom taking effect as the lines advanced. At all events, this was its exact effect.

Its international importance was far greater. The locking up of the world's source of cotton supply had been a general calamity, and the Confederate government and people had steadily expected that the English and French governments would intervene in the war. The conversion of the struggle into a crusade against slavery made intervention impossible.

The Emancipation Proclamation did more than lift the war to the level of a crusade for human freedom. It brought some very substantial practical results, for it gave the go-ahead signal for recruiting Negro soldiers. To this invitation to join the army the Negroes responded in goodly numbers, nearly 180,000 of them donning the Union blue during the remainder of the war. By Aug. 26, 1863, Lincoln could report, in a letter to James C. Conkling, that "the emancipation policy, and the use of colored troops, constitute the heaviest blow yet dealt to the rebellion."

Two months before the war ended—in February 1865—Lincoln told portrait painter Francis B. Carpenter that the Emancipation Proclamation was "the central act of my administration, and the greatest event of the nineteenth century." To Lincoln and to his countrymen it had become evident that the proclamation had dealt a deathblow to human bondage, a fate that was officially sealed by the ratification of the Thirteenth Amendment in December 1865. The Emancipation Proclamation exerted a lasting influence because it gave vitality to the concepts of liberty and equality upon which the American nation was founded.

Emancipist, any of the former convicts (and their supporters) in Australia in the late 18th and the first half of the 19th centuries who were struggling for full civil rights. Technically, the term applied only to pardoned convicts; it was generally used as well, however, for "expirees"—convicts whose full terms had been served. Before 1810, Emancipists were given land grants (from which only a few prospered), and some rose to prominence in business and the professions. They were excluded, however, from the political and social life of the New South Wales colony, which was dominated by free settlers and British officials. During the governorship of Lachlan Macquarie (1810–

21), attempts were made to alter this situation. Macquarie sought to introduce prominent Emancipists into the social life of the colony and to allow Emancipist attorneys to practice before the Supreme Court. He also appointed four Emancipists to the magistracy. Macquarie's efforts had the effect of stiffening opposition to Emancipist ambitions, and in the aftermath British imperial policy tended to support the free-settler faction (*see* Exclusive) in their determination to deny the Emancipists full citizenship. In the 1820s and 1830s the Emancipists joined lesser free settlers in supporting a faction of prominent liberals who sought a broadly based representative government for the colony (*see* Australian Patriotic Association). This was achieved in 1842 without restrictions against Emancipist participation.

embalming, the treatment of a dead body so as to sterilize it or to protect it from decay. For practical as well as theological reasons a well-preserved body has long been a chief mortuary concern. The ancient Greeks, who demanded endurance of their heroes in death as in life, expected the bodies of their dead to last without artificial aid during the days of mourning that preceded the final rites. Other societies, less demanding of their greats, developed a wide variety of preservatives and methods to stave off decay or minimize its effects. Corpses have been pickled in vinegar, wine, and stronger spirits: the body of the British admiral Lord Nelson was returned from Trafalgar to England in a cask of brandy. Even the Greeks sometimes made concessions: the body of Alexander the Great, for example, was returned from Babylon to Macedonia in a container of honey. The application of spices and perfumed unguents to minimize putrefaction was so common a practice that the English word embalming had as its original meaning "to put on balm." Generally, however, the word is used to describe a less superficial procedure, the introduction of agents into the body to ensure preservation.

History. The beginnings of the art and techniques of embalming are associated principally with ancient Egypt, where, as in parts of Asia and South America, a dry soil and climate encouraged its development. The early practice of wrapping the dead in cloth and burying them in charcoal and sand beyond the reach of the Nile waters preserved the corpses, which retained form and features for a long period. Those naturally preserved mummies are believed to have influenced the religious doctrines because they seemed to prove that the individual existed after his death. A belief in immortality and physical resurrection was central to Egyptian religion, both to the sun worship of early periods and to the later cult of Osiris. Central to the latter was the belief that when all of the elements that were present in life—soul, name, shadow, heart, and body—were reunited, the person would be resurrected, as the god Osiris was after his brother killed and dismembered him.

Since the body had to be attractive enough to lure back the soul and other elements, the highly skilled and trained embalmers took exquisite care to preserve it. Although it is held that embalming skill reached a peak during the New Kingdom period between 1738 and 1102 BC, the most detailed description of the various methods was given by the 5th-century-BC Greek historian Herodotus. The most elaborate method, at first reserved for the royal dead, involved surgical procedures. The brain, intestines, and other vital organs were removed, washed in palm wine, and placed in vases, known as canopic jars, filled with herbs. The body cavities were filled with powder of myrrh and other aromatic resins and perfumes. The incisions were stitched, and the body was placed in nitre (potassium nitrate, or saltpetre) for 70 days, after which it was washed, wrapped in cotton bandages, dipped in a gummy substance, and finally coffined and entombed. In a less expensive procedure, oil of cedar was injected into the body, which was then placed in nitre for 70 days. When the body was removed, the oil was withdrawn along with fleshy parts of the body, so that only skin and bones remained. A third method, employed on the bodies of the poor, consisted of purging the intestines and covering the body with nitre for the prescribed period.

A number of other early peoples also practiced embalming of a sophisticated nature. Archaeologists have found evidence of a high degree of embalming skill in the burial chambers of the prehistoric Paraca Indians of Peru. The Guanches, aborigines of the Canary Islands, used methods much like those of the Egyptians, removing the viscera and filling the cavity with salt and vegetable powders. The Jívaro tribes of Ecuador and Peru took the additional precaution of ensuring the immortality of their chiefs by roasting their embalmed bodies over very low fires. In Tibet some bodies are still embalmed according to an ancient formula: the corpse is put in a large box and packed in salt for about three months, after which it is in mummified condition.

The ancient Babylonians, Sumerians, and Greeks seldom practiced any but the most superficial kind of embalming, anointing the body with unguents, perfumes, and spices. Nor did the Jews employ embalming procedures, with the notable exception of Joseph, who ordered embalming for himself and his father, and further departed from Jewish custom by having his body placed in a coffin. Among the ancients who profoundly influenced Western culture only the Romans employed cavity embalming, not for religious reasons but for the temporary preservation of bodies exhibited for some time before burial. Although there is evidence that some early Christians were embalmed, generally they rejected embalming as well as cremation, considering them pagan customs that mutilated the corpse. Such scruples were sometimes overcome by the desire to have an outstanding person linger on, a desire that was reinforced by the belief that the bodies of some of the devout were kept intact after death as a mark of divine favour. Consequently, some Christians were embalmed, a notable example being Charlemagne, whose embalmed and richly dressed corpse was placed in a sitting position in his tomb at Aachen after his death in 814. The body of the 11th-century Spanish epic hero El Cid, which remained seated on an ivory chair in the monastery of San Pedro de Cardeña for a decade before burial, is also presumed to have been embalmed.

During the Middle Ages and the Renaissance a modest amount of embalming was done by specialists who employed the elaborate Egyptian method. For its return from France to England, the body of the 12th-century English king Henry I was embalmed and eviscerated and the cavities stuffed with medicinal herbs. But during the Middle Ages, embalming was such an expensive procedure that even most royal personages could not afford it; involving, as it did, the use of costly spices, unguents, wax, and wrappings in addition to the prices charged by skilled embalmers. Moreover, religious opposition was so strong and skill so limited that few would consider it. Instead, cerecloths, strips of fabric impregnated with wax and wrapped snugly around the body to exclude air, were used. This method of preservation was so prevalent that cerement became a synonym for grave clothes. The great interest in anatomy and surgery during the Renaissance stimulated experiments with other embalming methods. Leonardo da Vinci, who dissected at least 50 cadavers for study, developed a method of venous injection for preserving them that anticipated modern embalming procedures. One 17th-century Florentine physician is reported to have turned a corpse to stone by injecting the tissues with a solution of silicate of potash and then immersing the body in a mild acid solution.

Development of modern embalming. Embalming by arterial injection as a mortuary practice is considered to have begun in England in the 18th century. The technique had actually been developed in the first half of the 17th century by the noted English physiologist William Harvey in experiments leading to his discovery of the circulation of blood, during which he injected coloured solutions into the arteries of cadavers. Later the Dutch and German scientists Frederik Ruysch and Gabriel Clauderus are believed to have used similar arterial-injection techniques to prevent cadavers from decomposing. The Scottish anatomist William Hunter (1718–83), however, is credited with being the first to report fully on arterial and cavity embalming as a way to preserve bodies for burial. His discovery attracted wide attention after his younger brother, John Hunter, in 1775 embalmed the body of a Mrs. Martin Van Butchell, whose will specified that her husband had control of her fortune only as long as her body remained above ground. To meet that condition, Van Butchell had her embalmed, placed her fashionably dressed body in a glass-lidded case in a sitting room, and held regular visiting hours.

The demand for embalming grew in England and particularly in the United States, where it was promoted by a newly emerging group of undertaker-businessmen as superior to the customary but awkward and often unsatisfactory method of preserving bodies for transportation or for viewing by packing them in ice or laying them on "cooling boards," with a concave, ice-filled box fitted over the torso and head. Some of the more enterprising entrepreneurs exhibited well-preserved "cases" in the windows of shops, or took them on tour so that persons in rural areas and small towns could see the latest development.

The U.S. Civil War was the turning point in breaking down public resistance to "mutilating" the body and in establishing arterial embalming as a common practice in the United States. Although the government had established national cemeteries for the war dead, it freely awarded contracts to undertakers and embalmers to prepare the bodies of soldiers for shipment home. The widespread use of this service by soldiers' families and the embalming of such notable dead as Pres. Abraham Lincoln's son Willie and later of Lincoln himself brought about increased acceptance of the practice and even caused it to become associated with patriotic activity. Early practitioners included a number of vigorous salesmen, including Joseph H. Clarke, a road salesman for a coffin company. Impressed by embalming's possibilities and profits, he persuaded a staff member of a medical college in Cincinnati to institute a brief course in embalming in 1882, thus establishing the basis of mortuary education in the United States. Embalming remains the only specific skill required in the undertaking business.

Modern procedures. In the modern procedure of embalming, the blood is drained from one of the veins and replaced by a fluid, usually based on Formalin (a solution of formaldehyde in water), injected into one of the main arteries. Cavity fluid is removed with a long hollow needle called a trocar and replaced with preservative. This fluid is also based on Formalin mixed with alcohols, emulsifiers, and other substances (like embalming fluid) to keep the body temporarily from shriveling and turning brown. Arterial embalming is not permanent; even such carefully

prepared corpses as that of Lenin, on view in the Kremlin, must be given periodic renewal treatment. The chief purpose of embalming is rather to give the body a lifelike appearance during the days in which it is being viewed by mourners. To enhance this, cosmetics and masking pastes are often applied.

In the United States, embalming is a standard practice as a result of the government support it has received, and is mandatory when bodies are being transported by common carrier, and, in many states, usually when there is an interval of more than 48 hours between death and burial. In Europe, however, embalming is rarely practiced. In many countries permits are required; in most it is performed only by medical practitioners, and the costs are relatively high.

embankment dam: *see* earthfill dam.

embargo, the detention of merchant vessels or other property to prevent their movement to a foreign territory. To achieve its objective, an embargo should also prohibit shipment by air and, if necessary, by land. Embargo should be distinguished from *arrêt de prince*, a temporary detention of ships or aircraft; from angary, an emergency requisition of the use of foreign merchant vessels; and from boycott, an interruption of commercial and financial relations not confined to exports. An embargo is not imposed against enemy ships or other property, because the status of an enemy subjects such property to other action.

Embargo may be civil or hostile. A civil embargo is the detention of national vessels in home ports either to protect them from foreign depredation or to prevent goods from reaching a particular state. A hostile embargo is the detention of the transport or property of a foreign state.

An embargo may be employed either as a reprisal or for political purposes. As an act of reprisal an embargo may be imposed against a state that is felt to be violating its international legal duties. Of such nature was the U.S. embargo of 1807 against France and Great Britain. An embargo may also be employed for the political purpose of prohibiting exports of arms and other war materials to belligerent states or to states in rebellion, either in an attempt, usually collective, to force a cessation of hostilities or in an individual state's effort to preserve its neutrality. An example of the political embargo was the U.S. embargo of 1937, intended to promote U.S. neutrality during the Spanish Civil War.

Embargoes have been imposed by belligerents on neutral ships and by neutrals on belligerent ships. For example, during World War I, British, French, and even neutral embargoes were imposed in preparation for the exercise of the right of angary. In 1918 both Argentina and Chile, which had adopted a neutral policy, detained German ships. In 1940 Norway's prohibition against the carriage of oil to Italy led to an Italian embargo against Norway. In 1941, before it became officially a belligerent, the United States seized German, Italian, Danish, and French ships lying idle in U.S. waters and also froze Axis assets.

When employed as a collective measure of enforcement or prevention by an international organization, the effectiveness of an embargo depends upon cooperation both by members of the organization and, to prevent transshipment to the state subjected to such coercion, by nonmembers. In 1951, during the Korean War, the United Nations General Assembly adopted a U.S. recommendation that members of the UN prohibit shipments of arms and strategic materials to territories controlled by the Chinese and North Korean Communists. Thirty-three members and five nonmembers soon declared their intention to give effect to the resolution, and later the 14 states principally involved formed an international coordinating committee to implement their decision. This embargo, a means of supplementing UN military action in Korea, continued in effect after the 1953 Panmunjom armistice. In 1974 the Arab oil-producing states embargoed petroleum shipments to the West's industrialized powers in an unsuccessful attempt to force policy changes toward Israel.

Embargo Act (1807), Pres. Thomas Jefferson's nonviolent resistance to British and French molestation of U.S. merchant ships carrying, or suspected of carrying, war materials and other cargoes to the European belligerents. At Jefferson's request the two houses of Congress considered and passed the act quickly in December 1807. All U.S. ports were closed to export shipping in either U.S.

"Embargo," etching by Alexander Anderson reflecting hostile reaction to the Embargo Act of 1807
By courtesy of the Library of Congress, Washington, D.C.

or foreign vessels, and restrictions were placed on imports from Great Britain. The act was a hardship on U.S. farmers as well as on New England and New York mercantile and maritime interests, especially after being buttressed by harsh enforcement measures adopted in 1808. Its effects in Europe were not what Jefferson had hoped. French and British dealers in U.S. cotton, for example, were able to raise prices at will while the stock already on hand lasted; the embargo would have had to endure until these inventories were exhausted. Napoleon is said to have justified seizure of U.S. merchant ships on the ground that he was assisting Jefferson in enforcing the act. The Federalist leader Timothy Pickering even alleged that Napoleon himself had inspired the embargo. Confronted by bitter and articulate opposition, Jefferson on March 1, 1809 (two days before the end of his second term), signed the Non-Intercourse Act, permitting U.S. trade with nations other than France and Great Britain.

Embden, Gustav Georg (b. Nov. 10, 1874, Hamburg—d. July 25, 1933, Nassau, Ger.), German physiological chemist who conducted studies on the chemistry of carbohydrate metabolism and muscle contraction and was the first to discover and link together all the steps involved in the conversion of glycogen to lactic acid.

Embden studied in Freiburg, Strasbourg, Munich, Berlin, and Zürich under the direction of noted physiologists of the day—Johannes von Vries, Franz Hofmeister, Gaule, Paul Ehrlich, and Julius Richard Ewald. In 1904 he became director of the chemistry laboratory of the medical clinic at the Frankfurt-Sachsenhausen municipal hospital.

His research built the clinic into the Physiological Institute by 1907 and into the University Institute for Vegetative Physiology in 1914, the year in which the University of Frankfurt am Main was founded. He retained his directorship, served as a professor at the university, and was rector of the university from 1925 to 1926. His studies in the newly developing field of physiological chemistry were primarily concerned with chemical processes in living organisms, especially intermediate metabolic processes in liver tissue. By developing a technique to prevent tissue damage, he discovered the important role of the liver in metabolism and did preliminary studies that led to the investigation of normal sugar metabolism and of its pathological form, diabetes.

Embden and his co-workers isolated several intermediate metabolic products from muscle tissue and discovered the important metabolic compound adenyl phosphoric acid. In all his work he emphasized the relationships between his results and general cellular processes.

Ember Days and Ember Weeks, in the Roman Catholic and Anglican churches, four "times" set apart for special prayer and fasting and for the ordination of the clergy. The Ember Weeks are the complete weeks following (1) Holy Cross Day (September 14); (2) the Feast of St. Lucy (December 13); (3) the first Sunday in Lent; and (4) Pentecost (Whitsunday). The current practice is to compute the Ember Days directly as the Wednesday, Friday, and Saturday following the third Sunday of Advent, the first Sunday of Lent, Pentecost Sunday, and the third Sunday of September.

The exact origin of the Ember seasons is uncertain. In the early church, they were limited to three and may have been the Christian transformation of pagan festivals. From Rome the observance of the Ember Weeks and Days gradually spread throughout the Western Church. On Feb. 17, 1966, Pope Paul VI excluded the Ember Days as days of fast and abstinence for Roman Catholics.

Emberizidae, songbird family in the classification preferred by some authorities, absorbing some groups otherwise placed in the Fringillidae (*q.v.*), order Passeriformes. The family Emberizidae includes some species of buntings, finches, grosbeaks, and sparrows and all juncos; it is sometimes considered to include the tanagers and even the wood warblers. With these groups, the family numbers nearly 900 species. In the narrower sense the Emberizidae includes about 400 species, most of which are small seedeaters with conical bills. Except for a few species in the Old World, the family is confined to the New World. *See also* bananaquit; honeycreeper; swallow-tanager; tanager; towhee. For *Sporophilia, see* seedeater.

Emberres, Gil de: *see* Siloé, Gil de.

embezzlement, crime generally defined as the fraudulent misappropriation of goods of another by a servant, an agent, or another person to whom possession of the goods has been entrusted. The offense has no single or precise definition. Typically, embezzlement occurs when a person gains possession of goods lawfully and subsequently misappropriates them. In this respect, embezzlement is to be contrasted with the crime of larceny, which requires the taking of goods from the possession of another without the latter's consent. The scope of the old common-law crime of larceny has been gradually extended by various manipulations of the concept of possession. An English statute of 1529 held in effect that a servant who carried away goods entrusted to him by his master had committed larceny, since the legal title as opposed to the physical possession had never been transferred to him. This extension failed to cover situations in which the servant received goods from a third person intended for his master. The failure of the law of larceny to provide adequate protection for the property of employers against the depredations of servants and employees led to the passage of specific statutes.

Some countries limit such statutes to the misappropriation of goods received by an employee "by virtue of his employment." Others broaden the offense to include any property of the principal received by the defendant employee. Some jurisdictions include even property passed to an employee by mistake, while

others require the property to be deliberately passed. The most widely adopted statutes cover custodians of public funds. Many laws subject public servants to severe penalties, even if funds are lost through improper administration rather than a clear attempt to steal. *Compare* fraud; theft.

embiid (insect): *see* webspinner.

Embla (mythology): *see* Askr and Embla.

emblem book, collection of symbolic pictures, usually accompanied by mottoes and expositions in verse and often also by a prose commentary. Derived from the medieval allegory and bestiary, the emblem book developed as a pictorial-literary genre in 16th-century Italy and became popular throughout western Europe in the 17th century.

The father of emblem literature was the 16th-century Italian lawyer and humanist Andrea Alciato, with the *Emblemata* (Latin; 1531), which appeared in translation and in more than 150 editions. The Plantin press specialized in emblem literature, publishing at Antwerp in 1564 the *Emblemata* of the Hungarian physician and historian Johannes Sambucus; in 1565, that of the Dutch physician Hadrianus Junius (Adriaen de Jonghe); and, at Leiden, the early English emblem book, Geoffrey Whitney's *Choice of Emblemes* (1585), an anthology of emblems from Alciato, Junius, and others. English emblem books were either printed in the Netherlands or made by combining English text with foreign engravings, as in the English edition of the *Amorum Emblemata, Figuris Aeneis Incisa* (1608) of Octavius Vaenius (Otto van Veen), an important early Dutch emblem book.

The Netherlands became the centre of the vogue. Vaenius' *Amorum Emblemata* presented metaphors from Ovid and other Latin erotic poets with pictorial representation. The Dutch emblem books were widely translated, plagiarized, and reprinted with different text or engravings. From polyglot editions, begun by Heinsius' verses in Dutch and Latin and later in French, publication of emblem books became an international enterprise, and books

Page from Andrea Alciato's *Emblemata*, Augsburg, 1531
By courtesy of Mario Praz

of love emblems were exchanged by lovers and formed pretty little encyclopaedias of those "questions of love" that had been the erudite pastime of the academies throughout the Renaissance. Meanwhile, the Dutch emblematists had turned to religious emblems, serving Calvinists as well as Jesuits, who used them for propaganda. In Vaenius' *Amoris Divini Emblemata* (1615), quotations from St. Augustine replace those of Ovid, and Cupid reappears as the soul's preceptor.

The only English emblem book to achieve widespread popularity was the *Emblemes* (1635) of Francis Quarles, with plates from the *Pia Desideria* and from *Typus Mundi* (1627), popular Jesuit emblem books.

emblema, plural EMBLEMATA, central panel with figure representations—people, animals, and other objects—or occasionally another featured design motif in a Hellenistic or Roman mosaic. Emblemata were usually executed in *opus vermiculatum,* very fine work with tiny tesserae (stone, ceramic glass, or other hard cubes), and surrounded by floral or geometric designs in coarser mosaic work.

Although some emblemata were large scenes with several figures, most were small, vignette-

Drinking doves, *opus vermiculatum* emblema from Hadrian's Villa, Tivoli, Italy, either 1st century BC or 2nd century AD; in the Capitoline Museum, Rome
SCALA—Art Resource/EB Inc.

like pictures, and many were portable, manufactured ready-made in trays to be set into a larger floor mosaic. The first known emblema dates from about 200 BC; by the 3rd century, emblemata had given way in Italy to an overall decoration in coarser work, but they continued in common use in the provinces until the early Christian period.

Emboabas, War of the (1708–09), conflict in the Captaincy of Minas Gerais, Brazil, between the original settlers from São Paulo (Paulistas) and new settlers called *emboabas,* who were mostly European immigrants. In the late 17th century the Paulistas had opened gold mines in Minas Gerais and soon came into conflict with the *emboabas,* whom they considered trespassers. In the ensuing civil war the colonial government supported the successful *emboabas.* The Paulistas then moved to Mato Grosso, to the west, where in 1718 they discovered new gold deposits.

embolism, obstruction of the flow of blood by an embolus, a particle or aggregate of substance that is abnormally present in the bloodstream. The substance may be a blood clot that has broken loose from its point of formation (while it is still adherent to the vessel at the point where it was formed, the clot is called a thrombus); it may be a drop of oil from a crushing injury of fatty tissue, a clump of cancer cells, of bacteria, or of detached tissue cells; it may be a foreign body such as a bullet, which has penetrated a vessel wall; or it may be even an air bubble (called an air embolism) or a bubble of some other gas—*e.g.,* nitrogen in decompression sickness.

So long as the embolus travels unimpeded through the bloodstream, it is not likely to cause symptoms or damage. Trouble develops when the substance becomes wedged in a channel, usually an arterial branch, and blocks the flow of blood. Obstruction of a vessel that supplies blood to the brain may cause a stroke, with effects that include a period of unconsciousness, temporary or lasting paralysis of all or part of one side of the body, inability to use words (aphasia), impaired memory, and in severe cases, death. When there is a pulmonary embolism—an obstruction of blood flow to the lungs by an embolus in the pulmonary artery or in one of its branches—the affected person has difficulty breathing and experiences an unpleasant sensation beneath the breastbone, a feeling like that experienced in angina pectoris. When the blockage causes a section of lung tissue to die (this is called a pulmonary infarction), the affected person becomes feverish, and his heart beats rapidly. The physician attending him notes abnormal chest sounds, an increased number of white cells in the blood, and abnormalities in the chemical composition of the blood (a rise in bilirubin and in certain enzymes). Treatment includes administration of drugs to relieve pain, an anticoagulant to help prevent recurrence due to blood clot formation, and oxygen to aid breathing; fluid intake is reduced, and antibiotics are used to combat or prevent infection. Embolism in a coronary artery, which supplies blood to the heart muscle, can cause a number of serious effects, including death of a section of the heart muscle (myocardial infarction). *See also* thrombosis.

Embomma (Zaire): *see* Boma.

embossing, art of producing raised patterns on the surface of metal, leather, textiles, paper, and other similar substances. Strictly speaking, the term is applicable only to raised impressions produced by means of engraved dies or plates. Crests, monograms, and addresses may be embossed on paper and envelopes from dies set either in small handscrew presses or in ordinary letterpresses. Blocked ornaments on book covers or imitation tooling on leatherwork can be effected by means of powerful embossing presses. For impressing embossed patterns on wallpapers, textiles, and felt, copper cylinders are engraved with the patterns to be raised. The cylinders press against rollers with yielding surfaces or with elevations and depressions corresponding in reverse to those on the cylinders.

Embriaci FAMILY, a powerful Genoese family, whose members played notable roles in the Crusades in the Holy Land in the 11th and 12th centuries. Guglielmo Embriaco and his brother Primo di Castello sailed for the Holy Land in 1099 and participated in the capture of Jerusalem and the defeat of an Egyptian army at Ramla. Guglielmo returned to Genoa to raise fresh troops and then participated in the capture of Arsuf, south of Jaffa (1101). The supposed Holy Grail, thought to be carved from a single great emerald (much later found to be glass), was captured at Caesarea and sent to the cathedral of San Lorenzo in Genoa. Returning to Genoa, Guglielmo served a term as consul of the *comune.*

In 1109 Guglielmo's son Ugo (Hugh) took part in the capture of Gibilet, north of Beirut, two-thirds of which was ceded to the Embriaci; 30 years later the family acquired the remaining third, and in 1154 it received the Genoese quarter of Acre. Gradually an autocratic faction, made up of a handful of aristocratic clans, including the Embriaci, gained dominion over the Genoese *comune* and trade with the crusader states. The faction was ousted in Genoa in 1164; nevertheless, the Embriaci continued to rule Gibilet. Guglielmo's great-great-granddaughter, Plaisance, married Bohemond IV of Antioch and Tripoli; their son succeeded as Bohemond V. Eventually, the Embriaci renounced Genoese citizenship and, when the Holy Land fell in 1187, withdrew to Cyprus.

The Embriaci Tower, built in the 12th century, still stands in the old quarter of Genoa.

embroidery, art of decorating material, primarily textile fabric, by means of a needle and thread (and sometimes fine wire). The basic techniques include crewel work, petit point, cross-stitch, and quilting, as well as quillwork and featherwork (*qq.v.*).

Ancient Egyptian tomb paintings show that clothes, couch covers, hangings, and tents were so decorated. Quilting was known to the ancient Persians and, at the time of the Battle of Marathon (490 BC), was worn as armour; Greek vase paintings show these quilted suits covered with embroidery. Greeks depicted on vases, from the 7th and 6th centuries BC and later, are dressed in embroidered garments.

Panel from a Chinese imperial silk dragon robe embroidered in silk and gold thread, 17th century, early Ch'ing dynasty; in the Metropolitan Museum of Art, New York City

©Lee Boltin

The earliest surviving embroideries are Scythian, dated to between the 3rd and 5th centuries BC. Roughly from AD 330 until the 15th century, Byzantium produced embroideries lavishly ornamented with gold. Ancient Chinese embroideries have been excavated, dating from the T'ang dynasty (AD 618–907), but the most famous extant Chinese examples are the imperial silk robes of the Ch'ing dynasty (1644–1911/12). In India also it was an ancient craft, but it is from the Mughal period (from 1556) that numerous examples have survived, many finding their way to Europe from the late 17th to the early 18th century through the East India trade. Stylized plant and floral motifs, notably the flowering tree, influenced English embroidery. The Dutch East Indies also produced silk embroideries in the 17th and 18th centuries. In Islāmic Persia, examples survive from the 16th and 17th centuries, when embroideries show geometric patterns far removed by stylization from the animal and plant shapes that inspired them, owing to the Qur'ān's proscription of depicting living forms. In the 18th century these gave way to less severe, though still formal, flowers, leaves, and stems. In the 18th and 19th centuries a sort of patchwork called Resht was produced. Of the Middle Eastern work in the first half of the 20th century, there is a colourful peasant embroidery made in Jordan. In western Turkestan, Bokhara work with floral sprays in bright colours was done on covers in the 18th and 19th centuries; from the 16th century, Turkey produced elaborate embroideries in gold and coloured silks with a repertoire of stylized forms such as pomegranates, the tulip motif eventually predominating. The Greek islands in the 18th and 19th centuries produced many geometric embroidery patterns, differing from island to island, those of the Ionian islands and Scyros showing Turkish influence.

Northern European embroidery was, until the Renaissance, mostly ecclesiastical. An extant cape embroidered with eagles, presented to Metz Cathedral by Charlemagne, well represents Carolingian embroidery. The 10th-century stole of St. Cuthbert, embroidered in gold thread, preserved in Durham Cathedral, is the earliest surviving English embroidery. The 11th-century Bayeux tapestry—which is, in fact, embroidery—is Norman work done in England. The Crusades transmitted motifs of Saracenic art (such as pairs of confronting stylized animals), further reinforced Byzantine influence in Europe, and initiated heraldic embroidery. The sacks of Antioch (1098) and Constantinople (1204) resulted in pillage of embroideries, which (possibly as "conscience" gifts) were afterward presented to the church. Heraldry, also a formative influence after this time, is represented by the tunic (*c.* 1376) of the Black Prince in Canterbury Cathedral. The greatest period of English embroidery was 1100–1350, when it was known all over Europe as "English work," or opus anglicanum. In 1561 Elizabeth I granted a charter of incorporation to the Broderer's Company, a further step in the development of secular embroidery already apparent in Henry VIII's reign. Sixteenth-century English and French embroidery were closely related, both tending, for example, to adapt engraved designs for their needlework patterns. Embroidery during this period was becoming an amateur craft rather than a profession, a change that was even more marked in the 17th century. The fashion for crewel work, or worsted embroidery, dates largely from the 17th century, as does needlepoint, or canvas work. Samplers, used to record stitches and designs, became mainly decorative after the appearance of pattern books.

Detail of an embroidered waistcoat, French, 1800–25; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, gift of United Piece Dye Works, 1936

Embroidery in 17th- and 18th-century North America reflected European skills and conventions, such as crewel work, although the designs were simpler and the stitches were often modified to save thread; samplers, embroidered pictures, and mourning pictures were the most popular.

In the early 19th century almost all other forms of embroidery in England and North America were superseded by a type of needlepoint known as Berlin woolwork. A later fashion, influenced by the Arts and Crafts movement, was "art needlework," embroidery done on coarse, natural-coloured linen.

The South American countries were influenced by Hispanic embroidery. The Indians of Central America produced a type of embroidery known as featherwork, using actual feathers, and certain tribes of North America developed quillwork, embroidering skins and bark with dyed porcupine quills.

Embroidery is also commonly used as an embellishment in the savanna of western Africa and in Zaire.

embryo, the early developmental stage of an animal while it is in the egg or within the uterus of the mother. In humans the term is applied to the unborn child until the end of the seventh week following conception; from the eighth week the unborn child is called a fetus.

A brief treatment of embryonic development follows. For full treatment, *see* MACROPAEDIA: Growth and Development, Biological.

In organisms that reproduce sexually, the union of an ovum with a sperm results in a zygote, or fertilized egg, which undergoes a series of divisions called cleavages as it passes down the fallopian tube. After several cleavages have taken place, the cells form a hollow ball called a blastula. In mammals the blastula attaches itself to the uterine lining, thus stimulating the formation of a placenta, which will supply nutrients to the growing embryo. In lower animals the embryo is nourished by the yolk.

By the process of gastrulation, the embryo differentiates into three types of tissue: the ectoderm, producing the skin and nervous system; the mesoderm, from which develop connective tissues, the circulatory system, muscles, and bones; and the endoderm, which forms the digestive system, lungs, and urinary system. Mesodermal cells migrate from the surface of the embryo to fill the space between the other two tissues through an elongated depression known as the primitive streak. As the embryo develops, the cell layers fold over so that the endoderm forms a long tube surrounded by mesoderm, with an ectodermal layer around the whole.

Nutrients pass from the placenta through the umbilical cord, and the amnion, a fluid-filled membrane, surrounds and protects the embryo. The division of the body into head and trunk becomes apparent, and the brain, spinal cord, and internal organs begin to develop. All of these changes are completed early in embryonic development, by about the fourth week, in humans.

Between the head and the heart, a series of branchial arches, cartilaginous structures that support the gills of fishes and larval amphibians, begin to form. In higher vertebrates these structures form part of the jaw and ear. Limb buds also appear, and by the end of the embryonic stage, the embryo is distinguishable as a representative of its species.

embryology, the study of the formation and development of an embryo and fetus. In the 17th–18th century, embryology was based on descriptive and comparative studies, but toward the end of the 19th century, scientists began to use the analytical, or experimental, approach to determine how bodily organs and tissues acquired their distinctive forms and functions.

The German anatomist Wilhelm Roux (1850–1924) was among the first to envisage the scope of analytical embryology. He became the founder and most articulate exponent of experimental embryology, and his pioneer studies on frog eggs (beginning in 1885) gave a strong incentive to further research in this field. Other leading embryologists include Hans Spemann, also of Germany, who won a Nobel Prize in 1935 for his discovery of embryonic induction, and Ross G. Harrison, an American biologist noted for his work on tissue culture.

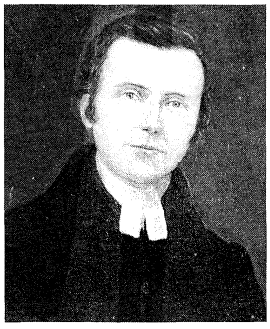
embryoma (tumour): *see* nephroblastoma.

Embu, town, central Kenya, eastern Africa, located at an elevation of about 4,400 feet (1,350 m), about 24 miles (40 km) south of Mount Kenya National Park. Embu was founded by the British in 1906. Missionary activity increased in the 1930s, and several schools were established. It is a market centre and carries out industrial activities; these in-

clude food processing, and the manufacture of clothing, footwear, beverages, and furniture. Roads link the town with Meru and Nairobi; there is also an airfield. Pop. (latest census) 3,928.

Embury, Philip (b. 1728, probably in Ballingrane, County Limerick, Ire.—d. August 1775, Camden, N.Y.), preacher and one of the founders of Methodism in the U.S.

Converted after a religious experience on Christmas Day, 1752, Embury was soon recognized as a potential leader and was licensed



Embury, portrait by an unknown artist

By courtesy of the John Street United Methodist Church, New York

as a local preacher. He emigrated to America in 1760 and settled in New York City, where in 1766 he began to preach. His first sermon was delivered to a company of five persons, whom he organized into a class in his own home. This gathering constituted the first Methodist society in New York City. After two years his audience had grown sufficiently to justify the building of Wesley Chapel (the first John Street Church), and in October of 1768 Embury preached the dedicatory sermon. In 1770 he moved to Ash Grove, near Camden, Washington County, N.Y. There he organized the first Methodist society north of New York City and continued until his death to preach and to act as the civil magistrate.

Emden, city, Lower Saxony *Land* (state), northwestern Germany, near the Ems River estuary and the North Sea coast of Ostfriesland (East Frisia). Founded about 800, it developed as a port for trade with the Baltic countries. It became the capital of the county of Ostfriesland in the 15th century and received storage and customs rights, by which it dominated the Ems trade. During the 16th-century Dutch wars of independence, it gained much of Holland's trade and became for a time the most important northwestern European port and a centre of Calvinism for Dutch refugees. Their return to the Netherlands, in addition to new Dutch policies and the development of a new course of the Ems farther from the town, led to a decline in the 17th century. It passed to Prussia in 1744, to France in 1810–14, and to Hanover in 1815.

After the port was improved and connected to the Ruhr by the Dortmund-Ems Canal in 1899, it became the German seaport for Westphalia. Despite severe destruction of the city in World War II, the harbour installations escaped damage, and Emden became one of the busiest ports of Germany. Shipping, shipbuilding, herring fishing, oil refining, and heavy industry dominate the economy. Remains of ramparts from 1616 and of the late Gothic Great Church (1648) survived World War II, and the East Friesland Museum and the town armoury from the 16th–17th century are notable. Pop. (1989 est.) 49,803.

Emden, Jacob Israel, original name JACOB BEN ZEBI, also called (by acronym) YAABETZ (b. June 4, 1697, Altona, Holstein [now in Denmark]—d. April 19, 1776, Altona), rabbi and Talmudic scholar primarily known for his lengthy quarrel with Rabbi Jonathan Eybeschütz (*q.v.*), an antagonism that sundered European Jewry.

Emden was thoroughly trained as a scholar of the Talmud, the rabbinical compendium of law, lore, and commentary. Emden evinced more widespread interests as well, studying Latin and Dutch. His traditionalism was revealed, however, in his belief that a Jew should pursue such secular subjects only during the twilight hour. Emden was a rabbi, serving four years in the city from which he took his name.

After moving to Altona, he established his own private synagogue and printing press and revealed a cantankerous nature in the frequent disputes he engaged in with members of the Jewish community. He attacked such people as the chief rabbi of the community, Ezekiel Katzenellenbogen, for his Talmudic decisions. When Katzenellenbogen died, Jonathan Eybeschütz, a rabbi of great popularity and European reputation, was chosen to take his place. Eybeschütz prescribed amulets to save women from death in childbirth, and one of the charms, with a prayer in cipher to Shabbetai Tzevi, the most important of the Jewish false messiahs, fell into Emden's hands. He publicly denounced the maker of the amulet (without specifying Eybeschütz) as a heretic deserving excommunication, thereby initiating a long, often violent quarrel.

Emden was a prolific and distinguished author. His writings fall into two categories: those of a polemical nature, in which he attacked Shabbetaian heresies, and religious commentaries. His diary is revealing as a record of Jewish thought in his time, and his critical study of the *Zohar*, a part of the Jewish mystical writings known as the Kabbala, made clear that it was the work of several hands.

Emden, Robert (b. March 4, 1862, St. Gallen, Switz.—d. Oct. 8, 1940, Zürich), physicist and astrophysicist who developed a theory of expansion and compression of gas spheres and applied it to stellar structure. In 1889 Emden was appointed to the Technische Hochschule, Munich, where he became professor of physics and meteorology in 1907. His famous book *Gaskugeln* (1907; "Gas Spheres") was a very important early work on the theory of stellar structure; it develops the physical theory of a gas sphere acted upon by its own gravity. He also devised a hypothesis, no longer taken seriously, to explain sunspots.

In 1924 Emden became honorary professor of astrophysics at the University of Munich, where he remained until his retirement in 1934. He took a leading role in founding the *Zeitschrift für Astrophysik* ("Journal of Astrophysics") in 1930 and edited it for six years.

Emecheta, Buchi (b. July 21, 1944, Lagos, Nigeria), Nigerian sociologist, poet, playwright, essayist, and children's author whose novels were published in English and German.

Emecheta was married at the age of 16 and followed her husband to London in 1962. The problems that she encountered in London during the early 1960s provided background for her first two books, *In the Ditch* (1972) and *Second-Class Citizen* (1974). The three major themes they introduced were quests for first-class citizenship, self-confidence, and dignity as a woman. She viewed her works as sociological statements that examine the universal female condition although they speak specifically for Nigerian women who are struggling against traditional mores that oppress or limit their progress.

Emecheta won the 1978 Jock Campbell-New Statesman Award and was called the "best black writer in Britain for 1978" by the *Afro-Caribbean Post* (London). Her best-known works include *The Bride Price* (1976), *The Slave Girl* (1977), *The Joys of Motherhood* (1979), *Titch the Cat* (1979), *Nowhere to Play* (1980), *Destination Biafra* (1981), and *Double Yoke* (1982).

'Emeq Yizre'el (Israel): *see* Esdraelon, Plain of.

Emerald, town, central Queensland, Australia, on the Nogoa River, at the junction of the Capricorn and Gregory highways, 172 mi (276 km) west of Rockhampton. P.F. MacDonald, an early settler, established Emerald Downs station (ranch) in the 1860s, but whether the name derives from gemstones found in the area or from the colour of the pastures after rain is a matter of local debate. In the 1880s the region's economy depended largely on gemstones, which still are exploited commercially and attract amateur gem collectors. Cattle and sheep raising, together with the cultivation of numerous crops (including cotton) irrigated with water from the Fairbairn Dam, are now the basis of the town's prosperity. Brisbane lies about 570 mi to the southeast. Pop. (1981) 4,628.

emerald, bright-green variety of beryl (*q.v.*) that is highly valued as a gemstone. The name comes indirectly from the Greek *smaragdos,* a name that seems to have been given to a number of stones having little in common except a green colour; Pliny's *smaragdus* undoubtedly included several distinct species. Much confusion has arisen with respect to the "emerald" of the Scriptures: the Hebrew word rendered emerald in the Authorized Version probably meant carbuncle, a garnet.

The ancients appear to have obtained emeralds from Upper Egypt, where it is said to have been worked as early as 1650 BC. Greek miners were working the mines in the time of Alexander the Great, and later the mines yielded their gems to Cleopatra. Remains of extensive workings were discovered in 1817; "Cleopatra's Mines" are situated in Jabal Sukayt and Jabal Zabārah near the Red Sea coast, east of Aswān. The Egyptian emeralds occur in mica schist and talc schist.

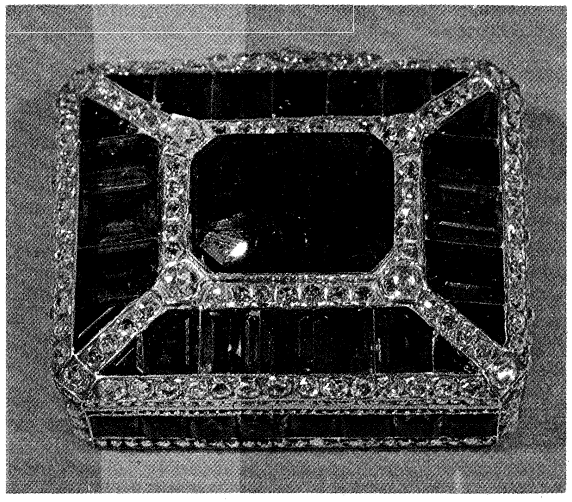
During the Spanish conquest of South America, vast quantities of emeralds were taken from the Peruvians, but the exact locality that yielded the stones was never discovered. The only South American emeralds now known occur near Bogotá. The most famous mine is at Muzo, but workings are known also at Coscuez and Somondoco. The emeralds are found in calcite veins in a black bituminous limestone containing ammonites of Lower Cretaceous age.

In 1830 emeralds were discovered in the Urals. They have been worked on the River Takovaya, northeast of Sverdlovsk, where they occur in mica schist. Emeralds have been found, also in mica schist, in the Habachthal, Austria, in granite in Eidsvold, Nor., and in a pegmatite vein piercing slaty rocks near Emmaville, N.S.W. Fine crystals have been obtained from Stonypoint, N.C.

Many virtues were formerly ascribed to emeralds. When worn, the stone was held to be a preservative against epilepsy and a cure for dysentery; it was supposed to assist women at childbirth, to drive away evil spirits, and to preserve the chastity of the wearer. Administered internally, it was reputed to have great medicinal value. Its refreshing green colour was said to be good for the eyesight.

The physical properties of emerald are essentially the same as those of beryl. Its refractive and dispersive powers are not high, so that cut stones display little brilliancy or fire. The magnificent colour that gives extraordinary value to this gem is probably due to small amounts of chromium. The stone loses colour when strongly heated.

Because of emerald's high value, attempts were long made to manufacture it synthetically. These efforts finally met with success shortly before World War II, when a German patent was issued to cover its synthesis.



Emerald box, formerly among the crown jewels of Iran
By courtesy of the Royal Ontario Museum, Toronto

Beginning in 1946 emeralds of fine quality were manufactured in the United States, in a water solution at elevated temperature and pressure. The crystals thus grown appeared very similar to natural crystals and rivaled them in colour and beauty. A synthetic emerald fluoresces deep red under ultraviolet light; natural stones do not.

The stone known as Uralian emerald is garnet; Brazilian emerald is green tourmaline; Cape emerald is prehnite; and evening emerald is peridot.

emergence, in evolutionary theory, the rise of a system that cannot be predicted or explained from antecedent conditions. George Henry Lewes, a mid-19th-century philosopher of science, distinguished between resultants and emergents—phenomena that are predictable from their constituent parts, and those that are not (*e.g.,* a physical mixture of sand and talcum powder as contrasted with a chemical compound such as salt, which looks nothing like sodium or chlorine). The evolutionary account of life is a continuous history marked by stages at which fundamentally new forms have appeared: (1) the origin of life; (2) the origin of nucleus-bearing protozoa; (3) the origin of sexually reproducing forms, with an individual destiny lacking in cells that reproduce by fission; (4) the rise of sentient animals, with nervous systems and protobrains; and (5) the appearance of an animal knowing all of this and more, namely man. Each of these new modes of life, though grounded in the physicochemical and biochemical conditions of the previous and simpler stage, is intelligible only in terms of its own ordering principle. These are thus cases of emergence.

Early in the 20th century, C. Lloyd Morgan, one of the founders of animal psychology, emphasized the negative character of the principle: nothing should be called an emergent unless it can be shown not to be a resultant. Like Lewes, he treated the distinction as inductive and empirical, not as metempirical or metaphysical; *i.e.,* not beyond the observable realm. Morgan condemned the early-20th-century French intuitionist Henri Bergson's creative evolution as speculative, while proclaiming emergent evolution as a scientific theory. Even so, the theory has not been accepted universally by biologists. With genetics illuminating the mechanism of heredity (and hence the very conditions of evolution) and biochemistry elucidating the workings of the cell nucleus, some biologists are confirmed in their belief that scientific treatment admits only of analysis into parts and not into new kinds of wholes. Thus, they tend to concentrate on the mechanisms of mutation and of natural selection, effective in microevolution—the change from variety to variety and species to species—and to extrapolate these findings to macroevolution, to the origin of the great groups of living things.

Nevertheless, the concept of emergence still figures in some evolutionary thinking. In the 1920s and '30s, Samuel Alexander, a British Realist metaphysician, and Jan (Christian) Smuts, the South African statesman and thinker, espoused emergence theories; and later, others, such as the Jesuit paleontologist Pierre Teilhard de Chardin and the French zoologist Albert Vandel, emphasized the series of levels of organization, moving toward higher forms of consciousness. The philosophy of organism of Alfred North Whitehead, the leading process metaphysician, with its doctrine of creative advance, is a philosophy of emergence; so also is the theory of personal knowledge of Michael Polanyi, a Hungarian scientist and philosopher, with its levels of being and of knowing, none of which are intelligible wholly in terms of those below it.

emergency medicine, medical specialty emphasizing the immediacy of treatment of acutely ill or injured individuals.

Among the factors that influenced the growth of emergency medicine was the increasing specialization in other areas of medicine. With the shift away from general practice—especially in urban centres—the emergency room became for many, in effect, a primary source of health care. Another factor was the adoption of a number of standard emergency procedures—such as immediate paramedic attention to severe wounds and the rapid transportation of the ill or injured to a hospital—that had evolved in the military medical corps; as used in the civilian hospital, these techniques resulted in such measures as the training of paramedics and the development of the hospital emergency room as a major trauma centre.

Together these factors led to a greatly increased demand for emergency services and in the early 1960s led to the full-time staffing of hospital emergency rooms. The physicians who led the emergency-room team, once recruited from other specialties, felt an increasing demand for specific training in the management of both major traumas and a wide range of acute medical problems. Emergency medicine became an officially recognized specialty in 1979.

Emerson, Peter Henry (b. May 13, 1856, Cuba—d. May 12, 1936, Falmouth, Cornwall, Eng.), English photographer, one of the first to promote photography as an independent art and to formulate an aesthetic theory for photography based on its peculiar characteristics.

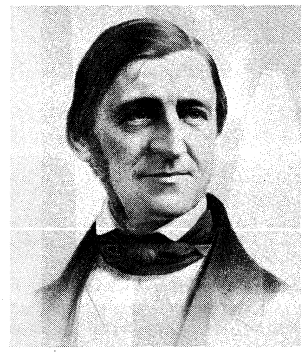
Trained as a physician, Emerson first began to photograph as an aid to an anthropological study of the peasants and fishermen of East Anglia. These photographs were published in such books as *Life and Landscape on the Norfolk Broads* (1886) and *Pictures of East Anglian Life* (1888). They form an intimate documentation of rural English life in the late 19th century.

Emerson soon became convinced that photography was a medium of artistic expression superior to all other black and white graphic media because it reproduces the light, tones, and textures of nature with unrivaled fidelity. He was repelled by currently fashionable composite photographs, which sought artistic merit by imitating sentimental genre paintings. In his handbook *Naturalistic Photography* (1889), he outlined his system of aesthetics, which he called naturalism. A correct photograph, he stated, should be direct and simple, showing real people in their own environment, not costumed models posed before fake backdrops. Compositions should be spontaneous, ignoring predetermined formulas. Above all, photographs should look like photographs, not paintings.

Emerson's book was so persuasive that, after its publication, he was generally considered one of the world's leading photographers. In 1891, however, he published a black-bordered pamphlet "The Death of Naturalistic Photography," recanting his opinion that the accurate reproduction of nature was synonymous with art. Nevertheless, his original views remained influential and formed the rationale of much 20th-century photography.

Emerson, Ralph Waldo (b. May 25, 1803, Boston—d. April 27, 1882, Concord, Mass., U.S.), American lecturer, poet, and essayist, the leading exponent of New England Transcendentalism.

Early life and works. Emerson was the son of the Rev. William Emerson, a Unitarian clergyman and friend of the arts. The son inherited the profession of divinity, which had attracted all his ancestors in direct line from



Ralph Waldo Emerson, lithograph by Leopold Grozelier, 1859
By courtesy of The Library of Congress, Washington, D.C.

Puritan days. The family of his mother, Ruth Haskins, was strongly Anglican, and among influences on Emerson were such Anglican writers and thinkers as Ralph Cudworth, Robert Leighton, Jeremy Taylor, and Samuel Taylor Coleridge.

On May 12, 1811, Emerson's father died, leaving the son largely to the intellectual care of Mary Moody Emerson, his aunt, who took her duties seriously. In 1812 Emerson entered the Boston Public Latin School, where his juvenile verses were encouraged and his literary gifts recognized. In 1817 he entered Harvard College, where he began his journals, which may be the most remarkable record of the "march of Mind" to appear in the United States. He graduated in 1821 and taught school while preparing for part-time study in

the Harvard Divinity School. Though Emerson was licensed to preach in the Unitarian community in 1826, illness slowed the progress of his career, and he was not ordained to the Unitarian ministry at the Second Church, Boston, until 1829. There he began to win fame as a preacher, and his position seemed secure. In 1829 he also married Ellen Louisa Tucker. When she died of tuberculosis in 1831, his grief drove him to question his beliefs and his profession. But in the previous few years Emerson had already begun to question Christian doctrines. His older brother William, who had gone to Germany, had acquainted him with the new biblical criticism and the doubts that had been cast on the historicity of miracles. Emerson's own sermons, from the first, had been unusually free of traditional doctrine and were instead a personal exploration of the uses of spirit, showing an idealistic tendency and announcing his personal doctrine of self-reliance and self-sufficiency. Indeed, his sermons had divested Christianity of all external or historical supports and made its basis one's private intuition of the universal moral law and its test a life of virtuous accomplishment. Unitarianism had little appeal to him by now, and in 1832 he resigned from the ministry.

Mature life and works. When Emerson left the church, he was in search of a more certain conviction of God than that granted by the historical evidences of miracles. He wanted his own revelation—*i.e.,* a direct and immediate experience of God. When he left his pulpit he journeyed to Europe. In Paris he saw Antoine-Laurent de Jussieu's collection of natural specimens arranged in a developmental order that confirmed his belief in man's spiritual relation to nature. In England he paid memorable visits to Samuel Taylor Coleridge, William Wordsworth, and Thomas Carlyle. At home once more in 1833, he began to write *Nature* and established himself as a popular and influential lecturer. By 1834 he had found a permanent dwelling place in Concord, Mass., and in the following year he married Lydia Jackson and settled into the kind of quiet domestic life that was essential to his work.

The 1830s saw Emerson become an independent literary man. During this decade his own personal doubts and difficulties were increasingly shared by other intellectuals. Before the decade was over his personal manifestos—*Nature,* "The American Scholar," and the divinity school *Address*—had rallied together a group that came to be called the Transcendentalists, of which he was popularly acknowledged the spokesman. Emerson helped initiate Transcendentalism (*q.v.*) by publishing anonymously in Boston in 1836 a little book of 95 pages entitled *Nature.* Having found the answers to his spiritual doubts, he formulated his essential philosophy, and almost everything he ever wrote afterward was an extension, amplification, or amendment of the ideas he first affirmed in *Nature.*

Emerson's religious doubts had lain deeper than his objection to the Unitarians' retention of belief in the historicity of miracles. He was also deeply unsettled by Newtonian physics' mechanistic conception of the universe and by the Lockean psychology of sensation that he had learned at Harvard. Emerson felt that there was no place for free will in the chains of mechanical cause and effect that rationalist philosophers conceived the world as being made up of. This world could be known only through the senses rather than through thought and intuition; it determined men physically and psychologically; and yet it made them victims of circumstance, beings whose superfluous mental powers were incapable of truly ascertaining reality.

Emerson reclaimed an idealistic philosophy from this dead end of 18th-century rationalism by once again asserting the human ability to transcend the materialistic world of sense experience and facts and become conscious of the all-pervading spirit of the universe and the potentialities of human freedom. God could best be found by looking inward into one's own self, one's own soul, and from such an enlightened self-awareness would in turn come freedom of action and the ability to change one's world according to the dictates of one's ideals and conscience. Human spiritual renewal thus proceeds from the individual's intimate personal experience of his own portion of the divine "oversoul," which is present in and permeates the entire creation and all living things, and which is accessible if only a person takes the trouble to look for it. Emerson enunciates how "reason," which to him denotes the intuitive awareness of eternal truth, can be relied upon in ways quite different from one's reliance on "understanding"—*i.e.,* the ordinary gathering of sense-data and the logical comprehension of the material world. Emerson's doctrine of self-sufficiency and self-reliance naturally springs from his view that the individual need only look into his own heart for the spiritual guidance that has hitherto been the province of the established churches. The individual must then have the courage to be himself and to trust the inner force within him as he lives his life according to his intuitively derived precepts.

Obviously these ideas are far from original, and it is clear that Emerson was influenced in his formulation of them by his previous readings of Neoplatonist philosophy, the works of Coleridge and other European Romantics, the writings of Emmanuel Swedenborg, Hindu philosophy, and other sources. What set Emerson apart from others who were expressing similar Transcendentalist notions were his abilities as a polished literary stylist able to express his thought with vividness and breadth of vision. His philosophical exposition has a peculiar power and an organic unity whose cumulative effect was highly suggestive and stimulating to his contemporary readers' imaginations.

In a lecture entitled "The American Scholar" (Aug. 31, 1837), Emerson described the resources and duties of the new liberated intellectual that he himself had become. This address was in effect a challenge to the Harvard intelligentsia, warning against pedantry, imitation of others, traditionalism, and scholarship unrelated to life. Emerson's "Address at Divinity College," Harvard University, in 1838 was another challenge, this time directed against a lifeless Christian tradition, especially Unitarianism as he had known it. He dismissed religious institutions and the divinity of Jesus as failures in man's attempt to encounter deity directly through the moral principle or through an intuited sentiment of virtue. This address alienated many, left him with few opportunities to preach, and resulted in his being ostracized by Harvard for many years. Young disciples, however, joined the informal Transcendental Club (founded in 1836) and encouraged him in his activities.

In 1840 he helped launch *The Dial,* first edited by Margaret Fuller and later by himself, thus providing an outlet for the new ideas Transcendentalists were trying to present to America. Though short-lived, the magazine provided a rallying point for the younger members of the school. From his continuing lecture series, he gathered his *Essays* into two volumes (1841, 1844), which made him internationally famous. In his first volume of *Essays* Emerson consolidated his thoughts on moral individualism and preached the ethics of self-reliance, the duty of self-cultivation, and the need for the expression of self. The second volume of *Essays* shows Emerson accommodating his earlier idealism to the limitations of real life; his later works show an increasing acquiescence to the state of things, less reliance on self, greater respect for society, and an awareness of the ambiguities and incompleteness of genius.

His *Representative Men* (1849) contained biographies of Plato, Swedenborg, Montaigne, Shakespeare, Napoleon, and Goethe. In *English Traits* he gave a character analysis of a people from which he himself stemmed. *The Conduct of Life* (1860), Emerson's most mature work, reveals a developed humanism together with a full awareness of man's limitations. It may be considered as partly confession. Emerson's collected *Poems* (1846) were supplemented by others in *May-Day* (1867), and the two volumes established his reputation as a major American poet.

By the 1860s Emerson's reputation in America was secure, for time was wearing down the novelty of his rebellion as he slowly accommodated himself to society. He continued to give frequent lectures, but the writing he did after 1860 shows his powers waning. A new generation knew only the old Emerson and had absorbed his teaching without recalling the acrimony it had occasioned. Upon his death in 1882 Emerson was transformed into the Sage of Concord, shorn of his power as a liberator and enrolled among the worthies of the very tradition he had set out to destroy.

Emerson's voice and rhetoric sustained the faith of thousands in the American lecture circuits between 1834 and the American Civil War. He served as a cultural middleman through whom the aesthetic and philosophical currents of Europe passed to America, and he led his countrymen during the burst of literary glory known as the American renaissance (1835–65). As a principal spokesman for Transcendentalism, the American tributary of European Romanticism, Emerson gave direction to a religious, philosophical, and ethical movement that above all stressed belief in the spiritual potential of every man.

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emery, impure corundum (aluminum oxide, or alumina; Al_2O_3) much-used as an abrasive or polishing material; it is a granular or massive, dark-coloured, dense substance, having

much the appearance of an iron ore. It is a mechanical aggregate of corundum (usually in bluish grains or minute crystals) with magnetite (also granular or crystalline). In addition to these minerals, emery sometimes contains diaspore, gibbsite, margarite, chloritoid, and sillimanite. Indeed, emery must be regarded as a rock rather than a definite mineral species.

The Mohs hardness of emery is about 8, whereas that of pure corundum is 9. Its abrasive power, or effective hardness, is not proportionate to the amount of alumina it contains but seems to depend on its physical condition.

Emery has been worked from very early times on the island of Náxos; it occurs as loose blocks and as lenticular, or lens-shaped, masses or irregular beds in granular limestone associated with crystalline schists. Important deposits, similar to that on Náxos, occur in Turkey, where emery is found as detached blocks in a reddish soil and as rounded masses embedded in a crystalline limestone associated with mica schist, gneiss, and granite. Emery has been worked at several localities in the United States; in the early 1980s, the only commercial production was at Peekskill, N.Y.

Emery was long used principally as an abrasive, but its largest application became that of a nonskid material in floors, stair treads, and pavements. A very fine emery dust is used by lens grinders, lapidaries, and plate-glass manufacturers, although other abrasives are often preferred. Emery wheels are made by consolidating the powdered material with a bonding medium and are used not only by dentists but also by machinists for grinding, shaping, and polishing steel. In emery sticks, cloth (also called crocus cloth), and paper, the powdered emery is bonded with adhesive.

emesis: *see* vomiting.

emf: *see* electromotive force.

Emi Koussi (mountain, Chad): *see* Koussi, Mount.

emigration, the departure from a country for life or residence in another. *See* human migration.

émigré, any of the Frenchmen, mostly aristocrats, who fled France at the time of the French Revolution of 1789. From their places of exile, the émigrés plotted against the Revolutionary government, seeking foreign help in their goal of restoring the old regime. The Revolutionary leaders in France, fearful of their activity, took action against them: émigrés who did not return by January 1792 were liable to death as traitors; in the same year their property was confiscated by the state.

Under the leadership of King Louis XVI's oldest brother, the Count de Provence (future king Louis XVIII), many émigrés set up a court at Coblenz in the Rhineland. One of their number, Louis-Joseph, Prince de Condé, commanded an army of émigrés that assisted foreign powers in the wars against France, but the exiles never posed a serious military threat. A defeat at Quiberon Bay in southern Brittany in July 1795, in an attempt to aid a peasant revolt, dashed their hopes of a military success.

A great number of émigrés also took refuge in England. Juniper Hall, a country house in Mickleham, Surrey, became a home for some and meeting place for many others passing through or visiting. Louis XVI's brother the Count d'Artois (future king Charles X), who headed the Ultras, or extreme reactionary royalists, spent most of the Revolutionary and Napoleonic years in England. Louis-Philippe, Duke d'Orléans and head of the Orleanists (who would become King Louis-Philippe), arrived in England in 1800 after sojourns in Scandinavia and the United States.

Napoleon Bonaparte granted the great majority of émigrés amnesty in 1802, and many returned to France. After the restoration of the Bourbon monarchy (1814), the émigrés became an important force in French politics, their views ranging from a moderate to an extreme royalist position. Their petitioning resulted in the Law of Indemnity of 1825, designed to reimburse the most needy of those who lost their lands. The gradual disappearance of the émigrés along with King Louis-Philippe's indifference to their cause ended their influence.

Emilia-Romagna, *regione,* north-central Italy, comprising the provinces of Bologna, Ferrara, Forlì, Modena, Parma, Piacenza, Ravenna, and Reggio nell'Emilia. With an area of 8,542 square miles (22,123 square km), it extends from the Adriatic Sea (east) almost across the peninsula between the Po River (north) and the Ligurian and Tuscan Apennines (south and west). It is bounded by the regions of Veneto and Lombardy on the north, Liguria on the west, and Tuscany, Marche, and the Republic of San Marino on the south.

The northern portion is a great plain extending from the Po southeast to Ravenna and Rimini, where the Apennine Mountains come down to the coast. The plain's highest point is no more than 200 feet (60 m) above sea level, and along the east coast there are lagoons near the mouths of the Po; Comacchio Lagoon is to the south. Immediately to the southwest of the ancient Roman road called the Via Aemilia, the mountains begin to rise, culminating in the central chain of the Apennines. Emilia-Romagna's southern boundary follows the summits of this mountain chain. With the exception of the Po, the region's main rivers descend from these mountains. The Trebbia, Taro, Secchia, Panaro (affluents of the Po), Reno, Ronco, Montone, and Savio (flowing to the Adriatic) are the most important rivers.

The name Emilia comes from the Via Aemilia, a Roman road which traversed the region from Ariminium (Rimini) in the southeast to Placentia (Piacenza) in the northwest; a modern railway closely follows its route. In popular usage the name was transferred to the area (which formed the eighth Augustan region of Italy) as early as the 1st century AD, and it was frequently named as a district under imperial judges. After the 3rd century, Ravenna was, as a rule, not treated as part of Aemilia, the chief town of which was Placentia. In the 6th century, Ravenna became the seat of a Byzantine exarchate.

After the Lombards had for two centuries attempted to subdue the maritime pentapolis (Rimini, Ancona, Fano, Pesaro, and Senigallia), the Frankish king Pepin took these five cities from the Lombard ruler Aistulf and in 755 gave them to the papacy, to which, under the name of Romagna, they continued to belong. The other chief cities of Emilia—Ferrara, Modena, Reggio nell'Emilia, Parma, and Piacenza—were independent. Whether belonging to the Romagna or not, each had a history of its own, and, notwithstanding the feuds of the Guelfs and Ghibellines (papal and imperial factions), they prospered considerably.

Papal supremacy in the Romagna remained little more than nominal until Cesare Borgia, the natural son of Pope Alexander VI, crushed most of the petty princes there, and the Romagna came under papal administration after the death of Alexander in 1503. The papacy also controlled Ferrara and Bologna after the 16th century, while the rest of the region was largely dominated by the Este duchy of Modena and the Farnese duchy of Parma and Piacenza. After a period of Napoleonic domination, the Congress of Vienna (1815) returned Romagna to the papacy and gave the duchy of Parma to Marie Louise, wife of the deposed Napoleon, and Modena to the archduke Francis of Austria, the heir of the last Este. After a period of continuous unrest and numerous attempts at revolt, Emilia passed to the Italian kingdom almost without resistance in 1860. The name of the region was changed to Emilia-Romagna in 1948.

With its broad lowland and adequate water supply (from both rainfall and irrigation), Emilia-Romagna is one of the leading agricultural regions of Italy. Wheat, corn (maize), fodder, and sugar beets are the principal crops; vegetables and fruits are also grown in the lowlands and grapes on the Apennine slopes. Livestock raising and dairy farming are extensive. There is a large food-processing and food-packing industry. The manufacture of cars and trucks, farm machinery, chemicals and pharmaceuticals, and clothing are also important. Small hydroelectric stations on the rivers provide power, and these are connected with the Alpine plants so that interchange at different seasons is possible. The discovery of large deposits of natural gas (at Cortemaggiore north of Piacenza and near Ravenna) and of oil (at Cortemaggiore, which is refined at Ravenna) gives the region a vital role in the energy economy of Italy. Bologna, the regional capital, is a communications hub for commerce between northern and southern Italy, and the region is well served by secondary railway lines and highways. Pop. (1988 est.) 3,924,199.

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Emin Paşa, Mehmed, original name EDUARD SCHNITZER (b. March 28, 1840, Oppeln, Silesia [now Opole, Pol.]—d. Oct. 23, 1892, Kanema, Congo Free State [now in Zaire]), physician, explorer, and governor of the Equatorial province of Egyptian Sudan who contributed vastly to the knowledge of African geography, natural history, ethnology, and languages.

In 1865 Schnitzer became a medical officer in the Turkish army and used his leisure to learn the Turkish, Arabic, and Persian languages. While serving the Ottoman governor of northern Albania (1870–74), he adopted a Turkish mode of living and a Turkish name. In 1876 he joined the British governor-general of the Sudan, General Charles Gordon, as medical officer at Khartoum. In this post he was known as Emin Effendi and was called upon to tend to administrative duties and to carry out diplomatic missions to Uganda and elsewhere. In 1878 Gordon appointed him governor of Equatoria (in the southern Sudan), with the title of bey. Conducting his excellent and enlightened administration from Lado, he traveled throughout the province, made extensive and valuable surveys, and also brought an end to slavery in the region. In the course of the Mahdist uprising, though the Egyptian government abandoned the Sudan (1884), the isolated Emin, now elevated to the rank of pasha, felt secure and was initially reluctant to be rescued by the famed explorer Henry Morton Stanley in 1888. Possibly owing to the arrival of Stanley with his forces, Emin had to contend with disaffection among his own troops. On April 10, 1889, he and Stanley, with some 1,500 others, left the region and crossed over to the eastern African coast, arriving at Bagamoyo, in present-day Tanzania, on Dec. 4, 1889.

The German government then asked him to undertake an expedition to equatorial Africa to secure territories south of and along Lake Victoria to Lake Albert. Soon after the expedition started, however, an Anglo-German agreement was signed (July 1, 1890) excluding Lake Albert from German influence. After experiencing difficulties with German authorities in Tanganyika, he crossed into the Congo Free State (May 1891) and on his journey

to the western African coast was murdered by Arab slave-raiders, among whom he had many enemies.

Though Emin Paşa published no books, he wrote many valuable papers on Africa for German journals and forwarded rich and varied collections of animals and plants to Europe. An account of his adventurous life is contained in A. Symons' *Emin, the Governor of Equatoria* (1928).

eminent domain, also called CONDEMNATION, or EXPROPRIATION, power of government to take private property for public use without the owner's consent. Constitutional provisions in most countries require the payment of compensation to the owner. In countries with unwritten constitutions, such as England, the supremacy of Parliament makes it theoretically possible for property to be taken without compensation, but in practice compensation is paid. Confiscation is the term most often used in contrast to eminent domain to describe the taking of property by the state without compensation.

The idea of eminent domain as a power peculiar to sovereign authority but coupled with a duty to pay compensation comes from such 17th-century natural-law jurists as Hugo Grotius and Samuel Pufendorf. The English practice in the early 17th century was for Parliament to authorize the taking of property and either to prescribe the amount to be paid or to provide a judicial proceeding to determine it. The proceeding was held without the presence of the owner. The American colonies developed judicial procedures enabling the owner to be heard on the question of compensation.

There have been few legislative attempts in the United States to control or define what is just compensation. In general, the judicial definition is that just compensation is the fair market value at the time of the taking, the market value including not only the existing use value but also the best use to which the property may be put. Many states and the federal government have "quick-taking" statutes providing that, upon the deposit of adequate security, the government may take title and possession before the price is judicially decided.

Nearly all other countries have constitutional or statutory provisions requiring that compensation be paid for property taken. The French and German systems, unlike Anglo-American law, require that it be paid in advance of the taking by the government. In the countries influenced by French and German law, the question of the public purpose to be served by the taking is an administrative one and is not determined in the regular courts. Also, there are fewer general statutes providing for blanket authorization of condemnation for particular purposes (such as highways) than there are in the United States, and more often there is a requirement that expropriation of each particular parcel be authorized by the Parliament.

Eminescu, Mihail, pseudonym of MIHAIL EMINOVICI (b. Jan. 15, 1850, Ipoteşti, Moldavia, Ottoman Empire,—d. June 15, 1889, Bucharest, Rom.), poet who transformed both the form and content of Romanian poetry, creating a school of poetry that strongly influenced Romanian writers and poets in the late 19th and early 20th centuries.

Eminescu was educated in the Germano-Romanian cultural centre of Cernăuţi (now Chernovtsy, Ukrainian S.S.R.) and at the universities of Vienna (1869–72) and Berlin (1872–74), where he was influenced by German philosophy and Western literature. In 1874 he was appointed school inspector and librarian at the University of Iaşi but soon resigned to take up the post of editor in chief of the conservative paper *Timpul.* His literary activity came to an end in 1883, when he suffered the onset of a mental disorder that led to his death in an asylum.

Eminescu's talent was first revealed in 1870 by two poems published in *Convorbiri literare,* the organ of the Junimea society in Iaşi. Other poems followed, and he became recognized as the foremost modern Romanian poet. Mystically inclined and of a melancholy disposition, he lived in the glory of the Romanian medieval past and in folklore, on which he based one of his outstanding poems, "Luceafărul" (1883; "The Evening Star").

Eminescu's poetry has a distinctive simplicity of language, a masterly handling of rhyme and verse form, a profundity of thought, and a plasticity of expression which affected nearly every Romanian writer of his own period and after. His poems have been translated into several languages, including an English translation in 1930, but chiefly into German. Among his prose writings, apart from many studies and essays, the best-known are the stories "Cezara" and "Sărmanul Dionis" (1872).

emir, Arabic AMĪR ("commander," or "prince"), in the Muslim Middle East, a military commander, governor of a province, or a high military official. Under the Umayyads, the emir exercised administrative and financial powers, somewhat diminished under the ʿAbbāsids, who introduced a separate financial officer. Sometimes, as in the cases of the Aghlabids and Ṭāhirids, the emirs ruled virtually independently in their provinces with but token allegiance to the caliph. In other cases the province was first taken by force, then the emirs applied for legitimacy to the caliph.

The title *amīr al-muʾminīn,* sometimes used of leaders of Muslim military campaigns, was assumed by ʿUmar, the second caliph, probably on the basis of the Qurʾānic "Obey God and obey the Apostle and those invested with command (*ūlī al-amr*) among you" (iv, 59); it was used by all his successors until the abolition of the caliphate in 1924.

In the 10th century the commander of the caliph's armies at Baghdad was styled *amīr al-umarāʾ* ("commander in chief"). Emir could also denote office, as in *amīr al-ḥājj,* "leader of the pilgrimage" to Mecca, held by the caliph or his delegate, a precedent set by Abū Bakr and Muḥammad himself (630 and 631).

The title emir was later adopted by the rulers of several independent states in central Asia, notably those of Bukhara and Afghanistan. In the modern United Arab Emirates, however, none of the rulers of the constituent states are called emirs; all are sheikhs. The word Emirates was included in the name of the federation by default, because *mashyakhah* (sheikhdom) was already in use for the smallest of Arab administrative units, comparable to a parish or township.

emission-control system, in automotive engineering, means employed to limit the discharge of noxious gases from the internal-combustion engine. There are four main sources of these gases: the engine exhaust, the crankcase, the fuel tank, and the carburetor. The exhaust pipe discharges burned and unburned hydrocarbons, carbon monoxide, oxides of nitrogen and sulfur, and traces of various acids, alcohols, phenols, and heavy metals such as lead. The crankcase is a secondary source of unburned hydrocarbons and, to a lesser extent, carbon monoxide. In the fuel tank and the carburetor, the hydrocarbons that are continually evaporating from the gasoline constitute a minor but not insignificant contributing factor in pollution.

A variety of systems for controlling emissions from all sources have been developed. Though the systems vary in detail, they are similar in principle. Crankcase emission controls provide positive crankcase ventilation by recirculating blowby (the leakage of combustion gases), combined with ventilating air, to the intake manifold for reburning in the combustion chamber.

To control exhaust emissions, which are responsible for two-thirds of the total engine pollutants, two types of system are used: the air-injection system and the improved combustion system. In a typical injection system, an engine-driven pump draws air through the carburetor air cleaner and pumps it into the exhaust ports of the cylinder head, in which it combines with the unburned hydrocarbons and carbon monoxide at high temperature and, in effect, continues the combustion process. In this way a large percentage of the pollutants that were formerly discharged through the exhaust system are eliminated. In some cases a specially designed exhaust manifold known as a thermal reactor is used to promote more complete combustion of the gases.

Improvements in combustion efficiency are effected by modifications in the components that control the whole process of combustion. These modifications have involved changes in the shape of the combustion chamber formed by the end of the piston and the cylinder head; a computer-controlled carburetor to ensure more precise and leaner (lower gasoline content) air–fuel mixtures; spark-timing changes to provide a retarded spark (late ignition) when idling; and increases in the idling speed.

Emissions from the fuel tank and carburetor are reduced by the evaporative control system, the heart of which is a canister of activated charcoal capable of holding up to 35 percent of its own weight in fuel vapour. In operation, the fuel-tank vapours flow from the sealed fuel tank to a vapour separator that returns the raw fuel to the tank and channels the fuel vapour to the canister. Fuel vapours from the carburetor bowl, which are consumed when the engine is running, flow to the canister via the air cleaner when the engine is stopped. The canister acts as a storehouse; when the engine is running, the vapours are purged from the canister through the air cleaner into the combustion chamber, where they are burned.

Other emission controls include the catalytic converter, consisting of an insulated chamber containing pellets of a variety of metal oxides through which the exhaust gases are passed. The hydrocarbons and carbon monoxide in the exhaust are converted to water vapour and carbon dioxide. These systems are not completely effective: during warmup the temperatures are so low that emissions cannot be catalyzed, and the catalysts are rendered ineffective by the lead compounds sometimes added to gasoline.

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emission nebula, in astronomy, a bright, diffuse light sometimes associated with supernova remnants or with stars whose temperatures exceed 20,000 K. The excitation process necessary to provide observed optical and radio energies in such gaseous regions was long an astronomical puzzle. Spectral and polarization studies of the 1950s suggested that their luminosity largely results from synchrotron radiation—energy from electrons accelerated in a magnetic field, as seen in certain particle accelerators.

Emma-ō, in Japanese Buddhist mythology, the overlord of hell (Jigoku), corresponding to the Indian deity Yama. He judges the souls of men, while his sister judges the souls of women. The sinner remains forever in one of the 16 regions of fire or ice assigned him by Emma-ō unless saved by the prayers of the living, in which case he is reborn either on earth or in a heavenly paradise. Emma-ō is usually represented with a fierce expression, wearing a Chinese judge's cap and holding his mace of office.

Emmanuel (personal name): *see under* Immanuel, or Manuel, except as below.

Emmanuel Philibert, byname EMMANUEL PHILIBERT IRON-HEAD, French EMMANUEL-PHILIBERT TÊTE DE FER, Italian EMANUELE

Emmanuel Philibert, detail of a portrait by G. Vighi; in the Pinacoteca, Turin, Italy

Alinari—Art Resource/EB Inc.

FILIBERTO TESTA DI FERRO (b. July 8, 1528, Chambéry, Savoy—d. Aug. 30, 1580, Turin), duke of Savoy who recovered most of the lands his father Charles III had lost to France and Spain. A skilled soldier and a wily diplomat, he was also an able administrator who restored economic equilibrium to Savoy while freeing it from foreign occupation.

Serving in the army of his mother's brother-in-law, the emperor Charles V, in the war against Francis I of France, Emmanuel Philibert distinguished himself by capturing Hesdin (July 1553). When he succeeded his father a month later, he began the reacquisition of his lands. His brilliant victory over the French at Saint-Quentin (August 1557) on the side of the Spanish solidified his power in Savoy. The Peace of Cateau-Cambrésis (1559), ending the wars between Charles V and the French kings, restored part of Emmanuel Philibert's duchy on the understanding that he marry Margaret of France, sister of King Henry II.

Taking advantage of political struggles between the European powers, the duke slowly increased his domain, recovering possessions from the French, including Turin, and other possessions from the Spanish, and buying two territories. He moved Savoy's capital from Chambéry to Turin (1562), substituted Italian for Latin as the official language, and at the time of his death was arranging for the acquisition of the marquisate of Saluzzo.

Emmen, *gemeente* (municipality), Drenthe *provincie* (province), northeastern Netherlands, on the Hondsrug ridge. It was a centre of the fen colonies (*veenkolonien*) established in the 19th century to convert the surrounding peat fields to agricultural use. As peat digging declined after 1920, Emmen suffered considerable unemployment. It has grown rapidly into the foremost urban centre of Drenthe since textile (silk, rayon, synthetics), metallurgical, chemical, pharmaceutical, and timber industries were established there after World War II. Emmen has a zoo and a museum, and in the vicinity are several *hunebedden* ("huns' graves"; prehistoric monuments built with large boulders that were probably deposited during the Ice Age). Immediately south, near Schoonebeek, are oil and gas fields. Pop. (1983 est.) 90,828.

Emmentaler, also spelled EMMENTHALER, also called SWISS CHEESE, cow's-milk cheese of Switzerland made by a process that originated in the Emme River valley (Emmental) in the canton of Bern. The essential process is followed in most other dairying countries, notably Norway, where the Jarlsberg variety is outstanding, and in the United States, where the cheese is generally called "Swiss."

Emmentaler is made in large wheel shapes, about 36 inches (90 centimetres) in diameter by 6 in. (15 cm) in thickness. The curd is formed by rennet. After the usual cutting, stirring, and heating to about 126° F (52° C), all the curd from 2,205 pounds (1,000 kilograms) of milk is lifted from the whey in one mass in a fine-mesh net and pressed into the characteristic wheel. It is shaped in blocks, salted in strong brine, and then wrapped in film to prevent drying. The cheese is held at a temperature of 72° to 80° F (22° to 27° C), so stimulating production of carbon dioxide, which forms the characteristic glossy holes or "eyes" in six to eight weeks. Complete ripening takes three to six months. Pure cultures of *Streptococcus thermophilus, Lactobacillus bulgaricus,* and *Propionibacterium shermanii* are used to control development of acid, eyes, and flavour.

This sweetcurd cheese has a pungent, sweetish odour and is slightly salty when fresh, and pleasingly sharp when fully ripened. Its consistency is firm and elastic, and it is easy to slice; the interior is a uniform light yellow in colour with holes about five-eighths in. (approximately 1.6 cm) diameter spaced 2–3 in. (5–7 cm) apart. The rind being kept clean, the cheese cures from the inside; the propionic acid bacteria, which produce carbon dioxide, are largely responsible for the many big holes.

Emmet, Robert (b. 1778, Dublin—d. Sept. 20, 1803, Dublin), Irish nationalist leader who inspired the abortive rising of 1803, remembered as a romantic hero of Irish lost causes.

Like his elder brother Thomas, Robert Emmet became involved with the United Irishmen and from 1800 to 1802 was on the Continent with their exiled leaders, who, with French support, were planning an insurrection against English rule. Back in Ireland in October 1802, he hid at his father's house near Milltown while pikes and other crude weapons were collected and stored in Dublin. In 1803 Emmet's hand was forced by an explosion at one of his secret arms depots, and he called for a rising on July 23. The ill-planned insurrection ended in utter confusion. The Wicklow contingent never arrived; the Kildare men retired thinking the rising had been postponed; while the men at Broadstairs waited vainly for the signal. Wearing a green and white uniform, Emmet marched with a small band against Dublin Castle. On the way they encountered the lord chief justice, Lord Kilwarden, and his nephew, pulled them from their carriage, and murdered them. Realizing the cause was lost, Emmet escaped and hid in the Wicklow Mountains. He then moved to Harold's Cross to be near his fiancée, Sarah Curran, with whom he hoped to escape to America. He was captured on August 25, tried for treason, and hanged on Sept. 20, 1803.

Thomas Moore's songs, "She is far from the land where her young hero sleeps" and "Oh breathe not the name" were inspired by Emmet's love affair with Curran.

Emmet, Thomas Addis (b. April 24, 1764, Cork, County Cork, Ire.—d. Nov. 14, 1827, New York City), lawyer in Ireland and, later, in the United States, a leader of the nationalist Society of United Irishmen, and elder brother of the Irish revolutionary Robert Emmet.

After studying medicine and law he was called in 1790 to the Irish bar, where he defended the patriot leader James Napper Tandy and other anti-British political prisoners. In 1795 he boldly took the United Irishmen's oath in open court, was elected secretary of the Society in the same year, and in 1797 became a director.

Before Lord Edward Fitzgerald's abortive revolt of 1798 he had tried to induce the rebels to wait for French military aid. Arrested with others on March 12, 1798, he was imprisoned until 1802, when he was exiled to Brussels and later moved to Paris. There he sought Napoleon I's support for an Irish battalion to fight Great Britain, and it was there that he heard of his brother Robert's execution.

In 1804 he went to the U.S., where he soon became a highly successful lawyer. Before the

Thomas Addis Emmet, detail of a pastel, by an unknown artist; in the National Gallery of Ireland, Dublin

By courtesy of the National Gallery of Ireland, Dublin

U.S. Supreme Court he eloquently but unsuccessfully argued the major constitutional case of *Gibbons* v. *Ogden* (1824), in which the court, in accepting the arguments of Daniel Webster and William Wirt based on the federal commerce power, struck down state impediments to interstate commerce.

Emmett, Daniel Decatur (b. Oct. 29, 1815, Mount Vernon, Ohio, U.S.—d. June 28, 1904, Mount Vernon), U.S. composer of "Dixie" (*q.v.*) and organizer of one of the first minstrel show troupes.

The son of a blacksmith, he joined the army at age 17 as a fifer. After his discharge in 1835 he played the drum in travelling circus bands. He was also a capable violinist, flutist, and singer. In 1843 in New York City he and three co-performers organized the Virginia Minstrels, a troupe that competes with the Christy Minstrels for recognition as the earliest minstrel show troupe. In 1858 Emmett joined the Bryant Minstrels.

His song "Dixie," written in 1859, was originally a "walk-around," or concluding number for a minstrel show. It attained national popularity and was later the unofficial national anthem of the Confederacy during the U.S. Civil War (1861–65) and the South thereafter. Several sets of words, Northern and Southern, were written for the song, but it survives in its version with Emmett's words. Emmett retired in 1888 but subsequently toured in 1895 with A.G. Field's minstrel troupe.

Emmitsburg, town, Frederick County, northern Maryland, U.S., near the Pennsylvania border, 20 mi (32 km) north-northeast of Frederick. Settled in the 1780s as Poplar Fields or Silver Fancy, it was renamed *c.* 1786 for William Emmit, a local landowner. The first American chapter of the Sisters of Charity was founded there in 1806 by St. Elizabeth Ann Seton (1774–1821), the first native-born American to be canonized (1975) by the Roman Catholic Church. Her cabin is preserved and her tomb, in a chapel on the grounds of St. Joseph's Provincial House, is maintained as a shrine. Nearby Mount St. Mary's College and Seminary was founded in 1808 and is the second oldest Catholic college in the U.S. (after Georgetown University); it incorporates the original buildings of a girls' school founded by Elizabeth Seton in 1809. A replica of the Grotto of Lourdes, on a mountain ridge above the college, was the first national Catholic shrine in the U.S. Catoctin Mountain Park, a few miles southwest, is the site of Camp David (*q.v.*), the presidential retreat. Emmitsburg has a basic agricultural economy (flour

milling, dairying, corn) supplemented by the manufacture of leather goods. Inc. 1874. Pop. (1984 est.) 1,523.

Emmy Award, any of the annual presentations made for outstanding achievement in television in the United States. The name Emmy derives from *Immy,* a nickname for *image orthicon,* a camera tube used in television. The Emmy Award statuette consists of a winged woman holding a globe aloft.

The Emmy Awards are made by the National Academy of Television Arts and Sciences (NATAS). Only members of the academy may vote for the awards, and members must vote within their own discipline—actors voting for actors, writers for writers, and so on. Categories in which awards are granted include dramatic series, comedy series, special drama, limited series, and variety, music, or comedy. Within each of these categories a best program is chosen; and in most categories the best actor and actress, supporting actor and actress, director, and writer are chosen. Occasionally awards are made for best lighting, hairstyling, and other backstage contributions.

The National Academy was formed in 1946 and in 1949 presented the first Emmys. In that year six awards were made. These were the days before network television, and the awards were distinctly regional in nature. By the next year there were 11 awards, and 30 years later there were 29 awards in the prime-time category alone. Others were given for special achievement, creative arts, and technical categories.

emollient, any ingredient of cosmetics that softens the skin by slowing evaporation of water. Sesame, almond, and olive oils were used in ancient Egypt; beeswax, spermaceti, almond oil, borax, and rosewater in Greece; and lanolin (sheep fat) in medieval Europe. Modern emollients include petrolatum, zinc oxide, paraffin, mineral oil, glycerin, beeswax, olive oil, coconut oil, lanolin, cocoa butter, and such synthetics as butyl stearate and diglycol laurate.

emotion, any of a number of extremely complex phenomena that are a synthesis of subjective experience, expressive behaviour, and neurochemical activity. Though psychologists have not found a simple yet comprehensive definition of emotion, they have generally agreed that emotions entail, to varying degrees, awareness of one's environment or situation, bodily reactions, and approach or withdrawal behaviour.

A brief treatment of emotion follows. For full treatment, *see* MACROPAEDIA: Emotion, Human.

Contemporary thinking on emotion is grounded in psychological experimentation, but the use of the experimental method in psychology came only after about 1850. The pioneer in this area was Wilhelm Wundt, who performed experiments in which subjects provided introspective reports of their responses to stimuli that were varied in a controlled way. Contemporary with Wundt's work was a theory, offered by Charles Darwin, that helped to focus investigation into emotion. Darwin suggested that emotional behaviour in animals was a vestige of adaptive behaviour from an earlier stage of the given species' development.

A particularly influential early theory of emotion was proposed independently by the psychologist William James and the physician Carl Georg Lange. The James–Lange theory firmly links mental states to physiological processes: it holds that an emotion is a perception of phenomena within the body. When a person sees a frightening sight, for example, the body immediately responds in certain ways (*e.g.,* the heart rate increases). The perception of bodily response to the original stimulus constitutes the emotion of fear, according to the James–Lange view. Thus people are happy because they smile, sad because they cry, and afraid because they flee.

It has been shown that emotions are accompanied by physiological changes manifested by excitation of the sympathetic division of the autonomic nervous system; specifically, these changes include the galvanic skin response (*see* psychogalvanic reflex), in which the electrical conductivity of the skin varies, and the heart rate, blood pressure, perspiration, and others. But according to the James–Lange view, these physiological changes would themselves be stimulated by a perception. It is argued that, by the time a signal from the senses reaches the appropriate centre in the brain, physiological changes have already taken place to cause the signal which then produces the feeling of the emotion. This element of the James–Lange view raised some serious objections.

A physiologist, Walter B. Cannon, proposed a theory that became one of the chief arguments against the James–Lange view. Cannon showed that subjects reacted emotionally even when the viscera was separated from the central nervous system, suggesting that physiological changes were not necessarily the primary cause of emotion. Cannon also proposed that signals from the senses may be received by the thalamus, which performs the dual function of providing the emotional content to the appropriate perceptual centre and transmitting the stimulus to other parts of the body.

Further research has called into question Cannon's view of the preeminence of the thalamus for emotions. But the basic insight of his theory continues to be upheld, with more sophisticated anatomical support. Cannon's successors examined a structure called the reticular formation, in the centre of the brain stem. Electrical activity throughout the brain was found to be accompanied by electrical activity in the reticular formation. When the reticular formation is "activated," the rest of the brain becomes active in response—this is the mechanism responsible for wakefulness. Emotion is held to be the result of a certain level of reticular-formation activation, a level less than that necessary to sustain such brain functions as perception and behaviour. Because the reticular formation serves to integrate virtually all brain activity, any perception or action is necessarily infused with emotional content.

A separate branch of inquiry into emotion has led some researchers to theorize that emotions are no more than strong motivational or drive states (*see* motivation). A motivational state is an inner condition of imbalance (for example, thirst) that provokes an organism to take some remedial action (in this case, to search for a drink). Although this approach to emotion was shown to be incomplete, later research gave evidence of what appear to be anatomical mechanisms of motivation. Significantly, these mechanisms serve a function in emotional behaviour as well.

The mechanisms in question involve the hypothalamus, a small structure near the base of the brain. The hypothalamus plays a very complex role in regulating a variety of physiological processes. It is also involved in behaviour that expresses the emotions of anger and fear. The results of complicated experiments involving electrical stimulation of the hypothalamus and related brain structures have led researchers to propose that emotions result from a dynamic process of stimulation and inhibition of certain bodily movements, as regulated by the hypothalamus.

An objection to this view is that it ignores the cognitive element in emotions. Presumably the same physiological events might be said to underlie emotions directed at different objects; how then are the emotions to be distinguished? It is here that the importance of perception and learning to discussions of emotion is apparent. However, the cognitive element in emotion cannot be processed by the relatively simple brain structures considered so far. While these can lead to emotional expression, the cognitive element must be processed by more complex structures found in higher parts of the brain.

Modern researchers often view emotions in three components, physiological, expressive, and experiential, each of which can be studied in terms of structure and functions.

Empangeni, town, northeastern Natal, South Africa, directly northwest of Richard's Bay on the Indian Ocean and northeast of Durban. The beginnings of the modern settlement can be traced to 1851, when the Norwegian Missionary Society established a station in the valley of a stream named for the large number of *mpange* (hard pear) trees. The station was later moved to another location, but in 1894 a magistracy named Empangeni was established in the valley. The present town site was established in 1931, and Empangeni was declared a town in 1960. Located in one of the important cattle-raising areas in South Africa, the town is the centre of the sugar industry in Zululand and also a market centre for cotton, dairy products, fruits, timber, and vegetables. It is a junction on the main railway line from Durban to Swaziland and has an airfield. The Enseleni Nature Reserve, an area with a rich vegetation of wild figs, papyrus, and mangroves, is 9 miles (14 km) east of Empangeni. Much of the land surrounding Empangeni comprises fragmented land units of KwaZulu, one of the South African-proclaimed black states, which are not internationally recognized. Pop. (1984 est.) mun., 13,750.

empathy, the ability to imagine oneself in another's place and understand the other's feelings, desires, ideas, and actions. It is a term coined in the early 20th century, equivalent to the German *Einfühlung* and modeled on "sympathy." The term is used with special (but not exclusive) reference to aesthetic experience. The most obvious example, perhaps, is that of the actor or singer who genuinely feels the part he is performing. With other works of art, a spectator may, by a kind of introjection, feel himself involved in what he observes or contemplates. The use of empathy is an important part of the counseling technique developed by the American psychologist Carl Rogers.

Empedocles (b. *c.* 490 BC, Acragas, Sicily—d. 430, the Peloponnese, Greece), Greek philosopher, statesman, poet, religious teacher, and physiologist.

According to legend, Empedocles was a self-styled god who brought about his own death, as commemorated by the English poet Matthew Arnold in "Empedocles on Etna," by flinging himself into the volcanic crater atop Mount Etna to convince followers of his divinity. To his contemporaries he did indeed seem more than a mere mortal; Aristotle reputedly hailed him as the inventor of rhetoric, and Galen regarded him as the founder of Italian medicine. Lucretius admired his hexametric poetry. Nothing remains of the various writings attributed to him other than 400 lines from his poem *Peri physeōs* ("On Nature") and fewer than 100 verses from his poem *Katharmoi* ("Purifications").

Although strongly influenced by Parmenides, who emphasized the unity of all things, Empedocles assumed instead that all matter was composed of four essential ingredients, fire, air, water, and earth, and that nothing either comes into being or is destroyed but that things are merely transformed, depending on the ratio of basic substances, to one another. Like Heracleitus, he believed that two forces, Love and Strife, interact to bring together and to separate the four substances. Strife makes

each of these elements withdraw itself from the others; Love makes them mingle together. The real world is at a stage in which neither force dominates. In the beginning, Love was dominant and all four substances were mixed together; during the formation of the cosmos, Strife entered to separate air, fire, earth, and water from one another. Subsequently, the four elements were again arranged in partial combinations in certain places; springs and volcanoes, for example, show the presence of both water and fire in the Earth.

Apparently a firm believer in the transmigration of souls, Empedocles declared that those who have sinned must wander for 30,000 seasons through many mortal bodies and be tossed from one of the four elements to another. Escape from such punishment requires purification, particularly abstention from the flesh of animals, whose souls may once have inhabited human bodies.

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emperor, feminine EMPRESS, title designating the sovereigns of the ancient Roman Empire and, by derivation, various later European rulers; it is also applied loosely to certain non-European monarchs.

In republican Rome (*c.* 509–27 BC), *imperator* denoted a victorious general, so named by his troops or by the Senate. Under the empire (after 27 BC), it was regularly adopted by the ruler as a forename and gradually came to apply to his office.

In medieval times, Charlemagne, king of the Franks and of the Lombards, was crowned emperor by Pope Leo III in Rome on Christmas Day, 800. Thenceforward until the fall of Constantinople in 1453 there were two emperors in the Christian world, the Byzantine and the Western. The term "Holy Roman emperor" is now generally used, for convenience, to designate the Western sovereigns, though the title was at first simply "emperor" (*imperator;* the German form *kaiser* being derived from the Roman *caesar*), then "august emperor," then, from 971, "Roman emperor." The addition of "Holy" to the designation of the emperor, in historical writing, follows from its having been added to that of the empire (*sacrum imperium,* 1157).

The dissolution of Frankish Europe into separate kingdoms under the later Carolingian sovereigns led eventually to the imperial title's passing in 962 to the East Frankish or German king Otto I, who was also king of Italy (the kingdom of Burgundy was further acquired by Conrad II in 1032). Thenceforward to 1806, though not all German kings were emperors (crowned by the pope), there were no emperors who were not German kings, so that election to the German kingship came to be *de facto* necessary for attainment of the imperial title—with the final result that from 1508 to 1806 the style "emperor elected" or, more briefly, "emperor" was given to the German king in anticipation of his coronation by the pope (only one such coronation, that of Charles V in 1530, actually took place in the period).

Outside the Frankish and German sphere of influence the title emperor was sometimes assumed by princes supreme over more than one kingdom: thus Sancho III the Great of Navarre styled himself "emperor of Spain" on his annexation of Léon (1034); Alfonso VI of Léon and Castile called himself "emperor of the Two Religions," to show his supremacy over Christians and Muslims alike; and Alfonso VII took the title "emperor of all Spain" (1135). The Russian tsar Peter I the Great assumed the title *imperator* on Oct. 22, 1721.

After the French Revolution had destroyed the kingdom of France, Napoleon Bonaparte in 1804, having been anointed by Pope Pius VII, crowned himself emperor of the French as Napoleon I. His claim to be the successor not of Louis XIV but of Charlemagne, together with his organization of the Confederation of the Rhine in Germany, was a threat to the Holy Roman Empire of the Habsburg dynasty. Seeing this, Francis II, to retain an imperial title, took that of "hereditary emperor of Austria" before he dissolved the old empire in 1806. His successors retained it until 1918.

Emperor, empress
foreign-language equivalents

	masculine	feminine
Czech	císař	císařovna
Danish	kejsare	kejsarinna
Dutch	keizer	keizerin
French	empereur	impératrice
German	Kaiser	Kaiserin
Hungarian	császár	császárnő
Italian	imperatore	imperatrice
Japanese	kōtei	kōgō
Latin	imperator	imperatrix
Norwegian	keiser	keiserinne
Polish	cesarz	cesarzowa
Portuguese	imperador	imperatriz
Romanian	împărat	împărăteasă
Russian	tsar	tsaritsa
Serbo-Croatian	car	carica
Spanish	emperador	emperatriz
Swedish	kejsare	kejsarinna

Napoleon III was emperor of the French from 1852 until his deposition in 1870–71 (the French Second Empire). Between 1871 and 1918 the kings of Prussia—William I, Frederick III, and William II— were German emperors, or kaisers. Victoria of Great Britain took the title empress of India in 1876, but her great-grandson George VI renounced the imperial title when India became independent.

In the Western Hemisphere Jean-Jacques Dessalines was emperor of Haiti from 1804 to 1806; princes of the house of Bragança were emperors of Brazil from 1822 to 1889; Agustín de Iturbide and the Austrian archduke Maximilian were emperors of Mexico from 1822 to 1823 and from 1864 to 1867 respectively. The title emperor is also generally and loosely used as the English designation for the sovereigns of Ethiopia and of Japan, for the Mogul rulers of India, for the former sovereigns of China, for the Inca rulers of Peru, and for the Aztec rulers of Mexico.

Emperors, Five Good (ancient Rome): *see* Five Good Emperors.

empfindsamer Stil (German: "sensitive style"), also called EMPFINDSAMKEIT ("sensitivity"), important movement occurring in German instrumental music during the early 18th century and characterized by an emphasis upon the expression of a variety of deeply felt emotions within a musical work. This aesthetic, somewhat opposed to the polished *style galant* of the contemporary French music, is typical of an age that was much given to the open expression of the most moving sentiments not only in art but in everyday life.

Closely allied with "sensitivity" was the desire to give a composition an aura of simplicity and naturalness, qualities highly prized in the philosophical outlook of the Enlightenment. The composers wanted to increase the effect of their music by imbuing each theme with a well-defined, even exaggerated, expressive character. Because the effect seemed to be considerably intensified by rapid changes of mood, phrases and sections of highly contrasting moods were placed in close juxtaposition.

The most significant representatives of the *empfindsamer Stil* were Carl Philipp Emanuel Bach, Johann Joachim Quantz, Wilhelm Friedemann Bach, Johann Abraham Peter Schulz, and Jiří Antonín Benda.

emphysema, also called PULMONARY EMPHYSEMA, abnormal distension of the lungs with air. The air ducts and the air sacs, or alveoli, are distended and there is destruction of the partitions between alveoli and loss of alveoli. The exact cause and mechanism producing emphysema are not definitely known. It is most commonly associated with cigarette smoking and chronic bronchitis.

Lungs affected by emphysema show loss or degeneration of elastic tissue, disappearance of capillary walls, and breakdown of the alveolar walls. The air sac first stretches and then tends to disintegrate. The lung therefore becomes filled with large pools of air, and loss of elastic support around small airways, or associated loss of small airways themselves, results in severe interference with expiration. The lung takes on a lace network, and the capillaries are found greatly diminished, leaving the lung tissue dry and pale.

Some emphysema patients show a deficiency in a substance called antitrypsin; this substance normally counteracts the enzyme trypsin produced by bacteria that tends to degenerate tissue. An insufficient amount of antitrypsin therefore gives even harmless bacteria an advantage and allows for the possibility of greater destruction.

The clinical manifestations are constant. There is severe breathlessness upon exertion, loss of weight, and swelling in the extremities; the skin takes on a bluish colour from lack of sufficient gas exchange; there is tightness in the chest; and the affected person wheezes and has an intolerance to sudden cold or smoky atmospheres. The chest may be noted to be held in the inspiratory position. The disease is one of the most common and crippling of respiratory diseases. There is no evidence that lung tissue destroyed by emphysema can be repaired.

Bullous emphysema is a variety of emphysema in which the distended alveoli actually form large air cysts on one or both of the lungs and occasionally rupture, causing lung collapse. When the blisters cause reduced heart or lung efficiency, they are sometimes removed by surgery.

emphyteusis and superficies, in Roman law, leases granted either for a long term or in perpetuity with most of the rights of full ownership, the only stipulation being that an annual rent be paid and certain improvements made to the property. Both originated in the early empire and were initially granted by the state, the former for agricultural purposes, the latter for building on land. The main purpose was to encourage individuals to develop land without the threat of removal once the development was finished. Even before the time of Hadrian (early 2nd century AD) the rights of *emphyteusis* and *superficies* began to be granted by private persons. They could be inherited, were transferable, and were protected in the courts. The basic principles and form of *emphyteusis* and *superficies* have survived in modern times in many civil-law countries.

Empire State Building, steel-framed 102-story building completed in New York City in 1931. It rises to a height of 1,250 feet (381 metres) and was the first skyscraper of such great vertical dimension. It was the highest structure in the world until 1954.

A 222-ft television antenna mast, added in 1950, increased its total height to 1,472 ft. The building stands on a site of about two acres in midtown Manhattan, on Fifth Avenue at 34th Street.

Empire style, phase of Neoclassical art (*see* Neoclassical age) that flourished during the time of the First Empire in France (1804–14). It was encouraged by Napoleon's desire for

a style inspired by the grandeur of imperial Rome. In architecture it was exemplified by such Parisian buildings and monuments as the Church of the Madeleine (originally the Temple of Glory) by Pierre-Alexandre Vignon, Jean Chalgrin's Arc de Triomphe de l'Étoile, and Charles Percier and Pierre Fontaine's Arc de Triomphe du Carrousel and Vendôme Column; in painting, by Jacques-Louis David's "Sacre de l'empereur Napoléon Ier et couronnement de l'impératrice Joséphine dans la cathédrale Notre-Dame de Paris, 2 décembre 1804" and Baron Antoine Gros's battle scenes; and in sculpture, by Antonio Canova's heroic statues of Napoleon and his family. The Empire style in dress also found its inspiration in classical times, at once consciously emulating the rich elegance of pre-Revolutionary France, gowning women to emphasize femininity and grace, in flowing floor-length creations of light fabrics, frequently having trains, that were universally quite décolletté and girdled immediately beneath the breasts. Paris winters demanded warm outer garments, which were numerous and various, among them scarves, stoles, capes, jackets, and overdresses. Men's fashions of the Empire period featured a cutaway tailcoat revealing a waistcoat and high-collared shirt with cravat, much resembling the tailoring of London.

The French architects Charles Percier and Pierre Fontaine, who designed furnishings for the state rooms of Napoleon, contributed in great measure to the creation of the Empire style of interior decoration and furniture design. Their ideas were incorporated and propagated in their *Recueil de décorations intérieures* (1801 and 1812; "Collection of Interior Decoration"). The strong archaeological bias of the Empire style led to direct copying of classical types of furniture and accessories; to this was added a new repertory of Egyptian ornament, stimulated by Napoleon's campaigns in Egypt. Mahogany-veneered furniture with ormolu mounts assumed the shapes of Roman, Greek, and Egyptian chairs and tables with winged-lion supports and pilasters headed with sphinxes, busts, or palm leaves. Where no classical prototypes existed, contemporary designs were enlivened with ancient ornamental motifs, often with symbolic implications in reference to Napoleon's reign—*e.g.*, winged victory and the laurel wreath used as decorative symbols of triumph; bees, sheaves of grain, and cornucopias for prosperity; and fasces and sphinxes for conquest.

Although the Empire style began in France (specifically Paris), it quickly spread throughout Europe, with each country adapting it to its own national taste. *See also* Biedermeier style; Greek Revival; and Regency style.

Empiricism (from Greek *empeiria*: "experience"), in philosophy, an attitude expressed in a pair of doctrines: (1) that all concepts are derived from the experience to which they are applied; and (2) that all knowledge of matters of fact is based on, or derived from, experience. Accordingly, all claims to knowledge of the world can be justified only by experience.

A brief treatment of Empiricism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines.

Empiricism argues that knowledge derived from a priori reasoning (involving definitions formed or principles assumed) either does not exist or is confined to "analytical" truths, which have no content, deriving their validity merely from the meanings of the words used to express them. Hence a metaphysics that seeks to combine the a priori validity of logic with a scientific content is impossible. Likewise there can be no "rational" method; the nature of the world cannot be discovered through pure reason or reflection.

In practice three different types of Empiricism are recognized, depending on the degree to which adherents admit a priori concepts or propositions. Absolute Empiricists admit neither a priori concepts nor a priori propositions, although they may recognize such analytical a priori truths as tautological definitions. Substantive Empiricists distinguish between formal and categorial a priori concepts. The existence of formal a priori concepts is admitted, provided such formal concepts are confined to the way ideas interact; categorial a priori concepts such as causation are denied. Substantive Empiricists argue that every a priori proposition is virtually a tautology, although it may take deduction to reveal this. Partial Empiricists claim that certain non-formal ideas may be a priori. Examples include the concepts of natural cause and effect, morality, etc. After granting this, however, the Partial Empiricist verifies everyday propositions about matters of fact by empirical means.

Historically, the first Western Empiricists were the ancient Greek Sophists, who concentrated their philosophical inquiries on such relatively concrete entities as man and society, rather than the speculative fields explored by their predecessors. Later ancient philosophers with Empiricist tendencies were the Stoics and the Epicureans, although both were principally concerned with ethical questions.

The majority of Christian philosophers in the Middle Ages were Empiricists. A notable thinker of the 14th century, for example, was William of Ockham, who argued that all knowledge of the physical world is attained by sensory means. In the 16th century another English Empiricist, Francis Bacon, believed in building up observed data about nature so as to arrive at an accurate picture of the world. To this extent he laid the foundations of the scientific method. John Locke in the 17th century was probably the leading Empiricist of the late- to post-Renaissance era. Later philosophers who subscribed to some degree of Empiricism included the Irish-born Bishop George Berkeley in the 17th and 18th centuries, the Scot David Hume in the 18th century, and the Britons John Stuart Mill and Bertrand Russell in the 19th and 20th centuries, respectively. Mill (who denied that he was an Empiricist) and Russell on occasion even claimed that mathematical truths or logical concepts are essentially Empirical.

The antithetical position to that of Empiricism in philosophical arguments over theories of knowledge has usually been the Rationalist one. Discussion centres on the extent to which concepts are innate or acquired.

Another group of Empiricists, but one that operated outside the Anglo-Saxon tradition, consisted of the Logical Positivists of the Vienna Circle. Logical Positivists hold that metaphysical statements are meaningless because they are inherently unverifiable.

The following ideas may be attributed to Empiricist influence, although not all of them need be held by any particular Empiricist thinker: (1) Experience is intelligible in isolation, or atomistically, without reference to the nature of its object or to the circumstances of its subject. Hence an experience can be described without saying anything about the mind that has it, the thoughts that describe it, or the world that contains it. (2) The person who undergoes experience is in some sense the recipient of data that are imprinted upon his intelligence irrespective of his activity; the person brings nothing to experience, but gains everything from it. (3) All method is scientific method. To discover the nature of the world it is necessary to develop a method of experiment whereby all claims to knowledge are tested by experience, since nothing but experience can validate them. (4) Reductionism: All facts about the world can be reduced to what are facts inasmuch as experiences confirm claims to knowledge as facts; hence no claims to knowledge of a transcendental world can have any foundation.

Empiricism's influence may be seen in the broad thesis of Nominalism, according to which reality is held to reside in the particular rather than in the universal. Nominalists argue that the whole has no reality that is not derived from that of its parts.

In the metaphysical sphere Empiricism generates a characteristic view of causation, seemingly an almost inevitable consequence of the Empiricist theory of knowledge. According to Empiricist metaphysics the world consists of a set of contingently connected objects and situations, united by regularities rather than necessities, and unrelated to any transcendental cause or destiny. Science, according to this view, investigates connections, and its aim is to make predictions on the basis of observed regularities. Furthermore, judgments of value have no place in science, say the Empiricists, as such judgments are subjective preferences of the investigator.

empiricism, radical (philosophy): *see* radical empiricism.

employee training, also called JOB TRAINING, or OCCUPATIONAL TRAINING, vocational instruction for employed persons.

During and after World War II, in-service training by employers became a common practice. The rapid changeover in industry from peace to war led to training schemes for semiskilled workers, for workers transferred to new jobs, and for women newly brought into industry. Thereafter, the rapid contemporary advance of technological change made training a necessity in almost all walks of life. At the operating level in industry and in public utilities, new techniques, new methods, new tools, new synthetics, new sources of power, and increased uses of automation have brought extensive changes in the past decades, and the rate of change tends to increase as time goes on. Comparable changes are taking place in the office with the extended use of computers and data processors, which provide for the storing and recall of information in amounts unknown 20 years ago.

All of this brought about a new approach to training. Great emphasis is now placed on a good start through initial job training, supplemented by orientation sessions or by attractively produced printed material describing the nature and objectives of the employment and the conditions of work. Since changes are frequent with technological advances, refresher training has become common in clerical as well as in industrial work.

For the more technical skills, it is quite common in the United States for the large employer to make arrangements with a university to set up special courses; in Great Britain it is more usual to encourage employees to attend regular class facilities to obtain technical certificates. Sometimes this is achieved by "sandwich" training, periods on the job alternating with periods at a technical institute. Many employers encourage further education by paying tuition fees or by allowing free time to attend classes. Some very large corporations have developed their own systems of technical classes, supplementary to direct job training.

This widespread interest in training has led to considerable innovation in method. Formal lectures have given way to group discussion. The case-study method has become popular; a problem situation is presented in considerable detail and trainees are asked to make suggestions for its solution. Another new technique is role playing. Members of the training staff create a situation by playacting, and the trainees either comment on what is taking place or participate in the attempt to find a solution, or they perform functions or services in conditions that simulate their working environment. Attention also has been given to

audiovisual aids. Sensitivity training has been introduced to help individuals to study their own behaviour and reactions to one another by means of group discussion in which there is frank analysis of interrelationships between members of the group.

New industries have created new needs. The instruction of airline flight attendants has become a highly developed operation for the major airlines. Television and sound-broadcasting organizations have introduced training schemes to improve the quality of their program services. At United Nations headquarters a training scheme has been developed for the guides who conduct visitors around the building, including daily briefing on the international events on which they may be questioned.

Initiative in training lies with the organization rather than with industry, and the large corporation tends to develop a variety of training projects and adequate administration of training. In a large organization, the individual employee needs to be introduced to his task and to identify himself with it, so as not to be lost in its complexity, and he needs to have subsequent periods of training to keep abreast with developments. In small- and medium-sized concerns some managements are interested in training; some tend to regard it as a luxury. It is impossible to determine which industries give the most attention to formal training; it depends on the initiative of the management rather than on the nature of the work.

Corporation schools in the United States date from the 1890s; the National Association of Corporate Training was created in 1919. Training schemes also have been supported by professional groups, such as the International City Managers' Association, the Public Personnel Association, and the Council of State Governments. The Industrial Training Act, which came into force in Great Britain in 1964, is perhaps the most elaborately structured government initiative in training so far undertaken. It provides for the establishment of an Industrial Training Board for each industry to make specific recommendations concerning the form and content of training courses and the standards to be set, and to recommend appropriate further education. By 1960, 26 boards had been set up, covering some 15,000,000 employees. They may impose a financial levy on firms in the industry and use the money to make grants in support of training schemes. There is a Central Council on Industrial Training and Further Education to give direction to the scheme.

With the rapid advances in technology and the growing complexity of business and industry, management training has become accepted as a necessity in both the public and private sectors. In the United States, graduate business education and senior executive training schemes, such as the advanced management program for senior executives at the Harvard Graduate School of Business Administration, were already well established in the immediate postwar period. In Great Britain the Administrative Staff College was set up at Henley-on-Thames in 1944 to offer short courses in problems of advanced management. It employs a novel technique of training by group initiative, drawing its inspiration from the professional experience of the participants. It has been copied successfully at Mount Eliza, Australia; Hyderabad, India; Lahore, Pak.; and Baguio, Phil. Individual corporations have established institutions of their own for the development of general management techniques at senior levels, and two international corporations, Unilever and Royal Dutch-Shell, have introduced management training for groups of senior staff drawn from a variety of countries.

In the Soviet Union, where industrial and commercial operations are under government control, higher education is related directly to professional development. The student undertakes specialized studies at a university or professional institute appropriate to the profession or specialization which he intends to make a career. Management itself is approached on an institutional basis through the Laboratory for Industrial Management Problems of Moscow State University.

The less developed countries have unique problems of training, their economic advance depending largely on the introduction of new and unfamiliar techniques. Training organization is needed in basic skills, both industrial and clerical, and for the provision of adequate quantities of trained technicians, supervisors, and competent managers. To achieve planned progress these nations need skilled administrators in large numbers, and above all they require educators and instructors. In some, the primary and higher educational structure is inadequate for current needs, no vocational training is built into the school system, and little or no science and technology are offered in the universities.

Inevitably they must send some of their key personnel for training abroad and call in foreign experts under one or another of the technical-assistance programs. But foreign experts cannot train workers for a whole industry or instruct the staff necessary to organize an entire national development program. They must concentrate first on building up local groups of indigenous experts, with aptitude for training others, organized if possible on an institutional basis.

The United Nations and its specialized agencies contribute to the development training schemes in these countries, emphasizing development of institutional training. The Regional Economic Commissions have sponsored the establishment of regional institutes of economic development in Africa, Latin America, Asia, and the Far East and have encouraged schemes for training in statistics to provide a sound basis for development planning. A particularly successful project is the Institute of Public Administration in Costa Rica, whose task is to train the staff necessary to administer the coordinated regional economic development of Central America. Eleven former French-African territories have established national schools of administration, noticeably influenced by the school in Paris.

Perhaps the most intractable problem associated with training is its evaluation. Its actual cost may be calculated in terms of the expenses of its administration and the salary costs of both the training staff and of the trainees while they are on nonproductive work. But the quality and ultimate success can be determined only by a value judgment on whether the effort seems justified as conducive to greater overall efficiency and to more successful operations. Craft skills and routine occupational skills can be measured by tests based on agreed standards, but occupations measurable in this way account only for a limited range of training activities. In the office, typing and shorthand work can be tested for speed and accuracy, but a great deal of clerical work cannot be analyzed statistically. Supervision, management, and administrative tasks depend on personal capability as much as they do on knowledge and experience. Knowledge can be imparted and experience acquired; the guided development of personality is more difficult. How far the training opportunities offered to a senior executive during his career have helped his professional development cannot be mathematically assessed.

employment, full: *see* full employment.

Empoli, town, Firenze (Florence) province, Toscana (Tuscany) region, north central Italy, on the lower Arno River. During the medieval Florentine wars, Empoli was the scene of the Ghibelline congress of 1260, where Farinata degli Uberti successfully opposed the destruction of defeated Florence, an episode referred to in Dante's *Inferno.* The painter Iacopo Chimenti da Empoli and the composer Ferruccio Busoni were born at Empoli, which is just south of Vinci, the birthplace of Leonardo da Vinci. An industrial target in World War II, the town was heavily damaged by Allied bombing but has been rebuilt. The collegiate church (1093) contains paintings by Francesco Botticini and terra-cottas by Luca della Robbia; Empoli also has a museum of Tuscan art. Varied industries include the manufacture of glass, textiles, and matches. Pop. (1981 prelim.) mun., 44,961.

Emporia, city, seat of Lyon County, east central Kansas, U.S., between the Cottonwood and Neosho rivers. Established in 1857 by a town company and named after the ancient city in North Africa, the settlement developed as a trading centre after the arrival of the railroad in 1869. Severe droughts that plagued the city were ended in 1938 with the damming of the Kahola Valley. *The Emporia Gazette* became probably the best known and respected "small-town" newspaper in the United States under the editorship of William Allen White, who bought it in 1895. After his death in 1944, the paper was edited by his son, William L. White. The city is now the trading and shipping centre of a large farming and dairying area and is the seat of Emporia State University (1863). Inc. 1870. Pop. (1980) 25,287.

empress: *see* emperor.

Empson, Sir Richard, Empson also spelled EMSON (b. Towcester, Northamptonshire, Eng.—d. Aug. 17, 1510, London), English lawyer and minister of King Henry VII, remembered, with Edmund Dudley, for his unpopular administration of the crown revenues.

He studied law in the Middle Temple and from 1475 held posts in Northamptonshire and then in Lancaster. From March 1486 Henry VII began to reward him with grants of stewardships and wardships. In 1491 Empson, one of the members of Parliament for Northamptonshire, was chosen speaker of the House of Commons. From 1494 Empson was sometimes styled "king's councillor" and, after becoming chancellor of the duchy of Lancaster in 1504, was knighted; Henry VII then joined him and Edmund Dudley by act of Parliament to the feoffees responsible for carrying out his will. From that time these men were closely associated in carrying out the King's legal and financial policy, which made them so unpopular. The death of Henry VII left them without a protector and they were arrested in April 1509, on Henry VIII's accession. Empson was sent to Northampton, where he was tried on a charge of constructive treason and convicted. He was brought back to London and executed.

Empson, Sir William (b. Sept. 27, 1906, Hawdon, Yorkshire, Eng.—d. April 15, 1984, London), British poet and critic known for his immense influence on 20th-century literary criticism and for his rational, metaphysical poetry.

Empson was educated at Winchester College and at Magdalene College, Cambridge. He earned degrees in mathematics and in English literature, which he studied under I.A. Richards. His first poems were published during this time. Several of the verses published in Empson's *Poems* (1935) also were written while he was an undergraduate and reflect his knowledge of the sciences and technology, which he used as metaphors in his largely pessimistic assessment of the human lot. Much influenced by John Donne, the poems are personal, politically unconcerned (despite the preoccupation with politics in the 1930s), el-

liptical, and difficult, even though he provided some explanatory notes.

Seven Types of Ambiguity (1930; rev. ed. 1953), one of the most influential critical works of the first half of the 20th century, was essentially a close examination of poetic texts. Empson's special contribution in this work was his suggestion that uncertainty or the overlap of meanings in the use of a word could be an enrichment of poetry rather than a fault, and his book abounds with examples. The book helped lay the foundation for the influential critical school known as the New Criticism. Empson applied his critical method to somewhat longer texts in *Some Versions of Pastoral* (1935) and further elaborated it in *The Structure of Complex Words* (1951). Empson's verbal analyses were based on the view that poetry's emotive effect derives primarily from the ambiguities and complexities of its cognitive and tonal meanings.

From 1931 to 1934 Empson taught English literature at the University of Tokyo, and he subsequently joined the English faculty of Peking National University in China. He was Chinese editor at the British Broadcasting Corporation during World War II and returned to teach at Peking National University from 1947 to 1952. Empson was professor of English literature at Sheffield University from 1953, becoming emeritus in 1971. He was knighted in 1979.

Empson's later criticism includes many uncollected essays and one book, *Milton's God* (1961). He was also a distinguished poet who influenced younger poets in the 1950s. His *Poems* appeared in 1935, *The Gathering Storm* in 1940, and his *Collected Poems* in 1955. Empson's poetry is characterized by ingenious conceits using a subject matter drawn from astrophysics, mathematics, and other sciences. A critical study of Empson's work is *William Empson: The Man and His Work* (1974), edited by Roma Gill.

emptiness, also called NOTHINGNESS, or VOID, in mysticism and religion, a state of "pure consciousness" in which the mind has been emptied of all particular objects and images; also, the undifferentiated reality (a world without distinctions and multiplicity) or quality of reality that the emptied mind reflects or manifests. The concept, with a subjective or objective reference (sometimes the two are identified), has figured prominently in mystical thought in many historical periods and parts of the world. The emptying of the mind and the attainment of an undifferentiated unity is a theme that runs through mystical literature from the *Upaniṣads* (ancient Indian meditative treatises) to medieval and modern Western mystical works. The concepts of *hsü* (*q.v.*) in Taoism, sunyata (*q.v.*) in Mahāyāna Buddhism, and the *En Sof* in Jewish mysticism are pertinent examples of "emptiness," or "holy Nothing," doctrines. Buddhism, with its basic religious ultimate of Nirvāṇa (*q.v.*), as well as its development of the sunyata doctrine, has probably articulated emptiness more fully than any other religious tradition; it has also affected some modern Western considerations of the concept. A good deal of 19th–20th century Western imaginative literature has been concerned with emptiness, as has a certain type of Existentialist philosophy and some forms of the Death of God movement. The particular meanings of "emptiness" vary with the particular context and the religious or cultural tradition in which it is used.

Empty Quarter (Saudi Arabia): *see* Rub' al-Khali.

empyema, accumulation of pus in a cavity of the body, usually in the pleura, which are the serous membranes covering the lungs. Empyema is usually the result of a microbial, usually bacterial, infection in a body cavity. Thoracic empyema is characterized by chest pain, fever, coughing, and weight loss, and the presence of fluid as ascertained by a chest X ray. Treatment is directed at drainage of small amounts of pus through a needle or larger amounts through a drainage tube. In addition to drainage, antibiotics are often used to treat the underlying infection. Empyemas may result from the infection of an obstructed gallbladder with a bacterial organism, in which case the high risk of perforation and systemic infection requires the immediate removal of the infected organ.

Ems River, Dutch EEMS, river, northwestern Germany. It rises on the south slope of the Teutoburger Forest and flows generally northwest and north through the *Länder* of North Rhine-Westphalia and Lower Saxony to the east side of the Dollart (baylike enlargement of its estuary), immediately south of Emden. It flows around the island of Borkum after passing through the Dollart on its way to the North Sea. There is a marked winter maximum and summer minimum flow. The Ems is 230 miles (371 km) long.

Between 1892 and 1899 the river was canalized to connect it with the Dortmund-Ems Canal in order to provide a German waterborne outlet for the Ruhr industrial district. There are also connections with the Rhine-Herne Canal and the Mittelland Canal system. Traffic northward on the canal system is mostly in coke and coal from the Aachen and Ruhr coalfields; southward, the traffic consists chiefly of imported raw materials and foodstuffs.

Consult the INDEX *first*

Ems telegram, report of an encounter between King William I of Prussia and the French ambassador; the telegram was sent from Ems (Bad Ems) in the Prussian Rhineland on July 13, 1870, to the Prussian chancellor, Otto von Bismarck. Its publication in a version edited by Bismarck so as to purposely offend the French government precipitated the Franco-German War.

Early in July, the candidacy of Prince Leopold of Hohenzollern-Sigmaringen, a relative of the Prussian king, for the Spanish throne had alarmed the French, who feared that the extension of Prussian influence into Spain would threaten France. Leopold's candidacy was withdrawn on July 12; the following day, the French ambassador to Prussia, Count Vincent Benedetti, approached King William at Ems to request an assurance that no member of his family would again be a candidate for the Spanish throne. The king politely refused Benedetti's demand, and their discussion ended.

A telegram describing the incident was sent to Bismarck. Bismarck's edited version, which he published the next day, omitted the courtesies in the two men's exchange and instead made it seem that each man had insulted the other. This touched off an intensified demand for war in Paris and Berlin, and France declared war on July 19. The incident provided the excuse for a trial of strength that was sought by both France and Prussia, but because of Bismarck's dishonest editing of the Ems telegram, it was France that was the first to declare war. This circumstance helped enlist the southern German states to Prussia's side in the ensuing war, which resulted in the unification of all the German states (except Austria) into modern Germany.

Ems-Weser-Elbe Canal (Germany): *see* Mittelland Canal.

Emser, Hieronymus (b. March 16/26, 1478, Ulm [Germany]—d. Nov. 8, 1527, Dresden, Saxony [Germany]), German theologian, lecturer, editor, and essayist who is remembered chiefly for his long public controversy with Martin Luther at the onset of the Reformation.

Emser studied humanities at the University of Tübingen and jurisprudence and theology at the University of Basel. In 1504 he lectured on classics at Erfurt (where Luther may have been among his listeners) and became secretary to Duke George of Saxony. He was ordained a priest *c.* 1512.

Emser first sided with the Reformers, but he desired a practical reformation of the clergy without any doctrinal breach with the past or with Rome. His liberal sympathies were mainly Humanistic. The radical opinions expressed by Luther at the theological disputation before notables of church and state at Leipzig (1519) brought their relationship to an open break.

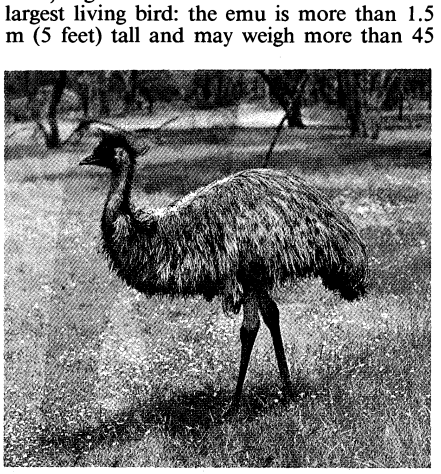
In the ensuing bitter controversy (which lasted until his death), Emser wrote eight polemical tracts (1520–21). He also entered into a controversy with Huldrych Zwingli, the most influential figure in the Swiss Reformation.

In 1527 Emser published a German translation of the New Testament, from the Vulgate, with annotations. It was meant to counter Luther's own translation, but it remained essentially a revision of Luther's work. Nevertheless, by the end of the 18th century Emser's translation had gone through more than 100 editions.

Emsland, region along the lower Ems River, in Lower Saxony *Land* (state), northwestern Germany. It lies on both sides of the river, from the town of Lingen to the Ems estuary. Comprising a belt about 60 miles (100 km) long from south to north and 6–9 miles (10–15 km) wide, it includes three strips of land: the bog of the Bourtanger Moor, which stretches across the Dutch border; a narrow adjoining strip of better-drained, sandy soil containing the main villages; and the drained meadowland of the Ems River floodplain. Oil-bearing beds in the region lie at depths of 1,300–2,800 feet (400–850 m) and have yielded considerable quantities of petroleum; an oil-refining industry has consequently developed in Ems. Although peat bog still covers large areas, much of it has been reclaimed since 1928 by drainage, removal of peat, and fertilization of the subsoil. Small agricultural holdings support rye and potato crops, and milk production is important as well. Tourism is also increasing in importance.

Emson, Sir Richard: *see* Empson, Sir Richard.

emu, flightless bird of Australia and second largest living bird: the emu is more than 1.5 m (5 feet) tall and may weigh more than 45

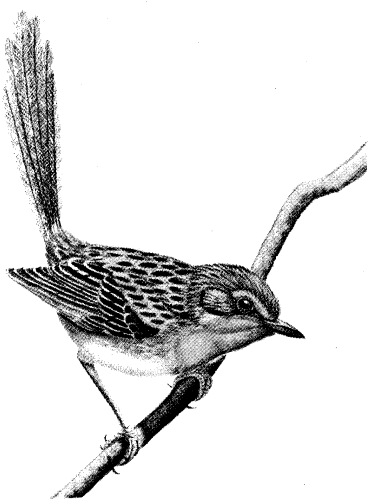


Emu (*Dromaius novaehollandiae*)
V. Serventy—Bruce Coleman Inc./EB Inc.

kilograms (100 pounds). The emu is the sole living member of the family Dromaiidae (or Dromiceiidae) of the order Casuariiformes, which also includes the cassowaries.

The common emu, *Dromaius* (or *Dromiceius*) *novaehollandiae,* the only survivor of several forms exterminated by settlers, is stout bodied and long legged, like its relative the cassowary. Both sexes are brownish, with dark-gray head and neck. Emus can dash away at nearly 50 kilometres per hour (30 mph); if cornered they kick with their big, three-toed feet. Emus mate for life; the male incubates from 7 to 10 dark-green eggs, 13 centimetres (5 inches) long, in a ground nest for about 60 days. The striped young soon run with the adults. In small flocks emus forage for fruits and insects but may also damage crops. The peculiar structure of the trachea of the emu is correlated with the loud booming note of the bird during the breeding season. Three subspecies are recognized, inhabiting northern, southeastern, and southwestern Australia; a fourth, now extinct, lived on Tasmania.

emu-wren, any of the three species of the Australian genus *Stipiturus,* of the songbird family Maluridae. In these tiny birds the narrow, cocked tail consists of six wispy feathers—in quality, like the feathers of the emu. The most widespread species, the southern



Southern emu-wren (*Stipiturus malachurus*)
Painting by H. Douglas Pratt

emu-wren (*S. malachurus*), is streaked brown, with pale-blue throat in the male. Emu-wrens are shy inhabitants of wet and dry scrublands.

emulsifier, in foods, any of numerous chemical additives that encourage the suspension of one liquid in another, as in the mixture of oil and water in margarine, shortening, ice cream, and salad dressing. Closely related to emulsifiers are stabilizers, substances that maintain the emulsified state. The consistency of food products may also be improved by the addition of thickeners, used to add body to sauces and other liquids, and texturizers. This class of additives has a dual purpose: they make food more appetizing by improving appearance and consistency, and they augment keeping qualities (*i.e.*, extend shelf life).

A number of substances in this group are derived from algae, among them algin, carageenan, and agar (*q.v.*). Lecithins, are also used as emulsifying agents (*see* lecithin).

Emulsifiers, stabilizers, and related compounds are also used in the preparation of cosmetics, lotions, and certain pharmaceuticals, where they serve much the same purpose as in foods—*i.e.*, they prevent separation of ingredients and extend storage life.

emulsion, in physical chemistry, mixture of two or more liquids in which one is present as droplets, of microscopic or ultramicroscopic size, distributed throughout the other. Emulsions are formed from the component liquids either spontaneously or, more often, by mechanical means, such as agitation, provided that the liquids that are mixed have no (or a very limited) mutual solubility. Emulsions are stabilized by agents that form films at the surface of the droplets (*e.g.,* soap molecules) or that impart to them a mechanical stability (*e.g.,* colloidal carbon or bentonite). Unstable emulsions eventually separate into two liquid layers. Stable emulsions can be destroyed by inactivating or destroying the emulsifying agent—*e.g.,* by adding appropriate third substances or also by freezing or heating. Some familiar emulsions are milk (a dispersion of fat droplets in an aqueous solution) and butter (a dispersion of droplets of an aqueous solution in fat).

Emulsions are important in many fields—*e.g.,* in the dyeing and tanning industries, in the manufacture of synthetic rubber and plastics, in the preparation of cosmetics such as shampoos, and of salves and therapeutic products.

The term emulsion is often applied to mixed systems that should better be characterized as solutions, suspensions, or gels. For example, the so-called photographic emulsion is actually a gelatin gel in which tiny crystals (*e.g.,* of silver bromide) are dispersed.

Emydidae, family of hard-shelled turtles native to both the Old and New Worlds, primarily in the Northern Hemisphere. The emydid turtles comprise more than 25 genera and 85 living species—roughly one-half of all the genera and one-third of all the species of turtles now living. With the exception of a few terrestrial forms, such as the box turtles (*Terrapene*) of North and Central America, emydid turtles are aquatic reptiles with streamlined shells. Some, such as the diamondback terrapin, are valued as food; others are kept as pets.

The majority of emydid turtles are native to Asia and North and Central America. The most widely known members of the family include Blanding's turtle, box turtle, chicken turtle, painted turtle, pond turtle, spotted turtle, terrapin, and wood turtle. The family Emydidae has been placed by some authorities as the subfamily Emydinae of the family Testudinidae (usually restricted to the land tortoises).

'En Gedi, also spelled EIN GEDI, oasis, archaeological site, and kibbutz (communal settlement) in southeastern Israel on the west bank of the Dead Sea. Because of its spring in an otherwise totally arid country, the site has been inhabited from remote antiquity. Excavations in the 1960s and early 1970s at an adjoining tell (stratified mound) revealed remnants of a sanctuary of the Chalcolithic period (4th millennium BC), and evidences of continuous habitation from the 7th century BC through Byzantine times. The kibbutz, established in 1953, raises dates, bananas, and early vegetables. The area around 'En Gedi, with its unusual tropical vegetation, is an Israeli nature reserve; tourism is popular.

en résille, in the decorative arts, technique of enamelwork in which the design is incised on rock crystal or glass paste and the incisions lined first with gold and then with opaque or translucent enamel. After low-temperature firing, the surface is filed and polished. The term *résille,* French for hairnet, suggests the highly intricate and delicate designs and patterns usually executed in this technique, as well as the exquisite craftsmanship the process requires. In appearance, *en résille* work resembles cloisonné, except that its base is crystal or glass, not metal, and its effect is more delicate. Used to decorate jewelry, hand mirrors, and various trinkets and curios, *en résille* was

Case for a miniature portrait, *en résille* enamel, French, early 17th century; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

especially popular in 16th- and 17th-century western Europe.

Enakievo (Ukrainian S.S.R.): *see* Yenakiyevo.

enamel, in anatomy, the hardest tissue of the body, covering part or all of the crown of the tooth in mammals. Enamel, when mature, consists chiefly of apatite crystals containing calcium and phosphate. Enamel is not living and contains no nerves. The thickness and density of enamel vary over the surface of the tooth; it is hardest at the biting edges, or cusps. The enamel of primary teeth is less hard than and only half as thick as that of permanent teeth. Normal enamel may vary in colour from yellow to gray. The surface enamel is harder, less soluble, and contains more fluoride than the underlying enamel and is very resistant to caries (*q.v.*; tooth decay). Two major malformations of enamel may occur: (1) hypoplasia, in which the amount of matrix is insufficient, so that there is a lack of enamel; this may result from infection or malnutrition during development or, rarely, from genetic anomaly; (2) hypocalcification, in which there is insufficient calcium and a soft enamel is produced; this may result, for example, from excess fluorine in the diet. *See also* cementum; dentine.

enamel miniature, portrait on a small opaque, usually white, enamel surface an-

"Admiral Churchill," enamel miniature by Charles Boit, *c.* 1705; in the National Maritime Museum, Greenwich, Eng.
By courtesy of the National Maritime Museum, Greenwich, Eng.; photograph, A.C. Cooper Ltd.

nealed to gold or copper plate and painted with metallic oxides. Since the pigments used are not vitreous enamels, this is not a true enamelling process. The metallic paints are slightly fused to the enamel surface through heating. After cooling, the completed picture is covered with a transparent vitreous enamel and heated again to give the image a glazed appearance.

The technique of making enamel miniatures was introduced in the 17th century by Jean and Henri Toutin. The first major artist working in this technique was Jean Petitot, who in the 17th century painted portrait miniatures for the courts of Charles I of England and Louis XIV of France (*see* Petitot, Jean).

In the early 18th century the enamel miniature enjoyed the greatest popularity among English patrons. The Swedish-born Charles Boit produced works in this medium in London for William III and Queen Anne. The German-born Christian Friedrich Zincke painted most of the English celebrities of the mid-18th century in enamels of remarkably even quality. The widespread European popularity of the miniature portrait painted on ivory brought about the decline of the enamel miniature in the second half of the 18th century, although the art continued to be practiced in England into the 19th century by such accomplished miniaturists as Henry Bone and William H. Craft (*see* Bone, Henry).

enamelling, porcelain: *see* porcelain enamelling.

enamelwork, technique of decoration whereby metal objects or surfaces are given a glasslike glaze that is fused onto the surface by intense heat to create a brilliantly coloured decorative effect. It is an art form noted for its brilliant, glossy surface, which is hard and long lasting.

A brief account of enamelwork follows. For full treatment, see MACROPAEDIA: Decorative Arts and Furnishings.

Enamelwork as a decorative art has affinities with inlay, mosaic, and painting. Objects most suitable for enamelling tend to be those that are delicate and small in scale. The technique is particularly well suited to the decoration of small, precious luxury objects, such as jewelry, snuffboxes, scent bottles, watches, and ecclesiastical objects. It is not, however, necessarily limited to such use.

Enamel itself is a comparatively soft glass. Various colours are obtained by adding metal oxides of various colours to the base enamel, called flux, or frit. By varying the proportions of different components, different colours are created. The best and most strikingly vivid colours tend to be the blues and greens, formed by adding an oxide of copper to the enamel flux. The enamel can be made more or less translucent or opaque by varying the components used.

Wet powder is spread onto the prepared metal surface of the object to be decorated and then allowed to dry before being heated, or fired, in a furnace. The heat causes the enamel to melt and to fuse with its metal base and to form the hard vitreous surface characteristic of enamelwork. The temperature at which the enamel is fired and, in particular, its consistency throughout the period of firing is crucial and will greatly affect the aesthetic properties and technical quality of the finished work.

There are many different techniques of enamelwork and an especially large variety of methods whereby the powdered enamel can be applied to the metal base. Various metals can be decorated with enamelwork, but the most common are copper, brass, bronze, and gold.

Two of the best known techniques are cloisonné and champlevé. In both of these processes, the design is delineated by an outline of metal within which the enamels are applied. In cloisonné work, thin strips of metal are soldered to the metal base to outline the design. In champlevé work, the base metal surface is cut away and the enamel is applied to the recesses so created, leaving the metal outline at surface level. In painted enamelwork, the colours are not separated by metal strips, and so the effect is less like that of a miniature stained-glass window and more like that of an oil painting.

Enamelwork may have existed as early as the 13th to the 11th century BC in Myce-

Painted enamel and copper pyx, Venetian, 15th century; in the Bargello, Florence

SCALA—Art Resource/EB Inc.

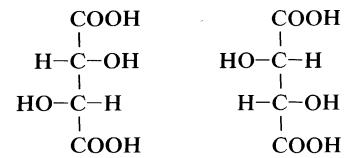
naean civilization. It was certainly known to the Celts and the Romans. It reached its first real peak as a decorative art in the Byzantine Empire, during which time remarkable cloisonné works on gold were made. It flourished throughout medieval and Renaissance Europe. Particularly fine work was done around the year 1200 in Limoges, Fr.

In the 17th century, French craftsmen, led by Jean I Toutin of Chateaudun, invented a type of enamel miniature painting. The technique of transferring a design onto an enamelled box was perfected at Battersea, Eng., in the mid-18th century.

Precious objects of gold, enamel, and jewels were among the highly prized exquisite objects made by the Russian jeweller Carl Fabergé at the turn of the 20th century. Enamelwork has a long tradition in China and Japan as well, but it is almost certain that the technique was originally introduced to China (and then to Japan) from Europe. Particularly fine cloisonné enamels, especially vases, were made in China during the Ming dynasty. In the late 19th century, Japanese craftsmen perfected a "lineless" cloisonné technique in which the brilliant colours characteristic of cloisonné work could be produced without the usual lines formed by the metal strips.

enantiomorph (from Greek *enantios*, "opposite"; *morphe*, "form"), also called ANTIMER, or OPTICAL ANTIPODE, either of a pair of objects related to each other as the right hand is to the left, that is, as mirror images that cannot be reoriented so as to appear identical. An object that has a plane of symmetry cannot be an enantiomorph because the object and its mirror image are identical. Molecular enantiomorphs, such as those of lactic acid, have identical chemical properties, except in their chemical reaction with other dissymmetric molecules and with polarized light. Enantiomorphs are important to crystallography because many crystals are arrangements of alternate right- and left-handed forms of a single molecule. A complete description of the crystal specifies how the forms are mixed with each other.

An example of a pair of substances that are enantiomorphs is the two optically active forms of tartaric acid, designated as *d*-tartaric acid and *l*-tartaric acid. The configurations of the individual molecules of these two substances have been shown to be mirror images of one another, as represented by the following projection formulas:



d-tartaric acid *l*-tartaric acid

The two acids have identical melting points, densities, and solubilities in optically inactive solvents and the same rates of reactions with optically inactive reagents.

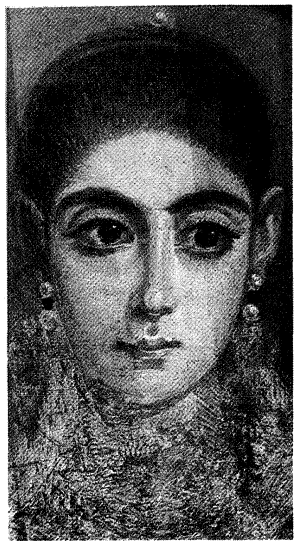
enargite, sulfosalt mineral, copper arsenic sulfide (Cu_3AsS_4), that is occasionally an important ore of copper. It occurs as heavy, metallic-gray crystals and masses in veins and replacement deposits. Economically valuable deposits have been found at Bor, Yugos.; several places in Peru; Chuquicamata, Chile; and Butte, Mont. It forms orthorhombic crystals. For detailed physical properties, *see* sulfosalt (table).

Encamp, village and *comun* (municipality), Andorra, on a headstream of the Riu (river) Valira. Its agricultural economy is supplemented by tourism, especially skiing. Encamp has a broadcasting transmitter of Radio Andorra. Above the village is Engolasters Lake, accessible by cable car. There are facilities for generating hydroelectric power. The *comun* has an area of 29 sq mi (74 sq km) and includes the Pic (peak) des Pessons (9,400 ft [2,865 m]). Pop. (1982) *comun*, 4,194.

Encarnación, formerly ITAPÚA, capital, Itapúa department, southeastern Paraguay. The city was founded in 1614 on the west bank of the Upper Paraná River, opposite Posadas, Arg., to which it is linked by ferry. Severely damaged by a tornado in 1926, it is now one of the largest cities of Paraguay and a busy commercial, manufacturing, and communications centre. The city is divided into two sectors: the High (old) City and the Low (new) City. The High City contains the church, the municipal offices, the courts, a baccalaureate college, a teachers college, commerce schools, and the principal residences. In the Low City are located the post office, various houses of commerce, factories, hotels, a branch of the Bank of Paraguay, and a radio and television station. It processes lumber, maté (tea), tobacco, cotton, corn (maize), rice, and cattle from the hinterland. Goods are shipped by highway or railway to Asunción or by ferry to Posadas. Another highway leads northeast to Puerto Presidente Stroessner and thence to Iguaçu Falls; there is also an airport. Pop. (1982 prelim.) 27,632.

encaustic painting, painting technique in which pigments are mixed with hot, liquid wax. After all of the colours have been applied to the painting surface, a heating element is passed over them until the individual brush

or spatula marks fuse into a uniform film. This "burning in" of the colours is an essential element of the true encaustic technique. Encaustic wax has many of the properties of oil paint: it can give a very brilliant and attractive effect and offers great scope for elegant and expressive brushwork. The practical difficulties of using a medium that has to be kept warm are considerable, though. Apart from the greater sophistication of modern methods of heating and the use of resin (or oil for use on canvas), present-day technique is similar to that described by the 1st-century-AD Roman scholar Pliny the Elder. Encaustic painting was invented by the ancient Greeks and was brought to the peak of its technical perfection by the genre painter Pausias in the 4th century BC.



Mummy portrait of a young girl, encaustic painting from al-Fayyūm, Egypt, 2nd century; in the Louvre, Paris

Giraudon—Art Resource/EB Inc.

Enceladus, second major satellite outward from Saturn. Little was known about this object other than its orbit until the flyby of the American planetary probe Voyager 2 in 1981. Approaching as close as 87,140 kilometres (54,027 miles), the spacecraft revealed that Enceladus is complex geologically; observations of its surface indicate that the satellite has undergone five distinct evolutionary periods. Several craterless areas are no more than 100,000,000 years old. Because this length of time represents only the last 2 percent of Enceladus' total lifespan, it might be assumed that the satellite is still an active body. The source of energy for this continuing geological activity is speculated to be the tidal influence of Saturn and the satellite Dione.

Enceladus measures 500 km (310 mi) in diameter and orbits Saturn in a circular orbit at a mean distance of 238,020 km (147,572 mi). Its average density is only 10 percent greater than that of water, which indicates that its composition is 50 percent or more ice. Its surface, which has a reflectance of 100 percent, is basically smooth but includes cratered and grooved plains. Enceladus is among the least dense of the satellites of Saturn.

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

Encephalartos, a genus of 20 or more species of palmlike cycads (plants of the family Cycadaceae), native to southern Africa and grown elsewhere as conservatory and house plants. The genus includes both tuberous and columnar varieties; they sometimes have spiny foliage. A breadlike food is prepared from the starchy centre of the stem of the Kaffir bread, or bread palm (*q.v.; E. caffer*).

Encephalartos

W.H. Hodge

encephalitis, plural ENCEPHALITIDES, inflammation of the brain; from Greek *enkephalos* ("brain") and *itis* ("inflammation"). In some cases, the inflammation affecting the brain may involve adjoining structures as well; there is inflammation of the brain and of the spinal cord in encephalomyelitis and of the brain substance and of the meninges (the membranes covering the brain) in meningoencephalitis. Encephalitis is most often caused by the direct or indirect action of an infective organism and sometimes by such noninfective agents as chemicals. Although encephalitis can be produced by many different types of organisms, such as bacteria, protozoa, and helminths (worms), viruses are the most frequent causal agents. The encephalitis-producing viruses may be divided into two groups: (1) those that invade the body and produce no damage until they are carried by the bloodstream to the nerve cells of the brain, where they lodge and multiply (*i.e.,* the rabies and arthropod-borne viruses); and (2) those that invade the body and first injure non-nervous tissues and then secondarily, and rarely, invade the brain cells (*e.g.,* the viruses causing herpes simplex, herpes zoster, dengue, and yellow fever).

The type of brain inflammation known as encephalitis lethargica, or sleeping sickness (to be distinguished from African sleeping sickness, or African trypanosomiasis), occurred in epidemics in Europe and in the United States about the time of World War I but has not been reported since 1930, though individuals with residual symptoms (postencephalitic Parkinsonism) may still be seen in neurological clinics. Although the influenza virus was suspected, the causative agent of sleeping sickness was never established.

Among children, a large number of acute encephalitides are of the type known as demyelinating encephalitis, which may develop as a complication of such viral diseases as measles or chicken pox or as a result of vaccination against such viral diseases as smallpox. It is so-called because damage is not done to the nerve cell body but to the insulation (myelin sheath) surrounding the nerve fibres. Multiple sclerosis is the best known of another group of encephalitides in which there is injury to the myelin. Among the chemicals that occasionally produce encephalitis are lead, arsenic, mercury, ethyl alcohol, chlorinated hydrocarbons, morphine, and barbiturates.

Symptoms common to most types of encephalitis are fever, headache, drowsiness, lethargy, coma, tremors, and a stiff neck and back. Convulsions may occur in patients of any age but are most common in infants. Characteristic neurological signs include uncoordinated and involuntary movements, weakness of the arms, legs, or other portions of the body, or unusual sensitivity of the skin to various types of stimuli. The symptoms, signs, and an examination of the cerebrospinal fluid can usually establish the presence of encephalitis, but they do not necessarily establish the cause, which often remains unknown. This situation makes specific treatment difficult, and even when the causative virus is known, there may be no drugs effective against it.

Generally, treatment aims to relieve the symptoms and ensure quiet rest for the patient. The symptoms remaining after recovery from the acute phase of brain inflammation vary considerably, depending on the type of encephalitis and on the age and general health of the patient. Many individuals are weak and debilitated after an attack but recover with no serious aftereffects. Some encephalitides (*i.e.,* Eastern and Western equine encephalitides, diseases of horses and mules that may be transmitted to humans by the mosquito) may cause irreparable brain damage in about 50 percent of the patients under one year of age. Any form of encephalitis in young children may damage the brain so that it can no longer develop properly.

encephalomyelitis, equine (animal disease): *see* equine encephalitis.

enchanter's nightshade, any herbaceous perennial plant of the genus *Circaea,* in the evening primrose family (Onagraceae), that occurs in damp woodlands of the Northern Hemisphere. The plants have slender stems with opposite leaves. The small, white, two-petaled flowers grow in clusters, and the fruits have hooked bristles.

Enchanter's nightshade (*Circaea lutetiana*)

G.E. Hyde from the Natural History Photographic Agency—EB Inc.

enchondroma, a solitary cartilaginous lesion that occurs mostly in the shafts of bones of the hands and feet, usually between adolescence and about age 50. Enchondromas are benign, slow-growing tumours. As they grow they expand and thin the cortex of the parent bone, producing considerable deformity. They may also erupt through their bony covering and project outward into the surrounding soft tissues. Enchondromas tend to be painless but are subject to sarcomatous change. They are usually treated by complete surgical excision. The solitary enchondroma is morphologically identical with the lesions produced in enchondromatosis (also called Ollier's disease).

Enciclopedia italiana di scienze, lettere ed arti (Italian: "Italian Encyclopaedia of Science, Letters, and Arts"), major encyclopaedia of Italy, containing 35 volumes of text and a one-volume index. Work on the encyclopaedia began in 1925 and the volumes were published serially from 1929 to 1936; appendixes have been published covering the years from 1937 to 1960.

The *Enciclopedia italiana* contains many excellent lengthy articles, usually signed with the initials of their authors, and thousands of illustrations.

Enciclopedia universal ilustrada europeo-americana, byname ESPASA, encyclopaedia published in Madrid, an outstanding reference work of 70 volumes—published between 1905 and 1933—plus a series of supplements.

Spanish and Spanish-American biography and gazetteer information are especially strong. Major articles—*e.g.*, on countries—are quite long and include lengthy bibliographies of international scope. Although coverage is considered universal, the Iberian Peninsula and Latin America are particularly well covered. A volume devoted to Spain is separately revised and reissued approximately every 10 years.

Special features of *Espasa* include reproductions and descriptions of paintings and other works of art, entered under titles; colour plates, for each country, of uniforms, flags, and coins; geographical, historical, geological, and statistical maps; and city and town plans, even of obscure and remote places not usually available in guidebooks. *Espasa* also functions as a language dictionary, giving etymologies and word equivalents in French, Italian, English, German, Portuguese, Catalan, and Esperanto.

From 1934, a *suplemento anual* has been published at irregular intervals. It is arranged alphabetically in subject groups, *e.g.*, Aeronautica, Agricultura, etc., with smaller topics included under these. In 1955 a miniature edition, entitled *Espasa-Calpe: diccionario enciclopédico abreviado,* was issued in a sixth edition of seven volumes.

Encina, Juan del (b. July 12, 1468?, Encinas?, near Salamanca, Castile—d. near the end of August 1529/30, León?, Spain), playwright, poet, priest, and composer of secular vocal music, who was the first Spanish dramatist to write specifically for performance.

After youthful training as a chorister at Salamanca cathedral (*c.* 1484) and at the University of Salamanca (before 1490), Encina entered the service of the Duke of Alba as a resident poet-dramatist-composer in 1492. He wrote for the court a number of *églogas* (short pastoral plays) incorporating music. Eight of his plays and most of his poetry were collected and published in *Cancionero* in 1496. Thereafter Encina lived much in Italy; he visited Rome at least three times, gaining various ecclesiastical posts and seeking the patronage of Pope Alexander VI, a Spaniard, in securing a position in Spain. In 1519 he journeyed to Jerusalem, later publishing an account of his pilgrimage. He was a prior at León from 1523 until his death.

The first half dozen of Encina's *églogas* are little more than dialogues in a humorously colloquial peasant speech between mock-realistic shepherds more interested in recreation than work. His later *églogas* introduce other types of characters and, although still rudimentary in plot, are more complex, refined, and sententious. These later plays, a notable example of which is *Égloga de Plácida y Vitoriano,* show the influence of the *égloga*'s Italian antecedents in their celebration of pagan love and their incorporation of themes from classical mythology.

Encina was also a poet and composer of wide range; he wrote both popular ballads and *villancicos* (rustic songs) as well as skillfully phrased and polished courtly poems. Indeed, he is now considered one of the most important songwriters in Spain in his time. His songs were based upon folklike tunes and rhythms, and some of the most appealing of them have an earthy or ribald quality, while others achieve a rare intensity of expression.

Encke, Johann Franz (b. Sept. 23, 1791, Hamburg—d. Aug. 26, 1865, Spandau, Ger.), German astronomer who in 1819 established the period of the comet now known by his name (*see* Encke's Comet).

Encke was educated at Hamburg and the University of Göttingen, where he worked under the direction of Carl Friedrich Gauss. In 1816 Encke became assistant at the Seeberg Observatory near Gotha, Ger., where he was made vice director in 1820 and director in 1822. In 1825 he was appointed professor of astronomy and director of the observatory of the University of Berlin. There he planned and supervised the construction of a new observatory, completed in 1835.

Besides the comet that bears his name, Encke is also known for his discovery of Encke's Division, in the outermost ring of Saturn. From observations of the transits of Venus recorded in 1761 and 1769, he derived a value for the solar parallax (in effect, for the Sun's distance from the Earth) that, at 8″.57, is close to the presently accepted figure. He also established methods for calculating the orbits of minor planets and orbits of double stars.

Enckell, Rabbe (Arnfinn) (b. March 3, 1903, Tammela, Fin.—d. June 17, 1974, Helsinki), Finnish poet, playwright, and critic, a leading representative of the Swedo-Finnish poetic revival that began in the 1920s.

Enckell

By courtesy of the Embassy of Finland, Washington, D.C.

Enckell studied art in France and Italy. His first collection of impressionistic nature poems, *Dikter,* appeared in 1923. In this collection and a sequel, *Flöjtblåsarlycka* (1925; "The Flutist's Happiness"), Enckell describes with a painter's eye the exquisite nuances in the phenomena of nature. A modernist, he was associated with the avant-garde journal *Quosego* in 1928–29. After writing a few semi-autobiographical novels, including *Ljusdunkel* (1930; "Chiaroscuro"), Enckell returned to poetry with *Vårens cistern* (1931; "The Cistern of Spring"), followed by *Tonbrädet* (1935; "The Sounding Board"). His poetic diction became more modern and contained reminiscences of the work of T.S. Eliot. *Valvet* ("The Vault"), another collection of his poems, appeared in 1937.

A student of classical poetry and mythology, Enckell made use of classical parallels to dramatize the problems of his time in a series of verse plays including *Orfeus och Eurydike* (1938) and *Alkman* (1959). Enckell reflects upon this continuous preoccupation with the classical myths of Greece in his most remarkable collection of poetry, *Andedräkt av koppar* (1946; "Breath of Copper"). In 1960 he was made poet laureate of Swedish Finland.

Encke's Comet, faint comet having the shortest orbital period (about 3.3 years) of any known; it was also only the second comet (after Halley's) to have its period established. The comet was first observed in 1786 by Pierre Méchain. Johann Franz Encke in 1819 calculated that sightings of apparently different comets in 1786, 1795, 1805, and 1818 were in fact appearances of the same comet, whose short orbital period he was able to deduce. The comet was named in his honour, though usually comets are named after their discoverers. Encke also found the comet's period to be decreasing by about 2½ hours in each revolution and showed that this effect could not be explained by perturbations (slight changes in an orbit) caused by planets. The shortening of its period continues, though at a reduced rate; the cause of this reduction is still uncertain.

enclosure, also spelled INCLOSURE, the division or consolidation of communal fields, meadows, pastures, and other arable lands in western Europe into the carefully delineated and individually owned and managed farm plots of modern times. Before enclosure, much farmland existed in the form of numerous, dispersed strips under the control of individual cultivators only during the growing season and until harvesting was completed for a given year. Thereafter, and until the next growing season, the land was at the disposal of the community for grazing by the village livestock and for other purposes. To enclose land was to put a hedge or fence around a portion of this open land and thus prevent the exercise of common grazing and other rights over it.

In England the movement for enclosure began in the 12th century and proceeded rapidly in the period 1450–1640, when the purpose was mainly to increase the amount of full-time pasturage available to manorial lords. Much enclosure also occurred in the period from 1750 to 1860, when it was done for the sake of agricultural efficiency. By the end of the 19th century the process of the enclosure of common lands in England was virtually complete.

In the rest of Europe enclosure made little progress until the 19th century. Agreements to enclose were not unknown in Germany in the 16th century, but it was not until the second half of the 18th century that the government began to issue decrees encouraging enclosure. Even then, little advance was made in western Germany until after 1850. The same policy of encouragement by decree was followed in France and Denmark from the second half of the 18th century, in Russia after the emancipation of the serfs (1861), and in Czechoslovakia and Poland after World War I. Common rights over arable land—which constitute the most formidable obstacle to modern farming—have now for the most part been extinguished, but some European land is still cultivated in the scattered strips characteristic of common fields, and common rights continue over large areas of pasture and woodland.

encomienda, in colonial Spanish America, legal system by which the Spanish crown attempted to define the status of the Indian population in its American colonies. It was based upon the practice of exacting tribute from Muslims and Jews during the Reconquista ("Reconquest") of Muslim Spain. Although the original intent of the *encomienda* was to reduce the abuses of forced labour (*repartimiento*) employed shortly after the discovery of the New World, in practice it became a form of enslavement.

As legally defined in 1503, an *encomienda* (from *encomendar,* "to entrust") consisted of a grant by the crown to a conquistador, soldier, official, or others of a specified number of Indians living in a particular area. The receiver of the grant, the *encomendero,* could exact tribute from the Indians in gold, in kind, or in labour and was required to protect them and instruct them in the Christian faith. The *encomienda* did not include a grant of land, but in practice the *encomenderos* gained control of the Indians' lands and failed to fulfil their obligations to the Indian population. The crown's attempts to end the severe abuses of the system with the Laws of Burgos (1512–13) and the New Law of the Indies (1542) failed in the face of colonial opposition and, in fact, a revised form of the *repartimiento* system was revived after 1550.

The *encomienda* was designed to meet the needs of the colonies' early mining economy. With the catastrophic decline in the Indian population and the replacement of mining with agriculture, the system lost its effectiveness and was gradually replaced by the hacienda (*q.v.*) system of landed estates. The *encomienda* was not abolished, however, until the late 18th century. *See also* repartimiento.

Encratite, member of an ascetic Christian sect led by Tatian, a 2nd-century Syrian rhetorician. The name derived from the group's doctrine of continence (Greek: *enkrateia*). The sect shunned marriage, the eating of flesh, and the drinking of intoxicating beverages, even substituting water or milk for wine in the Eucharist.

Tatian converted to Christianity while studying in Rome under the Christian apologist Justin Martyr. He early showed his ascetic bent, and after Justin's martyrdom (*c.* AD 165), Tatian drifted further toward dualism and Gnosticism, severed his ties with the church, and returned to Syria, where his association with the Encratites began. He formulated the doctrine that denied salvation to Adam, and he reinterpreted some of the Pauline texts of the New Testament (*e.g.,* The First Letter of Paul to the Corinthians 7:3–6) to make them concur with the Encratite view that marriage was licentious and a service of the devil. Eusebius of Caesarea stated in his 4th-century history of the church that the Encratites actually rejected both the Pauline Letters and The Acts of the Apostles.

encyclical, pastoral letter written by the pope for the whole Roman Catholic church on matters of doctrine, morals, or discipline. Although formal papal letters for the entire church were issued from the earliest days of the church, the first commonly called an encyclical was *Ubi primum,* dealing with episcopal duties, published by Benedict XIV in 1740. Only from the time of Pius IX (1846–78) have encyclicals been frequently used. Encyclicals are normally addressed to the bishops of the church, but a few (notably *Pacem in terris* by John XXIII) have been addressed also to "all men of good will." The formal title of an encyclical consists of the first few words of the official text; the language is usually Latin, and the document is not considered to be infallible.

encyclopaedia, also spelled ENCYCLOPEDIA (from Greek *enkyklios paideia,* "general education"), reference work that contains information on all branches of knowledge or that treats a particular branch of knowledge in a comprehensive manner.

A brief treatment of encyclopaedias follows. For full treatment, *see* MACROPAEDIA: Encyclopaedias and Dictionaries.

An encyclopaedia is a self-contained reference work with two main aims: to include up-to-date knowledge about a particular discipline or group of disciplines and to make this knowledge conveniently accessible. An encyclopaedia differs from a dictionary in that it can explain subjects in detail, rather than merely supplying definitions of words and phrases. It differs from an almanac in that the information contained in the latter is dated. It differs from pedagogical texts in its attempt to be easy to consult and to be readily understood by the lay person.

To ensure comprehensiveness and depth of coverage, an encyclopaedia is generally written in the form of many separate articles, often by experts in the field. These articles include background and historical information as well as current material. The many articles must be organized in such a way that the reader can easily find information on the subject he is looking for. Ordering the articles by their titles in a continuous alphabetical sequence is nearly universal now, although this has not always been true. In many early encyclopaedias, those articles deemed most important were placed at the beginning of the work; many medieval European encyclopaedias, for example, placed theological topics first, whereas the first Arabic encyclopaedia began with topics like "power" and "war" and ended with "food" and "women." Encyclopaedias ordering their entries in a more systematic manner, in which knowledge is classified and divided into broad areas which encompass numerous subdivisions, are known as classified encyclopaedias. Today, however, alphabetical order by entry title is the norm, partly because this format is the easiest to consult. Convenience in consultation is also facilitated in modern encyclopaedias by such things as a detailed index, cross-references, tables, charts, and illustrations. Some encyclopaedias also offer study and learning guides, as well as yearly supplements.

Encyclopaedias vary greatly in format and content. They have ranged from single-volume encyclopaedias (such as the *Columbia Encyclopedia*) to encyclopaedias of more than 100 volumes (China's *Yü-hai* encyclopaedia was printed in 1738 in 240 volumes). Early European encyclopaedias were almost always in Latin, while modern encyclopaedias are in the vernacular. A few encyclopaedias are published specifically for children. Major encyclopaedias may attempt to encompass the entire scope of knowledge as fully as possible, while an increasing number of others are restricted to special interests or fields of knowledge (*e.g.,* the *Encyclopedia of Chemical Technology*).

The prototype of modern encyclopaedias is usually acknowledged to be Ephraim Chambers' *Cyclopaedia* (1728). This encyclopaedia is thought to have been the first to use an extensive system of cross-references, as well as the first for which supplements were issued. The first modern encyclopaedia was the French *Encyclopédie* (1751–65). This encyclopaedia probably had more influence on its time than did any other work. (*See* Encyclopédie, L'.) The first edition of the *Encyclopædia Britannica* was published in 1768–71; as it passed through its 14 subsequent editions, the *Britannica* evolved into the largest and most comprehensive general encyclopaedia in the English language.

Encyclopædia Britannica, the oldest and largest English-language general encyclopaedia. The *Encyclopædia Britannica* has been published since 1768, when its first edition began to appear in Edinburgh.

First edition. The *Encyclopædia Britannica; or, A Dictionary of Arts and Sciences* was conceived by two printers, Andrew Bell and Colin Macfarquhar, and edited chiefly by the printer and antiquary William Smellie (*qq.v.*). It was printed and published in Edinburgh. Initial pieces of the work began to appear in December 1768, and the whole work was completed in 1771 in three volumes containing 2,659 pages and 160 copperplates engraved by Bell. The work's merit and novelty consisted, on the one hand, in its consolidating important subjects into lengthy, comprehensive treatises and, on the other, in facilitating reference by the inclusion of many shorter, dictionary-type articles on technical terms and other subjects.

Second edition. The second edition was a much more ambitious work in both length and scope, its 10 volumes totaling 8,595 pages and appearing in parts from 1777 to 1784. There were more treatises than in the first edition and many new articles, as well as previous articles much expanded. The scope of the second edition was enlarged beyond that of a "dictionary of arts and sciences" by the inclusion of biographical articles and the expansion of geographical articles to include history. The editor was James Tytler (*c.* 1747–1803).

Third edition. The third edition was still longer, appearing in parts forming 18 volumes of 14,579 pages (1788–97). It was edited by Macfarquhar until his death in 1793, after which it was completed by George Gleig (1753–1840), a Scottish Episcopalian clergyman. When the edition was completed, Andrew Bell bought out the share of ownership of Macfarquhar's heirs. A two-volume supplement, edited by Gleig and printed for Thomas Bonar, Bell's son-in-law, appeared in 1801. The fresh, energetic prose of the third edition and supplement proved to be engaging as well as informative and greatly helped to establish *Britannica*'s lasting reputation.

Fourth edition. The fourth edition appeared from 1801 to 1809 and, when completed, was bound in 20 volumes totaling 16,033 pages and dated 1810. Essentially it was a revised reprint of the third edition, adding two volumes to include new and enlarged treatises, extra pages to bring history articles up to date, and more biographical articles. The editor, James Millar (1762–1827), an Edinburgh physician and natural scientist, took pains to repair the omissions and other deficiencies caused in the third edition by the death of Macfarquhar in mid-career.

Fifth and sixth editions and supplement to the fourth, fifth, and sixth editions. The fifth edition (edited successively by Bonar and Millar) was a corrected reprint of the fourth, and the sixth (edited by Charles Maclaren) was a reprint of the fifth with some articles brought up to date. Both were of small importance compared with the supplement to the fourth, fifth, and sixth editions, which was being concurrently prepared and printed. This six-volume supplement appeared in half-volumes from 1815 to 1824, edited by Macvey Napier (1776–1847), who later became editor of the *Edinburgh Review.* The principal innovation of the supplement was that, instead of the editor merely compiling digests of the best available independent publications and using these as the treatises, almost all the articles were original signed contributions. Many of them were authored by the most distinguished British scholars of the day, as well as some French scholars. Meanwhile, Archibald Constable, an enterprising Edinburgh publisher, had bought the copyright of *Britannica* from Bell's and Bonar's heirs.

Seventh edition. Constable's firm went bankrupt in 1826, and Constable himself died the following year. The *Encyclopædia Britannica* was then bought by Adam Black, another Edinburgh publisher, for whom Napier edited the seventh edition. Its 21 volumes, totaling 17,101 pages and 506 plates, appeared in parts from 1830 to 1842. The seventh edition was a revision of previous editions, incorporating the supplement and a number of newly commissioned articles. An extra volume provided the useful innovation of a general index, which became a standard feature of further editions.

Eighth edition. The eighth edition, in 21 volumes with an extra index volume, contained a total of 17,957 pages and 402 plates and appeared from 1852 to 1860. Napier had died, and the new editor was T.S. Traill (1781–1862), professor of medical jurisprudence at the University of Edinburgh. Although retaining articles from older editions, the eighth edition was very thoroughly revised.

Ninth edition. The 24 volumes and index volume of the ninth edition—one of the greatest—appeared one by one between 1875 and 1889. Its editor was T.S. Baynes, a professor of logic, metaphysics, and English literature at St. Andrews and a Shakespearean scholar. He planned the edition and continued work on it until his death in 1887, working from 1881 with William Robertson Smith, a Semitic scholar, as joint editor. The ninth edition,

known as the "scholars' encyclopaedia," was controversial in its progressive and knowledgeable stance on the scientific and religious controversies of its day. The work's list of about 1,100 contributors includes more than 70 American scholars and about 60 scholars from the countries of continental Europe. Ownership of the *Encyclopædia Britannica* passed permanently to the United States when the American publisher Horace E. Hooper, along with another publisher, Walter M. Jackson, purchased the *Britannica* outright from Adam and Charles Black in 1901.

10th edition. The 10th edition (1902–03) was published under the sponsorship of *The Times* of London. It added 11 supplementary volumes to those of the ninth, updating much of the material, especially in history. The editors of the 10th edition were Sir Donald Mackenzie Wallace, Hugh Chisholm, Arthur T. Hadley, and Franklin H. Hooper, the brother of Horace Hooper.

11th edition. The famed 11th edition was issued in 29 volumes by the Cambridge University Press in 1910–11 after editorial disputes and a lawsuit between Jackson and Horace Hooper had prompted *The Times* to cancel its contract in 1909. As with the 10th edition, Franklin Hooper was in charge of the New York editorial office and Hugh Chisholm of the London office, where the greater part of the work was done. The 11th edition marked a major departure from previous editions in its splitting up of the traditional lengthy, comprehensive treatises into somewhat more particularized articles. This resulted in the 11th edition's having 40,000 articles—more than double the number of the 9th edition's 17,000—although its total amount of text was not much greater. The 11th edition took over and revised many articles from the 9th and 10th editions. In addition there were many new entries, as well as new sections to earlier entries which covered the history of the past in greater detail than previously. The rich, leisurely prose of the 11th edition marked the pinnacle of literary style in the *Britannica.*

In 1920 *Britannica* was bought by the Chicago mail-order house of Sears, Roebuck and Company, with Horace Hooper serving as its publisher until his death in 1922.

12th and 13th editions. In 1922 three supplementary volumes prepared under the editorial direction of Chisholm in London and Franklin Hooper in New York City were added to the 29 volumes of the 11th edition, which then became the 12th edition, and in 1926 three wholly new supplementary volumes, edited by Hooper in New York City and J.L. Garvin in London, became the 13th edition. During this period (1923–28) ownership shifted from Sears, Roebuck to Hooper's widow and his brother-in-law, William J. Cox.

14th edition. In 1928 Sears, Roebuck bought back the *Britannica,* retaining Cox as publisher to put out a revised edition of the now badly out-of-date 11th edition. It was edited by J.L. Garvin in London and Franklin Hooper in New York City, and it took approximately three years (1926–29) to complete this work. Space was found for many new articles on scientific and other subjects by cutting down the ample style and learned detail of the 11th edition, from which a great deal of material was carried over in shortened form. More than 3,500 authors of all nationalities contributed articles. The set of 24 volumes, one of which contained an index and a complete atlas, was published in 1929 on the eve of the Great Depression. In 1932 Cox resigned as publisher, and Elkan Harrison Powell, who was vice president of Sears, Roebuck, was chosen to replace him, becoming president of the company. Powell organized the direct-sales methods that gradually raised the sales of the encyclopaedia from their low-water mark during the Depression, and he also initiated an important change in editorial method—continuous revision. Thereafter, instead of appearing in completely reset editions at long intervals, the encyclopaedia was revised and reprinted annually. Also begun in 1938 was the volume called *Britannica Book of the Year,* which covered the significant developments of the year preceding publication.

Late in 1941 William Benton, a former advertising executive and then a vice president of the University of Chicago, obtained from Sears, Roebuck and Company the offer of all rights to the *Encyclopædia Britannica* as a gift to the university. When the trustees of the university decided not to undertake the financial risks, Benton supplied the working capital and became chairman of the board of directors of Encyclopædia Britannica, Inc., and majority stockholder. Robert M. Hutchins, then president of the university, was named chairman of the board of editors. Headquarters were established in Chicago.

15th edition. In 1952, with Britannica's publication of his *Great Books of the Western World,* there began the long association of philosopher Mortimer J. Adler with *Britannica.* (On Hutchins' retirement in 1974, Adler succeeded him as chairman of the board of editors.) Under the stewardship of Adler, Benton, and Charles E. Swanson (president of the company from 1967 to 1985), a vast editorial effort was assembled, resulting in the first publication of *Britannica 3,* or the 15th edition, in 1974. The new set consisted of three parts serving different functions: the *Micropædia* (Ready Reference), *Macropædia* (Knowledge in Depth), and *Propædia* (Outline of Knowledge). The 15th edition was given a world point of view by more than 4,000 contributing authors from more than 100 countries. The editorial creation of the work cost $32,000,000, exclusive of printing costs, representing the largest single private investment in publishing history up to that time. *Britannica 3*'s general editor was Warren E. Preece, and the executive editor was Philip W. Goetz (who subsequently became editor in chief).

Annual revisions of the set continued, and these revisions were supplemented by a major revision of the 15th edition for 1985. For that printing, the *Macropædia* was greatly restructured, with the amalgamation and regrouping of hundreds of articles; the index function was taken from the *Micropædia* and placed in a separate two-volume Index; and both the *Micropædia* and the *Propædia* were redesigned, reorganized, and revised. The entire set consisted of 32 volumes.

Encyclopedia Americana, The, American general encyclopaedia, published in Danbury, Conn., the second largest encyclopaedia in English and the first major multivolume encyclopaedia published in the United States.

First published in 1829–33, with subsequent editions in 1911 (20 volumes) and 1918–20 (30 volumes), and thereafter continuously revised, *Americana* is international in scope and is known for its detailed coverage of American and Canadian geography and history. It is also strong in biography and scientific and technical subjects, the latter focusing on 19th- and 20th-century American achievements. All major articles are signed, many by scholars preeminent in their fields.

Because of its continual volume-by-volume revision, some parts of the set are inevitably less current than others. The last complete revision and total resetting occurred in 1918–20, and that edition became the basis for its successors. The alphabetical index in dictionary form (volume 30) is kept up to date with each printing, however, and serves as an instructional as well as an updating device.

Other organizational aids include tables of contents for lengthy articles and information boxes that highlight specific data. Special features include numerous glossaries; separate articles evaluating particularly important literary, artistic, and musical compositions; and separate articles summarizing world, and particularly Western, history and culture for each century AD.

Encyclopédie, L', in full ENCYCLOPÉDIE, OU DICTIONNAIRE RAISONNÉ DES SCIENCES, DES ARTS ET DES MÉTIERS (French: "Encyclopaedia, or Classified Dictionary of Sciences, Arts, and Trades"), the 18th-century French encyclopaedia that was one of the chief works of the Philosophes, men dedicated to the advancement of science and secular thought and the new tolerance and open-mindedness of the Enlightenment. The *Encyclopédie* was a literary and philosophic enterprise that had profound political, social, and intellectual repercussions in France in the decades just prior to the Revolution. Its contributors were called Encyclopédistes.

The *Encyclopédie* was inspired by the success of Ephraim Chambers' *Cyclopaedia; or An Universal Dictionary of Arts and Sciences* (London, 1728). Indeed, the work originated in an abortive attempt to put out a five-volume French translation of Chambers' *Cyclopaedia.* When this project collapsed in 1745, its intended publisher, André Le Breton, immediately embarked on plans for an expanded *Encyclopédie.* He secured the services of the mathematician Jean d'Alembert in 1745 and of the translator and philosopher Denis Diderot in 1746 to assist in the project. In 1747 Diderot undertook the general direction of work on the *Encyclopédie,* except for its mathematical parts, which were edited by d'Alembert. (D'Alembert resigned in 1758.) Seventeen volumes of the *Encyclopédie*'s text were published between 1751 and 1765; 11 volumes of plates were also published between the years 1762 and 1772, making a total of 28 volumes. These were supplemented in 1776–77 by five more volumes—four of text and one of illustration plates—and by two volumes of index in 1780, all compiled under other editors, since Diderot had refused to edit the supplementary materials. These seven volumes, plus the 28 prepared by Diderot, constituted the first edition of the *Encyclopédie* in 35 folio volumes.

The *Encyclopédie* was a showcase for representatives of the new schools of thought in all branches of intellectual activity. The work was notable for its attitude of tolerance and liberalism and also for its innovative coverage of the trades and mechanical arts. In its skepticism, its emphasis on scientific determinism, and its criticism of the abuses perpetrated by contemporary legal, judicial, and clerical institutions, the *Encyclopédie* had widespread influence as an expression of progressive thought and served in effect as an intellectual prologue to the French Revolution.

The *Encyclopédie*'s publication was opposed by conservative ecclesiastics and government officials almost from the start. The work was subjected to Jesuit censorship and the suppression of several volumes by the French Council of State (1752), and it was formally condemned and denied permission for publication in 1759 and for several years thereafter. At this point Diderot's friends urged him to abandon the project, but he persuaded the publishers to secure permission to bring out the relatively uncontroversial volumes of illustration plates, while the remaining volumes of text were edited and printed. Diderot also discovered in 1764 that Le Breton and a compositor had secretly removed about 300 pages of liberal or controversial material from the proof sheets of about 10 folio volumes.

The group of writers that Diderot and d'Alembert assembled for the production of the *Encyclopédie* were at first relatively unknown, with the exception of Jean-Jacques

Rousseau and Baron d'Holbach. But as both the fame of the *Encyclopédie* and the attacks upon it grew, distinguished and expert contributors were attracted, including A.-R.-J. Turgot, Voltaire, J.-F. Marmontel, and Jacques Necker. Diderot himself contributed innumerable articles, especially on philosophy, social theory, and the trades, proving to be both an energetic general editor and the driving force behind the crisis-ridden project. It was he who compiled and supervised the preparation of the work's 3,000 to 4,000 plates, many of which vividly illustrated industrial arts and processes.

In 1782 the publication of a new, enlarged edition departing from the alphabetical arrangement of the first edition was begun under the title *Encyclopédie méthodique ou par ordre de matières* ("Systematic Encyclopaedia or Arranged by Subject"). Work on this topically arranged encyclopaedia continued through the French Revolution and was completed in 1832 with the appearance of the 166th volume, 50 years after the appearance of the first volume.

end-plate potential (EPP), chemically induced change in electric potential of the motor end-plate, which is that portion of the muscle-cell membrane that lies opposite the terminal of a nerve fibre at the neuromuscular junction. The end-plate membrane is electrically polarized, the inside being negative with respect to the outside because of an uneven distribution of ions. When a nerve impulse releases the neurotransmitter acetylcholine from the nerve terminal, it binds to channel-shaped receptor molecules on the end-plate, opening the channels and allowing positively charged sodium ions to flow into the muscle cell. This redistribution of ions slightly depolarizes the membrane. An enzyme then rapidly degrades the acetylcholine, closing the channels and allowing the membrane to return to its previous polarized state.

Acetylcholine is released in bursts, or quanta. A single quantum causes only a slight depolarization, called a miniature end-plate potential (MEPP). One hundred to 200 quanta, released simultaneously or in rapid series by a nerve impulse, cause multiple MEPPs, which summate, or combine, to produce the EPP. If the EPP depolarizes the cell to a crucial threshold level, it will fully activate sodium channels all along the membrane and produce the action potential. The action potential will then stimulate the muscle cell to contract. *See also* action potential.

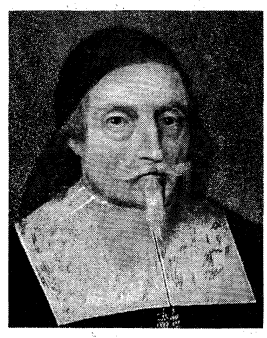
endangered species, any species of plant or animal that is threatened with extinction.

A number of agencies, both international and national, work to maintain lists of endangered species, to protect and preserve natural habitats, and to promote programs for recovery and reestablishment of these species. One such international agency is the Survival Service Commission of the International Union for Conservation of Nature and Natural Resources (IUCN), which publishes information on endangered species worldwide in a series of loose-leaf binders called the *Red Data Book*. Another agency is the Secretariat for the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

In the United States the U.S. Fish and Wildlife Service of the Department of the Interior is responsible for conservation and management of fish and wildlife resources and their habitats, including endangered species. The service was created in 1940 from the consolidation of the Bureau of Fisheries (1871) and the Bureau of Biological Survey (1885). The Endangered Species Act of 1973 (superseding those of 1966 and 1969) obligates the government to protect all animal and plant life threatened with extinction, including in this category "threatened" species, defined as any species "which is likely to become endangered in the foreseeable future throughout all or a significant portion of its range." It also provides for the drawing up of lists of such species and promotes the protection of critical habitats (areas designated as critical to the survival of a species).

By 1990 the U.S. Fish and Wildlife Service had compiled a list of almost 1,000 species of endangered or threatened animals and plants (of which more than 500 are found only in foreign countries), and some 200 recovery programs were in effect.

Endecott, John, Endecott also spelled ENDICOTT (b. *c.* 1588, probably Devon, Eng.—d. March 15, 1665, Boston), colonial governor of the Massachusetts Bay Colony, under whose leadership the new colony made rapid progress.



Endecott, detail of a portrait by an unknown artist, 17th century; in the State House, Boston

By courtesy of the State Library of Massachusetts, Boston

Little is known of Endecott before 1628, when, as one of the six grantees of the New England Company for a Plantation in Massachusetts, he was chosen manager and governor of their settlement. In that year Endecott, with about 60 fellow settlers, went to Naumkeag, a location already occupied by a group of seceders from Plymouth who were led by Roger Conant. According to tradition, the establishment of good relations between the two groups prompted the change of the name of the settlement to Salem (from the Hebrew word *shalom,* "peace"). When the jurisdiction of the New England Company was supplanted by that of the Massachusetts Bay Company (1629), Endecott briefly served as the local governor (April 1629–June 1630) of the Massachusetts Bay Colony. He was succeeded in 1630 by John Winthrop, with whom he worked in harmony despite strong religious differences. Endecott almost continuously occupied prominent official positions in the Massachusetts Bay Colony. He again served as governor in 1644–45, 1649–50, 1651–54, and 1655–64 and was deputy governor in 1641–44, 1650–51, and 1654–55.

Ender, Otto (b. Dec. 24, 1875, Altach, Austria—d. June 25, 1960, Bregenz), statesman and government official who served as chancellor of Austria during the early months of the Great Depression.

Ender served (1918–34) as governor of the Austrian state of Vorarlberg, on the Swiss border, and after World War I he negotiated unsuccessfully for the incorporation of Vorarlberg in the Swiss confederation. Despite his leadership of the Vorarlberg Heimwehr (rightist paramilitary defense force), his allegiances were considered to be democratic and anti-Fascist. Ender was appointed chancellor of Austria in December 1930 and held office through six months of economic depression, marked notably by the collapse of the Creditanstalt, the most important Austrian banking house. Later, as minister without portfolio in the government of Engelbert Dollfuss, he supervised the drafting of a new federal authoritarian constitution (1933–34). He headed (1934–38) the Austrian supreme board of accountancy. Imprisoned by the Nazis after the *Anschluss* (Austria's incorporation into Germany in 1938), he was later interned at Dachau, Ger., and finally released during the Allied liberation (1945).

Enderby Land, region of Antarctica, bordering on the Indian Ocean and extending from Prince Olav Coast of Queen Maud Land (west) to Edward VIII Bay and Kemp Coast (east). Primarily a barren, ice-capped plateau in the interior sections, it rises to rugged peaks along the coast, where the Napier Mountains exceed 7,400 feet (2,260 m). The English navigator John Biscoe, sailing for Enderby Brothers, a London whaling firm, discovered the coast in 1831 and named it for his employers. Enderby Land, claimed by Australia, is the site of a research station opened by the Soviet Union in 1963.

Enders, John Franklin (b. Feb. 10, 1897, West Hartford, Conn., U.S.—d. Sept. 8, 1985, Waterford, Conn.), American virologist and microbiologist who, with Frederick C. Robbins and Thomas H. Weller, was awarded the Nobel Prize for Physiology or Medicine for 1954 for his part in cultivating the poliomyelitis virus in nonnervous-tissue cultures, a preliminary step to the development of the polio vaccine.

Enders was a student of English literature at Harvard University (M.A., 1922) before he turned to bacterial studies there (Ph.D., 1930). His early researches contributed new and basic knowledge to problems of tuberculosis, pneumococcal infections, and resistance to bacterial diseases. In 1929 he joined the Harvard faculty as an assistant in the department of bacteriology and immunology, later advancing to assistant professor (1935) and associate professor (1942) in the university's medical school.

In World War II he was a civilian consultant on infectious diseases to the U.S. War Department. From 1945 to 1949 he served the U.S. Army in a like capacity, with particular work on the mumps virus and rickettsial diseases. During this period Enders, with his coworkers Weller and Robbins, began research into new methods of producing in quantity the virus of poliomyelitis. Until that time the only effective method of growing the virus had been in the nerve tissue of living monkeys, and the vaccine thus produced had been proved dangerous to humans. The Enders–Weller–Robbins method of production, achieved in test tubes using cultures of nonnerve tissue from human embryos and monkeys, led to the development of the Salk vaccine for polio in 1954. Similarly, their production in the late 1950s of a vaccine against the measles led to the development of a licensed vaccine in the United States in 1963. Much of Enders' research on viruses was conducted at the Children's Hospital in Boston, where he had established a laboratory in 1946.

Endicott, John: *see* Endecott, John.

endive (*Cichorium endivia*), edible annual leafy plant of the family Asteraceae, variously believed to have originated in Egypt and Indonesia and cultivated in Europe since the 16th century. Its many varieties form two groups, the curly-leaved, or narrow-leaved, endive (*crispa*), and the Batavian, or broad-leaved, endive (*latifolia*). The former is mostly used for salads, the latter for cooking.

The plant requires a rich, light, well-drained, unshaded soil. When sown late in the season, it behaves as a biennial. About three months after sowing, the plant's outer leaves are tied together or are covered, to exclude light. This prevents the development of the natural bitter taste. This bleaching process takes 10 days to 4 weeks.

Endlicher, Stephan (Ladislaus) (b. June 24, 1804, Pressburg, Hung. [now Bratislava, Czech.]—d. March 28, 1849, Vienna), Austrian botanist who formulated one of the three major systems of plant classification representative of more than 24 taxonomies comprising the "parade of systems" that dominated mid-19th-century plant study.

Although Endlicher's system was based on erroneous ideas concerning the modes of growth of different types of plant life, it included a relatively modern approach to the classification of certain lower vascular plant families and was widely adopted on the European continent for a time; his *Genera Plantarum Secundum Ordines Naturales Disposita* (1836–40; "Plant Genera Arranged According to a Natural Order"), in which he presented his system dividing the plant kingdom into thallophytes (including the algae, fungi, and lichens) and cormophytes (including the mosses, ferns, and seed plants), remained a valuable descriptive index to plant families and genera for more than a half century.

Endlicher, lithograph by J. Höfelich after a portrait by Josef Kriehuber

By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

Turning from the study of theology to natural history and medicine at the universities of Budapest and Vienna (M.D., 1840), Endlicher in 1836 became curator of the Vienna Museum of Natural History, to which he donated his herbarium of 30,000 specimens. While reorganizing the museum's botanical collections, he wrote the *Genera Plantarum,* treating 6,835 genera (6,285 of vascular plants). He was appointed professor of botany at the University of Vienna in 1840.

Having exhausted his modest resources buying botanical collections and books and publishing his own and others' writings, Endlicher committed suicide.

Endō Shūsaku (b. March 27, 1923, Tokyo), one of the major contemporary Japanese novelists, notable for his examination of the relationship between East and West through a unique Christian perspective.

Endō became a Roman Catholic at age 11, with the encouragement of his mother and an aunt. He graduated from Keio University (B.A., 1949) with a major in French literature, a subject he studied from 1950 to 1953 at the University of Lyon in Lyon, France. His first collections of fiction, *Shiroi hito* and *Kiiroi hito* (both 1955; "White Man" and "Yellow Man"), indicate the direction that most of his later fiction was to take: they contrast Japanese and Western experience and perspectives. In *Umi to dokuyaku* (1957; *The Sea and Poison*), he examines the Japanese sense of morality through his recounting of a war story about Japanese doctors performing a vivisection on a downed American pilot. One of Endō's most powerful novels, *Chimmoku* (1966; *Silence*), is a fictionalized account of Portuguese priests who traveled to Japan and the subsequent slaughter of their Japanese converts. This novel and *Samurai* (1980; *The Samurai*)—a fascinating account of a samurai's journey on behalf of his shogun to open trade with Mexico, Spain, and Rome—are considered to be his best writing, showing the complexities of the interactions between cultures as well as presenting a supple and well-told narrative.

Endō's other extended works of fiction include *Kazan* (1959; *Volcano*), *Kuchibue o fuku toki* (1974; *When I Whistle*), and a number of comic novels; he also wrote short stories, drama, essays, and a biography. Endō also was president of the Japanese branch of PEN, an international literary guild.

endocarditis, inflammation of the heart lining, or endocardium. The inflammation may be associated with a noninfectious disease or may be caused by infection with any of a number of organisms, including bacteria and fungi. The site of the infection is usually the lining of the heart valves. Traditionally, infective endocarditis was classified as acute or subacute; more recently it has been classified by causative organism. The variety traditionally identified as acute usually results from severe infection with a well-known disease organism, such as *Staphylococcus aureus* (which is responsible for boils and abscesses) or *Neisseria gonorrhoeae* (the gonorrhea organism). This form of infectious endocarditis develops rapidly, with fever, sweating, chills, pain in and swelling of the joints, weakness, loss of appetite and weight, visual disturbances, recurrent nosebleeding, frequent bruising, symptoms of heart failure, and a general feeling of ill health. Clumps of bacteria may break loose from the valve and enter the circulation, blocking the blood flow at some point. Petechiae, minute specks of colour from the bleeding of small blood vessels, may appear in the skin, in the mucous membrane lining the mouth or the throat, or in the conjunctivas. "Subacute"—or chronic—endocarditis is usually caused by bacteria that do not cause disease except in tissues that are already weakened; thus, the chronic form may attack hearts weakened by congenital defects or previous infection. Bacterial endocarditis is usually treated by long-continued administration of bactericidal antibiotics, particularly some form of penicillin.

Nonbacterial thrombotic endocarditis is an inflammation of unknown cause marked by the growth of blood clots along the closure lines of the heart valves. Symptoms include nosebleeds, bleeding of the gums, pain in the joints, fever, and a heart murmur during systole (heart contraction). Endocarditis may also be a feature of systemic lupus erythematosus, a disease of unknown cause that affects the connective tissues and may invade any organ of the body.

endocrine system, group of ductless glands that regulate body processes by their secretion of chemical substances called hormones, which are carried to specific target organs and tissues by the bloodstream.

A brief treatment of endocrine systems follows. For full treatment, *see* MACROPAEDIA: Endocrine Systems.

For a depiction of some of the structures that make up the human endocrine system, shown in relation to other parts of the gross anatomy, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

Hormones are necessary for normal growth and development, for reproduction, and for homeostasis (a constant internal environment). They stimulate or inhibit various biochemical processes by combining with specific receptors on the membranes of target organs. Thus, although a hormone circulates in the bloodstream, it does not affect every cell with which it comes in contact but only those cells that contain a specific receptor site.

The major endocrine glands in humans are the hypothalamus, the pituitary, the thyroid, the islets of Langerhans in the pancreas, the adrenals, the parathyroids, the ovaries, and the testes. Almost every other organ or tissue of the body—including the intestinal tract, the stomach, and the heart—has been found to be involved in endocrine secretions. In the muscle cells of vertebrate hearts, for example, there are bodies that release a hormone that affects the regulation of blood pressure, blood volume, and the salt-and-water balance. Tumours may be sites of hormonal secretions.

Hormonal secretions are generally regulated by negative-feedback loops. In the simple loops, the concentration of another hormone or a metabolite (such as calcium) influences sensitive regulators in an endocrine gland to inhibit or stimulate hormonal secretions in the target organ. The complex loops involve a mechanism called the hypothalamo-pituitary-target organ axis, in which the hypothalamus secretes releasing hormones that stimulate the pituitary to secrete a target hormone, which then enters the circulation and binds with the receptors of the target organ.

Because the hypothalamus is an integral part of the brain and central nervous system, and because it is involved in negative-feedback loops in the endocrine system, the hypothalamus forges a critical link between the body's two control systems—the nervous system and the endocrine system. In addition, stimulation by the autonomic (involuntary) nervous system partly regulates the adrenal medulla and pancreas, and the two systems are again linked. The interrelationship of the two systems provides an opportunity for the body to respond to changes in the internal or external environments.

Diseases of the endocrine system result from too much or too little hormone secretion or from the inability of the body to utilize a hormone effectively. Growth hormone, for example, is an anterior pituitary secretion that is necessary for normal growth in children. An excess of this hormone during childhood can lead to gigantism; a deficiency, on the other hand, can result in dwarfism.

One of the most common—and serious—endocrine diseases is diabetes mellitus. In its severest form, which usually begins during childhood or adolescence, diabetes results from insufficient production of the pancreatic hormone insulin. A milder form of the disease, which usually strikes middle-aged adults who are overweight and sedentary, results from an inability to utilize insulin effectively. *See also* hormone.

endocrinology, medical discipline dealing with the role of hormones and other biochemical mediators in regulating bodily functions and with the treatment of imbalances of these hormones. Although some endocrine diseases, such as diabetes mellitus, have been known since antiquity, endocrinology itself is a fairly recent medical field, depending as it does on the recognition that body tissues and organs secrete chemical mediators directly into the bloodstream to produce distant effects.

Friedrich Henle in 1841 was the first to recognize "ductless glands," glands that secrete their products into the bloodstream and not into specialized ducts. In 1855 Claude Bernard distinguished the products of these ductless glands from other glandular products by the term "internal secretions," the first suggestion of what was to become the modern hormone concept.

The first endocrine therapy was attempted in 1889 by Charles Brown-Séquard, who used extracts from animal testes to treat male aging; this prompted a vogue in "organotherapies" that soon faded but that led to adrenal and thyroid extracts that were the forerunners of modern cortisone and thyroid hormones. The first hormone to be purified was secretin, which is produced by the small intestine to trigger the release of pancreatic juices;

it was discovered in 1902 by Ernest Starling and William Bayliss. Starling applied the term "hormone" to such chemicals in 1905, proposing a chemical regulation of physiological processes operating in conjunction with nervous regulation; this essentially was the beginning of the field of endocrinology.

The early years of this century saw the purification of a number of other hormones, often leading to new therapies for patients affected by hormonal disorders. In 1914 Edward Kendall isolated thyroxine from thyroid extracts; in 1921 Frederick Banting and Charles Best discovered insulin in pancreatic extracts, immediately transforming the treatment of diabetes; and in 1929 Edward Doisy isolated an estrus-producing hormone in the urine of pregnant females.

The availability of nuclear technology after World War II also led to new treatments for endocrine disorders, notably the use of radioactive iodine to treat hyperthyroidism, greatly reducing the need for thyroid surgery. Combining radioactive isotopes with antibodies against hormones, Rosalyn Yalow and S.A. Berson in 1960 discovered the basis for radioimmunoassays, which enable endocrinologists to determine with great sensitivity minute amounts of hormone, permitting the early diagnosis and treatment of endocrine disorders. These assays have become increasingly important in the late 20th century.

endoderm, the innermost of the three germ layers, or masses of cells (lying within ectoderm and mesoderm), which appears early in the development of an animal embryo. The endoderm subsequently gives rise to the epithelium (tissue that covers, or lines, a structure) of the pharynx, including the eustachian tube, the tonsils, the thyroid gland, parathyroid glands, and thymus gland; the larynx, trachea, and lungs; the gastrointestinal tract (except mouth and anus), the urinary bladder, the vagina (in females), and the urethra. The term endoderm is sometimes used to refer to the gastrodermis, the simple tissue that lines the digestive cavity of cnidarians and ctenophores. *Compare* ectoderm; mesoderm.

endodontics, in dentistry, diagnosis, treatment, and prevention of diseases of the dental pulp and the surrounding tissues. (The dental pulp is soft tissue in the centre of the tooth; it contains the nerve, blood and lymphatic vessels, and connective tissue.)

The practice of endodontics is concerned primarily with the removal of diseased dental pulp and its replacement with filling material, an operation known as root canal therapy. After the pulp is removed, the tooth continues to be nourished by connecting blood vessels in the jaw. The tooth is then considered to be dead, although the fibres that hold the teeth in the jawbone are alive.

Operations on the pulp are performed with the aid of local anesthesia. Preservation of the natural tooth in this manner serves both appearance and utility; a natural tooth implanted in the jaw maintains the integrity of the dental arch and can withstand about 10 times more pressure than can artificial teeth.

endogamy (kinship): *see* exogamy and endogamy.

endometriosis, disorder of the female reproductive system characterized by the growth of endometrial tissue in an abnormal location. This may occur in the uterus or elsewhere. The most common location of the implants of endometrial tissue are the ovaries; other areas and organs that are affected (in order of incidence) are uterosacral ligaments (thickened portions of the sheet of connective tissue covering the pelvic organs), the rectovaginal septum (the membrane dividing the rectum from the vagina), the sigmoid colon (that portion of the large intestine that leads into the rectum), the lower genital tract, the round ligaments of the uterus, and the peritoneum (membrane) lining the pelvis. Symptoms associated with this disease include (1) progressive, severe pain associated with menstruation or occurring just before it; (2) dyspareunia (painful intercourse); (3) painful defecation; (4) slight bleeding before menstruation and excessive flow during menstruation; (5) painful urination and blood in the urine; and (6) infertility. The treatment includes suppression of ovulation for 6 to 9 months by administration of hormones, and surgical treatment.

In the late 1980s researchers suggested that endometriosis was linked to relatively thin bones—by means of the circulation of an immune-system hormone that suppresses bone growth—and put women with endometriosis at higher risk for osteoporosis.

endomorph, a human physical type (somatotype) tending toward roundness, as determined by the physique classification system developed by American psychologist W.H. Sheldon. Although classification by the Sheldon system is not absolute, a person classed as an endomorph has a body type that is more endomorphic than ectomorphic or mesomorphic. The extreme endomorph has a body as nearly globular as humanly possible; he has a round head, a large, round abdomen, large internal organs relative to his size, rather short arms and legs with fat upper arms and thighs, but slender wrists and ankles. Under normal conditions the endormorphic individual has a great deal of body fat, but he is not simply a fat person; if starved, he remains an endomorph, only thinner. *Compare* ectomorph; mesomorph.

endoparasitic slime mold: *see* Plasmodiophoromycetes.

endoplasmic reticulum (ER), in biology, a complex system of membranous vesicles within the cytoplasm of a cell. Often it constitutes more than half the membrane of a cell. Endoplasmic reticulum has two functionally distinct forms: smooth (SER), which most notably synthesizes phospholipids and cholesterol, and rough (RER; so-called because of the ribosomes attached to its outer surface), which synthesizes and exports proteins and glycoproteins. *See also* cell.

Endor, Witch of, in the Old Testament (I Samuel 28:3–25), a female sorcerer who was visited by Saul, the first king of Israel. Although Saul had banished all sorcerers and conjurers from his kingdom, his concern about the final outcome of Israel's battle against the Philistines caused him to seek the services of someone with "a familiar spirit." When his servants told him of such a woman at Endor, he disguised himself and visited her that night. He asked her to conjure up the spirit of the prophet Samuel to tell his fortunes. When the woman reminded him of the law against practicing her art, he assured her that she would be protected. The woman accordingly conjured up a spirit identified by Saul as Samuel. The spirit informed Saul that he and his three sons would die in battle the next day and that the Israelites would fall to the Philistines.

The story of the Witch of Endor has excited the creative imagination through the ages and inspired further embellishment of her practices. Chaucer, for example, in the Friar's Tale of *Canterbury Tales,* speaks of her as a "pithonesse," and the 16th-century writer Guillaume du Bartas suggests in *La Semaine* that she used a "flambeau" made from the fat of her own son in the necromantic art.

endorphin, any of a group of opiate proteins with pain-relieving properties that are found naturally in the brain. The main substances identified as endorphins include the enkephalins, beta-endorphin and dynorphin, all discovered in the 1970s. Endorphins are distributed in characteristic patterns throughout the nervous system, with beta-endorphin found almost entirely in the pituitary gland.

Endorphins have been found to be clearly involved in the regulation of pain; even the analgesic effects of acupuncture treatments may be attributable to them. Such substances are also believed to have some relation to appetite control, the release of sex hormones through the pituitary, and the adverse effects of shock. There is strong evidence that endorphins are connected with "pleasure centres" in the brain. Knowledge about the behaviour of the endorphins and their receptors in the brain has implications for the treatment of opiate addictions and chronic pain disorders.

endoscopy, medical examination of the interior of the body, usually through a natural body opening, by the insertion of a lighted optical shaft or open tube. It is customarily performed with local anesthesia. Instruments used include the esophagoscope, a rigid pipe for examination of the esophagus; the bronchoscope, a similar pipe for examination of the bronchial tubes; and the gastroscope, a flexible lighted shaft for examination of the stomach. These are passed through the mouth into the respective organs. The examinations are usually performed in a hospital, but the patient ordinarily is dismissed immediately thereafter. The open-tube proctosigmoidoscope is passed through the anal orifice without anesthesia for examination of the rectum and lower colon and is a common office procedure. The cystoscope, a lighted rod, is passed through the urethra with local or general anesthesia for examination of the bladder.

Three endoscopic procedures require incisions for the introduction of the lighted shaft where natural openings do not exist. The thoracoscope permits examination (for suspected adhesions in patients with tuberculosis) of the chest cavity and surface of the lungs through a small incision between the ribs. The peritoneoscope allows examination of the abdominal cavity and lower surface of the liver and gallbladder through a small incision in the abdominal wall. The culdoscope permits examination of the female pelvic organs through a small vaginal incision.

The fibre-optic endoscope is a pliable, highly maneuverable instrument that allows access to channels in the digestive tract that were previously inaccessible to the older, semirigid instruments. Composed of multiple hairlike glass rods bundled together, this instrument can be more easily bent and twisted, and the intense light enables the endoscopist to see around corners as well as forward and backward. Accessories can be added that make it possible to obtain cell and tissue samples, excise polyps and small tumours, and remove foreign objects.

endosperm, tissue that surrounds and nourishes the embryo in the seed. In most flowering plants, endosperm cells contain not the usual two but three sets of chromosomes, resulting from fusion of two nuclei of the embryo sac with an accessory sperm nucleus from the pollen grain. In some seeds the endosperm has been completely absorbed at maturity (*e.g.,* pea and bean); in others, part is present until germination (*e.g.,* wheat, castor bean). In the coconut, the liquid endosperm (coconut "milk") contains important growth substances and is used in artificial culture of plant tissues. Endosperm accounts for the economic importance of cereal grains and oilseeds. The endosperm of *Phytelephas* (vegetable ivory) has a heavy deposit of mannan, a gum, and is used to make buttons and billiard balls.

endotoxin, toxic substance found inside a bacterial cell. Endotoxins are antigens consisting of complexes of proteins, polysaccharides,

and lipids. The protein component determines the antigen's quality of being recognized as foreign; the polysaccharide component determines what types of antibodies can react with the endotoxin molecule to produce an immune reaction. *See also* antitoxin.

Endre (Hungarian): *see* Andrew.

endrin, chlorine-containing organic compound used as an insecticide. *See* aldrin.

Endymion, in Greek mythology, a beautiful youth who spent much of his life in perpetual sleep. Endymion's parentage varies among the different ancient references and stories, but several traditions say that he was originally the king of Elis. According to one tradition, Zeus offered him anything that he might desire, and Endymion chose an everlasting sleep in which he might remain youthful forever. According to another version of the myth, Endymion's eternal sleep was a punishment inflicted by Zeus because he had ventured to fall in love with Zeus's wife, Hera. In any case, Endymion was loved by Selene, the goddess of the moon, who visited him every night while he lay asleep in a cave on Mount Latmus in Caria; she bore him 50 daughters. A common form of the myth represents Endymion as having been put to sleep by Selene herself so that she might enjoy his beauty undisturbed.

Endymion, in John Keats's long poem of that name (1818), is a shepherd and the lover of the goddess Diana. Written in heroic couplets, the poem was vigorously attacked by *Blackwood's Magazine* and the *Quarterly Review* when it first appeared, but it is now treasured for its magnificent lyric passages. It begins with the famous line "A thing of beauty is a joy for ever."

energy, in physics, the capacity for doing work. It may exist in potential, kinetic, thermal, electrical, chemical, nuclear, or other various forms. There are, moreover, heat and work—*i.e.,* energy in the process of transfer from one body to another. After it has been transferred, energy is always designated according to its nature. Hence, heat transferred may become thermal energy, while work done may manifest itself in the form of mechanical energy.

All forms of energy are associated with motion. For example, any given body has kinetic energy if it is in motion. A tensioned device such as a bow or spring, though at rest, has the potential for creating motion; it contains potential energy because of its configuration. Similarly, nuclear energy is potential energy because it results from the configuration of subatomic particles in the nucleus of an atom.

Energy can be converted from one form to another in various ways. Usable mechanical or electrical energy is, for instance, produced by many kinds of devices, including fuel-burning heat engines, generators, batteries, fuel cells, and magnetohydrodynamic systems.

Energy is treated in a number of articles in the MACROPAEDIA. For the development of the concept of energy and the principle of energy conservation, *see* Physical Science, Principles of; Mechanics; Thermodynamics, Principles of. For the major sources of energy and the mechanisms by which the transition of energy from one form to another occur, *see* Atoms; Fuels, Fossil; Electricity and Magnetism; Energy Conversion.

For a description of the place of energy in the circle of learning and for a list of both MACROPAEDIA and MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part One, Division II; Part Seven, Division II.

energy, conservation of, principle of physics according to which the energy of interacting bodies or particles in a closed system remains constant. The first kind of energy to be recognized was kinetic energy, or energy of motion. In certain particle collisions, called elastic, the sum of the kinetic energy of the particles before collision is equal to the sum of the kinetic energy of the particles after collision. The notion of energy was progressively widened to include other forms. The kinetic energy lost by a body slowing down as it travels upward against the force of gravity was regarded as being converted into potential energy, or stored energy, which in turn is converted back into kinetic energy as the body speeds up during its return to Earth. So the sum of the kinetic and the potential energy of, say, a satellite or a freely swinging pendulum is constant or nearly so. Friction, however, slows down the most carefully constructed mechanisms, thereby dissipating their energy gradually. During the 1840s it was conclusively shown that the notion of energy could be extended to include the heat that friction generates. The truly conserved quantity is the sum of kinetic, potential, and thermal energy. This version of the conservation-of-energy principle, expressed in its most general form, is the first law of thermodynamics. The conception of energy continued to expand to include energy of an electric current, energy stored in an electric or a magnetic field, and energy in fuels and other chemicals.

With the advent of relativity physics (1905), mass was first recognized as equivalent to energy. The total energy of a system of high-speed particles includes not only their rest mass but also the very significant increase in their mass as a consequence of their high speed. After the discovery of relativity, the energy-conservation principle has alternatively been named the conservation of mass-energy or the conservation of total energy.

When the principle seemed to fail, as it did when applied to the type of radioactivity called beta decay (spontaneous electron ejection from atomic nuclei), physicists accepted the existence of a new subatomic particle, the neutrino, that was supposed to carry off the missing energy rather than reject the conservation principle. Later, the neutrino was experimentally detected.

Energy conservation, however, is more than a general rule that persists in its validity; it can be shown to follow mathematically from the uniformity of time. If one moment of time were peculiarly different from any other moment, identical physical phenomena occurring at different moments would require different amounts of energy, so that energy would not be conserved.

energy, equipartition of, law of statistical mechanics stating that, in a system in thermal equilibrium, on the average, an equal amount of energy will be associated with each independent energy state. Based on the work of physicists James Clerk Maxwell of Scotland and Ludwig Boltzmann of Germany, this law states specifically that a system of particles in equilibrium at absolute temperature T will have an average energy of $\frac{1}{2}kT$ associated with each degree of freedom (*see* freedom, degree of), in which k is the Boltzmann constant. In addition, any degree of freedom contributing potential energy will have another $\frac{1}{2}kT$ associated with it. For a system of s degrees of freedom, of which t have associated potential energies, the total average energy of the system is $\frac{1}{2}(s+t)kT$.

For example, an atom of a gas has three degrees of freedom (the three spatial, or position, coordinates of the atom) and will, therefore, have an average total energy of $\frac{3}{2}kT$. For an atom in a solid, vibratory motion involves potential energy as well as kinetic energy, and both modes will contribute a term $\frac{1}{2}kT$, resulting in an average total energy of $3kT$.

energy state, also called ENERGY LEVEL, in physics, any discrete value from a set of values of total energy for a subatomic particle confined by a force to a limited space or for a system of such particles, such as an atom or a nucleus. A particular hydrogen atom, for example, may exist in any of several configurations, each having a different energy. These energy states, in their essentials, remain fixed and are referred to as stationary states.

The state of a hydrogen atom, or any submicroscopic system, however, may change from one configuration to another by emitting or absorbing a discrete amount of energy. Such configurations are also called energy levels; the atom, or system, is said to undergo a transition between two energy levels when it emits or absorbs energy. The lowest energy level of a system is called its ground state; higher energy levels are called excited states. *See also* Franck–Hertz experiment.

Enesco, Georges, Romanian GEORGE ENESCU (b. Aug. 19, 1881, Liveni, near Dorohoi, Rom.—d. May 4, 1955, Paris), violinist and composer, known for his interpretations of Bach and his works in a Romanian national style.

At age seven Enesco went to the Vienna Conservatory, where he studied violin. In 1894 he became acquainted with Johannes Brahms, whose formal symphonic developments he later took as a model. In 1895 he went to Paris, where he studied composition and violin. In 1898 his *Poème roumain* was played in Paris, and in 1899 he won the first prize for violin at the Paris Conservatory. He then began his career as a virtuoso violinist and became widely known for his interpretations of Bach. He was also known as a conductor.

Enesco's chamber works include three violin sonatas (the last in the popular Romanian style), three piano sonatas, and two string quartets. Among his orchestral works are three symphonies, two Romanian rhapsodies, and an overture on Romanian folk themes. National themes are also used in his opera *Oedipe* (Paris Opéra, 1936). In his later years he became the leader of the Romanian school of composers. He was also greatly respected as a violin teacher.

Enewetak, also spelled ENIWETOK, atoll, northwestern end of the Ralik chain, Republic of the Marshall Islands, in the western Pacific Ocean. Circular in shape (50-mile [80-kilometre] in circumference), it comprises 40 islets around a lagoon 23 miles (37 km) in diameter. During World War II it was captured from the Japanese by U.S. forces (February 1944), and its fine anchorage was made into a naval base. Its inhabitants were evacuated to other atolls after it was designated, with Bikini atoll, a testing ground for atomic weapons. Tests were held in 1948, 1951, 1952, 1954, and 1956. In 1980, after the island's contaminated topsoil was removed, Enewetak was declared decontaminated, and its people were given an opportunity to return. Their first crops grown were found to be too badly contaminated, and, as at Bikini atoll, the people had to be removed again. Pop. (1985 est.) 88.

Enfantin, Barthélemy-Prosper (b. Feb. 8, 1796, Paris—d. Sept. 1, 1864, Paris), eccentric French social, political, and economic theorist, a leading member of the St. Simonian movement who had a substantial impact on economic and technological innovation in 19th-century France.

After studies at the École Polytechnique, Enfantin traveled widely and frequented secret societies in Paris. When introduced to the social reformer Claude-Henri de Rouvroy St. Simon (1825), he quickly became one of his most ardent followers and helped organize *Le Globe,* an important forum for St. Simonian ideas.

After the death of St. Simon (May 1825), Enfantin and St. Amand Bazard emerged as the two *pères suprêmes* ("supreme fathers")

Enfantin, detail of a portrait by an unknown artist, 19th century
By courtesy of the Bibliotheque Nationale, Paris

of what began to take the characteristics of a religious movement. They broke in 1831, for Bazard favoured the formation of a political movement, while Enfantin envisioned an apolitical moral and social revolution. Enfantin, often called "Père Enfantin," and his followers formed a model community at Ménilmontant (1832); but the "Père" was imprisoned soon after for sponsoring an illicit secret society and encouraging practices contrary to public morality.

Upon his release, Enfantin and some disciples journeyed to Egypt in search of the eternal *mère suprême* ("supreme mother"). At the same time, they hoped to begin construction of a canal linking the Mediterranean and Red Seas (1837). Failing both, he returned to Paris (1837), and in recognition of his undeniable technical talents, he was appointed to the Scientific Commission on Algeria.

Throughout his life, Enfantin was a prolific writer. In 1829 he published *Doctrine de St. Simon* and in 1831 *Religion Saint-Simonienne. Économie politique et politique* ("St. Simonian Religion. Political Economy and Politics"). This was followed by *Correspondance politique* (1835–40), *Correspondance philosophique et religieuse* (1843–45), and *Colonisation de l'Algérie* (1843). Shortly before his death he wrote *La Vie eternelle, passée, présente, future* (1861), a kind of spiritual testament. In addition, a 47-volume edition of the combined works of St. Simon and Enfantin was published (1865–78).

In 1845, thanks largely to the influence of friends and former students who were now playing an important role in the economic development of France, Enfantin was invited to join in the formation of the new Lyon Railroad Company. He quickly became its first director and leading light. Continuing to be an influential voice in technical and fiscal planning, he was one of the first to advocate the creation of the Crédit Foncier, a government promoted bank designed to offer capital at reduced interest rates for socially productive activity.

Enfants sans Souci (French: Carefree Children), one of the largest of the *sociétés joyeuses* of medieval France, an association of the merchants, craftsmen, and students of Paris, founded for the purpose of staging theatrical entertainments and other amusements. Such societies are thought to be descended from the earlier Feast of Fools (*q.v.*), a holiday of the lower clergy that was suppressed in the late Middle Ages.

The members of Enfants sans Souci, who performed in the traditional jester's costume of cap and bells and called themselves *sots* ("fools"), marched in comic processions through the streets on holidays and performed satirical farces and morality plays in the public squares. A number of their leaders, who bore the title of "Prince of Fools," or "Mother Fool," were talented and popular performers, who both wrote and acted in farces. The organization, along with most of the other societies and confraternities that engaged in theatrical activities, gradually died out by the early part of the 17th century.

Enfield, outer borough of Greater London, on its northern perimeter, covering 31 sq mi (55 sq km). The eastern part of the borough lies on the low ground of the Lea Valley; the western part is higher and includes the undulating farmland and parkland of Enfield Chase in London's Greenbelt. Two main traffic arteries, the radial A10 (Cambridge) road and North Circular Road, cross the borough and are lined with consumer-goods industries. The earlier developed (and canalized) River Lea Navigation is lined with timber industries.

The New River, constructed to supply water from Hertfordshire to Clerkenwell, London (1613), remains a scenic element in the modern district. Forty Hall, a large house now preserved as a museum, was built in the 18th

South wall of the Forty Hall in Enfield, London
A.F. Kersting

century. Faster residential growth in Edmonton and Southgate followed the introduction of cheap workingmen's fares on the suburban railways in the 1870s. Besides consumer goods industries, there are engineering plants together with the well-known royal small arms factory that produced the Enfield series of rifles. By the 1970s the Lea Valley itself was being transformed from an industrial wasteland and rubbish tip into London's first regional park. Pop. (1982 est.) 262,100.

Enfield, town (township), Hartford County, northern Connecticut, U.S., on the Connecticut River at the Massachusetts border. It includes the industrial subdivisions of Thompsonville and Hazardville. The area was first settled by a group from Salem, Mass., in 1680 and was named for Enfield, Eng. Because of a surveyor's error in 1683, it was considered to be in Massachusetts. After a long boundary dispute, it was annexed to Connecticut in 1749, but it was not until 1804 that the boundary was finally established. The carpet industry begun by Orrin Thompson *c.* 1828 at Thompsonville and expanded by a series of mergers, has long been the economic mainstay. The gunpowder industry, developed by Col. A.G. Hazard (1833), was another early enterprise. Asuntuck Community College was opened (1972) in Enfield. Pop. (1980) 42,695.

Enga, province (established in 1978), west central Papua New Guinea, in the southwestern Pacific. It has an area of 4,900 sq mi (12,800 sq km) and was separated from the Western Highlands district in 1973. Located northeast of the Southern Highlands province, Enga comprises the western half of the central plateaus. It is bounded by the provinces of East Sepik on the north, Madang on the northeast, and Western Highlands on the east. The province consists of rugged mountains and high-altitude valleys. The Schrader Range rises in the northeast, and Mt. Hagen in the southeast has a height of 12,392 ft (3,777 m). Enga is drained by rapidly flowing rivers, the main one being the Lai and Lagaip. The landscape is marked by wide swaths burned through the forest cover by Papuan hunters in search of small game. The resulting deforestation has extended the areas of grassland dominated by rice grass. Although there were early trade routes from the area south to the Gulf of Papua, the first extended contact with Europeans (from Australia) occurred in 1938. Today, roads link Wabag, the provincial headquarters, with Porgera, location of alluvial gold mines, to the west and with Lae, a port on Huon Gulf, to the southeast. Coffee, vegetables (particularly potatoes), and pyrethrum (used in insecticides) are the principal cash crops. The province has airstrips near many of the towns. Pop. (1984 est.) 174,900.

Engadin (German), French ENGADINE, Italian ENGADINA, Romansh ENGIADINA, Swiss portion of the upper Inn (Romansh En) River valley, in Graubünden canton, extending about 60 mi (100 km) from the Inn's source near the Maloja Pass (5,955 ft [1,815 m]) northeast to Finstermünz (3,621 ft), near the Austrian border. It is bounded on the south by the Bernina Alps and on the north by the Albula and Silvretta groups. The valley is divided both administratively and geographically (at the Zernez Gorge) into Upper and Lower Engadin.

There are traces of Bronze Age settlement in the valley. As part of the Roman province of Raetia, it was thoroughly Romanized. During the 4th and 5th centuries territorial sovereignty passed to the bishops of Chur (Coire). The bishop later became a prince of the Holy Roman Empire and allied himself with the Habsburgs. Lower Engadin, not entirely an ecclesiastical domain, was in the 8th century assigned by Charlemagne to the counts of Toggenburg and was absorbed into what came to be known as the county of Tirol, which passed to the Habsburgs in 1363. The Raetian leagues were formed and joined with the Gotteshausbund in 1471 to curtail the power of the Habsburgs. Lower Engadin officially achieved independence with the defeat of the Habsburgs in the battle at Calven Gorge in 1499, but this was not secured until 1652. The Engadin was included in Raetia canton of the Helvetic Republic (1801–03) and in Graubünden canton after 1803.

Because of high elevation the scenery of the Upper Engadin is stark, with no tillage; firs and larches flourish, and the Alpine flora is rich and varied. The chief resources are hay meadows, pastures, and forests. In Lower Engadin tillage is more varied, and grain is grown. There are important reserves of waterpower. Tourism is a major industry. The mineral spring of Sankt Moritz has been famous for centuries, and the Upper Engadin, including the villages of Sils-Maria (with the Friedrich Nietzsche house) and Pontresina, became fashionable in the 19th century as an "air cure" and winter-sports centre. Lower Engadin has two major tourist attractions: the mineral springs of Scuol, below Tarasp, and the Swiss National Park, a wildlife sanctuary.

Because Tarasp remained in the hands of the Habsburgs until 1803, its inhabitants adhered to Roman Catholicism. Easier communications with the Tirol caused Samnaun to adopt Catholicism and German speech. The upper Spöl Valley (Livigno) is Italian speaking. The population is primarily, however, Protestant and Romansh speaking.

Engano (Indonesia): *see* Enggano Island.

Engelbrekt ENGELBREKTSSON (b. *c.* 1390—d. May 1436, near Örebro, Swed.), Swedish national hero who led a 15th-century rebellion

against Erik of Pomerania, king of the united realms of Denmark, Norway, and Sweden.

Of German origin, Engelbrektsson was a mine owner of the petty nobility from the Bergslagen area of Sweden. When, in the summer of 1434, the Bergslagen miners and peasants rose against the economically ruinous and unconstitutional policies of the absolutist Erik, they chose Engelbrekt as their leader. The early successes of Engelbrekt's forces against Erik's troops encouraged the nobles and clergy to join the rebellion, "Engelbrekt's Feuds," and transform it into a truly national struggle. A truce in November 1434 led to an agreement early in 1435 calling for a return to the pre-rebellion status quo. Although Erik promised to respect Sweden's constitutional rights, it shortly became clear that he had acted in bad faith. When renewed war was decided upon, Engelbrekt, in January 1436, again led his forces against the King's forts, taking Stockholm almost immediately. In the meantime, however, the Swedish nobles had begun to quarrel, and in May 1436 Magnus Bengtsson, an enemy of Engelbrekt, slew him.

The rebels' loss enabled Erik to gain his former position. Continuing discontent, however, and the appeal to the memory of Engelbrekt, whose death had made him a national hero, gave the Swedes the strength necessary to depose Erik by the summer of 1439.

Engelmann, George (b. Feb. 2, 1809, Frankfurt am Main—d. Feb. 4, 1884, St. Louis, Mo., U.S.), U.S. botanist, physician, and meteorologist who is known primarily for his botanical monographs, especially one on the cactus and also *A Monography of North American Cuscutinae* (1842).

Engelmann studied at the universities of Heidelberg and Berlin and received his M.D. degree from the University of Würzburg in 1831. His illustrated thesis, *De Antholysi Prodromus,* was an important study of the morphology of monstrosities. He went to the United States in 1833, and in 1835 he settled in St. Louis, where he became a leading physician. Continuing his studies in biology, he pointed out the adaptation of the pronuba moth for pollinating yuccas and made the economically important discovery of the immunity of the North American grape to the plant lice *Phylloxera.* His systematic meteorological observations, begun in 1836, were a pioneering effort that he continued until his death. Much of his work was assembled in *The Botanical Works of the Late George Engelmann Collected for Henry Shaw* (1887).

Engels, city, Saratov *oblast* (administrative region), Russian Soviet Federated Socialist Republic, on the left bank of the Volga River, opposite Saratov, to which it is connected by a highway bridge (completed 1965). Founded in 1747 as Pokrovskaya *sloboda* (military settlement), the city was the capital of the former Volga-German Republic from 1922 to 1941, being renamed Engels in 1931. It is the main trolley bus manufacturing centre in the U.S.S.R. and also produces artificial fibres, rolling stock, and diesel motors. Local agricultural products, especially meat, are processed there. Many workers commute to Saratov. Pop. (1983 est.) 173,000.

Engels, Friedrich (b. Nov. 28, 1820, Barmen, Rhine Province, Prussia—d. Aug. 5, 1895, London), German Socialist philosopher, the closest collaborator of Karl Marx in the foundation of modern Communism. They co-authored the *Communist Manifesto* (1848), and Engels edited the second and third volumes of *Das Kapital* after Marx's death.

Early life. Engels grew up in the environment of a family marked by moderately liberal

Engels, detail of a portrait by H. Schey
Novosti Press Agency

political views, a steadfast loyalty to Prussia, and a pronounced Protestant faith. His father was the owner of a textile factory in Barmen and also a partner in the Ermen & Engels cotton plant in Manchester, Eng. Even after Engels openly pursued the revolutionary goals that threatened the traditional values of the family, he usually could count on financial aid from home. The influence of his mother, to whom he was devoted, may have been a factor in preserving the tie between father and son.

Aside from such disciplinary actions as the father considered necessary in rearing a gifted but somewhat rebellious son, the only instance in which his father forced his will on Engels was in deciding upon a career for him. Engels did attend a *Gymnasium* (secondary school), but he dropped out a year before graduation, probably because his father felt that his plans for the future were too undefined. Engels showed some skill in writing poetry, but his father insisted that he go to work in the expanding business. Engels, accordingly, spent the next three years (1838–41) in Bremen acquiring practical business experience in the offices of an export firm.

In Bremen, Engels began to show the capacity for living the double life that characterized his middle years. During regular hours, he operated effectively as a business apprentice. An outgoing person, he joined a choral society, frequented the famed *Ratskeller,* became an expert swimmer, and practiced fencing and riding (he outrode most Englishmen in the fox hunts). Engels also cultivated his capacity for learning languages; he boasted to his sister that he knew 24. In private, however, he developed an interest in liberal and revolutionary works, notably the banned writings of "Young German" authors such as Ludwig Börne, Karl Gutzkow, and Heinrich Heine. But he soon rejected them as undisciplined and inconclusive in favour of the more systematic and all embracing philosophy of Hegel as expounded by the "Young Hegelians," a group of leftist intellectuals, including the theologian and historian Bruno Bauer and the anarchist Max Stirner. They accepted the Hegelian dialectic—basically that rational progress and historical change result from the conflict of opposing views, ending in a new synthesis. The Young Hegelians were bent on accelerating the process by criticizing all that they considered irrational, outmoded, and repressive. As their first assault was directed against the foundations of Christianity, they helped convert an agnostic Engels into a militant atheist, a relatively easy task since by this time Engels' revolutionary convictions made him ready to strike out in almost any direction.

In Bremen, Engels also demonstrated his talent for journalism by publishing articles under the pseudonym of Friedrich Oswald, perhaps to spare the feelings of his family. He possessed pungent critical abilities and a clear style, qualities that were utilized later by Marx in articulating their revolutionary goals.

After returning to Barmen in 1841, the question of a future career was shelved temporarily when Engels enlisted as a one-year volunteer in an artillery regiment in Berlin. No antimilitarist disposition prevented him from serving commendably as a recruit; in fact, military matters later became one of his specialties. In the future, friends would often address him as "the general." Military service allowed Engels time for more compelling interests in Berlin. Though he lacked the formal requirements, he attended lectures at the university. His Friedrich Oswald articles gained him entrée into the Young Hegelian circle of The Free, formerly the Doctors Club frequented by Karl Marx. There he gained recognition as a formidable protagonist in the philosophical battles, mainly directed against religion.

Conversion to communism. After his discharge in 1842, Engels met Moses Hess, the man who converted him to communism. Hess, the son of wealthy Jewish parents and a promoter of radical causes and publications, demonstrated to Engels that the logical consequence of the Hegelian philosophy and dialectic was communism. Hess also stressed the role that England, with its advanced industry, burgeoning proletariat, and portents of class conflict, was destined to play in future upheavals. Engels eagerly seized the opportunity to go to England, ostensibly to continue his business training in the family firm in Manchester.

In England (1842–44), Engels again functioned successfully in business. After hours, however, he pursued his real interests: writing articles on communism for continental and English journals, reading books and parliamentary reports on economic and political conditions in England, mingling with workers, meeting radical leaders, and gathering materials for a projected history of England that would stress the rise of industry and the wretched position of the workers.

In Manchester, Engels established an enduring attachment to Mary Burns, an uneducated Irish working girl, and, though he rejected the institution of marriage, they lived together as husband and wife. In fact, the one serious strain in the Marx–Engels friendship occurred when Mary died in 1863 and Engels thought that Marx responded a little too casually to the news of her death. In the future, however, Marx made a point of being more considerate, and, when Engels later lived with Mary's sister Lizzy, on similar terms, Marx always carefully closed his letters with greetings to "Mrs. Lizzy" or "Mrs. Burns." Engels finally married Lizzy, but only as a deathbed concession to her.

In 1844 Engels contributed two articles to the *Deutsch-Französische Jahrbücher* ("German-French Yearbooks"), which were edited by Marx in Paris. In them Engels put forth an early version of the principles of scientific socialism. He revealed what he regarded as the contradictions in liberal economic doctrine and set out to prove that the existing system based on private property was leading to a world made up of "millionaires and paupers." The revolution that would follow would lead to the elimination of private property and to a "reconciliation of humanity with nature and itself."

Partnership with Marx. On his way to Barmen, Engels went to Paris for a 10-day visit with Marx, whom he had earlier met in Cologne. This visit resulted in a permanent partnership to promote the socialist movement. Back in Barmen, Engels published *Die Lage der arbeitenden Klasse in England* (1845; *The Condition of the Working Class in England in 1844,* 1887), a classic in a field that later became Marx's specialty. Their first

major joint work was *Die deutsche Ideologie* (1845; *The German Ideology,* 1938), which, however, was not published until more than 80 years later. It was a highly polemical critique that denounced and ridiculed certain of their earlier Young Hegelian associates and then proceeded to attack various German socialists who rejected the need for revolution. Marx's and Engels' own constructive ideas were inserted here and there, always in a fragmentary manner and only as corrective responses to the views they were condemning.

Upon rejoining Marx in Brussels in 1845, Engels endorsed his newly formulated economic, or materialistic, interpretation of history, which assumed an eventual communist triumph. That summer he escorted Marx on a tour of England. Thereafter he spent much time in Paris, where his social engagements did not interfere significantly with his major purpose, that of attempting to convert various émigré German worker groups—among them a socialist secret society, the League of the Just—as well as leading French socialists to his and Marx's views. When the league held its first congress in London in June 1847, Engels helped bring about its transformation into the Communist League.

Marx and he together persuaded a second Communist Congress in London to adopt their views. The two men were authorized to draft a statement of Communist principles and policies, which appeared in 1848 as the manifest der *kommunistischen Partei* (commonly known as *Communist Manifesto*). It included much of the preliminary definition of views prepared earlier by Engels in the *Grundsätze des Kommunismus* (1847; *Principles of Communism,* 1925) but was primarily the work of Marx.

The Revolution of 1848, which was precipitated by the attempt of the German states to throw off an authoritarian, almost feudal, political system and replace it with a constitutional, representative form of government, was a momentous event in the lives of Marx and Engels. It was their only opportunity to participate directly in a revolution and to demonstrate their flexibility as revolutionary tacticians with the aim of turning the revolution into a Communist victory. Their major tools were the *Neue Rheinische Zeitung, Organ der Demokratie,* which Marx edited in Cologne with the able assistance of Engels. Such a party organ, then appearing in a democratic guise, was of prime importance for their purposes; with it they could furnish daily guidelines and incitement in the face of shifting events, together with a sustained criticism of governments, parties, policies, and politicians.

After the failure of the revolution, Engels and Marx were reunited in London, where they reorganized the Communist League and drafted tactical directives for the Communists in the belief that another revolution would soon take place. But how to replace his depleted income soon became Engels' main problem. To support both himself and Marx, he accepted a subordinate position in the offices of Ermen & Engels in Manchester, eventually becoming a full-fledged partner in the concern. He again functioned successfully as a businessman, never allowing his Communist principles and criticism of capitalist ways to interfere with the profitable operations of his firm. Hence he was able to send money to Marx constantly, often in the form of £5 notes, but later in far higher figures. When Engels sold his partnership in the business in 1869, he received enough for it to live comfortably until his death in 1895 and to provide Marx with an annual grant of £350, with the promise of more to cover all contingencies.

Engels, who was forced to live in Manchester, corresponded constantly with Marx in London and frequently wrote newspaper articles for him; he wrote the articles that appeared in the *New York Tribune* (1851–52) under Marx's name and that were later published under Engels' name as *Revolution and Counter-Revolution in Germany in 1848.* In the informal division of labour that the two protagonists of communism had established, Engels was the specialist in nationality questions, military matters, to some extent in international affairs, and in the sciences. Marx also turned to him repeatedly for clarification of economic questions, notably for information on business practices and industrial operations.

Marx's *Kapital,* his most important work, bears in part a made-in-Manchester stamp. Marx similarly called on Engels' writing facility to help "popularize" their joint views. While Marx was the brilliant theoretician of the pair, it was Engels, as the apt salesman of Marxism directing attention to *Das Kapital* through his reviews of the book, who implanted the thought that it was their "bible." Engels almost alone wrote *Herrn Eugen Dührings Umwälzung der Wissenschaft* (1878; *Herr Eugen Dühring's Revolution in Science* [*Anti-Dühring*], 1934), the book that probably did most to promote Marxian thought. It destroyed the influence of Karl Eugen Dühring, a Berlin professor who threatened to supplant Marx's position among German Social Democrats.

Last years. After Marx's death (1883), Engels served as the foremost authority on Marx and Marxism. Aside from occasional writings on a variety of subjects and introductions to new editions of Marx's works, Engels completed volumes 2 and 3 of *Das Kapital* (1885 and 1894; *Capital,* 1907 and 1908) on the basis of Marx's uncompleted manuscripts and rough notes. All the while he corresponded extensively with German Social Democrats and followers everywhere, so as to perpetuate the image of Marx and to foster some degree of conformity among the "faithful." His work was interrupted when he was stricken with cancer; he died of the disease not long after.

During his lifetime, Engels experienced, in a milder form, the same attacks and veneration that fell upon Marx. An urbane individual with the demeanour of an English gentleman, Engels customarily was a gay and witty associate with a great zest for living. He had a code of honour that responded quickly to an insult, even to the point of violence. As hatchetman of the "partnership," he could be most offensive and ruthless, so much so that in 1848 various friends attempted unsuccessfully to persuade Marx to disavow him.

Except for the Communist countries, where Engels has received due recognition, posterity has generally lumped him together with Marx without adequately clarifying Engels' significant role. The attention Engels does receive is likely to be in the form of a close scrutiny of his works to discover what differences existed between him and Marx. As a result, some scholars have concluded that Engels' writings and influence are responsible for certain deviations from, or distortions of, "true Marxism" as they see it. Yet scholars in general acknowledge that Marx himself apparently was unaware of any essential divergence of ideas and opinions. The Marx–Engels correspondence, which reveals a close cooperation in formulating Marxist policies, bears out that view.

(O.J.H.)

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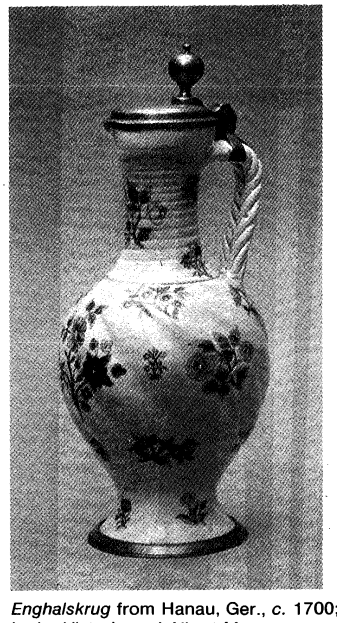
Enggano Island, Bahasa Indonesia PULAU ENGGANO, Enggano also spelled ENGANO, island in the Indian Ocean, off the southwestern coast of Sumatra, Bengkulu *propinsi* (province), Indonesia. Enggano lies about 110 mi (177 km) south of Bengkulu city. It is about 22 mi long east–west and 10 mi wide north–south and covers an area of 171 sq mi (443 sq km). Its average elevation is about 330 ft (100 m). Hills, rising to about 922 ft, cover most of the area and are thickly forested in hardwood. The climate is hot and moist, with heavy precipitation throughout the year. The low-lying coastal areas have coconut plantations; timber and copra are exported. Enggano is sparsely populated; Barhau and Kayaapu are the principal settlements.

Enghalskrug, German faience ewer with an ovoid body and a long narrow neck, which has a hinged pewter lid, a slight lip, and a broad foot, usually bound with a ring of pewter. After having been developed as a specialty at



Enghalskrug from Hanau, Ger., *c.* 1700; in the Victoria and Albert Museum, London

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

Hanau, *Enghalskrüge* were made at a number of German factories in the 17th and 18th centuries. There are many local variations in shape and style: the long-necked jugs of Frankfurt, for instance, are large-bellied with a spreading neck and a thin, twisted handle; those of Ansbach have long, pointed handles; those of Nürnberg are pear-shaped with semicircular handles. Those of Künersberg, with a brilliant white glaze, are of great elegance.

Enghien (French), Flemish EDINGEN, municipality, Hainaut *province,* southwest-central Belgium, 16 miles (26 km) southwest of Brussels. Established in the 11th century and a French possession until 1606, it was a medieval commercial centre noted for its tapestry. Modern industries include lace making and linen weaving. The title "duc d'Enghien" was long borne by the eldest son of the nearby princely house of Condé, even after the ancestral castle (the dungeon of which survives as a chapel) and park were sold to the house of Arenberg at the start of the 17th century. The superb park at Enghien was created by Antoine d'Arenberg, son of Charles d'Arenberg and Anne de Croy, who bought the estate in 1606 from Henry IV, king of France. Pop. (1983) mun., 10,233.

Enghien, Henri-Jules de Bourbon, duc d' (duke of): *see* Condé, Henri-Jules de Bourbon, 5e prince de.

Enghien, Louis-Antoine-Henri de Bourbon-Condé, duc d' (duke of) (b. Aug. 2, 1772, Chantilly, Fr.—d. March 21, 1804, Vincennes), French prince whose execution, widely proclaimed as an atrocity, ended all hope of reconciliation between Napoleon and the royal house of Bourbon.

The only son of Louis-Henri-Joseph, Duke de Bourbon, and Louise-Marie-Thérèse-Bathilde d'Orléans, he emigrated with his father at the outbreak of the French Revolution and served in his grandfather's émigré army from 1792 until its dissolution after the Treaty of Lunéville (1801). He secretly married Charlotte de Rohan-Rochefort and settled at Ettenheim, in Baden.

In 1804 Napoleon, then first consul, received intelligence that connected the Duke d'Enghien with the conspiracy to overthrow him then being planned by Georges Cadoudal and Charles Pichegru. The report was false, but Napoleon ordered Enghien's arrest; and French gendarmes crossed the Rhine secretly and seized him. He was brought to the castle of Vincennes near Paris, where a court-martial was hurriedly gathered to try him, and he was shot about a week after his arrest. Though his father survived him, the Duke d'Enghien was genealogically the last prince of the house of Condé.

The indignation that the execution aroused throughout Europe provoked the often quoted and misquoted comment upon the execution, *"C'est pire qu'un crime, c'est une faute"* ("It's worse than a crime, it's a mistake").

Engiadina (Switzerland): *see* Engadin.

engine, a machine that can convert any of various forms of energy into mechanical power or motion. *See* diesel engine; gasoline engine; internal-combustion engine; jet engine; rocket; rotary engine; steam engine.

engineering: *see under* descriptive word (*e.g.,* chemical engineering, industrial engineering, nuclear engineering), except as below.

engineering, the application of scientific principles to the optimal conversion of natural resources into structures, machines, products, systems, and processes for the benefit of mankind.

A brief treatment of engineering follows. For full treatment, *see* MACROPAEDIA: Engineering.

Engineering is one of the oldest professions in the world; there are a plethora of examples of spectacular engineering feats dating back to ancient times, the best-known being the pyramids of ancient Egypt.

There are traditionally four primary engineering disciplines, namely civil, mechanical, electrical, and chemical engineering, each of these having several distinct specialized branches. Other important and distinct engineering disciplines are concerned with mining, nuclear technology, and environmental control.

The oldest of the four main disciplines is civil engineering, which developed from techniques used in the ancient world. It is concerned with the design, site preparation, and construction of all types of structures and facilities, such as bridges, roads, tunnels, harbours, and airfields. Most of the projects involving civil engineering are undertaken by the public sector and are concerned with the development of urban, regional, and national infrastructures. Within the overall context of civil engineering there are several specialized branches such as structural engineering, foundation engineering, public health and sanitary engineering, and irrigation engineering. Municipal and traffic engineering are more recent specializations.

The advent of the Industrial Revolution in the first half of the 19th century resulted in the evolution of mechanical engineering as a distinct discipline that is concerned with the design, development, and testing of all types of industrial machinery and engines. This discipline has likewise evolved into many diverse specializations, such as automotive, aeronautical, and marine engineering. Precision engineering and production engineering are other important subdisciplines of mechanical engineering, as is agricultural engineering.

Electrical engineering, covering the design and installation of main electrical systems, evolved during the latter part of the 19th century, when electrical technology began making rapid strides. Since that time, various specialties within the electrical-engineering spectrum have emerged, such as electronics engineering, communications engineering (which includes radio and television), and instrument engineering. More recent specialties within the electrical-engineering field include medical engineering and computer engineering.

The newest of the four basic engineering disciplines is chemical engineering. Although the basic concepts were propounded a century ago, the main stimulant to its evolution was the development of the oil industry and the use of oil-derived products as raw materials for the chemical industry over the last 50 years or so. The discipline is concerned with the design of processes and equipment for the large-scale conversion of petroleum components by means of chemical reactions; its specialty areas include process engineering and petroleum engineering. Chemical engineering differs from the other three major classes of engineering in that it adds a third science (chemistry) to the two cornerstones of engineering, mathematics and physics.

Between these diverse fields of engineering there is inevitably some overlap of interest and expertise. It is, however, common to all branches of engineering that academic training must begin with a thorough grounding in the fundamental principles of science, particularly mathematics and physics. Education may then be continued in general engineering subjects, including draftsmanship. There is naturally a differing emphasis in these subjects according to the branch of engineering selected by the student.

All engineers must have a positive interest in the translation of the theoretical into the practical. Not only is an appropriate basic academic qualification necessary to enter the profession but a considerable period of time must be spent in gaining practical experience before the engineer can be considered to be properly qualified in the profession.

Engineers of some kind can be found in virtually every type of manufacturing and processing industry appropriate to their skills, as well as in public service and in many of the service industries. However, there are considerable variations in the definition and status of the professional engineer among different countries, these being due primarily to historical reasons. Whereas in many countries (such as Germany and the United States), the engineer may be accorded a professional status similar to that of a lawyer or a physician, in others until the late 20th century the term engineer was synonymous with that of a mechanic, at least until recently.

engineering drawing: *see* drafting.

engineering geology, also called GEOLOGICAL ENGINEERING, the scientific discipline concerned with the application of geological knowledge to engineering problems—*e.g.,* to reservoir design and location, determination of slope stability for construction purposes, and determination of earthquake, flood, or subsidence danger in areas considered for roads, pipelines, or other engineering works.

England, byname ALBION, predominant country of the United Kingdom of Great Britain and Northern Ireland. It occupies more than half of the island of Great Britain. It is bounded on the north by Scotland; on the west by the Irish Sea, Wales, and the Atlantic Ocean; on the south by the English Channel; and on the east by the North Sea.

A brief treatment of England follows. For full treatment, *see* MACROPAEDIA: United Kingdom.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

Physical and human geography. Constitutionally, England does not exist. It is not mentioned in the title of the sovereign who rules "the United Kingdom of Great Britain and Northern Ireland and of Her other Realms and Territories." Scotland, Wales, and Northern Ireland have certain governmental institutions of their own, but England, having subsumed or created those institutions at one time or another, needs no special mention. Holding more than four-fifths of the population, however, England's dominance in the United Kingdom is beyond question.

London was the largest town in Roman Britain and has been the capital of a unified England since the Norman Conquest of 1066. England has played a dominant role in British history since that time.

England is a land of low hills and plateaus and a 2,000-mile (3,200-kilometre) coastline cut into by bays, coves, and estuaries. A substantial upland, the Pennines (Scafell Pike, 3,210 feet [975 m]) with moorland tops rising to between 2,000 and 3,000 feet (600 to 900 m), splits northern England into northwestern and northeastern sectors.

English weather is diverse, with a generally mild but erratic temperate maritime climate. Temperatures in the Thames valley range from about 35° F (2° C) in January to 69°–72° F (21°–22° C) in July. The extremes recorded in England, however, go below 0° F (−18° C) and above 90° F (32° C). Northeastern and central England receive less than 40 inches (1,000 mm) of rainfall annually, and in parts of southeastern England annual rainfall averages as little as 20 inches (500 mm). Winter snows are sometimes heavy, but England frequently suffers from summer drought.

The English people are a mixed lot, their language polyglot with respect to source. Basically, the language of Anglo-Saxon invaders of the 5th and 6th centuries has prevailed,

providing about half the words in the modern English vocabulary. The remainder have come mainly from French and Latin. The English have absorbed numerous conquerors, as well as the Scots, Irish, and Welsh. Jews, too, have settled in England in large numbers, and recent immigration has added peoples from Pakistan, Africa, and the Caribbean islands to the English population.

England has eight geographic regions, often referred to as the standard regions of England; they do not serve any administrative function. The South East, centred on London, is an economically dominant area. It contains an extensive range of manufacturing and science-based industry and commercial endeavours; approximately one-third of the region is devoted to agriculture. London is the hub of the nation's railroad and airline system, with two international airports: Heathrow and Gatwick. The Port of London is the largest and commercially most important port in Britain.

The West Midlands, a diversified manufacturing region, centres on Birmingham, where iron and steel and automotive-vehicle manufacturing are major industries. The district also includes the Shakespeare country, centred on Stratford-upon-Avon, as well as the fruit-growing orchards of the Vale of Evesham. The East Midlands is also a manufacturing region, featuring hosiery and knitwear, bicycle, pharmaceutical, and aircraft industries. The region contains coalfields and some of England's best farmland.

East Anglia is mainly an agricultural district. Products there include cereals, potatoes, and sugar beets. Industrial beginnings in East Anglia date from the first shipments of gas and petroleum from the North Sea fields to points along the Norfolk coast.

Manchester and Liverpool are the chief manufacturing cities of the North West, and Liverpool is an important port. The North West includes the conurbations of South East Lancashire (including Manchester) and Merseyside (including Liverpool). This district is known for textile manufacturing, an industry that is gradually giving way to engineering industries. The Yorkshire and Humberside area contains the conurbation of West Yorkshire (including the cities of Leeds and Bradford), where the manufacture of textiles has long been an important occupation. Steel making is found at Sheffield, noted especially for its cutlery, and the region also has chemical and engineering industries and extensive farmland. The North region extends to the Scottish border. It includes the celebrated Lake District, as well as the more prosaic coalfields around Durham and the shipyards at Tyneside.

The South West, including the last Celtic stronghold in England—Cornwall—is an area that has been in economic decline since its mineral deposits were exhausted toward the end of the 19th century. The counties of the South West are, however, enjoying a large share of the expanding tourist industry, and those portions of the region closest to London are becoming increasingly industrialized.

England's internationally renowned universities—especially Cambridge and Oxford—lay claim to many achievements in science and technology. English physicists at Cambridge were the first to split the atom, and geneticists there discovered the structure of the DNA molecule. English scientists and technicians have been responsible for penicillin, radar, advanced aircraft design, and the jet engine. Research centres have excelled in the development of laser and optical-fibre technology.

England is equally noted for its architecture, for its literature and drama, for the British Museum, and for the London Symphony. London is the leading centre for radio and television broadcasting, for book and other publishing, as well as for contemporary drama; more than 60 theatres can be found in and near the city. In addition to its well-deserved reputation for intellectual and artistic life, England gave to the world the sports of cricket, association football (soccer), and rugby football. Area 50,363 square miles (130,439 square km). Pop. (1990 est.) 47,900,000.

England, Bank of, the central bank of the United Kingdom. Headquarters are in London.

It was incorporated by act of Parliament in 1694 with the immediate purpose of raising funds to allow the government to wage war in the Low Countries. A royal charter allowed the bank to operate as a joint-stock bank with limited liability. No other joint-stock banks were permitted in England and Wales until 1826. This special status and its position as the government's banker gave the bank considerable competitive advantages.

It soon became the largest and most prestigious financial institution in England, and its bank notes were widely circulated. As a result it became banker to other banks, which, by maintaining balances with the Bank of England, could settle debts among themselves. The bank's standing was considerably enhanced by its actions in raising finance for the Napoleonic Wars.

During the 19th century the bank gradually assumed the responsibilities of a central bank. In 1844 the Bank Charter Act recognized the bank's position as the central note-issuing authority, and it undertook the roles of lender of last resort and guardian of the nation's gold reserves in the following few decades.

The bank remained privately owned until 1946 when it was nationalized. It continues to be headed by a governor and court of directors, but its freedom for independent action is limited. It plays an important role in advising the government on monetary policy and is largely responsible for implementing the chosen policy by its dealings in the money, bond, and foreign-exchange markets. It also funds public borrowing, manages the registers of government securities, issues bank notes, and manages the country's gold and foreign-exchange reserves. It was also responsible for implementing the regulations concerning exchange control until they were abolished in 1979.

England, Church of, English national church that traces its history back to the arrival of Christianity in Britain during the 2nd century and the original church of the Anglican Communion since the 16th-century Protestant Reformation. As the successor of the Anglo-Saxon and medieval English Church, it has valued and preserved much of the traditional framework of medieval Roman Catholicism in church government, liturgy, and customs, while it also has usually held the fundamentals of Reformation faith.

The conversion of the Anglo-Saxons, who began invading Britain after Rome stopped governing the country in the 5th century, was undertaken by St. Augustine, a monk in Rome who was chosen by Pope Gregory I to lead a mission to the Anglo-Saxons. He arrived in 597, and within 90 years all the Saxon kingdoms of England had gradually accepted Christianity.

In the centuries before the Reformation, the English Church experienced periods of advancement and of decline. During the 8th century, English scholarship was highly regarded, and several English churchmen worked in Europe as scholars, reformers, and missionaries. Subsequently, Danish invasions destroyed monasteries and weakened scholarship. Political unity in England was established under the Wessex kings in the 10th century, however, and reforms of the church took place.

In the 11th century the Norman Conquest of England (1066) united England more closely with the culture of Latin Europe. The English Church was reformed according to Roman ideas: local synods were revived, celibacy of the clergy was required, and the canon law of western Europe was introduced in England.

During the European Middle Ages, English clergy and laity made important contributions to the life and activities of the Western Church. The English Church, however, shared in the religious unrest characteristic of the later Middle Ages. John Wycliffe, the 14th-century Reformer and theologian, became a revolutionary critic of the papacy and is considered a major influence on the 16th-century Protestant Reformation.

The break with the Roman papacy and the establishment of an independent Church of England came during the reign of Henry VIII (1509–47). When Pope Clement VIII refused to approve the annulment of Henry's marriage to Catherine of Aragon, the English Parliament, at Henry's insistence, passed a series of acts that separated the English Church from the Roman hierarchy and in 1534 made the English monarch the head of the English Church. The monasteries were suppressed, but few other changes were immediately made, since Henry intended that the English Church would remain Catholic, though separated from Rome.

After Henry's death, Protestant reforms of the church were introduced during the six-year reign of Edward VI. In 1553, however, when Edward's half-sister, Mary, a Roman Catholic, succeeded to the throne, her repression and persecution of Protestants caused sympathy for their cause. When Elizabeth I became queen in 1558, the independent Church of England was reestablished. *The Book of Common Prayer* (*q.v.;* 1549, final revision 1662) and the Thirty-nine Articles (*q.v.;* 1571) became the standards for liturgy and doctrine.

In the 17th century the Puritan movement led to the English Civil War (1642–51) and the Commonwealth (1649–60). The monarchy and the Church of England were repressed, but both were restored in 1660.

The Evangelical movement in the 18th century emphasized the Protestant heritage of the church, while the Oxford Movement in the 19th century emphasized the Roman Catholic heritage. These two attitudes have continued in the church and are sometimes referred to as Low Church and High Church, respectively. In the 20th century the church was active in the ecumenical movement.

The Church of England has maintained the episcopal form of government. It is divided into two provinces, Canterbury and York, each headed by an archbishop, with Canterbury taking precedence over York. Provinces are divided into dioceses, each headed by a bishop and made up of several parishes. Women deacons, known originally as deaconesses and serving basically as assistants to priests, were first ordained by the Church of England in 1987, allowing them to perform virtually all clerical functions except the celebration of mass.

England, John (b. Sept. 23, 1786, Cork, County Cork, Ire.—d. April 11, 1842, Charleston, S.C., U.S.), Irish-born American Roman Catholic prelate who became the first bishop of Charleston and who founded the first Catholic newspaper in the United States.

Ordained in 1808, England became an instructor at St. Patrick's Seminary, Cork, where in 1812 he was made president. His outspoken opposition to governmental intervention in the selection of Irish and English bishops displeased some of his superiors, and he was transferred in 1817 to the nearby village of Bandon as parish priest.

While serving there, he was named bishop of the new diocese of Charleston—comprising the states of North Carolina, South Carolina, and Georgia—and was consecrated in Ireland

(Sept. 21, 1820). Seeing that the first need of his diocese was education, he prepared and printed a catechism and a missal for Americans. He founded the *United States Catholic Miscellany,* the first Catholic newspaper in the U.S., which continued publication until 1861. He began two schools: the Philosophical and Classical Seminary for boys and an academy, conducted by the Ursulines, for girls. For the care of the sick and orphans he founded a religious community, the Sisters of Our Lady of Mercy. To assist immigrants and workingmen he organized the Brotherhood of San Marino. His attempt to found a school for free blacks was blocked by public opposition.

In 1833 England was appointed apostolic delegate to Haiti, the first important diplomatic mission given to a prelate in the U.S. His efforts to secure a concordat were, however, unsuccessful. An eloquent orator, he was the first Roman Catholic clergyman invited to speak before the U.S. Congress (1826), where for two hours he described the doctrines of his church. He became a U.S. citizen in the same year.

Englefield, Sir Francis (b. *c.* 1520—d. 1596), English Roman Catholic who was a personal friend and influential adviser to Queen Mary I and a vigorous opponent in exile of Queen Elizabeth I.

During the reign of Henry VIII, Englefield accepted the principle of royal supremacy over the English Church but rejected the Protestant doctrines imposed under King Edward VI. He befriended Mary Tudor, the Catholic heir to the throne, and, upon her accession, she appointed Englefield a privy councillor. His influence with the Queen helped bring about the severe persecutions of Protestants that marked her reign.

When Queen Elizabeth came to power in 1558, Englefield fled to the Continent, where he became a confidant of such notable Catholic exiles as William Cardinal Allen and Robert Parsons. Eventually he advocated forcible intervention by Spain to restore Catholicism in England. During the last 20 years of his life Englefield, suffering from blindness, lived in Valladolid, Spain, on a pension from the Spanish king Philip II.

Engler, (Gustav Heinrich) Adolf (b. March 25, 1844, Sagan, Ger.—d. Oct. 10, 1930, Berlin), German botanist famous for his system of plant classification and for his expertise as a plant geographer.

Engler obtained a Ph.D. from the University of Breslau in 1866. After four years of teaching he became, in 1871, custodian of botanical collections of the Botanical Institute of Munich, remaining there until 1878, when he accepted a professorship at the University of Kiel. In 1884 he was appointed professor of botany and director of the botanical garden of the University of Breslau. From 1889 to 1921 he was director of the Berlin Botanical Garden, Dahlem, during which period it became one of the foremost botanical gardens in the world. He visited Africa in 1902, 1905, and 1913; India and Java in 1905; and in 1913 made a journey around the world.

Engler
BBC Hulton Picture Library

Engler was a great administrator and the leader of German taxonomic and geographical botany. He collaborated with Karl Friedrich Philipp von Martius in the *Flora Brasiliensis* (1861–1906; "The Flora of Brazil") and with Alphonse de Candolle in the *Monographiae Phanerogamarum* (1878–91; "Monographs of Flowering Plants"). His greatest contribution to taxonomy is his monumental *Die natürlichen Pflanzenfamilien* ("The Natural Plant Families") edited with Karl von Prantl and others (published in parts, 1887–1911), followed by *Das Pflanzenreich* (1900–37; "The Plant Kingdom"). His *Syllabus der Pflanzennamen* (1892; "Syllabus of Plant Names") is still a standard and indispensable reference book. He was also the founder of the *Botanische Jahrbücher* ("Botanical Yearbooks"), which he edited from 1880 until his death.

Englewood, city, Bergen County, northeastern New Jersey, U.S., across the Hudson River from the Bronx, New York City. Founded in 1647 as part of Hackensack, it was detached for urban development as the township of Englewood in 1871, incorporated as a city in 1895, and again in 1899 after the discovery of a constitutional flaw in the 1895 act. Mainly residential, it has light manufactures (leather goods, drugs, metal products). The Actors' Fund Home for sick and retired actors was established there in 1928. In 1951 its telephone system installed the first direct-distance dialing. The adjacent borough of Englewood Cliffs (south) contains the headquarters of the vast Prentice-Hall publishing complex. Pop. (1980) 23,701.

Englische Komödianten (German: English Comedians), any of the troupes of English actors who toured the German-speaking states during the late 16th and the 17th century, exerting an important influence on the embryonic German drama and bringing with them many versions of popular Elizabethan and Jacobean plays that are of particular interest to modern scholars. One of the earliest English troupes to visit Europe was that led by Robert Brown, formerly a member of Worcester's Men. Brown's actors performed at Leiden in 1591 and by the following year had attracted the patronage of the playwright-duke Heinrich Julius of Brunswick. Several of the Duke's subsequent dramas are thought to contain plot elements from some of the plays of Shakespeare, including *Richard III* and *The Merry Wives of Windsor.* Other groups of English actors quickly followed Brown, touring throughout central Europe. The English professionals, with their elaborate costumes, properties, and full repertories of new plays, were immediately successful with German audiences. The English clowns were especially popular, and one of them, Robert Reynolds (fl. 1610–40), was such a favourite that his comic character, called Pickelherring, became a stock figure in German farces. The actors overcame the language barrier with the aid of an interpreter and by much use of mime and crude slapstick, violent action, and extravagant emotion. Later actors learned German and joined with German writers in clumsy and macaronic translations of their plays.

Troupe of the Englische Komödianten appearing on an improvised stage, engraving by Hans Tröschel, 1623
By courtesy of William W. Melnitz

Except for the period of the Thirty Years' War (1618–48), the English companies flourished during the 17th century. They gradually augmented themselves with native actors and actresses, training many of the German professionals who eventually succeeded them.

English, Basic (artificial language): *see* Basic English.

English Bāzār, also called ANGREZĀBĀD, town, administrative headquarters of Mālda district, West Bengal state, northeastern India, just west of the Mahānanda River. The town was chosen as the site of the British East India Company's silk factories (trading stations) in 1676. The Dutch and French also had settlements there. A major road and rail junction, English Bāzār is an important silk and agricultural trade centre. Constituted a municipality in 1869, it has a sericultural station nearby. Pop. (1981) town, 79,010; metropolitan area, 93,244.

English billiards, also called BILLIARDS, game played on a rectangular table 12 feet by 6 feet 1½ inches (366 by 187 centimetres), with six pockets, one at each corner and one at the centre of each of the long sides. Three balls of equal weight and size are used: two are white, one being distinguished by one or two black spots, and the third is red. The marked white ball is called "spot," the other "plain." One player cues the spot and the other the plain. The object of the game is to score by driving the cue ball into both of the other (object) balls or by knocking one or more balls into the pockets, *i.e.,* potting it or them.

A line drawn on the table 29 inches (74 centimetres) from the face of the bottom cushion and parallel to it is called the balkline. The area between it and the bottom cushion is called the balk. A semicircle 11½ inches (29 centimetres) in radius, with its centre at the middle of the balkline, is marked in the balk; this is called the D. The cue ball, when retrieved from a pocket after a score, must then be played from within or on the lines of the D and must be sent out of, not into, balk.

Four spots are marked on the table as follows: the billiard spot, 12¾ inches from the face of the top cushion and equidistant from the two long cushions; the centre spot, halfway between the centre pockets; the pyramid spot, halfway between the centre spot and the face of the top cushion; and the spot on the middle of the balkline. Thus, all four spots are on an imaginary central longitudinal line. There is also a similar spot at each end of the D line; these are used only in snooker.

To begin, the red ball is placed on the billiard spot. The first player puts his ball in the D and shoots until he fails to score. Then his opponent places his ball in the D and follows suit. The object of the game is to score more points than one's opponent.

There are three ways of scoring: (1) the losing hazard, or loser, a stroke in which the cue ball is pocketed after contact with another ball; (2) the winning hazard, or pot, a stroke in which

a ball other than the cue ball is pocketed after contact with another ball; and (3) the cannon (carom), a stroke in which the cue ball contacts the two other balls successively or simultaneously. Two points are scored for a losing hazard off white, three for one off red. Three points are scored for a winning hazard if red is potted; two if white. Two points are scored for a cannon. If a cannon and pocketing occur on the same stroke, the ball pocketed is scored as the first ball touched by the cue ball on that stroke (two if white contacted first, three if red), and that score is added to the cannon score. Points are forfeited for certain violations of rules, such as missing both object balls with the cue ball (one point) and pocketing the cue ball on such a miss (three points).

A succession of scoring strokes is called a break. Losing hazards are limited to 25 in succession or 15 in professional and amateur championships. Consecutive cannons are limited to 35, after which the player must make either a losing or a winning hazard, a direct cannon in conjunction with a hazard, or an indirect cannon (one in which the striker's ball, after contact with the first object ball, strikes a cushion or cushions before making contact with the second object ball).

English bond, form of bonding courses of stones or bricks in walling. *See* bond.

English bulldog: *see* bulldog.

English Channel, also called THE CHANNEL, French LA MANCHE, arm of the Atlantic Ocean separating the southern coast of England from the northern coast of France.

The French name ("The Sleeve") is a reference to its shape, which gradually narrows from west to east from a maximum of about 112 miles (180 km) to a minimum of 21 miles (34 km) between Dover, Eng., and Calais, Fr. At the eastern end the Strait of Dover connects the channel with the North Sea. Occupying an area of 34,700 square miles (89,900 square km), it is the smallest of the shallow seas covering the continental shelf of Europe, and its average depth decreases eastward from 400 to 150 feet (120 to 45 m). The English Channel's historical association as both a route for, and barrier to, invaders of Britain from the continent made it an important region of early, detailed hydrographic survey; its seabed is one of the most intensively examined seafloors in the world. The seafloor dips fairly steeply near the coast and is generally flat in the west and undulating in the east. Formed about 40 million years ago, the channel is a feature of notable scientific interest, especially with regard to the effects of strong tides.

The traditional fishing industry of the channel has declined in the 20th century with the development of deep-sea fishing, the exhaustion of resources, and the advent of the pollution problem partially caused by the channel's development into one of the busiest sea routes in the world for oil tankers and ore carriers. Portsmouth and Plymouth are declining naval ports, and Southampton and Le Havre are losing transoceanic passengers but gaining tremendous container-ship and oil-refining capacities. Both England and France use the channel waters for cooling nuclear-powered generating stations. Many cross-channel ports are connected by scheduled ferry (particularly hovercraft) service.

The often-considered idea of an English Channel tunnel at the Strait of Dover was first proposed in 1802 by a French engineer who perceived the possibilities inherent in the English Channel's chalk floor. Napoleon showed interest; but the renewal of war suspended the question, which was, nonetheless, taken up repeatedly during the 19th century. In the early 1880s private companies actually commenced digging a railroad tunnel near Folkestone, Kent, Eng., and Santerre, Fr. A pilot tunnel 6,000 feet (1,828 m) long was bored from the English side before a press furor over the alleged threat to Britain's security caused the government to cancel the project.

In the mid-1960s the French and British governments again agreed to build a rail tunnel, but by the mid-1970s—with approximately 1.5 miles (2 km) of preliminary digging completed on each side of the channel—the British government had to cancel the publicly financed project owing to cost. The Eurotunnel project was revived once more in 1986. It was chosen over proposals for a suspension bridge, a bridge-and-tunnel link, and a combined rail-and-road link; and it was privately financed (with stock sales and bank loans from several international banks) by a consortium of French and British firms. Upon its completion in the mid-1990s, the double-rail tunnel (dug through the chalk layer beneath the channel) would run between Dover and Calais and, with the use of high-speed trains, was expected to cut surface travel time between Paris and London in half.

English Civil Wars (1642–51), also called GREAT REBELLION, the fighting that took place in the British Isles between Parliamentarians and supporters of the monarchy. It was precipitated by the Bishops' War (1639, 1640) with Scotland, to finance which King Charles I was forced to summon Parliament (1640) after having governed 11 years without it. Tension between monarch and House of Commons steadily increased; after his unsuccessful attempt to arrest five members of Parliament (Jan. 4, 1642), Charles left London (January 10), and both sides prepared for war.

Initially the opposing armies were of equal numbers (each around 13,000 men); the royalists were superior in cavalry until the formation of Parliament's New Model Army (1645). However, Parliament's greater economic resources presaged the conflict's ultimate outcome. Whereas royalist support came largely from Wales and from the North and West of England, Parliament held the richer South and East and controlled London, the majority of the ports, and the navy. Parliament was able to levy taxes, but for ready money the king was dependent on the generosity of his supporters.

The first phase of the wars lasted from 1642 to 1646. Charles I raised his standard at Nottingham in August 1642, and a number of inconclusive encounters followed. Although unchecked at Edgehill (Oct. 23, 1642), he abandoned an advance on London when confronted by a Parliamentary force at Turnham Green; he then withdrew to Oxford, which became his military headquarters. In 1643 the royalists at Adwalton Moor (June 30) won control of almost all Yorkshire, while Parliament was victorious at Winceby (October 11) and took Lincoln; in the Southwest there were royalist victories at Lansdown and Broadway Down (July), and Charles's nephew Prince Rupert captured Bristol. After the inconclusive first Battle of Newbury (September), both sides sought allies. Parliament in the Solemn League and Covenant bought Scottish military aid; the king made peace with the Irish (in rebellion since 1641), thereby freeing troops for deployment in Britain.

Despite the Parliamentary victory at Marston Moor (July 2), in general the royalist operations of 1644 were the more successful. A second Battle of Newbury (September 20) settled nothing. It was only in 1645, following the formation of the New Model Army and after its overwhelming victory at Naseby (June 14) that the war took a decisive turn. The last royalist army was beaten at Langport (July 10), while in Scotland the Marquess of Montrose was defeated at Philiphaugh (September 13). The Scots swept through the North of England, and Parliamentary forces through the Southwest; the year 1646 saw the final disbandment of royalist troops and the surrender of Oxford. King Charles took refuge with the Scots who, however, handed him over as a prisoner to the Parliamentarians when they left England in January 1647.

During 1647 Charles was first kidnapped by the army, increasingly at odds with Parliament, and then escaped, arriving by mischance in the Isle of Wight. There he negotiated with a Scottish group the secret "Engagement" (December 26), promising to establish Presbyterianism in England and suppress Independents in exchange for aid. This started the second phase of the wars, a series of royalist rebellions, and a Scottish invasion (July 1648). All were defeated, and resentment at Charles's duplicity led to his trial and execution (January 1649).

Fighting next broke out in Ireland, where Oliver Cromwell for the newly established Commonwealth suppressed (1649–50) a major uprising of Roman Catholics and royalists. A Scottish rebellion under Montrose was crushed (April 1650), and Charles II then made terms with the Presbyterian Covenanters. Cromwell decisively defeated them at Dunbar (Sept. 3, 1650); but, unable to follow up his victory, he then allowed Charles, recently crowned in Scotland, to march deep into England. The utter rout of the royalists at Worcester (Sept. 3, 1651) and Charles II's subsequent flight abroad effectively ended the civil wars.

The civil wars caused comparatively little loss of life or destruction of property. Politically, their consequence was the establishment of the Commonwealth and Protectorate. In religion they fostered the English Nonconformist tradition; they also left Englishmen with a profound distrust of standing armies.

English Classics, in horse racing, five of the oldest and most important English horse races. They are the Derby, the Oaks, the One Thousand Guineas, the Saint Leger, and the Two Thousand Guineas (*qq.v.*). For winners, *see* Sporting Record.

English East India Company: *see* East India Company.

English horn, French COR ANGLAIS, German ENGLISCHHORN, orchestral woodwind instrument, a large oboe pitched a fifth below the

English horn
From *Scientific American* (October 1960)

ordinary oboe, with a bulbous bell and, at the top end, a bent metal crook on which the double reed is placed. It is pitched in F, being written a fifth higher than it sounds. Its compass is from the E below middle C to the second E above. The name first appeared in Vienna in about 1760; "cor" refers to the curved or hornlike shape it then had, but the origin of "anglais" ("English") remains a mystery. The curved form, which survived locally to 1900, was nearly identical to the 18th-century *oboe da caccia* and is now sometimes used for J.S. Bach's parts for that instrument. The English horn was also built in an angular form.

The modern straight form was first exhibited in 1839 by Henri Brod of Paris. The English horn appears in many Romantic works, notably those of Hector Berlioz, César Franck, and Richard Wagner.

English language, language widely spoken on six continents. In the British Isles, North America, and Australasia, where English is spoken as the primary language, the English-speaking population is fairly stable. In Africa, the Indian subcontinent, and Southeast Asia, however, where English is used as a secondary language, its future is uncertain. English speakers fall into three groups: those who have inherited it as their native language, those who have acquired it as their second language in a society that is largely bilingual, and those who have learned it as a necessary medium of their education or profession. In the entire world, one person in seven now belongs to one of these groups. (*See also* Old English language; Middle English language.)

A brief treatment of the English language follows. For full treatment, *see* MACROPAEDIA: Languages of the World.

English is a Germanic language of the Indo-European language family. Scholars usually divide the Germanic languages into three subgroups: East (all these languages are now extinct); North (the Scandinavian languages); and West. English is in the western group and is closely related to German, Frisian, and Netherlandic (Dutch and Flemish).

English is an analytic (*i.e.,* relatively uninflected) language, whereas Proto-Indo-European, the ancestral tongue of most European, Iranian, and North Indian languages, is synthetic, or inflected. Over thousands of years, English has lost most of its inflections, while other European languages have retained more of theirs. Indeed, English is the only European language in which adjectives have no distinctive endings, aside from determiners and endings denoting degrees of comparison.

Another characteristic is flexibility of function. This means that one word can function as various parts of speech in different contexts. Fox example, the word "book" can be an adjective in "book review," a noun in "read a book," or a verb in "book a room." Because other European languages retain more inflectional endings than does English, they almost never have this characteristic. A third feature, openness of vocabulary, allows English to admit words freely from other languages and to create compounds and derivatives.

In Great Britain, British Received Pronunciation (RP) is the usual speech of educated people. In the United States, Inland Northern (popularly known as Great American) is commonly used. In both countries, however, other pronunciations are acceptable.

British Received Pronunciation and American Inland Northern show several divergences: (1) After some vowels American has a semiconsonantal glide. (2) The vowel in "cod," "box," and "dock" is pronounced like "aw" in British and a sound similar to "ah" in American. (3) The vowel in "but," "cut," and "rung," is central in American but is fronted in British. (4) The vowels in the American "bath" and "bad" and in the British "bad" are all pronounced the same, but the vowel in the British "bath" is pronounced like "ah," since it is before one of the fricatives *s, f,* or *th* (as in "thin"). (5) When a high back vowel is preceded by *t, d,* or *n* in British, a glide (consonantal *y*) is inserted between them (*e.g.,* "tulip," "news"); in American the glide is omitted.

The 24 consonantal sounds comprise six stops (plosives): *p, b, t, d, k, g;* the fricatives *f, v, th* (as in "thin"), *th* (as in "then"), *s, z, sh* (as in "ship"), *zh* (as in "azure"), and *h;* two affricatives, *ch* (as in "church") and *j* (as in "jam"); the nasals *m, n,* and *ng* (as in "young"); the lateral *l;* the vibrant or retroflex *r;* and the semivowels *y* and *w.* American and British consonants have the same pronunciation with two exceptions: (1) When *r* occurs after a vowel, it is dropped in British but pronounced in American. (2) A *t* between two vowels is pronounced like *t* in "top" in British, but in American the sound is close to that of a *d.*

English is a strongly stressed language, with four degrees of stress: primary, secondary, tertiary, and weak. A change in stress can change the meaning of a sentence or a phrase. Although in comparison with other languages English stress is less predictable, there is a tendency toward antepenultimate (third syllable from the last) primary stress. This is apparent in such five-syllable words as equanímity, longitúdinal, and notoríety. French stress is often sustained in borrowed words, *e.g.,* bizárre, critíque, and hotél.

Pitch, or musical tone, may be falling, rising, or falling–rising. Word tone, which is also called pitch, can influence the meaning of a word. Sentence tone is called intonation and is especially important at the end of a sentence. There are three important end-of-sentence intonations: falling, rising, and falling–rising. The falling intonation is used in completed statements, commands, and some questions calling for "yes" or "no" answers. Rising intonation is used in statements made with some reservation, in polite requests, and in certain questions answerable by "yes" or "no." The third type of intonation, first falling and then rising pitch, is used in sentences that imply concessions or contrasts. American intonation is less singsong and stays in a narrower range than does British. Everywhere that English is spoken, regional dialects show distinct patterns of intonation.

Modern English nouns, pronouns, and verbs are inflected; but adjectives, adverbs, prepositions, conjunctions, and interjections are not. Most English nouns have the plural inflection *(-e)s,* but seven have mutated (umlauted) plurals, (*e.g.,* man, men); three have plurals ending in *-en* (*e.g.,* ox, oxen), and some remain unchanged (*e.g.,* deer). Five of the seven personal pronouns have separate forms for subject and object. English verbs are not complex. Regular or weak verbs have only four forms, strong verbs have five, and "to be" has eight. Some verbs ending in *t* or *d* have only three forms.

Besides employing inflection, English exhibits two other main morphological (structural) processes—affixation and composition—and two subsidiary ones—back-formation and blend. Affixes, word elements attached to a word, may either precede as prefixes (pre-, dis-) or follow as suffixes (-able, -er). They can be native (over-, -ness), Greek (hyper-), or Latin (-ment). Greek and Latin have become so acclimatized that they can occur together in the same word. English makes varied use of affixes; often, many different ones have the same meaning, or the same one has many meanings. Suffixes are attached more closely to the stem than are prefixes and often remain permanent.

Composition, or compounding, describes putting two free forms together to form a new word. The new word can differ from the previous forms in phonology, stress, and juncture. Five types of compounds are defined by describing the relationship of the free forms to each other: (1) a compound in which the first component noun is attributive and modifies the second noun (*e.g.,* cloverleaf, beehive, vineyard); (2) one made up of a noun plus an agent noun, itself consisting of a verb-plus-agent suffix (*e.g.,* icebreaker, landowner, timekeeper); (3) a verb plus an object (*e.g.,* pastime, scarecrow, daredevil); (4) an attributive adjective plus a noun (*e.g.,* bluebell, grandson, shorthand); and (5) a noun and a present participle (*e.g.,* fact-finding, heartrending, life-giving).

Back-formation, the reverse of affixation, is the analogical formation of a new word falsely assumed to be its derivation. The verbs "to edit" and "to act" have been formed from the nouns "editor" and "actor," respectively. Blends fall into two groups: (1) coalescences, such as "bash" from "bang" and "smash," and (2) telescoped forms, called portmanteau words, such as "motorcade" from "motor cavalcade."

Sentences can be classified as simple; multiple, or compound; and complex. Simple, declarative, affirmative sentences fall into two main groups, each with five subsidiary patterns. The first group consists of a subject, a verb, and a complement, the verb and the complement being the variables. The five patterns of this group are a subject followed by: (1) a transitive verb and a direct object; (2) a meaningless copula, such as "is," followed by the predicative noun; (3) a meaningful copula, such as "becomes," with a predicative noun; (4) a verb and a predicative adjective; and (5) a verb with a predicative past participle. If one changes the word order in any of these 10 patterns, without adding or subtracting a word, one almost always changes the meaning of the sentence.

The syntax rules governing adjectives are not as strict as those governing nouns and verbs. When more than one adjective describes a noun, the adjectives are arranged in the following order: determiner; quantifier; adjective of quality; adjective of size, shape, or texture; adjective of colour or material; noun adjunct; head noun. Adverbs are normally more mobile than adjectives, with only tentative principles at work. As their etymology implies, prepositions usually precede nouns, but there are a few exceptions, *e.g.,* "the whole world over." Because of the laxity of syntax principles, English is a very easy language to speak poorly.

The vocabulary of Modern English is approximately half Germanic (Old English and Scandinavian) and half Italic or Romance (French and Latin), with copious importations from Greek in science and borrowings from many other languages. Almost all basic concepts and things come from Old English, or Anglo-Saxon, as do most personal pronouns, all auxiliary verbs, most simple prepositions, all conjunctions, and almost all numbers. Many common nouns, adjectives, and verbs are of Scandinavian origin; and some other words would be the same whether they were of Scandinavian or Anglo-Saxon origin.

The English language owes a great debt to French. Many terms relating to dress, cuisine, politics, literature, and art come from French. The words denoting skilled artisans are usually French, whereas those for craftsmen are usually Anglo-Saxon. Comparison between French and English synonyms reveals the former to be more intellectual and abstract, and the latter more human and concrete. Many of the Greek compounds and derivatives in English have Latin equivalents with either similar or considerably different meanings.

The English adopted the 23-letter Latin al-

phabet, to which they added the letters *W, J,* and *V.* For the most part, English spelling is based on that of the 15th century. Pronunciation, however, has changed greatly since then. During the 17th and 18th centuries, fixed spellings were adopted, although there have been a few changes since that time. Numerous attempts have been made to reform English spelling, many during the 20th century.

The history of the English language begins with the migration of the Jutes, Angles, and Saxons from Germany and Denmark to Britain in the 5th and 6th centuries. The formation of separate kingdoms in Britain to some extent coincided with the development of the Old English dialects of Northumbrian, Mercian, West Saxon, and Kentish. Northumbrian was in a position of cultural superiority until the destructive Viking raids of the 9th century caused cultural leadership to pass to the West Saxon kingdom of Wessex.

One result of the Norman Conquest of 1066 was to place all four Old English dialects on the same cultural level and to allow them to develop independently. So West Saxon lost its supremacy, and the centre of culture gradually shifted to London. During this Middle English period the Northumbrian dialect split into Scottish and Northern, and Mercian became East and West Midland. Another outcome of the Norman Conquest was the adoption of the Carolingian script, then in use on the Continent, and changes in spelling. For the first century after the Conquest, a vast number of loanwords entered the English language from the dialects of northern France; but, with the expansion of English control into southwestern France during the reign of Henry II (reigned 1154–89), southern dialects also made contributions.

The transition from Middle to Modern English started at the beginning of the 15th century. This century witnessed three important developments: the rise of London English, the invention of printing, and the spread of new learning. The Renaissance in England produced many more scholars who were knowledgeable in foreign languages, especially Greek and Classical Latin. Their liberal attitude toward language made possible the introduction of a great number of words into English. Scholars generally date the beginning of the Modern English period at 1500.

The 50-year period after the restoration of the English monarchy in 1660 saw several unsuccessful attempts to found an academy to standardize the English language. During the 18th century, however, several works on grammar were produced that gave English greater uniformity. The number of works of grammarians and scholars has greatly increased since these early efforts. Some have taken a narrow view and spent much time condemning certain usages, but others have made valuable contributions, especially in the form of dictionaries.

In the British Isles numerous dialects of English are spoken. Those in Wales, Scotland, and Ireland are strongly influenced by the Celtic substratum. In the United States there are three dialects, which can be clearly divided into 18 subdialects along the Atlantic littoral. Further west the boundaries between dialects become less clear. The frontier with Canada nowhere corresponds to any linguistic boundary, and American influence is strong there, being least felt in the Maritime Provinces. Austral English refers to the language of Australasia. Many words have changed meaning, and others have been borrowed from Aboriginal tongues to describe the Australian environment.

In India, English remains an alternative, or associate, language with Hindi and is the principal language of science. In South Africa, English is an official language along with Afrikaans and has borrowed many Afrikaan words. English is the official language in many multilingual countries in sub-Saharan Africa, though it is often in competition with vigorous indigenous languages.

English lavender (aromatic plant): *see* lavender.

Consult the INDEX *first*

English literature, the body of written works produced in the English language by inhabitants of the British Isles from the 7th century to the present day. The major literatures written in English outside the British Isles are treated separately under American literature, Australian literature, and Canadian literature.

A brief treatment of English literature follows. For full treatment, *see* MACROPAEDIA: English Literature.

English literature is traditionally divided into the Old English, Middle English, Renaissance and Elizabethan, Jacobean, Restoration, 18th-century, Romantic, Victorian, and Modern periods. Literary traditions often overflow such categories, however, and diverse approaches have always coexisted. Old English and, to a lesser extent, Middle English appear to the modern reader to be foreign languages.

Old English is the first recorded English literature. The alliterative verse of Caedmon was mentioned in the Venerable Bede's *Historia ecclesiastica gentis Anglorum* ("Ecclesiastical History of the English People") in the 8th century. Manuscripts from about AD 1000 contain the best known Old English work, *Beowulf,* a heroic poem written in about 700 to 750. Such poems were originally written to be sung, and the subject matter was generally religious or heroic. In prose there were plain-narrative historical chronicles such as *The Anglo-Saxon Chronicle.*

Middle English arguably begins with the Norman Conquest of 1066. This brought both the French language, which in time combined with the Germanic Anglo-Saxon to form the basis of modern English, and a French literary influence. The Arthurian cycle became the central myth for English literature, as seen in works such as *Sir Gawayne and the Grene Knight,* an example of the alliterative revival of the 14th century, and Sir Thomas Malory's *Morte Darthur.* Geoffrey Chaucer, master of the complex narrative and sometimes presented as the first modern English writer, occupies the central position in Middle English literature. He combined the classical epic and European philosophical influence in his *Troilus and Criseyde* but also gave the vernacular a solid basis in his comic *Canterbury Tales.*

The European Renaissance had filtered into England by the 16th century and led to the questioning of the religious beliefs and assumptions of the Middle Ages. Literature began to look back beyond the medieval period to the classics for inspiration, and Neoplatonism, through Edmund Spenser and lyrical courtly poetry, became the dominant philosophical theme. Humanism emerged in Sir Philip Sidney's *Defence of Poesie* (the beginnings of English literary criticism), in Francis Bacon's prose essays, and particularly in the plays of William Shakespeare. As the central figure of the English Renaissance, Shakespeare expresses both its conflicts and its glorious energy and provides the basis for its reputation as the golden age of English literature and of English drama in particular.

The political strife accompanying the accession of James I in 1603 produced a strain of cynicism manifested in the darkness and confusion of the revenge tragedies of Cyril Tourneur and John Webster. There emerged also at this time the intellectual passion of metaphysical poetry—with John Donne at its centre—containing the conflicts between love, religion, and the individual. Out of this grew a period of Puritanism, leading to the closure of all English theatres in 1642 and to Oliver Cromwell's Puritan regime. The dominant literary figure was John Milton, and his influential religious epic *Paradise Lost* (1667) provided a link between the Puritan era and the restoration of the monarchy.

The return of Charles II in 1660 brought the courtly Restoration period, characterized by the social drama of William Congreve and the satirical poetry of Andrew Marvell and John Dryden. The diary and biography forms emerged as useful genres in the works of Samuel Pepys and Izaak Walton particularly, and these forms reappeared in the beginnings of the novel during the 18th century.

The 18th century contains two major literary currents. The first current was the Augustan age, or Neoclassical period, marked by the appearance of a literary elite and exemplified by the mock-heroic satires of Alexander Pope, the pamphleteering and allegory of Jonathan Swift (perhaps the greatest satirist in the language), and the criticism of Samuel Johnson. Journalism and the prose essay flourished, both influencing and being nurtured by this movement, as seen in Joseph Addison's periodical *The Spectator.* Of great importance is the rise of the novel as an independent literary form in the works of Daniel Defoe, Henry Fielding, and Samuel Richardson.

The second current in 18th-century literature was Romanticism, which was in part a reaction against the elitism and self-imposed classical limitations of the Augustans. It began with William Blake's poetry of rebellion against convention and with the creation of a new mythology of the imagination. William Wordsworth and Samuel Taylor Coleridge were central to the movement, producing a manifesto of Romantic beliefs in the preface to their joint *Lyrical Ballads* (1798). These poets concentrated on the universal power of nature and the imagination and turned away from the grayness of increasing industrialization. The Romantic movement includes widely disparate elements, however, from the lyrical sensuality of John Keats to the complex and committed literary criticism in Coleridge's *Biographia Literaria.*

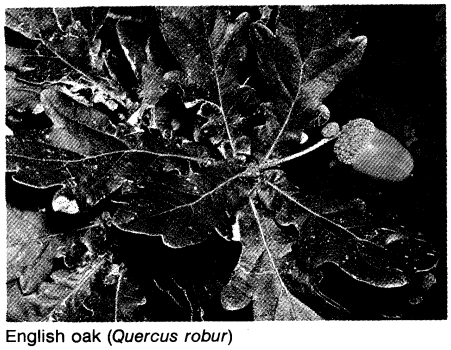
The novel, too, continued to gather strength in the baroque fantasies of the Gothic novel and in the insight into polite society shown by Jane Austen. The basic form of the historical novel was established by Sir Walter Scott in the 1820s. Scott was succeeded by Charles Dickens, arguably the most popular English novelist of the Victorian age, with his masterly caricature and scenes of low life. Following Dickens were Elizabeth Gaskell's novels of working-class life, George Eliot's portrayals of 19th-century society and its moral dilemmas, William Thackeray's varied productions, and Anthony Trollope's depictions of contemporary manners and mores. Thomas Hardy marks the end of the Victorian era and the threshold of modernism, through his agnosticism and use of irony.

The Modern age began with World War I, which created a sense of disillusion manifested in the cynicism of the war poets Siegfried Sassoon and Wilfred Owen, as contrasted with the romantic fervour of Rupert Brooke. This disillusion became a sense of life's bleakness and lack of promise, as seen in the Modernist poetry of T.S. Eliot. There was an increasing concentration on form and language, as in the novels of James Joyce and those of Virginia Woolf and the Bloomsbury Group, and this continued into the second half of the 20th century with the poetry of W.H. Auden. Peripheral to the Modernist movement are D.H. Lawrence, whose novels examined the inner life of sexuality and the emotions, and the Irish poet W.B. Yeats, whose work moved from Symbolism to Modernism and

who was a leading figure in the Irish literary renaissance.

The second half of the 20th century has been characterized by no particular movement, although there has been significant development in drama, from Realism in John Osborne to Absurdism in Samuel Beckett. Since the revolutionary treatment of the novel in the stream-of-consciousness technique of Joyce and Woolf, there have been no outstanding developments in the genre as an art form, although it has found solid expression in the works of such writers as Graham Greene, Evelyn Waugh, William Golding, and Iris Murdoch.

English oak, also called BROWN OAK (*Quercus robur*), ornamental and timber tree of the beech family (Fagaceae) that is native to Eurasia but also cultivated in North America and Australia. The tree has a short, stout trunk with wide-spreading branches and may



English oak (*Quercus robur*)
G.R. Roberts

grow to a height of 25 metres (82½ feet). The short-stalked leaves, 13 centimetres (5 inches) or more long, have three to seven pairs of rounded lobes; they are dark green above, pale green beneath, and retain their colour into winter. Many varieties are cultivated as ornamentals, including a popular columnar form. The heavy heartwood was once extensively used in Great Britain for shipbuilding and carving.

English round hand (in calligraphy): *see* copperplate script.

English school, dominant school of painting in England throughout the second half of the 18th century and the first half of the 19th. Its establishment marked the rise of a national tradition that began with the emergence of native artists whose works were no longer provincial but rivalled continental art in quality and ended by exercising a decisive influence on the course of European painting.

William Hogarth, a London painter and engraver, was an early representative of the English school and the first modern English master. Hogarth worked in the playful, elegant Rococo style of contemporary French art but perfected between 1730 and 1750 two new, peculiarly British forms: a type of genre painting, the "modern moral subject," which satirized contemporary life and manners with a highly narrative approach, and the small-scale group portrait, or "conversation piece."

English full-scale portraiture was revitalized by two painters, Sir Joshua Reynolds and Thomas Gainsborough. Reynolds, who began his career by studying the works of Raphael and Michelangelo in Italy, introduced the "Grand Manner" into English portraiture, using an extensive repertory of poses derived from Italian art in his strongly characterized portraits. His theoretical "Discourses," delivered yearly to Royal Academy students, were the single most important influence on subsequent English art. Gainsborough, who never left England and lacked Reynolds' intellectual gifts, nevertheless produced a Rococo lyricism not evident in Reynolds' work, revealing a light, fluid technique, delicate colouring, and a sensitivity to character that surpassed Reynolds' own.

Historical painting was seldom successfully attempted by English artists in the 18th century. Nevertheless, Benjamin West and John Singleton Copley, two American-born painters who gained impressive reputations in England, made moderate achievements with their innovative, if largely uninspired, depictions of current history. Genre painting, on the other hand, flourished under the encouragement of the Royal Academy, with such notable artists as George Morland, Joseph Wright, and the animal painter George Stubbs.

The early phase of the English school also included the beginning of the English landscape tradition, the founder of which was Richard Wilson. Applying the Classical principles of clarity and order to the depiction of the English countryside, Wilson contributed a delicate sense of light and distance and a grandeur of design to the English tradition. Though the bulk of his work was portraiture, Gainsborough was also a master of landscape and treated it with the same light touch that characterizes his portraits. Toward the close of the century, John Robert Cozens painted watercolour landscapes of great beauty.

Before the turn of the 19th century, the spirit of Romanticism had begun to grow in England, and it remained dominant in English art until the mid-19th century. Among the enduring works produced are the visionary drawings of the poet William Blake and the portraits of Sir Thomas Lawrence and Sir Henry Raeburn.

The flowering of English Romantic art, however, came with the work of England's two greatest landscapists, J.M.W. Turner and John Constable. Both artists built on the tradition of Wilson, Cozens, and Gainsborough, as well as on the works of earlier continental painters, but they developed their mature styles with complete disregard for convention and according to their own very different personalities. Turner expressed in his highly poetic art a troubled search for peace in nature. His late work approaches abstraction—light dissolves all but the slightest indications of mass, producing pictures of almost disembodied colour. Constable limited himself almost entirely to the countryside of southern England and evolved a profoundly innovative style, characterized by a use of rough, broken touches of colour and of a fresh, bright palette free of the conventional browns within a Classical composition of receding planes. This style was especially suited to capturing the effects of weather on the landscape, with which he was particularly concerned. Constable's influence on European painting was far-reaching, providing considerable inspiration to the French Impressionists and forming the basis for modern landscape painting.

After about 1850 the fresh observation and direct approach that had become traditional in the best English art was superseded by a self-conscious revivalism and a concern with involved theory. Though England continued to produce active movements, truly innovative development passed to other centres.

English sparrow: *see* house sparrow.

English sweat: *see* sweating sickness.

English toy spaniel, breed of dog known in Britain since Tudor times but which apparently originated in ancient Japan or China. It was favoured by Mary, Queen of Scots, King Charles II (after whom it was named the King Charles Spaniel), and Queen Victoria, as well as by members of the aristocracy. A compact little dog with a domed head, short nose, and

English toy spaniel, Ruby variety
Sally Anne Thompson—EB Inc.

large, dark eyes, it has long, heavily haired, hanging ears and a long, soft, wavy coat. It stands 9 to 10 inches (23 to 25.5 centimetres) and weighs about 9 to 12 pounds (4 to 5.5 kilograms). There are four varieties, all similar except in colour. The King Charles variety is black-and-tan, as in the original members of the breed; the Prince Charles is black, tan, and white; the Blenheim is reddish brown and white; the Ruby is solid reddish brown. In Britain, all varieties except the Blenheim are grouped as King Charles spaniels.

The Cavalier King Charles spaniel is a different breed, recognized in Britain but not in the United States. It appears in the same coat colours as the English toy spaniels, but it is larger (weight, 10 to 18 pounds [4.5 to 8 kilograms]) and has a longer muzzle.

English yew (*Taxus baccata*), also called COMMON YEW, or EUROPEAN YEW (all three are lumber trade names), an ornamental evergreen tree of the yew family (Taxaceae), widely distributed throughout Europe and Asia as far east as the Himalayas. Some botanists consider the Himalayan form to be a separate species, called Himalayan yew. Rising to a height of from 10 to 30 metres (about 35 to 100 feet), the tree has spreading branches and slightly drooping branchlets. The bark is

English yew (*Taxus baccata*)
G.E. Hyde—EB Inc.

reddish brown and flaky, sometimes deeply fissured in very old trees. All parts of an English yew contain a substance poisonous to humans and animals. Many horticultural varieties have been developed, some of which are small shrubs. One of the most popular is the Irish yew. It has a compact, columnar form and is used in formal plantings. Several hybrids have been obtained by crossing the English yew with the Japanese yew (*q.v.*); the most common, *Taxus* × *media,* has several varieties.

engraved glass, glassware decorated with finely carved, three-dimensional patterns or pictures. The most common engraving technique involves incising a design into glass with a rapidly spinning copper wheel fed with abrasives. Other techniques include diamond scribing and stipple engraving; the former produces very delicate lines and the latter creates shaded patterns. A design engraved in the surface of a glass article may be left rough, etched with acid, or polished.

The Romans engaged in wheel engraving as early as 1 BC, producing glassware characterized by massive cut shapes. From about AD 700 to 1400 Islāmic glassworkers significantly refined engraving. In addition to perpetuating the earlier modes of facet and boss cutting, they also introduced two new styles, linear intaglio and relief cutting.

engraver beetle: *see* bark beetle.

engraving, technique of making prints from metal plates into which a design has been incised with a cutting tool called a burin. Modern examples are almost invariably made from copperplates; hence, the process is also called copperplate engraving. Another term for the process, line engraving, derives from the fact that this technique reproduces only linear marks. Tone and shading, however, can be suggested by making parallel lines, or crosshatching.

"Madonna and Child," engraving by Andrea Mantegna

By courtesy of the National Gallery of Art, Washington, D.C., Rosenwald Collection

Engraving originated independently in the Rhine Valley in Germany and in northern Italy around the middle of the 15th century. It seems to have been first developed by German goldsmiths now known only by their initials or pseudonyms. The most prominent of these early engravers are the Master E.S. and the Master of the Playing Cards. Martin Schongauer is the first engraver known to have been not only a goldsmith but also a painter. His "Temptation of St. Anthony" (*c.* 1470) is unprecedented in its sophisticated use of the medium to achieve a sense of form and surface texture.

In Italy, engraving grew out of both the goldsmith's art and niello work, a type of decorative metalwork. One of its earliest practitioners was the Florentine goldsmith and niellist Maso Finiguerra (1426–64). Major Italian painters adopted engraving much more enthusiastically than did their German counterparts. Before the 15th century had passed, important engravings had been made by two great Italian painters: Andrea Mantegna and Antonio Pollaiuolo. Although its quick association with painting in Italy resulted in such prodigious prints as Pollaiuolo's "Battle of the Nudes" (*c.* 1465), this also prevented the independent development of engraving, which soon was used primarily to reproduce paintings. By the 16th century, the reproductive role of engraving had become so firmly established that Italy's greatest master of engraving technique, Marcantonio Raimondi, is mainly known for his copies of Raphael's paintings.

In northern Europe, however, engraving followed its own course, and two of its greatest 16th-century masters, Albrecht Dürer and Lucas van Leyden, produced some of their finest original work in this technique.

During the remainder of the 16th century, engravers such as Hendrik Goltzius (1558–1617) continued to develop increasingly brilliant techniques. Simultaneously, however, engraving became more and more restricted to reproducing paintings. This trend, which continued throughout the 17th century, was facilitated by the popularization of techniques capable of producing gradations of tone. The dotting of the plate with short jabs of the burin, common from the late 15th century, evolved in the late 17th and 18th centuries into the techniques known as stipple engraving and crayon manner (also known as chalk-manner or pastel-manner engraving). These techniques scored the plate with numberless dots and nicks made with a burin or special tools called rockers and roulettes. With mezzotint (*q.v.*), a related technique invented in the 17th century by Ludwig von Siegen, they almost completely replaced line engraving in the 18th century. It was revived to an extent, however, in the 20th century by the French artist Jacques Villon and the English artists Eric Gill and Stanley William Hayter. The latter successfully demonstrated that line engraving is a suitable medium for much modern art, including abstraction. The U.S. printmakers Mauricio Lasansky and Gabor Peterdi have also produced engravings.

Engsi: *see* Hatchlu rug.

enhanced radiation warhead: *see* neutron bomb.

enharmonic, in the system of equal temperament tuning used on keyboard instruments, two tones or intervals that sound the same but are notated differently; for example, c♯ and d♭ (enharmonic tones) or c–f♯ and c–g♭ (enharmonic intervals). The different notations indicate the key to which the tone or interval belongs. Enharmonic tones and intervals often serve as pivots in modulation (change of key).

In earlier systems of tuning, such as just intonation and mean-tone tuning, the pitch of enharmonic tones was not identical; c♯ then sounded slightly lower than d♭ by about one-fifth of a tone. While the piano, harpsichord, and other fixed-pitch, equally tempered instruments cannot maintain this distinction, singers and violinists frequently do. Enharmonic in ancient Greek music referred to the tetrachord, or four-note series, containing intervals of less than a semitone.

ENI, abbreviation of ENTE NAZIONALE IDROCARBURI (Italian: State Hydrocarbons Authority), state-owned Italian energy group.

ENI is a fully integrated petroleum producer, transporter, refiner, and retailer established in 1953. It supplies nearly half of Italy's energy needs, primarily through overseas purchases.

Since World War II, the public sector has played an exceptionally large role in Italian economic life. ENI is one of the three major state economic holding corporations, operating primarily in oil and natural gas. Although responsible to the Ministry of State Participations, ENI enjoys considerable financial and operating autonomy. The company is an outgrowth of AGIP, an oil and gas agency set up by the Italian Fascist government in the 1930s. In 1952 Enrico Mattei, a former resistance fighter, persuaded the Italian postwar government to coordinate the AGIP gas and oil holdings in the new ENI. AGIP is now the retail subsidiary of ENI and sells oil products through service stations in Africa and Europe.

Exploration for oil, especially in offshore areas, has been intensified by ENI, but national production accounts for only a small portion of domestic consumption. Oil is imported from a number of diversified sources, especially in the Middle East. ENI is also in charge of natural gas exploration and imports.

ENI subsidiaries engage in exploration, production, and refining of oil and natural gas. The company also has interests in textiles, nuclear energy, and chemicals, and owns a mass-circulation daily newspaper, a news service, and several advertising agencies. In 1981 ENI entered into a joint venture with the U.S. firm Occidental Petroleum Corp. The venture, named Enoxy, operates coal properties in the U.S. and owns a British rubber company.

Enid, city, seat (1907) of Garfield County, north central Oklahoma, U.S. Located at a watering place on the Chisholm (cattle) Trail (reached by the Rock Island Railroad in 1889), it was founded overnight as a tent city around a U.S. land office when the Cherokee Strip was opened by settlers on Sept. 16, 1893. Tents and shacks quickly gave way to frame houses and business establishments. The settlement was supposedly named for the character Enid in Tennyson's *Idylls of the King.* Enid subsequently became the commercial and cultural centre of northwestern Oklahoma. Wheat, cattle, and oil are its principal economic resources. Industries include flour and grain milling, meat processing, dairying, oil refining, and the manufacture of oil-field equipment. Enid is the site of Phillips University (1906), and Vance Air Force Base is nearby. Inc. 1894. Pop. (1980) 50,363.

Eniwetok (Marshall Islands): *see* Enewetak.

Enkeldoorn (town, Zimbabwe): *see* Chivhu.

Enkhuizen, *gemeente* (municipality), Noordholland *provincie* (province), northwestern Netherlands, on the IJsselmeer (Lake IJssel). Chartered in 1355, the town gained importance during the 16th and 17th centuries as a fishing and shipping centre for herring, although the herring-fishing industry later declined with the silting up of the Zuiderzee (late 17th century). Enkhuizen was one of the first towns in the Netherlands to revolt against the Spanish in 1572 and is today still predominantly Protestant. The Drommedaris Tower (1540) and Zuiderkerk (South Church), the latter containing a carillon with 48 bells, overlook the harbour. The Westerkerk (West Church) dates from the 15th century. The Waag (Weighhouse; 1559), a former meeting place for surgeons, contains a 17th-century surgery, or doctor's office. The 17th-century town hall contains a self-portrait of Paul Potter (1625–54), a renowned local painter of animals. Industries in Enkhuizen produce electrical goods, chemicals, paper, foodstuffs, and tobacco products. Vegetables, fruit, and flowers are cultivated and dairy cattle are raised in the surrounding area and marketed in Enkhuizen. Eel fishing and the distribution of local agricultural products are economic activities connected with the harbour. A railway and roads connect Hoorn with Enkhuizen; a ferry connects it with Urk Island. A road across the IJsselmer, between Enkhuizen and Lelystad, was completed in 1976. Pop. (1981 est.) 15,540.

Enki (Mesopotamian deity): *see* Ea.

enlarger, also called PROJECTION PRINTER, in photography, device for producing a photographic print or negative larger than the orig-

inal negative or transparency. The enlarger consists of a projection system, or head assembly, mounted on a horizontal base. The head assembly includes an enclosed light source, a holder for positioning and flattening the negative, a lens for projecting the image onto the base (which holds the paper), and a mechanism for focusing the image. The head assembly may be raised or lowered to adjust the size of the print.

A filter drawer between the light source and the negative permits the insertion of colour filters or variable contrast filters. Modern enlargers designed for colour printing generally incorporate adjustable filters within the head assembly itself.

Enlightenment, French SIÈCLE DE LUMIÈRES ("Age of the Enlightened"), German AUFKLÄRUNG, a European intellectual movement of the 17th and 18th centuries in which ideas concerning God, reason, nature, and man were synthesized into a worldview that gained wide assent and that instigated revolutionary developments in art, philosophy, and politics. Central to Enlightenment thought were the use and the celebration of reason, the power by which man understands the universe and improves his own condition. The goals of rational man were considered to be knowledge, freedom, and happiness.

A brief treatment of the Enlightenment follows. For full treatment, *see* MACROPAEDIA: European History and Culture.

The powers and uses of reason had first been explored by the philosophers of ancient Greece, who discerned in the ordered regularity of nature the workings of an intelligent mind. Rome adopted and preserved much of Greek culture, notably including the ideas of a rational natural order and natural law. Amid the turmoil of empire, however, a new concern arose for personal salvation, and the way was paved for the triumph of the Christian religion. Christian thinkers gradually found uses for their Greco-Roman heritage. The system of thought known as scholasticism, culminating in the work of Thomas Aquinas, resurrected reason as a tool of understanding but subordinated it to spiritual revelation and the revealed truths of Christianity.

The intellectual and political edifice of Christianity, seemingly impregnable in the European Middle Ages, fell in turn to the assaults made on it by humanism, the Renaissance, and the Protestant Reformation. Humanism bred the experimental science of Francis Bacon, Nicolaus Copernicus, and Galileo and the mathematical rigour of René Descartes, G.W. Leibniz, and Sir Isaac Newton. The Renaissance rediscovered much of classical culture and revived the notion of man as a creative being, while the Reformation, more directly but in the long run no less effectively, challenged the monolithic authority of the Roman Catholic church. For Luther as for Bacon or Descartes, the way to truth lay in the application of human reason. Received authority, whether of Ptolemy in the sciences or of the church in matters of the spirit, was to be subject to the probings of unfettered minds.

The successful application of reason to any question depended on its correct application—on the development of a methodology of reasoning that would serve as its own guarantee of validity. Such a methodology was most spectacularly achieved in the sciences and mathematics, where the logics of induction and deduction made possible the creation of a sweeping new cosmology. The success of Newton, in particular, in capturing in a few mathematical equations the laws that govern the motions of the planets gave great impetus to a growing faith in man's capacity to attain knowledge. At the same time, the idea of the universe as a mechanism governed by a few simple (and discoverable) laws had a subversive effect on the concepts of a personal God and individual salvation that were central to Christianity.

Inevitably, the method of reason was applied to religion itself. The product of a search for a natural—rational—religion was deism, which, although never an organized cult or movement, conflicted with Christianity for two centuries, especially in England and France. For the deist a very few religious truths sufficed, and they were truths felt to be manifest to all rational beings: the existence of one God, often conceived of as architect or mechanician, the existence of a system of rewards and punishments administered by that God, and the obligation of men to virtue and piety. Beyond the natural religion of the deists lay the more radical products of the application of reason to religion: skepticism, atheism, and materialism.

The Enlightenment produced the first modern secularized theories of psychology and ethics. John Locke conceived of the human mind as being at birth a tabula rasa, a blank slate on which experience wrote freely and boldly, creating the individual character according to the individual experience of the world. Supposed innate qualities, such as goodness or original sin, had no reality. In a darker vein, Thomas Hobbes portrayed man as moved solely by considerations of his own pleasure and pain. The notion of man as neither good nor bad but interested principally in survival and the maximization of his own pleasure led to radical political theories. Where the state had once been viewed as an earthly approximation of an eternal order, with the city of man modeled on the city of God, now it came to be seen as a mutually beneficial arrangement among men aimed at protecting the natural rights and self-interest of each.

The idea of society as a social contract, however, contrasted sharply with the realities of actual societies. Thus the Enlightenment became critical, reforming, and eventually revolutionary. Locke and Jeremy Bentham in England, Jean-Jacques Rousseau, Montesquieu, and Voltaire in France, and Thomas Jefferson in America all contributed to an evolving critique of the arbitrary, authoritarian state and to sketching the outline of a higher form of social organization, based on natural rights and functioning as a political democracy. Such powerful ideas found expression as reform in England and as revolution in France and America.

The Enlightenment expired as the victim of its own excesses. The more rarefied the religion of the deists became, the less it offered those who sought solace or salvation. The celebration of abstract reason provoked contrary spirits to begin exploring the world of sensation and emotion in the cultural movement known as Romanticism. The Reign of Terror that followed the French Revolution severely tested the belief that man could govern himself. The high optimism that marked much of Enlightenment thought, however, survived as one of the movement's most enduring legacies: the belief that human history is a record of general progress.

Enlil (Mesopotamian deity): *see* Bel.

Enmebaragesi, also spelled ENMEBARAGISI, also called ME-BARAGESI (fl. *c.* 2700 BC), king of Kish, in northern Babylonia, and the first historical personality of Mesopotamia.

Enmebaragesi is known from inscriptions about him on fragments of vases of his own time, as well as from later traditions. He was the next-to-last ruler of the first dynasty of Kish. He "despoiled the weapons of the land of Elam," one inscription asserts. His son, Agga, was the last king of the dynasty, owing to his defeat by Gilgamesh, according to the Sumerian epic *Gilgamesh and Agga of Kish.*

Enmerkar, ancient Sumerian hero and king of Erech, a city-state in southern Mesopotamia, who is thought to have lived at the end of the 4th or beginning of the 3rd millennium BC. Along with Lugalbanda and Gilgamesh, Enmerkar is one of the three most significant figures in the surviving Sumerian epics.

Although scholars once assumed that there was only one epic relating Enmerkar's subjugation of a rival city, Aratta, it is now believed that two separate epics tell this tale. One is called *Enmerkar and the Lord of Aratta.* The longest Sumerian epic yet discovered, it is the source of important information about the history and culture of the Sumero-Iranian border area. According to this legend, Enmerkar, son of the sun god Utu, was envious of Aratta's wealth of metal and stones, which he needed in order to build various shrines, especially a temple for the god Enki in Eridu. Enmerkar therefore requested his sister, the goddess Inanna, to aid him in acquiring material and manpower from Aratta; she agreed and advised him to send a threatening message to the lord of Aratta. The lord of Aratta, however, demanded that Enmerkar first deliver large amounts of grain to him. Though Enmerkar complied, the lord of Aratta refused to complete his part of the agreement; threatening messages were again sent out by both men, each claiming the aid and sanction of the goddess Inanna. The text becomes fragmented at that point in the narrative, but in the end Enmerkar was apparently victorious.

The other epic relating the defeat of Aratta is known as *Enmerkar and Ensuhkeshdanna.* In this tale the ruler of Aratta, Ensuhkeshdanna (or Ensukushsiranna), demanded that Enmerkar become his vassal. Enmerkar refused and, declaring himself the favourite of the gods, commanded Ensuhkeshdanna to submit to him. Although the members of Ensuhkeshdanna's council advised him to comply with Enmerkar, he listened instead to a local priest, who promised to make Erech subject to Aratta. When the priest arrived in Erech, however, he was outwitted and killed by a wise old woman, Sagburru, and the two sons of the goddess Nidaba. After he learned the fate of his priest, Ensuhkeshdanna's will was broken and he yielded to Enmerkar's demands.

A third epic, *Lugalbanda and Enmerkar,* tells of the heroic journey to Aratta made by Lugalbanda in the service of Enmerkar. According to the epic, Erech was under attack by Semitic nomads. In order to save his domain, Enmerkar required the aid of Inanna, who was in Aratta. Enmerkar requested volunteers to go to Inanna, but only Lugalbanda would agree to undertake the dangerous mission. The epic concerns the events of Lugalbanda's journey and the message given him from Inanna for Enmerkar. Although obscure, Inanna's reply seems to indicate that Enmerkar was to make special water vessels and was also to catch strange fish from a certain river.

Enna, Latin ENNA, or HENNA, city, capital of Enna *provincia,* central Sicily, Italy, on a plateau dominating the valley of the Dittaino, northeast of Caltanissetta. A city of the Siculi, an ancient Sicilian tribe, and a centre of the pre-Hellenic cult of Demeter and Kore (Persephone), it originated as Henna and early came under Greek influence, first from Gela (7th century BC) and later from Syracuse, after which it fell into the hands of the Syracusan tyrant Dionysius I in about 397 BC. After a brief period (4th century) of Carthaginian rule, it passed to the Romans in 258 BC. It was the headquarters (134–132 BC) of the great Sicilian slave revolt. It was of little note in later classical times, but its natural strength and strategic position gave it renewed importance in the Middle Ages. Held by the Saracens from 859 until 1087, it was then taken by the Normans. Its medieval name Castrogio-

vanni, derived from the Arabic Kasr-Yani, is a corruption of the Latin Castrum Hennae. A favourite residence of the emperor Frederick II of Hohenstaufen and of Frederick II and III of Aragon, it was among the first Sicilian cities to rally to the Italian cause in 1848 and 1860. In 1927 it resumed its ancient name.

Notable buildings include an octagonal tower of Emperor Frederick II, the cathedral (1307; rebuilt in Baroque style), and the Castello di Lombardia, the work of many periods. The Lago (lake) di Pergusa, 4 mi (6 km) south, is the traditional scene of the seizure of Persephone (Proserpina) by Hades (Pluto), king of the underworld.

An episcopal see, the city is a summer resort and agricultural centre. Sulfur is mined in the vicinity. Pop. (1983 est.) mun., 28,203.

Ennedi, plateau region, northeastern Chad, central Africa, centred around the town of Fada. The terrain is primarily arid desert, with sandstone peaks rising to 4,756 ft (1,450 m). Wild game is abundant. The region has a sparse population of semi-nomads, chiefly Muslims who speak the Dazaga dialect. They live in permanent villages during the rainy months of July, August, and September but disperse for the dry season. Their herds include camels, horses, donkeys, sheep, and goats. Dates, wheat, millet, and barley grow in the oases. Because the area was considered ungovernable, following Chad's independence in 1960 it remained under French military administration until 1965, when the French withdrew at Chad's request.

Ennin, original name MIBU, also called JIKAKU DAISHI (b. 794, Tsuga District, Shimotsuke Province, Japan—d. Feb. 24, 864, Japan), Buddhist priest of the early Heian period, founder of the Sammon branch of the Tendai sect, who brought from China a system of vocal-music notation still used in Japan.

At the age of 8 Ennin began his education at Dai-ji (*ji*, "temple"), and he entered the Tendai monastery of Enryaku-ji on Mt. Hiei near Kyoto when he was 15. He became a disciple of the priest Saichō, founder of the sect and the temple. Efforts were under way to harmonize Buddhism and Shinto, and the emperor Nimmyō named Ennin to a large study mission to T'ang China, where Saichō's inspiration for Tendai had originated.

Ennin spent nine years there, observing, studying, reading, and writing, and when he returned home in 847 he brought with him 559 volumes of Chinese Buddhist literature and many religious implements for Buddhist rituals. Tendai Buddhism had a strong tradition of music, and to the temple at Enryaku-ji, Ennin also brought the method of musical notation for chants used in China, a system of curved and shaped lines and figures called neumes, whose use continues in Japan. Among his voluminous writings was a detailed journal of his Chinese travels.

It was also Ennin who introduced to Japanese Buddhism *nembutsu,* the practice of chanting the name of Amida Buddha, and this contributed to a new piety developing in rural Japan. The Imperial Court recognized Ennin's contributions by naming him *daihosshi* ("great priest") in 848. Ennin's doctrines and teachings, stressing piety and the possibility of becoming a Buddha in this life, developed into the Sammon branch of Tendai Buddhism, one of the three branches of the sect that continue to exist, and influenced the course of Japanese Buddhism for centuries to come. He became chief priest of his order in 854. Upon his death in 864 the title *hōin daichi* (the highest priestly rank, in effect, "high priest of supreme wisdom") was posthumously conferred on him, and two years later he was given the honorific name Jikaku Daishi.

Ennis, Irish INIS (River-Meadow), county town (seat) of County Clare, Ireland, on the River Fergus. Incorporated in 1612, it is now controlled by an urban district council. A Franciscan abbey, founded about 1242, is a national monument. Ennis, on the main Limerick–Galway road, is the principal rail and road junction of County Clare and has flour mills and textile, imitation jewelry, electronics, and engineering industries. Pop. (1981) 6,223.

Enniskillen, also spelled INNISKILLING, Irish INIS CEITHLEANN, town and seat, Fermanagh district (established 1973), formerly in County Fermanagh, Northern Ireland. Situated on Cethlin's Island, it was a strategic crossing point of Lough Erne and an ancient stronghold of the Maguires of Fermanagh. Incorporated by the English king James I, it defeated a force sent by James II in 1689 and gained a reputation as a Protestant stronghold. Long a garrison town, it gave its name to the Royal Inniskilling Fusiliers and the 6th (Inniskilling) Dragoons, both famous regiments of the British Army. Enniskillen functions as an agricultural market; other activities include bacon curing and hosiery manufacture. On nearby Devenish Island are the ruins of St. Mary's Abbey, a 6th-century foundation of St. Molaise. Oscar Wilde, late 19th-century poet and dramatist, was a student at the Royal School, founded in 1618. Pop. (1981) 10,429.

Ennius, Quintus (b. 239 BC, Rudiae, southern Italy—d. 169 BC), epic poet, dramatist, and satirist, the most influential of the early Latin poets, rightly called the founder of Roman literature. His epic *Annales,* a narrative poem telling the story of Rome from the wanderings of Aeneas to the poet's own day, was the national epic until it was eclipsed by Virgil's *Aeneid.*

Because of the place of his birth, Ennius was at home in three languages and had, as he put it, "three hearts": Oscan, his native tongue; Greek, in which he was educated; and Latin, the language of the army with which he served in the Second Punic War. The elder Cato took him to Rome (204), where he earned a meagre living as a teacher and by adapting Greek plays, but he was on familiar terms with many of the leading men in Rome, among them the elder Scipio. His patron was Marcus Fulvius Nobilior, whose son Quintus obtained Roman citizenship for Ennius. Nothing else of significance is known about his life.

Only some 600 lines of the *Annales* survive. As an epic, it lacks unity and suffers from mixing mythological elements with eyewitness accounts of contemporary history.

Ennius excelled in tragedy. Titles survive of 19 plays adapted from the Greek, mostly Euripides; *e.g., Iphigenia at Aulis, Medea, Telephus,* and *Thyestes.* About 420 lines remain, indicating remarkable freedom from the originals, great skill in adapting the native Latin metres to the Greek framework, heightening the rhetorical element and the pathetic appeal (a feature of Euripides that he greatly admired) through skillful use of alliteration and assonance. His plays on Roman themes were *Sabinae* and, if they really were plays, *Ambrachia* (on the capture of that city by Fulvius) and *Scipio.*

In the *Saturae* Ennius developed the only literary genre that Rome could call its own. Four books in a variety of metres on diverse subjects, they were mostly concerned with practical wisdom, often driving home a lesson with the help of a fable. More philosophical were two works on the theories of Epicharmus, the Sicilian poet and philosopher. Some epigrams, on himself and Scipio Africanus, are the first Latin elegiac couplets.

Ennius, who is credited also with the introduction of the double spelling of long consonants and the invention of Latin shorthand, was a man of wide interests and was conversant with the intellectual and literary movements of the Hellenistic world. He created and did not fall far short of perfecting a mode of poetic expression that reached its greatest beauty in Virgil and was to remain preeminent in Latin literature.

Cicero and others admired the work of Ennius throughout the republican period. Critical remarks appeared in Horace, becoming more severe in Seneca and Martial.

Ennodius, Magnus Felix (b. 473/4, Arelate, Gaul—d. 521, Ticinum, Pavia), Latin poet, prose writer, rhetorician, and bishop, some of whose prose works are valuable sources for historians of his period.

A member of the important and influential family of the Anicii, Ennodius lived in Ticinum and Mediolanum (Milan), an important centre of learning. Though his interests were largely secular and literary, in 493 he was ordained deacon to the Bishop of Ticinum, and in 507 he was appointed by the Pope to compose a panegyric on Theodoric, expressing gratitude for the Arian king's tolerance of Catholicism. After a sudden illness he renounced secular pursuits in fulfillment of a vow. After appointment to the see of Ticinum in about 513, Ennodius was sent by Theodoric on an embassy to the court of the emperor Anastasius I at Constantinople. Ennodius has been represented as a friend of Theodoric, but his support of him may have been a consequence of the friendship between Theodoric and Epiphanius, the former bishop of Ticinum.

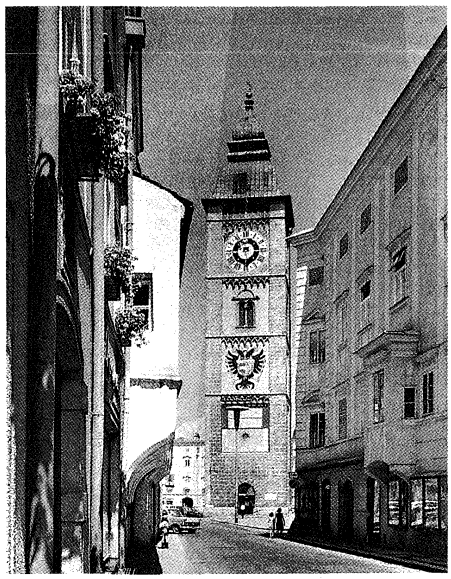
Ennodius' literary output is considerable and varied. He composed occasional poems, including two itineraries of his journeys, two poems on works of art, another on a garden, some epigrams, and other miscellaneous poems of lesser merit. His prose works include a biography of Epiphanius, which throws a valuable light on the political activity of the church and is, together with a panegyric on Theodoric, an important source for the historian; *Dictiones,* a collection of model speeches which reveal the continuance of the traditional rhetorical education and give a valuable description of the school of the grammarian Deuterius in Milan; epistles on a wide range of subjects (including some addressed to Boethius, to whom he was related); and the *Eucharisticum de vita sua,* a kind of confession. He also wrote, in a mixture of prose and verse, the *Paraenesis didascalica,* otherwise entitled *Ennodius Ambrosio et Beato,* a didactic treatise on grammar and rhetoric.

Much of Ennodius' writing shows his devotion to pagan Roman tradition, which was zealously fostered by the Anician family; like other members of his family, he sought to reconcile this tradition with Christianity. The rhetorical basis of his training and interest is reflected throughout his works, the chief concern of which is form, but his style is affected, excessive, overelaborate, and diffuse.

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

Enns, town, *Bundesland* Oberösterreich (federal province of Upper Austria), northeast central Austria, on the Enns River near its junction with the Danube, southeast of Linz. Its suburb of Lorch (incorporated into Enns in 1938) is on the site of the Roman camp of Lauriacum. Enns itself was established as a fortress in the 9th century and was chartered in 1212, making it the oldest chartered municipality in Austria. Notable landmarks include the parish church (1308–43), one of the finest early Gothic buildings in Austria; the Stadtturm, or Town Tower (1554–68); the castle of Ennsegg (1565; on older foundations); and the

old town hall (1547), now housing a local museum with Roman relics. The Baroque Abbey of St. Florian is to the west of the town. Enns



Stadtturm, or Town Tower, Enns, Austria
F. Wolfsberger—ZEFA

manufactures glassware, jewelry, and roofing and has breweries. Pop. (1981) 9,731.

Enoch, First Book of, also called ETHIOPIC BOOK OF ENOCH, pseudepigraphal work (not included in any canon of scripture) whose only complete extant version is an Ethiopic translation of a previous Greek translation made in Palestine from the original Hebrew or Aramaic.

Enoch, the seventh patriarch in the book of Genesis, was the subject of abundant apocryphal literature, especially during the Hellenistic period of Judaism (3rd century BC to 3rd century AD). At first revered only for his piety, he was later believed to be the recipient of secret knowledge from God. This portrait of Enoch as visionary was influenced by the Babylonian tradition of the 7th antediluvian king, Enmenduranna, who was linked to the sun god and received divine revelations. The story of Enoch reflects many such features of the Babylonian myth.

I Enoch is a compilation of several separate works, most of which are apocalyptic. Its oldest portion is the "Apocalypse of Weeks," written shortly before the Maccabean uprising of 168 BC against the Romans. Other sections, especially those dealing with astronomical and cosmological speculations, are difficult to date. Because of its views on messianism, celibacy, and the fate of the soul after death, parts of *I Enoch* may have originated with or been influenced by the Essene community of Jews at Qumrān. No fragments of the longest portion of the work (chapters 37–71), however, were found among the Qumrān writings. This has led scholars to theorize that this section was perhaps written in the 2nd century AD by a Jewish Christian who wished to imbue his own eschatological speculations with the authority of Enoch, and added his work to four older apocryphal Enoch writings.

I Enoch was at first accepted in the Christian Church but later excluded from the biblical canon. Its survival is due to the fascination of marginal and heretical Christian groups, such as the Manichaeans, with its syncretic blending of Iranian, Greek, Chaldean, and Egyptian elements.

Enoch, Second Book of, also called SLAVONIC BOOK OF ENOCH, pseudepigraphal work whose only extant version is a Slavonic translation of the Greek original. The Slavonic edition is a Christian work, probably of the 7th century AD, but it rests upon an older Jewish work written sometime in the 1st century AD (but before the destruction of the Temple of Jerusalem in AD 70, because there are references to pilgrimages and cultic rituals connected with temple worship). In its apocalyptic and cosmological emphases, the book is similar to *First Book of Enoch* and may be dependent on it, although *II Enoch* is recognized as a separate part of the literary tradition surrounding the patriarch Enoch.

The first part of the book (chapters 1–21) deals with Enoch's journey through the seven tiers of heaven; it thus invites comparisons with descriptions of the heavenly spheres and their inhabitants in the *I Enoch* and the "Testament of Levi" in *Testaments of the Twelve Patriarchs.* The second section (chapters 22–38) is an explication of the tradition of Enoch's reception of secret wisdom from God. The final section (chapters 39–68) includes Enoch's advice to his sons and an account of his life, including his final ascension.

A product of the Greek-speaking Jewish Diaspora centred in Alexandria, Egypt, *II Enoch* includes many of the motifs characteristic of Hellenistic religious literature: visionary journeys, astrological calculations, a highly developed angelology, personal confrontations with divine beings, and a structural view of heaven.

Enomoto Takeaki, also called ENOMOTO BUYO (b. Oct. 5, 1836, Edo, Japan—d. Oct. 26, 1908, Tokyo), Japanese naval officer and statesman who was the last supporter of the Tokugawa family—which ruled Japan for 264 years—to capitulate to the forces that favoured the restoration of power to the emperor.

In 1868, as the fighting to end the long domination of the nation by the Tokugawa family neared a close, Enomoto took eight ships of the Tokugawa navy to Hokkaido, the northernmost Japanese island, with the intention of making it an independent republic. He surrendered to Imperial forces in 1869, after which he spent three years under house arrest. Restored to favour, Enomoto later held many important ministerial positions with the government of the Meiji emperor. As envoy extraordinary to Russia (1873–76), he concluded the Treaty of St. Petersburg, by which Japan gave up its claim to Sakhalin Island in exchange for the northern Kurils. He next served as navy minister (1876–82) and was minister to China (1882–84). He subsequently held the portfolios of communications, education, foreign affairs, agriculture, and commerce. He was created viscount in 1887.

Enotah, Mount (Georgia, U.S.): *see* Brasstown Bald.

Enquêtes, Chambre des (French law): *see* Chambre des Enquêtes.

Enquist, Per-Olov (b. Sept. 23, 1934, Hjoggböle, Swed.), Swedish writer and social critic of the 1960s.

Enquist's first novels, *Kristallögat* (1961; "The Crystal Eye") and *Färdvägen* (1963; "The Route Travelled"), reflect his aesthetic interest in the form of the novel and the influence of the French new novel. As the political climate of the 1960s changed, Enquist moved from a liberal viewpoint to a socialist position. He began to take a documentary approach in both his novels and dramas. This technique, with its quasi-scholarly method, first became noticeable in *Hess* (1966) and was carried out with great effectiveness in *Legionärerna* (1968; *The Legionnaires,* 1973), a study of the extradition of Baltic refugees from Sweden at the end of World War II. A year later the book was awarded the Nordic Prize. His novel *Musikanternas uttåg* (1978; "The Departure of the Musicians") deals with early unionizing efforts in his native province. His most successful drama, *Tribadernas natt* (1975; *The Night of the Tribades,* 1977), presents Enquist's analysis of August Strindberg's marital relationship.

Enragé (French: Madman), any of a group of extreme revolutionaries in France in 1793, led by a former priest, Jacques Roux, and Varlet, a postal official, who advocated social and economic measures favoured by the lower classes. The Enragés' name reflects the horror that they aroused in the bourgeoisie. Concerned primarily with the problem of a critical food shortage, the Enragés supported a program of price controls over commodities, requisitioning of grain, and government assistance to the poor. In the spring of 1793, they took an active part in the popular agitation that led to the overthrow of the moderate Girondins in the National Convention and pressured the Montagnards, or the Jacobins in the Convention, into taking emergency and terroristic measures to protect the Revolution. The leaders of the Enragés, fierce critics of the government, charged it with inaction and were arrested in September 1793 by order of the ruling Committee of Public Safety. The Enragés were replaced as popular leaders of the Revolution by the group known as the Hébertists.

Enrico (Italian personal name): *see under* Henry.

Enright, D(ennis) J(oseph) (b. March 11, 1920, Leamington, Warwickshire, Eng.), British poet, novelist, and teacher.

After receiving a master's degree at Cambridge, he began a prolonged period of academic wandering with a lectureship in English at the University of Alexandria, Egypt (1947–50), followed by posts at the University of Birmingham (1950–53); Kōnan University, Japan (1953–56); Free University of Berlin (1956–57); Chulalongkorn University of Bangkok (1957–59); the University of Singapore (1960–70); and honorary professor at the University of Warwick from 1975. He was joint editor of *Encounter* in London (1970–72). *Memoirs of a Mendicant Professor* (1969) tells of his years abroad.

Both his poetry (*Selected Poems,* 1969) and his novels (*Academic Year,* 1955; *Figures of Speech,* 1965) are anti-sentimental and reflect his life abroad. Later poetry is based on literary works or themes, as *Paradise Illustrated* (1975) and *A Faust Book* (1979). He also wrote fiction for children, such as *Joke Shop* (1976) and *Wild Ghost Chase* (1978). He edited *The Oxford Book of Contemporary Verse 1948–1980* (1980).

Enrique (Spanish personal name): *see under* Henry.

Enschede, *gemeente* (municipality), Overijssel *provincie* (province), eastern Netherlands, on the Twente Canal, near the German border, comprising the villages of Lonneker, Glanerbrug, and Boekelo and the town of Enschede. Chartered in 1325, it was a small village until the industrial development of the Twente district in the late 19th century. Now the largest town in Overijssel, it is the centre of the Dutch cotton-textile industry and is a rail junction with a canal harbour. Metallurgy and the manufacture of rubber goods and tires are also important. Destroyed by fire in 1862 and badly damaged in World War II, Enschede has been rebuilt in modern style. Twente military airport, 3.5 mi (5.6 km) to the north, is also used for domestic commercial transport. The town's principal features are the town hall (1933), the municipal theatre (1955), the Twente National Museum, the natural history museum and vivarium, the Roman Catholic and Dutch Reformed churches, and the modern synagogue. There is a technical school for textiles, as well as a technical university (1961), and Enschede is the triennial meeting

place of De Kogge, an association of Dutch, Flemish, and German writers. Boekelo is a summer resort. Enschede metropolitan area is contiguous with Hengelo (*q.v.*). Pop. (1983 est.) 144,897.

Ensenada, city, northwestern Baja California Norte state, northwestern Mexico. It is on Bahía (bay) Todos Santos of the Pacific Ocean, 43 ft (13 m) above sea level. The climate is cool and dry. Ensenada, the third largest city in Baja California Norte, derives much of its income from tourism, for it is only about 75 mi (120 km) south of Tijuana, on the United States border. Attractions include excellent seafood, swimming, hunting, and deep-sea fishing.

It is one of Mexico's most important Pacific ports. Agriculture (wheat, barley, and wine grapes), livestock raising, and fishing (sardines and lobster) are also important. The city has experienced substantial growth since 1950. It is accessible by highway and air as well as by ocean. Pop. (1979 est.) 129,000.

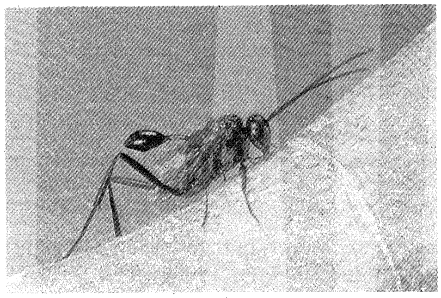
Ensenada, Zenón de Somodevilla y Bengoechea, marqués de la (marquess of) (b. June 2, 1702, Alesanco, near Logroño, Spain—d. Dec. 2, 1781, Medina del Campo), Spanish statesman who as prime minister from 1743 to 1754 pursued a vigorous reform policy that succeeded in advancing internal prosperity and promoting military strength.

Ensenada owed his early advancement to the chief minister of King Philip V (reigned 1700–46), José Patiño, who put him in charge of work at the new naval arsenal at El Ferrol del Caudillo. Ensenada accompanied the successful expedition against Oran in 1732. Four years later he organized the expedition to Naples that put Philip's son Carlos on the Neapolitan throne and was rewarded with the title of marqués. He also carried out various diplomatic missions in Italy and helped negotiate an alliance with France (the Second Family Compact) in 1743. Ensenada was appointed prime minister that year.

An able and effective administrator, Ensenada encouraged the development of agriculture and industry, undertook public works, sought to reform tax collection methods, fostered education, and removed abuses in the customs system to help facilitate internal commerce. He also stimulated the development of the army and especially the navy, building up both the Atlantic and Mediterranean fleets.

In foreign affairs Ensenada took a generally pro-French yet independent stance but regarded England with some hostility. This attitude aroused resentment in the court and helped contribute to intrigues by the British ambassador that brought about Ensenada's downfall (1754) and his banishment to Granada. Ensenada was received at court after the accession of Charles III in 1759 and served as a member of a commission on taxation reform. Because of his pro-Jesuit views, he was once more banished in 1766 and thereafter took no further part in public life.

ensign wasp, any member of the insect family Evaniidae (order Hymenoptera), so called because the small, oval abdomen is held high like an ensign, or flag. A few hundred species of this widely distributed family have been described.



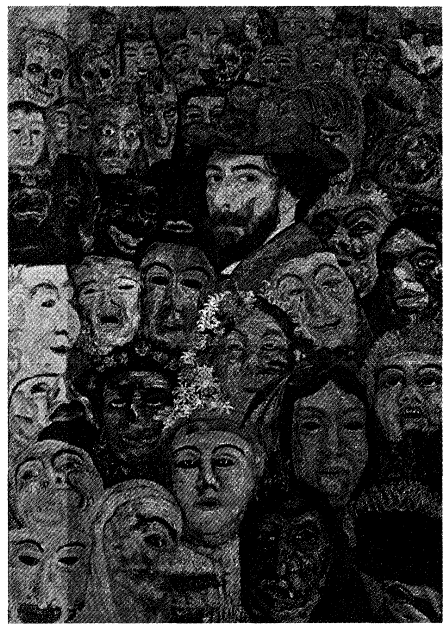
Ensign wasp (*Evania appendigaster*)

Grace Thompson—The National Audubon Society Collection/Photo Researchers

The body, which is black and somewhat spider-like in appearance, ranges in length from about 1 to 1.5 centimetres (about 0.4 to 0.6 inch). All species are parasites of cockroaches, which are common household pests; thus, ensign wasps are beneficial to man. The female places its eggs in the cockroach's egg case. *Evania appendigaster* is a common North American species.

ensilage (agriculture): *see* silage.

Ensor, James (Sydney), BARON (b. April 13, 1860, Ostend, Belg.—d. Nov. 19, 1949, Ostend), Belgian painter and printmaker whose works are known for their bizarre fantasy and sardonic social commentary.



"Portrait of the Artist Surrounded by Masks," oil painting by James Ensor, 1899; private collection

Ensor was an acknowledged master by the time he was 20 years old. After a youthful infatuation with the art of Rembrandt and Rubens, he adopted the vivacious brushstroke of the French Impressionists.

When Ensor's works were rejected by the Brussels Salon in 1883, he joined a group of progressive artists called Les Vingt (*q.v.*; The Twenty). During this period, in such works as his "Scandalized Masks" (1883; Musée Royal des Beaux-Arts de Belgique, Brussels), he began to depict images of grotesque fantasy—skeletons, phantoms, and hideous masks.

Ensor's interest in masks probably began in his mother's curio shop. His "Entry of Christ into Brussels" (1888; Musée Royal des Beaux-Arts, Antwerp), filled with carnival masks painted in smeared, garish colours, provoked such indignation that he was expelled from Les Vingt.

Ensor, nevertheless, continued to paint such nightmarish visions as "Masks (Intrigues)" (1890) and "Skeletons Fighting for the Body of a Hanged Man" (1891; both in the Musée Royal des Beaux-Arts, Antwerp). As criticism of his work became more abusive, the artist became more cynical and misanthropic, a state of mind given frightening expression in his "Portrait of the Artist Surrounded by Masks." He finally became a recluse and was seen in public so seldom that he was rumoured to be dead.

After 1900 Ensor's art underwent little change. When, in 1929, his "Entry of Christ into Brussels" was first exhibited publicly, King Albert of Belgium conferred a barony on him.

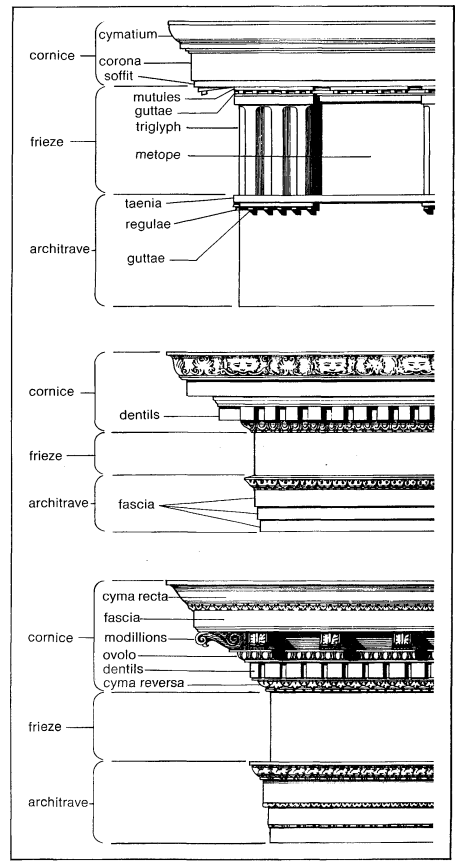
enstatite, common silicate mineral in the pyroxene family. It is the stable form of magnesium silicate ($MgSiO_3$, often with up to 10 percent iron) at low temperatures. *See* orthopyroxene.

The other forms of magnesium silicate are protoenstatite, which occurs at very high temperatures, and clinoenstatite, which occurs in unstable form at low temperatures. Enstatite and protoenstatite crystallize in the orthorhombic system (three unequal axes at right angles to each other); clinoenstatite crystallizes in the monoclinic (three unequal axes with one oblique intersection). Clinoenstatite forms a series with clinoferrosilite that is analogous to the enstatite–ferrosilite series.

Ensuhkeshdanna, also spelled ENSUKUSHSIRANNA, legendary ruler of the ancient Sumerian city-state of Aratta and rival of the king of Erech, Enmerkar (*q.v.*).

entablature, in architecture, assemblage of horizontal moldings and bands supported by and located immediately above the columns of Classical buildings or similar structural supports in non-Classical buildings.

The entablature is usually divided into three main sections: the lowest band, or architrave, which originally took the form of a simple beam running from support to support; the central band, or frieze, consisting of an unmolded strip with or without ornament; the top band, or cornice, constructed from a se-



Ancient Greek entablatures
(Top) Doric order; (centre) Ionic order; (bottom) Corinthian order

From (top) M.S. Briggs, *Everyman's Concise Encyclopaedia of Architecture*; E.P. Dutton & Co., Inc., and J.M. Dent & Sons Ltd., (centre) Sir Banister Fletcher, *A History of Architecture on the Comparative Method*, p. 132 (1961), (bottom) John Fleming, Hugh Honour, Nikolaus Pevsner, *The Penguin Dictionary of Architecture*. Copyright © John Fleming, Hugh Honour, Nikolaus Pevsner, 1966, 1972; Penguin Books Ltd.

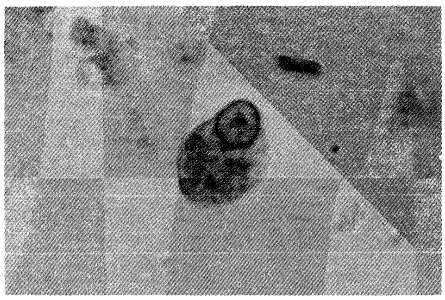
ries of moldings that project from the edge of the frieze.

The germinal styles of the entablature correspond to and are one of the distinguishing features of three of the main orders of architecture: Doric, Ionic, and Corinthian. Most entablatures not associated with these three orders are derived from them. *See also* order.

entail, also called FEE TAIL, in feudal English law, an interest in land bound up inalienably in the grantee and then forever to his direct descendants. A basic condition of entail was that if the grantee died without direct descendants the land reverted to the grantor. The concept, feudal in origin, supported a landed aristocracy because it served to prevent the disintegration of large estates through divisible inheritance or the lack of heirs. Statutory reforms in England now permit the owner to convey the entailed land by a simple deed and even by will.

There were entailed estates in the American colonies, principally in the Middle and Southern colonies, but almost all the states emulated Thomas Jefferson's statute of 1776 for Virginia and abolished entails.

Entamoeba, protozoan genus of the rhizopodian order Amoebida. Most species are parasitic in the intestines of many vertebrates, including humans; *E. histolytica* is the cause of human amebic dysentery. The cell nucleus,



Entamoeba coli
A.L. Leu

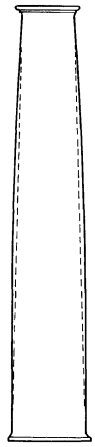
which is distinctive for the genus, contains a central body, the endosome, and a ring of uniformly sized granules attached to the nuclear membrane.

Primary infection of the large intestine with *E. histolytica* (amebiasis) is often asymptomatic; however, diarrhea, abdominal pain, and fever may result from invasion and ulceration of intestinal walls. Secondary infection occurs in the liver, lungs, brain, and spleen after the amoebas enter the circulation by way of the portal vein and produce abscesses in these tissues. Encysted *E. histolytica* are transmitted through food and water, often by fly and cockroach droppings. Excystment (emergence from the cyst) occurs in the vertebrate intestine. The species sometimes is separated by size into the larger, pathogenic form and the smaller, nonpathogenic form, *E. hartmanni.*

Another species, *E. gingivalis,* is found around the gum margins, especially in unhealthy or pyorrheic mouths. It has not, however, been shown to cause disease.

Entartete Kunst: *see* Degenerate Art.

entasis, in architecture, the convex curve given to a column, spire, or similar upright member, to avoid the optical illusion of hollowness or weakness that would arise from normal tapering. Entasis is almost universal in Classic columns. Exaggerated in Greek archaic Doric work, it grew more and more subtle in the 5th and 4th centuries BC. (Entasis is also occasionally found in Gothic spires and in the smaller Romanesque columns.)



Entasis of a Doric column (the dash lines indicate how a column would look if tapered without entasis)
From M.S. Briggs, *Everyman's Concise Encyclopaedia of Architecture;* J.M. Dent & Sons and E.P. Dutton and Company, Inc.

In the many attempts that have been made to find a mathematical basis for the entasis, it has been reduced to all kinds of elliptical hyperbolic, parabolic, and even cycloidal curves. The immense variety of forms indicates, however, that the curve was probably laid out freehand and purely empirically.

Ente Nazionale Idrocarburi: *see* ENI.

Entebbe, city, south-central Uganda, eastern Africa, at the end of a peninsula jutting into Lake Victoria 21 miles (34 km) south of Kampala. Founded as a garrison post in 1893, it served as the British administrative centre of Uganda until 1958. Its elevation (3,760 feet [1,146 m] above sea level) gives it a perpetually moderate summer climate. Entebbe has noted botanical gardens, a veterinary research laboratory, and a virus research institute. Basically a residential centre for government employees, the city has no industry. It is, however, a transportation crossroads for eastern Africa, with an international airport and steamship connections via Lake Victoria to the countries of Kenya and Tanzania and to other parts of Uganda. The airport was the site of an Israeli airborne commando raid on the night of July 3/4, 1976, that freed 103 hostages from a jet

Botanical gardens in Entebbe, Uganda
Agence Hoa-Qui

hijacked by Palestinian terrorists. The population is African, with small minorities of Europeans. The Asian minority was expelled in 1972. Pop. (1980) 21,289.

Entebbe raid (July 3–4, 1976), rescue by an Israeli commando squad of 103 hostages from a French jet airliner en route from Israel to France that, after stopping at Athens, had been hijacked on June 27 by Palestinian terrorists and flown to Entebbe, Uganda. At Entebbe, the hijackers freed those of the 258 passengers who did not appear to be Israeli and held the rest hostage for the release of 53 fellow terrorists imprisoned in Israel, Kenya, West Germany, and elsewhere. In response, Israel, on July 3, dispatched four Hercules C-130H cargo planes carrying 100–200 soldiers and escorted by Phantom jet fighters. After flying 2,500 miles from Israel to Uganda, the Israeli force rescued the hostages within an hour after landing. Seven of the terrorists were killed, and 11 MiG fighters supplied to Uganda by the Soviet Union were destroyed; the Israelis lost one soldier and three hostages during the operation. On the return trip the Israeli planes met an awaiting hospital plane and refueled at Nairobi, Kenya. The success of the Entebbe raid substantially boosted Israeli morale.

entelechy (from Greek *entelecheia*), in philosophy, that which realizes or makes actual what is otherwise merely potential. The concept is intimately connected with Aristotle's distinction between matter and form, or the potential and the actual. He analyzed each thing into the stuff or elements of which it is composed and the form which makes it what it is (*see* hylomorphism). The mere stuff or matter is not yet the real thing; it needs a certain form or essence or function to complete it. Matter and form, however, are never separated; they can only be distinguished. Thus, in the case of a living organism, for example, the sheer matter of the organism (viewed only as a synthesis of inorganic substances) can be distinguished from a certain form or function or inner activity, without which it would not be a living organism at all; and this "soul" or "vital function" is what Aristotle in his *De anima* (*On the Soul*) called the entelechy (or first entelechy) of the living organism. Similarly, rational activity is what makes a man to be a man and distinguishes him from a brute animal.

Gottfried Wilhelm Leibniz, a 17th-century German philosopher and mathematician, called his monads (the ultimate reality of material beings) entelechies in virtue of their inner self-determined activity. The term was revived around the turn of the 20th century by Hans Driesch, a German biologist and philosopher, in connection with his vitalistic biology to denote an internal perfecting principle which, he supposed, exists in all living organisms.

Entente Cordiale (April 8, 1904), Anglo-French agreement that, by settling a number of controversial matters, ended antagonisms between Great Britain and France and paved the way for their diplomatic cooperation against German pressures in the decade preceding World War I (1914–18). The agreement in no sense created an alliance and did not entangle Great Britain with a French commitment to Russia (1894).

The Entente Cordiale was the culmination of the policy of Théophile Delcassé, France's foreign minister from 1898, who believed that a Franco-British understanding would give France some security against any German system of alliances in western Europe. Credit for the success of the negotiation belongs chiefly to Paul Cambon, France's ambassador in London, and to the British foreign secretary Lord Lansdowne; but the pro-French inclination of the British sovereign, Edward VII, was a contributory factor.

The most important feature of the agreement was that it granted freedom of action to Great Britain in Egypt and to France in Morocco (with the proviso that France's eventual dispositions for Morocco include reasonable allowance for Spain's interests there). At the same time, Great Britain ceded the Los Islands (off French Guinea) to France, defined the frontier of Nigeria in France's favour, and agreed to French control of the upper Gambia valley, while France renounced its exclusive right to certain fisheries off Newfoundland. Furthermore, French and British zones of influence in Siam (Thailand) were outlined, with the eastern territories, adjacent to French

Indochina, becoming a French zone, and the western, adjacent to Burmese Tenasserim, a British zone; arrangements were also made to allay the rivalry between British and French colonists in the New Hebrides.

By the Entente Cordiale both powers reduced the virtual isolation into which they had withdrawn—France involuntarily, Great Britain complacently—while they had eyed each other over African affairs: Great Britain had had no ally but Japan (1902), useless if war should break out in European waters; France had had none but Russia, soon to be discredited in the Russo-Japanese War of 1904–05. The agreement was consequently upsetting to Germany, whose policy had long been to rely on Franco-British antagonism. A German attempt to check the French in Morocco in 1905 (the Tangier Incident, or First Moroccan Crisis), and thus upset the Entente, served only to strengthen it. Military discussions between the French and the British general staffs were soon initiated. Franco-British solidarity was confirmed at the Algeciras Conference (1906) and reconfirmed in the Second Moroccan Crisis (1911).

enteritis, inflammation of the intestines (especially of the small intestine), caused by irritants, poisons, disease organisms, or unknown factors. Regional enteritis (ileitis, or Crohn's disease) is a chronic inflammation that, in its classic form, is confined to the terminal portion of the ileum, the portion of the small intestine farthest from the stomach. The symptoms are extremely variable but usually include continuous or intermittent diarrhea, sometimes bloody, accompanied by painful abdominal cramps. Fever is common and sometimes overshadows the digestive symptoms; grave complications may occur, especially in infants and the elderly. Enterocolitis involves the colon as well as the small intestine, and gastroenteritis includes stomach inflammation. In all forms of enteritis, treatment is usually directed toward relief of symptoms, with anti-inflammatory agents playing an important role.

enterocoelomate, any animal in which the body cavity (coelom) arises embryologically as an outpocketing of the developing gut (enteron). This form of development, found in echinoderms (*e.g.,* starfishes, sea urchins) and a few other invertebrate phyla and in chordates (*e.g.,* fishes, amphibians, reptiles, birds, mammals), has been viewed as evidence of the common ancestry of echinoderms and chordates.

enterogastrone, a hormone secreted by the intestinal mucosa when fatty food is in the stomach or intestine; it is also thought to be released when sugars and proteins are in the intestine. Enterogastrone is transported by the bloodstream to the glands and muscles of the stomach, where it inhibits gastric movements and secretions, possibly by blocking the production or activity of gastrin, the hormone that initially causes these functions. Enterogastrone may slow down stomach emptying by reducing the amount of acid produced. High acid content causes the valve between the stomach and intestine to relax, allowing food passage.

The chemical identity of enterogastrone is still uncertain. Substances from the intestine that were thought to be enterogastrone have been shown to be composed of not one but possibly as many as three independent hormones. Two of these hormones are now known as secretin and cholecystokinin. Consequently, many functions originally thought to be performed by enterogastrone have been reassigned to these other hormones.

enterokinase, proteolytic enzyme (*q.v.*), secreted from the duodenal mucosa, that changes the inactive pancreatic secretion trypsinogen into trypsin, one of the enzymes that digest proteins. Enterokinase is believed to be produced by the glands of Brunner in the membrane lining of the duodenum. It resists destruction from the various enzymes in the small intestine but is destroyed by bacteria in the large intestine. Enterokinase can also change inactive procarboxypeptidase into the active enzyme carboxypeptidase.

enteropneust: *see* acornworm.

Enterprise, city, Coffee and Dale counties, southeastern Alabama, U.S. Founded in 1884 near the settlement of Drake Eye, its economy was based on cotton until the Mexican boll weevil ravaged the area (1915–16), creating a need for a more diversified economy. The unusual Boll Weevil Monument (1919) in the public square symbolizes diversification from cotton to peanuts, mixed farming, and manufacturing. Ft. Rucker Army Aviation Center is nearby. Enterprise State Junior College was opened in 1966. Inc. 1896. Pop. (1980) 18,-033.

enterprise unionism, in Japan, the organization of trade unions within one enterprise rather than within a craft or industry. More than 90 percent of Japanese unions are of the enterprise type—in private as well as public and in single-plant and multiplant corporations.

The enterprise union is composed of both white- and blue-collar workers. Strikes do not last long. Frequently, unions call strikes that are scheduled in advance as a series of short work stoppages. The independence of each enterprise union puts a limit on the duration of a strike, as no national strike fund is available to aid a particular union.

Although many enterprise unions have formed federations along regional or industrial lines that are in turn associated with national councils or federations, bargaining is conducted at the enterprise level. National federations may influence the demands of their member unions, but the actual agreements are drawn up by the individual union and the management.

Enterprise unionism to some degree reflects the low turnover of labour in Japan, where workers tend to remain with one employer for life. Wages often have only a vague relationship to skills or occupation. The coincidence of the union's and firm's boundaries tends to reinforce the stability of the worker–management relationship and makes union membership a natural part of the employment commitment.

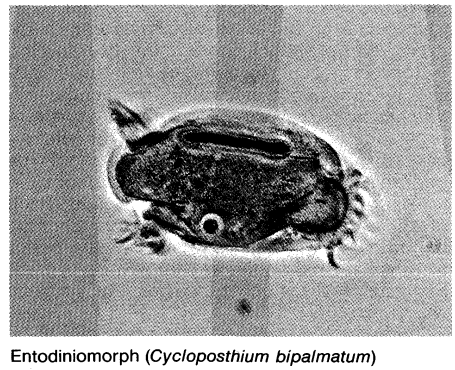
enthalpy, the sum of the internal energy and the product of the pressure and volume of a thermodynamic system. It is an energy-like property or state function—it has the dimensions of energy, and its value is determined entirely by the temperature, pressure, and composition of the system and not by its history. In symbols, the enthalpy, H, equals the sum of the internal energy, E, and the product of the pressure, P, and volume, V, of the system: $H = E + PV$.

According to the law of energy conservation, the change in internal energy is equal to the heat transferred to, less the work done by, the system. If the only work done is a change of volume at constant pressure, the enthalpy change is exactly equal to the heat transferred to the system. As with other energy functions, it is neither convenient nor necessary to determine absolute values of enthalpy. For each substance, the zero-enthalpy state can be some convenient reference state.

enthymeme, in syllogistic, or traditional, logic, name of a syllogistic argument that is incompletely stated. In the argument "All insects have six legs; therefore, all wasps have six legs," the minor premise, "All wasps are insects," is suppressed. Any one of the propositions may be omitted—even the conclusion; but in general it is the one that comes most naturally to the mind. Often in rhetorical language the deliberate omission of one of the propositions has a dramatic effect. This use of the word differs from Aristotle's original application of it (in his *Prior Analytics,* ii, 27) to a rhetorical syllogism (employed for persuasion instead of instruction) based on "probabilities or signs"; *i.e.,* on propositions that are generally valid or on particular facts that may be held to justify a general principle or another particular fact.

entisol, soil type distinguished from the nine other orders of soil taxonomy by the absence or rudimentary development of soil horizons. Such soils are formed under a wide variety of climatic and surface conditions. Entisol soils tend to be of recent origin, such as those forming over young geologic formations (fresh lava, land exposed by uplift or landslip, or stabilized sand dunes). They also include soils degraded by erosion or altered plant cover, soils forming over rock that resists weathering or is chemically toxic to plants, and youthful alluvial soils deposited by rivers and streams. Entisols are most common in mountainous and desert regions and occupy about one-twelfth of the total world land area.

entodiniomorph, any ciliated protozoan of the order Entodiniomorphida. They are harmless parasites in the rumen and intestines of cattle, horses, and other herbivores. Entodiniomorphs are common and extremely numerous: one cow may harbour 10,000,000,000 or more. The cells are irregularly shaped, and extensive syncilia (specialized ciliary tufts) spiral into the anterior, elevated mouth. Several projections are found at the posterior of the cell; the largest is believed to serve as a rudder. It is possible that entodiniomorphs maintain a commensal or symbiotic relationship with their host by aiding digestion; certain species digest cellulose. Entodiniomorphs reproduce



Entodiniomorph (*Cycloposthium bipalmatum*)
J.M. Langham

asexually by binary fission and also exhibit the sexual phenomenon of conjugation. Representative genera include *Cycloposthium,* which is found in horses, and *Diplodinium,* which inhabits ruminants, such as cattle, antelopes, and dromedary camels.

entomology, the scientific study of insects. The largest single class of animals, the Insecta, is composed of about 700,000 known species; probably at least another 700,000 are not yet known to science. They are of greater importance to man's livelihood (often detrimentally so) than any other animal group.

Like most other areas of biology, entomology may be divided into numerous subdisciplines; *e.g.,* taxonomy, ecology, behaviour, and physiology. Most branches of the science have both applied and pure research aspects. The former relate to pests and to useful insects; the latter, to basic information on insects and their life histories. Applied entomology

is commonly subdivided into medical, veterinary, agricultural, horticultural, orchard, and forest branches.

Insects were among the many animal groups studied by the Greek philosopher and naturalist Aristotle, who noted, in the 4th century BC, that they have three basic body sections. From him comes the word *entoma* after which the science was named. Aristotle described many aspects of insect natural history that were ignored until 1602, when the Italian naturalist Ulisse Aldrovandi published a major treatise, *De Animalibus insectis* . . . ("Of Insect Animals"). The advent of the microscope in the mid-17th century led to many discoveries about insect anatomy, especially by the Dutch naturalist Jan Swammerdam (*q.v.*). The 18th century saw the beginning of modern insect classification. An important milestone was *Mémoires pour servir à l'histoire des insectes* ("Notes on the Biology of Insects"), the first volume of which appeared in 1734, by the French biologist R.A.F. de Réaumur. The binomial nomenclature of Carolus Linnaeus was applied to animals in his *Systema Naturae* (10th ed., 1758), which simplified the burgeoning nomenclature of insect species.

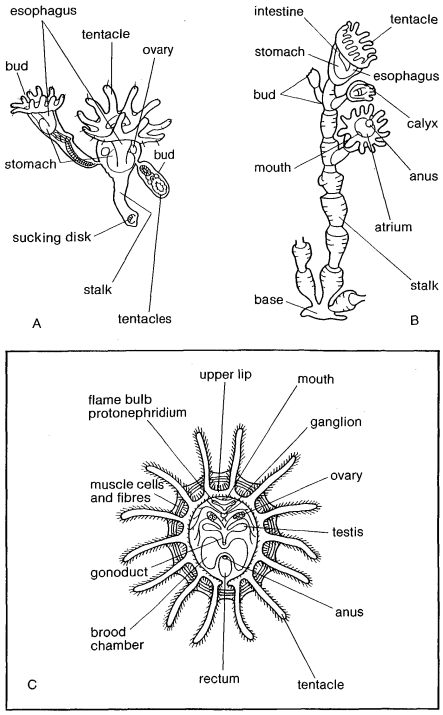
Much of modern entomology is still in the descriptive stage of taxonomy; and, even in well-studied groups such as the butterflies and moths (Lepidoptera), new species are continually being discovered. It is often exceedingly difficult to identify life stages other than the adult in insect groups that exhibit complete metamorphosis (a major change in body plan from larva to adult).

The biology of an important pest insect is usually much more fully known than that of its benign or obscure relatives. Government departments of agriculture and the chemical industry, through universities and field stations, spend enormous sums of money on the biology of pest insects with the aim of determining the best means of control.

entoproct, any member of the phylum Entoprocta, a group of aquatic invertebrate animals, composed of more than 100 species. Entoprocts occur throughout the world, primarily in marine habitats. One genus, *Urnatella*, is a freshwater form, however. Entoprocts may either exist singly or form colonies of communicating members, called zooids, by budding. The zooids measure only about 0.4 to 5 mm (0.016 to 0.2 inch) in height. Each of them has a stalk (peduncle), which may be jointed, that attaches to shells, seaweed, or to other animals, such as sponges, bryozoans, hydroids, and segmented worms, that produce water currents.

The body of an entoproct consists of a globular head (calyx) that houses a U-shaped gut and the nervous, excretory, and reproductive systems. A crown of ciliated tentacles creates a water current that draws food particles toward a central mouth. The calyx is often discarded and then regenerated in colonial species. The solitary species develop daughter buds, which detach themselves when mature. Entoprocts also have free-swimming larvae that settle and develop into new colonies or individuals. Although the larva and the pattern of its early development indicate that the entoprocts may be linked remotely with the annelids and their related phyla, there is no evidence of a close link with any phylum.

First described in 1774, entoprocts were classified with the moss animals (bryozoans), in which filter-feeding, tentaculated zooids also are present. The similarities between the two groups, however, are superficial. Their methods of food capture, for example, differ fundamentally; in addition, bryozoan zooids are coelomate, and the anus opens outside the tentacles. The name Entoprocta was introduced in 1869, and the group was first recognized as a phylum in 1888. Alternative names (Calyssozoa and Kamptozoa) were proposed in 1921 and 1929.



Structure of entoprocts
(A) *Loxosoma singulare* zooid with two buds, (B) *Urnatella gracilis* colony consisting of a flexible stalk with urnlike segments, and (C) *Pedicellina cernua* calyx (top view)

From *McGraw-Hill Encyclopedia of Science & Technology* (1960); reproduced by permission of McGraw-Hill Book Co., (A) after Atkins and (B) after Rogick

The phylum Entoprocta is small and has no known fossil members. The subdivision of the phylum into three families does not accord fully with the considerable differences between colonial and noncolonial forms. It might be more accurate if two orders were recognized; the first order would include the families Pedicellinidae (about 30 species classified into six genera according to stalk structure) and Urnatellidae (2 species), and the second order would contain only the Loxosomatidae (about 100 species).

entotrophian: *see* dipluran.

entrapment, in law, instigation or inducement of a person into the commission of a crime by an officer of the law.

Entrapment does not include situations in which the officer has not instigated the offense but merely provided the opportunity or occasion for its commission. Thus, the use of deceptions, tricks, decoys, informers, and undercover operators, in order to convict a criminal offender, does not in itself constitute entrapment.

The doctrine has received its most frequent application in cases of liquor violations and narcotics and gambling offenses. The courts have taken the view that offenders who have been led into criminal acts by law-enforcement personnel are not guilty.

Entre Ríos, *provincia,* eastern Argentina. It is located between two rivers, the Paraná (west) and the Uruguay (east), the latter of which forms the Uruguayan border; the province's name means "between rivers." Entre Ríos is the southern part of the region sometimes referred to as the Argentine Mesopotamia. Its area (30,418 square miles [78,781 square km]) occupies an undulating plain that is interrupted in the north and along its eastern and western margins by forested, hilly ridges. The province tapers in the south into the Paraná deltaic lands of the northwestern Río de la Plata estuary. El Palmar National Park (21,000 acres [8,500 hectares]), near the city of Concepción del Uruguay, includes a palm forest, parts of which are 800 years old, and archaeological remains.

There were some late 16th-century colonial settlements, but the region did not receive provincial status until 1814. During the dictatorship of Juan Manuel de Rosas (1829–52), Entre Ríos became a centre of opposition based upon antagonism to his control of river trade. General Justo José de Urquiza, one of the opposition leaders, contrived Rosas' overthrow and, as head of the new Argentine Confederation, made Paraná the national capital. The downfall of Urquiza in 1861 led to the reinstatement of Buenos Aires as the capital. In the second half of the 19th century, Entre Ríos was settled by large numbers of Italian, German, and Swiss immigrants, which led to its rapid agricultural development and economic expansion. The earliest meat-packing and preserving plants in Argentina were established there.

Agricultural activities (cattle raising, wheat, flax, rice, and citrus fruits) are of great economic significance in the province. Food-processing and consumer-goods industries are numerous, particularly in Paraná (*q.v.*), the provincial capital. Gualeguay, on the Gualeguay River in southern Entre Ríos, is the hub of a cattle-ranching area and has port facilities for river traffic. The first direct transportation links between the Argentine Mesopotamia and Buenos Aires were achieved in the late 1970s when a 20-mile-(33-kilometre-) long system of bridges, roadways, and railways was completed across the Paraná River delta. Pop. (1986 est.) 968,000.

entrechat (probably from Italian *intrecciare:* "to weave," or "to braid"), jump in ballet, beginning in the fifth position, during which the dancer crosses his straight legs at the lower calf. Numerous rapid crossings make the entrechat a spectacular jump. Numbers (*trois,* "three"; *quatre,* "four"; and so on) are

Entrechat executed by Rudolf Nureyev; solo variation from "Flower Festival at Genzano"
Fred Fehl

affixed to the term to designate the amount of leg movement (*entrechat-quatre* has two crossings; *entrechat-dix* has five). The dancer lands on both feet for even-numbered and on one foot for odd-numbered entrechats. Vaslav Nijinsky's famous jumps reputedly included the *entrechat-dix,* and an *entrechat-douze* was captured more recently on English television as danced by Wayne Sleep.

entropion, turning in of the border of the lower eyelid, a condition sometimes occurring

in elderly persons. It is caused by (1) spasms of the orbicularis oculi, a muscle that extends along the lid margin and functions during winking, and (2) relaxation of the orbital septa, membranes of the eye socket that support the lids. The turning in of the lid margin allows the eyelashes to rub against the cornea, with resultant irritation. Ulceration of the cornea may be a complication. The treatment is surgical correction of the abnormality. Entropion may also occur as a complication of other eye diseases. *See also* ectropion.

entropy, thermodynamic property or state function—*i.e.,* its value is determined by the condition or state of the system and not by its history—of matter related to the amount of energy that can be transferred from a system to others in the form of work. For a given system with a fixed energy, the value of the entropy ranges from zero to a maximum. If the entropy is zero, the amount of work that can be transferred is equal to the energy. If the entropy is at its maximum, the amount of work that can be transferred is equal to zero. When heat q is transferred to a system from another at absolute temperature T, the entropy of the system increases by an amount $\Delta S = q/T$ if the process is reversible, or by a larger amount ($\Delta S > q/T$) if the process is irreversible. Entropy is an extensive property; that is, its magnitude depends on the amount of the substance in a given thermodynamic state.

The concept of entropy was proposed in 1850 by Rudolph Clausius, a German physicist, and is sometimes presented as the second law of thermodynamics (*see* thermodynamics, laws of). According to this law, entropy increases during an irreversible process such as the spontaneous mixing of hot and cold gases, the uncontrolled expansion of a gas into a vacuum, and the combustion of a fuel.

In one statistical interpretation of entropy, it is found that for a very large system in a thermodynamic equilibrium state, entropy S is proportional to the natural logarithm of a quantity W representing the maximum number of microscopic ways in which the macroscopic state corresponding to S can be realized; that is, $S = k \ln W$, in which k is the Boltzmann constant.

All spontaneous processes are irreversible; hence, it has been said that the entropy of the universe is increasing: that is, more and more energy becomes unavailable for conversion into mechanical work, and because of this the universe is said to be "running down."

Enugu, town, capital of Anambra State, southern Nigeria, at the foot of the Udi Plateau (altitude 745 ft [227 m]). It is on the railroad from Port Harcourt, 151 mi (243 km) south-southwest, and at the intersection of roads from Aba, Onitsha, and Abakaliki. The town owes its existence to the discovery of coal on the plateau in 1909, which led to the building of Port Harcourt. With the completion of the railway from the port in 1916, Enugu developed rapidly. Its name, enu Ugwu, meaning "at the top of the hill," comes from the traditional Ibo village of Enugu Ngwo on the plateau. The headquarters (1939–51) of the Eastern provinces and the regional capital (1951–67) of Eastern Nigeria, it served briefly (May–October 1967) as the provisional capital of the secessionist Republic of Biafra until its capture by Federal troops.

Coal mining is still important, but Enugu's economy became more diversified in the 1960s. Near the airport, 7 mi east, is the industrial estate of Emene, where steel rods, asbestos cement products, and oxygen and acetylene gases are manufactured. Enugu also has a railway workshop, an automobile assembly plant, furniture and pottery factories, a sawmill, and smaller textile and foodstuff enterprises. A cement plant at Nkalagu, 33 mi east, uses Enugu coal and supplies Emene's cement plant. Enugu is also a trade centre (yams, cassava, taro, corn [maize], pigeon peas, rice, onions, cattle) for the Ibo people and a collecting point (timber from Obubra and cashew nuts from nearby Oghe) for the railway.

Enugu is an educational as well as a governmental and industrial centre. It is the site of the law and medical faculties of Enugu University. It is likewise one of two sites of Anambra State University of Technology, the Institute of Management and Technology, several teacher-training colleges, numerous secondary schools, and a trade centre. Enugu is served by several hospitals, including the Teaching Hospital of the University of Nigeria and an orthopedic hospital. The state library and a radio station are also located there. It also has an airport. Pop. (1983 est.) 228,400.

enuresis, also called BED-WETTING, any apparently involuntary urination after an age when control presumably should have been achieved. Some authorities think this age should be three years, but many children do not achieve such control until five or six. About 5 percent of all children wet the bed occasionally after age five, and the incidence decreases until puberty. A few cases persist into adult life. Boys are affected twice as often as girls. A small percentage wet during the day as well as at night, and a few wet only during the day.

About 5 percent of the cases of bed-wetting are due to anatomical defect or disease or are deliberate while appearing to be involuntary. The cause of the other 95 percent is obscure. Some believe that these cases of "true" enuresis are caused by a persistence of the physiological incontinence of infancy due to inadequate or poor training. Some believe that it is caused by a retarded maturation or developmental defect of the nervous system. Others believe that enuresis is a result of psychological factors, that the child has emotional needs that are not satisfied during the waking hours; the enuresis may be a substitute for sexual gratification, an expression of deep-seated anxiety, or a disguised expression of hostility toward a parent.

The treatment of enuresis also is a matter of controversy. A great variety of methods, drugs, and manipulations have been used, all with some success, and yet no single method has been entirely successful.

envelope, in differential geometry, in three dimensions a surface, traced out by a succession of curves called characteristics that can be represented in terms of a common parameter—that is, a representative number that is constant along a curve but is changed from curve to curve of the series. As an example, the envelope of the family of paraboloids $x^2 + y^2 = 4a(z - a)$ is the circular cone $x^2 - y^2 = z^2$.

envelope, in musical sound, growth, duration, and decay of a sound. Growth consists of the attack, or onset, and rate of increase of a sound to steady-state intensity. Duration refers to the steady state of a sound at its maximum intensity, and decay is the rate at which it fades to silence.

Envelope is an important element of timbre (*q.v.*), the distinctive quality, or tone colour, of a sound. Every musical instrument has its characteristic attack, duration, and decay pattern.

Articles are alphabetized word by word, not letter by letter

Enver Paşa, original name ENVER BEY (b. Nov. 22, 1881, Constantinople—d. Aug. 4, 1922, near Baldzhuan, Turkistan), Ottoman general and commander in chief, a hero of the Young Turk Revolution of 1908, and a leading member of the Ottoman government from 1913 to 1918. He played a key role in the Ottoman entry into World War I on the side

Enver Paşa, detail of an oil painting by A. Fischer, 1917; in the Topkapı Saray Museum, Istanbul

By courtesy of the Topkapi Saray Museum, Istanbul

of Germany, and, after the Ottoman defeat in 1918, he attempted to organize the Turkic peoples of Central Asia against the Soviets.

An organizer of the Young Turk Revolution, Enver joined Gen. Mahmud Şevket, under whose command an "Army of Deliverance" advanced to Constantinople to depose Abdülhamid II. In 1911, when warfare broke out between Italy and the Ottoman Empire, he organized the Ottoman resistance in Libya, and in 1912 he was appointed the governor of Bengazi (in modern Libya).

Back in Constantinople, he participated in the politics of the Committee of Union and Progress, leading the coup d'etat of Jan. 23, 1913, which restored his party to power. In the Second Balkan War (1913), Enver was chief of the general staff of the Ottoman Army. On July 22, 1913, he recaptured Edirne (Adrianople) from the Bulgars. Thenceforth, until 1918, the empire was dominated by the triumvirate of Enver, Talât, and Cemal.

In 1914 Enver, as minister of war, was instrumental in the signing of a defensive alliance with Germany against Russia. When the Ottoman Empire entered World War I on the side of the Central Powers (November 1914), Enver cooperated closely with German officers serving in the Ottoman Army. His military plans included Pan-Turkic (or Pan-Turanian) schemes for uniting the Turkic peoples of Russian Central Asia with the Ottoman Turks.

These plans resulted in the disastrous defeat in December 1914 at Sarıkamış, where he lost most of the 3rd Army. He recovered his prestige, however, when the Allied forces were defeated at Gallipoli (1916). In 1918, following the Russian Revolution of 1917 and Russia's withdrawal from the war, he occupied Baku (now in the Azerbaijan Soviet Socialist Republic). After the Armistice in Europe, Enver fled to Germany (November 1918).

In Berlin he met the Bolshevik leader Karl Radek, and in 1920 he went to Moscow. He proposed the idea of overthrowing the regime of Mustafa Kemal (Atatürk) in Turkey with Soviet aid, but this plan received no support from Moscow. Though the Russian leaders became suspicious of him, Enver was nevertheless allowed to go to Turkistan with a plan for helping to organize the central Asian republics. In 1921, however, the revolt of the Basmachi in Bukhara against the Soviet regime flared up, and Enver joined the insurgents. He was killed in action against the Red Army near Baldzhuan, in Turkistan.

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Envigado, city, Antioquia *departamento,* northwestern Colombia. It is situated near the Porce River, between the Occidental and Central ranges of the Andes Mountains, at an elevation of 5,085 feet (1,550 m) above sea level. Formerly a commercial and manufacturing centre for a fertile agricultural and pastoral area, Envigado is now part of the industrial complex centring on the department capital of Medellín, 6 miles (10 km) north by highway. Its principal industry is textile manufacturing. Pop. (1985) 85,539.

environment, the complex of physical, chemical, and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival. The Earth's environment is treated in a number of articles in the MACROPAEDIA. The relationship between the principal systems and components of the environment, and the major terrestrial and aquatic ecosystems of the Earth are treated in the article Biosphere. The pollution of the environment and the conservation of its natural resources are treated in the article Conservation of Natural Resources.

environmental biology: *see* ecology.

environmental geology, field concerned with applying the findings of geologic research to the problems of land use and civil engineering. It is closely allied with urban geology and deals with the impact of human activities on the physical environment (*e.g.,* contamination of water resources by sewage and toxic chemical wastes). Other important concerns of environmental geology include reclaiming mined lands; identifying geologically stable sites for constructing buildings, nuclear power plants, and other facilities; and locating sources of building materials, such as sand and gravel. Specialists in the field draw heavily from engineering geology in dealing with these and related matters.

environmental sculpture, 20th-century art form intended to involve or encompass the spectator rather than merely to face him; the form developed as part of a larger artistic current that sought to break down the historical dichotomy between life and art. The environmental sculptor can utilize virtually any medium, from mud and stone to light and sound.

The works of the American sculptor George Segal (*q.v.*) are among the best-known self-contained sculptural environments; his characteristic white plaster figures situated in mundane, authentically detailed settings evoke feelings of hermetic alienation and suspension in time. By contrast, the eerily realistic figures of Duane Hanson, an American influenced by Segal, are usually displayed in such a way as to partake of, contribute to, and indeed often disturb the given exhibition environment. Other notable sculptors of indoor environmental works include the American artist Edward Kienholz, whose densely detailed, emotionally charged works often incorporate elements of the surreal, and Lucas Samaras and Robert Irwin, also Americans, both of whom have employed transparent and reflective materials to create complex and challenging optical effects in gallery and museum spaces.

The larger context of the natural and urban outdoors has preoccupied another group of environmental artists. The controversial "earthworks" of Robert Smithson and others have frequently entailed large-scale alterations of the Earth's surface; in one notable example, Smithson used earth-moving equipment to extend a rock and dirt spiral, 1,500 feet (460 metres) long, into Great Salt Lake in Utah ("Spiral Jetty"; 1970). The Bulgarian-born artist Christo (*q.v.*) has involved large numbers of people in the planning and construction of such mammoth alfresco art projects as "Valley Curtain" (1972; Rifle Gap, Colo.). Christo's numerous "wrapped buildings" have been notable among urban environmental works of the past few decades.

environmental theatre, a branch of the New Theatre movement of the 1960s, whose aim is to heighten audience awareness of theatre by eliminating the distinction between the audience's and the actors' space. Richard Schechner's environmental productions *Dionysus in 69, Makbeth,* and *Commune* were performed in his Performing Garage on off-Off-Broadway in New York City.

Schechner and the Performance Group (founded 1968) shaped the theatre to conform to each play, constructing different audience frameworks for each production. The sets were usually based on multilevel platforms, balconies, ramps, and scaffolds surrounding a stage that encroached on the audience's territory, providing a wider range of space for the actors and a greater flexibility of interaction between the audience and performers. The audience of the environmental theatre was invited, even expected, to participate. The minimum involvement for the production of *Commune,* for example, was the audience's removal of its shoes upon entering the garage. To enhance the immediacy of experience the multiple-focus theatre replaced the traditional single focus, allowing more than one scene to be staged at the same time. Schechner's theatrical experiments, inherited from the Polish director Jerzy Grotowski, included the use of psychophysical conditioning exercises for actors, the "collaging" of texts, and the shaping of theatre space.

environmentalism, in the social sciences, any theory that concerns the importance of environmental factors in the development of culture and society.

The theory of environmental determinism states that the physical milieu of a people, including natural resources, climate, and geography, is the major determining factor in the formation of their culture. Determinism thereby rejects history and tradition, social and economic factors, and other aspects of culture as explanations of social development. Environmental possibilism, an opposing doctrine, suggests that habitat acts only to create possibilities from which man may choose.

Contemporary environmentalists recognize that physical surroundings are only part of a total environment that includes social and economic factors, cultural tradition, and reciprocal influences between societies and their environment.

Enzeli (Iran): *see* Anzalī, Bandar-e.

Enzinas, Francisco de (b. 1520, Burgos, Spain—d. Dec. 30, 1552?, Strassburg, Ger. [now Strasbourg, Fr.]), Spanish scholar and humanist, one of the most important figures of the abortive Spanish Reformation.

Educated at the universities of Louvain and Wittenberg, Enzinas became a friend and protégé of the Lutheran reformer Philipp Melanchthon. Enzinas' Spanish translation of the New Testament, which was published in Antwerp in 1543, was proscribed by the Spanish Inquisition, but he escaped to Wittenberg. He founded a Protestant colony in Constantinople (now Istanbul) and then taught Greek at the University of Cambridge for three years before settling in Strassburg.

Enzinas' published works, which often appeared under the pseudonyms of Francisco de Chesne and Dryander, included a history of religion in Spain and translations of Livy and Plutarch. His memoirs, written in Latin and translated into French, were left unpublished until the mid-19th century.

enzyme, complex protein that makes possible the biochemical reactions that constitute the metabolism of living organisms by acting as a specific biological catalyst.

A brief treatment of enzymes follows. For full treatment, *see* MACROPAEDIA: Biochemical Components of Organisms.

Enzymes are indispensable to life. Nearly all of the complex and integrated chemical reactions that take place in animals, plants, and microorganisms are regulated by enzymes. For example, some enzymes, like those in the digestive tract of animals, break down the large protein, carbohydrate, and fat molecules of foodstuffs into small molecules; others assist in passing these small molecules from the intestine into the bloodstream; and still others use the molecules in building the complex molecular structures of cellular constituents. Enzymes are also responsible for the storage and release of energy in organisms. Many inherited human diseases, such as albinism, result from a deficiency of a particular enzyme.

Enzymes also have valuable industrial and medical applications. The fermenting of wine, leavening of bread, curdling of cheese, and brewing of beer have been known from earliest times, but not until the 19th century were these reactions understood to be due to the catalytic activity of enzymes. Since then, enzymes have assumed an increasing importance in industrial processes that involve organic chemical reactions. The uses of enzymes in medicine include the killing of disease-causing microorganisms, the promotion of wound healing, and the diagnosis of certain diseases.

Each enzyme acts on only one kind of substance or group of related substances, called the substrate, and catalyzes only one kind of reaction. With a few exceptions, enzymes have names that end in "-ase" and are grouped according to the nature of the reactions they catalyze. Oxidoreductases, for instance, catalyze oxidation-reduction reactions, in which hydrogen is transferred from one molecule to another. Enzymes are further classified according to the substrates on which they act.

A biological phenomenon that may seem like a single action—the contraction of a muscle, for example—actually consists of a number of chemical steps by which one or more substrates are converted to products that serve in turn as substrates for the next step in the metabolic pathway. The same compound may be converted to several different products, depending on which enzymes in its pathway are active.

Because the metabolic needs of organisms and their constituent cells vary, so also do their enzyme contents and activities. Some enzymes are not found in certain cells, others are formed only when required, and still others occur in all cells. Ultimately, the enzyme content of a cell is determined by the cell's genetic material, which codes for the synthesis of enzymes and other proteins. The rates of enzyme synthesis and activity are influenced by hormones, neurosecretions, and other chemicals that affect the cell's internal environment.

Enzymes are large molecules that, like all proteins, are composed of one or more amino acid chains. They are damaged by excessive heat or cold and are sensitive to changes in acidity. Except for proteins that act as structural elements, most of the protein matter of physiologically active tissues, such as those of the liver and the kidney, consists of enzymes. To enable them to act, many enzymes are bound to a nonprotein cofactor, which may be a metal ion or an organic molecule called a coenzyme. Many coenzymes are only loosely bound to the protein part of the enzyme. In effect, such a coenzyme serves as a special type of substrate, which takes part in the reaction as an acceptor or donor of electrons or of a chemical group. The coenzyme thus provides a link, or shuttle, in the metabolic pathway. Many coenzymes are composed wholly or partially of vitamins—compounds that generally

cannot be synthesized by the body and must therefore be supplied in the diet.

Catalysts, including enzymes, accelerate chemical reactions without themselves being consumed in the process. In the absence of enzymes, an energy barrier prevents the molecules in a cell from reacting more than occasionally to form products. An enzyme magnifies the chances for reaction by combining temporarily with molecules of its substrate and making them more reactive. The enzyme attracts substrate molecules to its surface by physical forces, forming an enzyme-substrate complex. The enzyme then catalyzes the chemical reaction, and the products dissociate from the enzyme. Many enzymatic reactions involve the formation of an intermediate product with a chemical bond between enzyme and substrate. The unstable intermediate compound quickly breaks down to form reaction products, and the unchanged enzyme is free to react with other substrate molecules.

Only part of the large enzyme molecule, called the active site, reacts with the substrate. It is thought that the three-dimensional structure and the chemical and electrical properties of the amino acids at the active site permit only molecules of a particular substrate to fit into the site, thus determining the enzyme's specificity. According to this "key-lock" hypothesis, a molecule that is the wrong shape or that lacks essential attractive forces will not fit and therefore will not react with the enzyme. Enzyme specificity keeps separate the many pathways of metabolism in the organism.

The key-lock hypothesis does not completely explain certain properties of enzymes; therefore, it has been expanded by what is known as the induced-fit model. According to this model, as the substrate approaches the enzyme surface, it produces a change in the shape of the enzyme that results in the correct alignment of its catalytic groups, permitting a reaction to take place.

The velocity of an enzymatic reaction increases with increased substrate concentration, reaching maximum velocity when all active sites of the enzyme surface are filled. Enzymes are much more efficient than man-made catalysts, partly because of the precise positioning of substrate molecules and catalytic groups at the active site. Enzyme action can be inhibited when molecules very similar to substrate molecules become bound to the active site and prevent binding of the actual substrate. This is called competitive inhibition. Competitive inhibitors such as sulfanilamide, which blocks the active site of an enzyme essential to certain disease-causing bacteria, are widely used in chemotherapy.

Noncompetitive inhibition occurs when an inhibitor binds to the enzyme at a location other than the active site. In some cases of noncompetitive inhibition, the inhibitor is thought to bind to the enzyme in such a way as to physically block the normal active site. In other instances, the binding of the inhibitor is believed to change the shape of the enzyme molecule, thereby deforming its active site and preventing it from reacting with its substrate. This latter type of noncompetitive inhibition is called allosteric inhibition; the place where the inhibitor binds to the enzyme is called the allosteric site. Frequently, an end-product of a metabolic pathway serves as an allosteric inhibitor on an earlier enzyme of the pathway. This inhibition of an enzyme by a product of its pathway is a form of negative feedback.

Allosteric control can involve stimulation of enzyme action as well as inhibition. An activator molecule can be bound to an allosteric site and induce a reaction at the active site by changing its shape to fit a substrate that could not induce the change by itself. Common activators include hormones and the products of earlier enzymatic reactions. Allosteric stimulation and inhibition allow production of energy and materials by the cell when they are needed and inhibit production when the supply is adequate.

enzyme analysis, in blood serum, measurement of the activity of specific enzymes in a sample of blood serum, usually for the purpose of identifying a disease. The enzymes are normally concentrated in cells and tissues where they perform their catalytic function; in disease, however, certain enzymes tend to leak into the circulation from the injured cells and tissues. More than 40 enzymes have been found in human serum; in routine clinical practice, the most common ones include (1) amylase, a starch-digesting enzyme that originates chiefly from the pancreas and salivary glands; its serum activity is usually elevated in the early stages of acute inflammation of the pancreas, in obstruction of the pancreatic duct, and in mumps; (2) lipase, a fat-digesting enzyme that also originates in the pancreas and that shows the same clinical variations as amylase in disorders involving the pancreas; (3) alkaline phosphatase, an enzyme found in most body tissues, notably in bone marrow and liver, and that usually shows elevated serum values in such conditions as Paget's disease (inflammation of the bone) and osteomalacia (softening of the bone), as well as in hepatitis and obstructive jaundice; (4) acid phosphatase, an enzyme found in most body tissue but in unusually high concentration in the adult prostate gland; it is released into the circulation in metastatic cancer of the prostate; (5) peptidases, a group of enzyme-digesting proteins found in greater concentrations in the serum in conditions associated with excessive tissue breakdown, such as shock, fever, and traumatic injury, and in anemia resulting from fragility of the red blood cells; (6) transaminases, namely, glutamic-aspartic transaminase and glutamic-alanine transaminase, enzymes that are found in most body tissues, but in particularly high concentrations in the liver and heart tissue, and are usually substantially increased in serum in disorders involving the liver, such as hepatitis, and the heart, such as myocardial infarction.

As with other types of blood analyses, the clinical trend is to automate the enzyme assays with autoanalyzers, which make it possible to obtain data on the serum activity of up to 20 or more enzymes simultaneously on one sample of serum.

Consult the INDEX *first*

eobiont, also called PROTOBIONT, the hypothetical first form of life on Earth. Eobiont, a term coined by the British biochemist Norman Wingate Pirie, is equivalent to the protobiont of the Soviet biochemist A.I. Oparin and others. These first forms presumably developed in the primitive ocean and were the link between free-floating molecules and a definite organism. They consisted of systems of very large molecules combined in a unit capable of reproduction and energy exchange.

According to this theory, eobionts probably occurred in a variety of forms and were composed of different substances. Those better able to survive absorbed and used the less successful forms in a process that led to fewer and more complex systems and resulted in a supersystem. This biochemical evolution developed into organic evolution as the supersystem developed cells and organelles. *See also* biopoiesis; spontaneous generation.

Eocene epoch, major worldwide division of the Tertiary period that began about 57.8 million years ago and ended about 36.6 million years ago. It follows the Paleocene epoch and precedes the Oligocene epoch. The Eocene is often divided into Early (57.8 to 52 million years ago), Middle (52 to 43.6 million years), and Late (43.6 to 36.6 million years) epochs. The name Eocene is derived from the Greek *ēōs* ("dawn") and refers to the dawn of recent life; during the Eocene, all the major divisions, or orders, of modern mammals appeared.

Eocene rocks have a worldwide distribution. In western Europe, several stages and their temporal equivalents (ages) are recognized on the basis of characteristic lithologies and fossil faunas; they are from earliest to latest, the Ypresian, Lutetian, Bartonian, and Priabonian. In North America, stages are recognized on the basis of marine rocks and fossil assemblages as well as primarily terrestrial or continental deposits and vertebrate faunas; the vertebrate stages, which are well known and of great importance, consist, from oldest to youngest, of the Wasatchian, Bridgerian, Uintan, and Duchesnean stages. Lower Eocene assemblages are poorly represented in England and in the Patagonian region of South America. Later Eocene vertebrate faunas are somewhat better developed in areas outside of North America; the Mokattam Beds in Egypt contain a middle Eocene vertebrate assemblage. Late Eocene faunas occur in Myanmar (Burma) and Mongolia. It is in North America, however, especially the western United States, that the most abundant and extensive Eocene record exists. Eocene rocks were deposited in much the same regions as those of the preceding Paleocene epoch. During the Eocene, climates were warm and humid. Temperate and subtropical forests were widespread, but grasslands were of limited extent; the Eocene forests of Oregon, for instance, consisted of trees and plants similar to or identical to those now found in Central and South America.

The lower Eocene vertebrate faunas of North America and Europe are very similar; many genera occur in both regions, indicating that interchange could occur. Early Eocene faunas were essentially those of the Paleocene with the addition of newer types, but the archaic Paleocene groups gradually became extinct.

The start of the Eocene is marked by the appearance of two new groups of animals: the perissodactyls, or odd-toed ungulates; and the artiodactyls, the even-toed ungulates. The perissodactyls include the horses, rhinoceroses, and tapirs; among the artiodactyls are the deer, cattle, and sheep. The early horse ancestor, the dawn horse, known in North America as *Eohippus,* is among the fossil perissodactyls found in the lower Eocene rocks of North America and Europe. Artiodactyls, rare during the early Eocene, became abundant later in the epoch.

The archaic Paleocene primate forms declined during the Eocene; many of their ecological niches were usurped by the more efficient rodents. Middle Eocene vertebrate faunas were not as cosmopolitan as those of the early Eocene; the isolation that resulted allowed different evolutionary trends to occur in the ungulate groups of North America and Europe. Extensive interchanges of faunal elements were possible once again late in the Eocene epoch. The Eocene epoch marks the first appearance in the fossil record of the two completely marine mammal groups, the cetaceans (whales, porpoises, and dolphins) and the sirenians (akin to the modern manatees and dugongs). Similarly, the Eocene provides the first elephant-like animals and the early bats. Many essentially modern bird orders appeared during the Eocene.

Eochaid Ollathair (Celtic mythology): *see* Dagda.

EOKA, abbreviation of ETHNIKÍ ORGÁNOSIS KIPRIAKOÚ AGÓNOS (Greek: "National Organization of Cypriot Struggle"), underground nationalist movement of Greek Cypriots dedicated to the expulsion of the British from Cyprus (achieved in 1960) and the eventual union (Greek *énosis*) of Cyprus with Greece.

EOKA was organized *c.* 1955 by Col. Georgios Grivas, an officer in the Greek Army, with the support of Makarios III, Orthodox archbishop of Cyprus. Its terrorist campaign, begun early in 1955, reached a climax in 1956, with the exile of Makarios and the temporary depletion of British forces in the island because of the Suez crisis. By early 1957, however, a reinforced British army successfully attacked the terrorists' mountain hideouts, considerably weakening EOKA, which had never numbered more than 300 men. Violence subsided after Makarios' release in March 1957, though there was a recurrence in mid-1958, when EOKA clashed with Turkish Cypriot guerrillas. In 1958 Makarios announced he would accept independence for Cyprus rather than *énosis*, and in March 1959 Grivas reluctantly disbanded his organization after obtaining amnesty for its members.

In 1971 Grivas, who had served for a time as commander of the Greek Cypriot National Guard but had been recalled by the Greek government, reentered Cyprus secretly to form EOKA B, to "prevent a betrayal of *énosis*." After Grivas' death in January 1974, his followers vowed to continue the struggle. President Makarios officially proscribed EOKA B in April 1974, three months before he was ousted and before Turkish forces landed and divided the country in a brief civil war. Thereafter, EOKA disappeared.

eolian sound, also spelled AEOLIAN, sound produced by wind when it encounters an obstacle. Fixed objects, such as buildings and wires, cause humming or other constant sounds called eolian tones; moving objects, such as twigs and leaves, cause irregular sounds. A wind that flows over a cylinder or stretched wire produces a sound the frequency (pitch) of which is a function of wind speed and the diameter of the cylinder or wire; it is independent of the tension, composition, and length of the wire.

Eolie Islands, Italian ISOLE EOLIE, Latin INSULAE AEOLIAE, also called AEOLIAN ISLANDS, or LIPARI ISLANDS, volcanic group in the Tyrrhenian Sea (of the Mediterranean) off the north coast of Sicily, Italy. The group, administered as part of Messina province, consists of seven major islands and several islets, with a total land area of 34 sq mi (88 sq km), lying in a general "Y" shape, the base of the "Y" being the westernmost island, Alicudi, the northern tip Stromboli, and the southern tip Vulcano. The other major islands are Lipari, Salina, Filicudi, and Panarea.

The islands represent the summits of a submerged mountain chain rising to 3,156 ft (962 m) on Salina. Seismic and volcanic activity has been known since ancient times, and the Greeks believed the islands to be the home of Aeolus, king of the winds, whence their name. Vulcano and Stromboli are active and there are fumaroles on Lipari and Panarea.

Excavations in the 20th century have established an uninterrupted archaeological record from the Neolithic period (7000–3000 BC). The volcanic obsidian, the islands' principal export in prehistoric times, has been detected as far east as Crete. Panarea has remains of a Bronze Age village (dating from 3000 BC). The Greeks established themselves in the islands early in the 6th century BC. Later there was a Carthaginian naval station, until the Romans took over in 252 BC. In Roman times, as in the Fascist era prior to World War II in the 20th century, the islands served as a place of banishment for political prisoners. In early medieval times they were conquered by the Saracens, who were expelled by the Normans in the 11th century. The Eolie Islands frequently changed hands between the Angevins of Naples and the Sicilian kings in the 14th century. Alfonso V of Aragon annexed them to Naples, but Ferdinand II of Aragon finally united them to Sicily in the late 15th century.

Pumice is exported from the islands, and the principal agricultural product is a heavy malmsey-type wine from Lipari. There are alum quarries on Vulcano. Lipari, the chief town of the islands, is the seat of a bishop and of the important Aeolian archaeological museum; much of the remaining population is concentrated in the three towns on Lipari. Stromboli's continuously active volcano is a noted tourist attraction. There is regular steamer service to Milazzo, Messina, and Naples, and in summer a hydrofoil service to Palermo. Pop. (1981 prelim.) 10,208.

eon (religion): *see* aeon.

Éon de Beaumont, Charles (-Geneviève-Louis-Auguste-André-Timothée), chevalier d' (knight of) (b. Oct. 5, 1728, Tonnerre, Fr.—d. May 21, 1810, London), French secret agent from whose name the term "eonism," denoting the tendency to adopt the costume and manners of the opposite sex, is derived.

His first mission was to the Russian empress Elizabeth in 1755, on which he seems to have disguised himself as a woman. After good service as a dragoon captain, he went to London in 1762, with the Duc de Nivernais (Louis Jules Mancini). On returning to Versailles with the Treaty of Paris ratified (1763), he received the cross of St. Louis. Sent back to London with secret instructions from the King for espionage, he became involved in a quarrel with the French ambassador but refused to return to France—afterward claiming that Louis XV had instructed him to redisguise himself as a woman and to hide in the city.

Speculation began in London as to the Chevalier's sex. Eventually, in need of money, he pretended to Beaumarchais in 1775 that he was really a woman. Believing this, Beaumarchais managed to get him a pension, but Éon was ordered to return to France wearing women's dress. In 1777 he received the command; "By order of the king: Charles-Geneviève-Louise-Auguste-Andrée-Timothée d'Éon de Beaumont is commanded to leave off the dragoon's uniform which she is wearing, and to dress according to her sex." Thenceforth he always wore women's dress. Having returned to London in 1785, he died there 25 years later. An autopsy performed two days after his death certified him male.

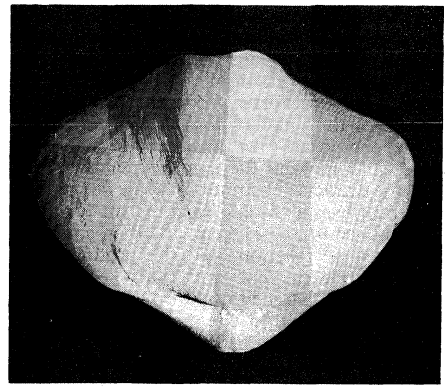
Eondekoeter, Melchior de (Dutch painter): *see* Hondecoeter, Melchior de.

Eos (Greek), Roman AURORA, in Greco-Roman mythology, the personification of the dawn. According to the Greek poet Hesiod, she was the daughter of the Titan Hyperion and the Titaness Theia and sister of Helios, the sun god, and Selene, the moon goddess. By the Titan Astraeus she was the mother of the winds Zephyrus, Notus, and Boreas, and of Hesperus (the Evening Star) and the other stars; by Tithonus of Assyria she was the mother of Memnon, king of the Ethiopians. She bears in Homer's works the epithet Rosy-Fingered.

Eos was also represented as the lover of the hunter Orion and of the youthful hunter Cephalus, by whom she was the mother of Phaethon. In works of art she is represented as a young woman, either walking fast with a youth in her arms or rising from the sea in a chariot drawn by winged horses; sometimes, as the goddess who dispenses the dews of the morning, she has a pitcher in each hand.

In Latin writings the word aurora was used (*e.g.*, by Virgil) for the east.

Eospirifer, genus of extinct brachiopods, or lamp shells, found as fossils in Middle Silurian to Lower Devonian marine rocks (the Silurian Period ended and the following Devonian Period began about 395,000,000 years ago). The genus *Eospirifer* is closely related to



Eospirifer

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

other genera included in the brachiopod group known as the spiriferids, a formerly important group of animals. *Eospirifer* has a moderate-sized shell bearing fine, radiating ribs (costae). Arcuate (bow-shaped) growth lines are also present.

Eötvös, József, Báró (Baron) (b. Sept. 13, 1813, Buda, Hung.—d. Feb. 2, 1871, Pest), novelist, essayist, educator, and statesman, whose life and writings were devoted to the creation of a modern Hungarian literature and to the establishment of a modern democratic Hungary.

József Eötvös, steel engraving by C. Mahlknecht after a drawing by Miklós Barabás, 1841

By courtesy of the Petofi Irodalmi Muzeum, Budapest

During his studies in Buda (1826–31), Eötvös became inspired with liberalism and the desire to reform Hungarian society. Between 1836 and 1841 he studied social conditions in England and France and returned deeply impressed by liberal philanthropy, Romanticism, and Utopian socialism.

Eötvös proclaimed the social mission of literature and in all his writings fought for alleviation of poverty. His first novel, *A karthausi* (1839–41; "The Carthusians"), expresses disappointment at the July Revolution in France (1830); Eötvös intended it as a criticism of feudalism in Hungary. His essays and prose works also advocated a modernized penal code and an end to poverty. *A falu jegyzője* (1845; *The Village Notary,* 1850) bitterly satirized old Hungary, and a historical novel about the 16th-century Hungarian peasant rebellion, *Magyarország 1514-ben* (1847; "Hungary in 1514") mobilized public opinion against serfdom.

Eötvös became minister of education in the revolutionary government of 1848, but disagreement with Lajos Kossuth caused him to resign later that year. Until 1851 he lived in Munich, where he began his great work, *A tizenkilencedik század uralkodó eszméinek befolyása az álladalomra* (1851–54; "The Influence of the Ruling Ideas of the 19th Cen-

tury on the State"). This work attempted to work out the principles of the French Revolution and depicted an ideal liberal state, based on English constitutional ideas and practice. Eötvös wished to base the relationship between Austria and Hungary on the principles of 1848, and the compromise of 1867 was partly his work.

His later years were devoted to political and philosophical activity. His collected reflections (published 1864) show a growing stoicism of a type peculiar to Hungarian literature of the post-revolutionary period. He played a distinguished part in the reorganization of the Hungarian Academy and maintained close relations with Western scholars. Eötvös became minister of education again after 1867 and devoted his energies to modernizing the educational system.

After the revolution, Eötvös wrote no poetry and only one novel, *Növerèk* (1857; "The Sisters"), which explained his ideas on education. Yet his literary work is of great importance. His short stories mark the beginning of a new portrayal of the peasant in Hungarian literature, and at a time when the Romantic novel was in fashion he was a pioneer of Realism.

Eötvös, Roland, Baron von (German), Hungarian LORÁND, BÁRÓ EÖTVÖS (b. July 27, 1848, Pest, Hung.—d. April 8, 1919, Budapest), Hungarian physicist who introduced the concept of molecular surface tension. His study of the Earth's gravitational field—which led to his development of the Eötvös torsion balance, long unsurpassed in precision—resulted in proof that inertial mass and gravitational mass are equivalent, later a major principle of Albert Einstein's general theory of relativity.

Eötvös, the son of Baron József Eötvös, was minister of public instruction in the Cabinet of Sandor Wekerle, resigning in 1895 to devote himself to teaching physics at the University of Budapest.

Epaminondas (b. *c.* 410 BC, Thebes—d. 362, Mantineia), Theban statesman and military tactician and leader who was largely responsible for breaking the military dominance of Sparta and for altering permanently the balance of power among the Greek states. He defeated a Spartan army at Leutra (371 BC) and led successful expeditions into the Peloponnese (370–369, 369–368, 367, and 362), being killed in battle during the last of those invasions.

Epaminondas was the son of a Theban aristocrat. His father, though poor, provided him with a good education. Particularly attracted to philosophy, the boy became a devoted pupil of Lysis of Tarentum, a Pythagorean, who had settled in Thebes. Epaminondas did not at first take any part in political life but served on military expeditions. There is a legend that he saved the life of his colleague Pelopidas in battle in 385.

In 382 the Spartans took advantage of an expedition to northern Greece to conspire with a few Thebans and seize power by a sudden coup. For three and a half years the government was in the hands of this small dictatorship, backed by a Spartan garrison in the Cadmeia (the citadel of Thebes). Many of the previous leaders, including Pelopidas, were driven into exile. Epaminondas remained in private life, but when Pelopidas, returning secretly from Athens, successfully overthrew the dictatorship in 379 and frightened the Spartan garrison into surrender, Epaminondas is said to have been one of those who led the popular uprising in Thebes. No individual part is attributed to him for the next eight years, during which Thebes, in alliance with Athens, successfully fought off Sparta and reestablished its traditional leadership in a federation of the cities of Boeotia. In 371 the general war was ended at a peace conference, but Sparta and Athens combined to refuse recognition to the Theban federation by insisting that each city of Boeotia should be a separate party to the treaty, while Thebes claimed that its federation should be treated as a single unit. Epaminondas, who was boeotarch (one of the five magistrates of the federation), maintained this position, even when it led to the exclusion of Thebes from the peace treaty. The Spartans had an army stationed on Thebes's western frontier, waiting to follow up their diplomatic success by a crushing military attack. But in the Battle of Leuctra (371) Epaminondas was ready with a tactical innovation. Instead of the usual advances of heavily armed infantry drawn up in an equal number of ranks over the whole front, he massed his troops on the left wing to the unprecedented depth of 50 ranks against an overall Spartan depth of 12. The Spartans, who according to Greek convention had their best troops on the right wing, were overwhelmed by the force of the Theban advance. The novelty consisted in striking the enemy first at their strongest, instead of their weakest, point, with such crushing force that the attack was irresistible. The defeat of the Spartans inflicted such heavy losses on the very limited numbers of the Spartan soldiers that it seriously threatened the possibility of raising another Spartan army. The Boeotian federation had been saved, and after more than a year the Theban army, once more led by Epaminondas, proceeded to press home its victory. In the winter (a most unusual season for Greek warfare) of 370–369 they invaded the Peloponnese and penetrated the valley of the Eurotas (modern Evrótas). For the first time for at least two centuries an enemy army was in sight of Sparta. The subject population of Helots revolted, and Epaminondas re-created the state of Messenia, which had been enslaved by the Spartans for 300 years. He also encouraged the Arcadians, who had broken from Sparta's league, to found Megalopolis (Big City) as a federal capital. These new political creations served to keep Sparta in check so that it was never again a serious military power outside the Peloponnese. Epaminondas' brilliant success was met with jealousy and political opposition at home. He had stayed abroad over his year of office and was impeached on his return but acquitted. In 369–368 he led a second successful invasion of the Peloponnese, gaining further allies for Boeotia. In 367 he also served as a common soldier in an army sent to rescue his friend Pelopidas, who was a prisoner of Alexander, tyrant of Pherae (Thessaly). The expedition got into difficulties from which it was only rescued when Epaminondas was appointed general. This resulted in his reelection as boeotarch. He then returned to Thessaly and secured the release of Pelopidas. In 366 he invaded the Peloponnese for a third time, with a view to strengthening the Theban position there. He obtained assurances of fidelity from several states and, perhaps because of these assurances, decided not to overthrow the oligarchical governments that had been established by the Spartans. This was not accepted by the Theban government, which was in favour of overthrowing the oligarchs and establishing new democracies.

Athens had supported Sparta and was at war with Thebes. In 364–363 Epaminondas made a bold attempt to challenge Athens' naval empire. With a new Boeotian fleet, he sailed to Byzantium, with the result that a number of cities in the Athenian Empire rebelled against their now-threatened masters. But the next year the outbreak of civil war in the Arcadian league brought Epaminondas once more to the head of a large allied army in the Peloponnese. He was met by Sparta, Athens, and their allies in the Battle of Mantineia (362). Epaminondas repeated on a large scale the tactics of Leuctra and was once more victorious but died of a wound on the field of battle. With his death all constructive initiative appeared to vanish from Theban policy.

(H.W.P.)

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Epanagoge (Greek: "Introduction"), legal code compiled *c.* 879, during the reign of the Byzantine emperor Basil I, intended as the introduction to a comprehensive collection of laws to be published in Greek. Its chief importance lies in its exposition of the theory of the separation of the powers of church and state.

Based on the Ecloga, a law code drawn up during the reign of the Byzantine emperor Leo III the Isaurian (717–741), and the law books of the emperor Justinian I (reigned 527–565), the Epanagoge is original in those parts dealing with the rights and obligations of the emperor, the patriarch, and other lay and ecclesiastical dignitaries. State and church were conceived as a unity presided over by emperor and patriarch, who should work in harmony for the benefit of mankind, the emperor fostering the material well-being of his subjects, the patriarch promoting their spiritual welfare. Photius, patriarch of Constantinople during this period and defender of the autonomous traditions of the Eastern Orthodox Church, is believed to have been the author of this theory.

The Epanagoge served as the basis for the Basilica, an extensive revision of Justinian's code published during the reign of Leo VI (886–912). Many extracts from it can also be found in Slavic codes including the Russian Book of Rules, an administrative code.

eparch, the leading Byzantine government official from the 6th to the 11th century, entrusted with the authority to maintain public order and safety in Constantinople (modern Istanbul), the Byzantine capital. Called the "father of the city," he ranked just beneath the emperor in importance.

His authority included the direction of the lawcourts, provisioning of the city, and the conduct of trade and industry. His jurisdiction over the corporations and guilds (*collegia*) of craftsmen and traders was delineated in the *Book of the Eparch,* probably written in the 9th–10th century. His primary economic concern focussed on guilds such as those of cattle traders, butchers, fishmongers, bakers, and innkeepers, which held monopolies on supplying provisions for the capital. An entire bureau of the government, the *secretum,* acted to carry out his orders.

In 1028 the eparch Romanus Argyrus married the daughter of the dying emperor Constantine VIII (reigned 1025–28) and was later proclaimed emperor as Romanus III Argyrus (reigned 1028–34). In the 12th century the eparch's most important functions passed to other officials, and under the Palaeologian dynasty (1261–1453) the name survived only as a court title.

Epe, town and port, Lagos State, southwestern Nigeria; it lies on the north bank of the coastal Lagos Lagoon and has road connections to Ijebu-Ode and Ikorodu. A traditional settlement of the Ijebu people (a subgroup of the Yoruba), it was established by the mid-18th century as the chief port (slaves, cloth, agricultural produce) for Ijebu-Ode (17 mi [27 km] north-northwest), the capital of the

Ijebu Kingdom. It later served as the refuge for the forces of Kosoko, the Yoruba king ousted from Lagos (42 mi west-southwest) by the British in 1851; and in 1892 it was the embarkation point for the military expedition sent by Sir Gilbert Carter, the governor of Lagos, to defeat the *awujale* (the Ijebu political and spiritual ruler) at Ijebu-Ode.

Modern Epe is a collecting point for the export of fish, cassava, corn (maize), green vegetables, coconuts, cocoa, palm produce, rubber, and firewood to Lagos. Special leaves useful in preserving kola nuts are trucked to Ijebu-Ode, Shagamu, and the other main kola-shipping towns. Epe is best known for its construction of the motorized, shallow-draft barges that navigate the coastal lagoons. Fishing is the major occupation. The town is the headquarters of the local government council and is served by secondary schools, several hospitals, and a health office. Pop. (1983 est.) 72,900.

épée, sword developed in the 19th century for use in fencing practice and contests. In early contests, fencers used blunted duelling swords and tried for a single touch on any point of the opponent's body, with no regard for the usual fencing conventions of limited target and right-of-way on attack. The number of touches required to win a match was increased to three in 1932 and five in 1955, but other rules have remained essentially the same.

The modern épée is a thrusting weapon 770 grams (27.16 ounces) in weight and 110 centimetres (3 feet, 7 inches) in overall length, with a blade 900 millimetres (35.43 inches) long. The blade is triangular in cross section and fairly rigid, tapering to a sharp point blunted with a stop, or button. The handguard is circular and bowl-shaped, similar to that of the foil but slightly larger.

If used with electrical scoring apparatus, the épée's tip contains a spring device that registers only touches of 750 grams or more. The device will not register an opposing hit scored more than $\frac{1}{25}$ of a second after the first. If a double hit is recorded, it is scored against both fencers.

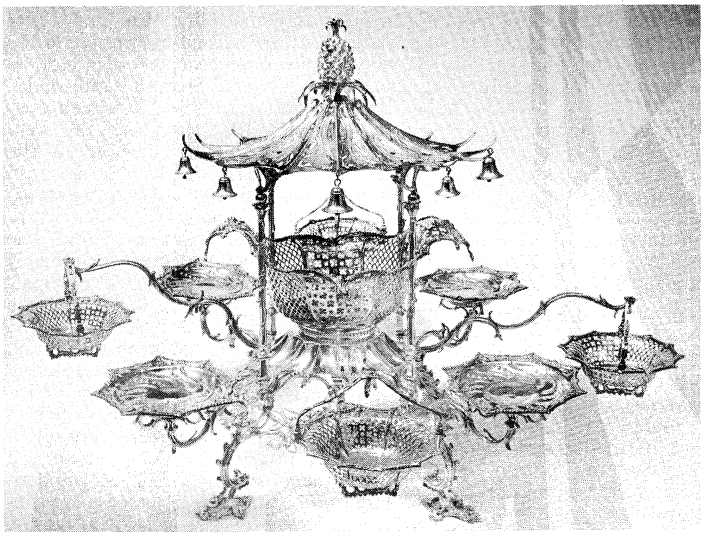
Touches are made with the tip only, and a retreat by a fencer of more than 10 metres (about 33 feet) scores as a touch against the defender. If both contestants reach five on a double hit, both are defeated.

Épée fencing is an international and Olympic Games fencing event and is also included in modern (or military) pentathlon competition. For world épée champions since 1947, *see* Sporting Record: *Fencing. See also* Olympic Games.

epeirogeny, in geology, broad regional upwarp of the cratonic (stable interior) portions of continents. In contrast to orogeny (*q.v.*), epeirogeny takes place over broad, nonlinear areas, is relatively slow, and results in only mild deformation. Accompaniments of epeirogeny include the development of regional disconformities that gently bevel underlying strata and the formation of regressive deposits if marine incursions have taken place. Igneous intrusion and regional metamorphism rarely, if ever, are associated with epeirogeny. Causes of epeirogeny are not well known but may include large-scale adjustments of the continental crust to phase transitions in the Earth's mantle and the presence of spreading centres under continental crust.

Some geologists believe that large-scale cycles of epeirogeny that affect entire cratonic plates can be recognized. Strata deposited in the intervals between such cycles in North America have been called sequences and have been given formal names. The most widely recognized of these are the Sauk Sequence (Late Precambrian to mid-Ordovician; about 650,000,000 to 460,000,000 years ago), the Tippecanoe Sequence (mid-Ordovician to Early Devonian; about 460,000,000 to 350,000,000 years ago), the Kaskaskia Sequence (Early Devonian to latest Mississippian; about 350,000,000 to 330,000,000 years ago), and the Absaroka Sequence (Pennsylvanian to mid-Jurassic; about 325,000,000 to 160,000,000 years ago).

epergne, dining table centrepiece—usually of silver—that generally sits on four feet supporting a central bowl, with four or more dishes held by radiating branches. Occasionally, epergnes had additional holders for candles, casters, or cruets.



George II silver epergne, by Thomas Pitts, London, 1761; in the Folger's Coffee Collection of Antique English Silver
By courtesy of the Procter and Gamble Company

The earliest record of an epergne is in 1725, and extant pieces date from the 1730s. In the late 19th century similar pieces, made largely of glass or porcelain and intended to hold flowers, came into fashion.

Eperjes (Czechoslovakia): *see* Prešov.

Épernay, town, Marne *département,* Champagne-Ardenne region, northeastern France, on the left bank of the Marne River, 17 mi (27 km) south-southwest of Reims. The archbishops of Reims held it from the 5th to the 10th century, and it then passed to the counts of Champagne and in 1642 to the Duke of Bouillon. Having been destroyed or burned more than 20 times, the town has few old buildings. With Reims, Épernay is the main centre for bottling, storing, and selling Champagne wines. Most of the town is built on chalk rock, in which numerous tunnels more than 30 mi long have been cut for storing the wine. The Château Perrier houses a library with famous 9th-century manuscripts, as well as a wine museum and some archaeological artifacts. The town has railway repair yards and manufactures furniture, ceramics, and wood products. Pop. (1982) 27,466.

Épernon, Jean-Louis de Nogaret de la Valette, duc d' (duke of) (b. May 1554, Caumont, Fr.—d. Jan. 13, 1642, Loches), one of the most powerful new magnates in French politics at the turn of the 17th century.

Of obscure nobility, La Valette rose to prominence as a favourite of Henry III, who created him duke and peer of France in 1582. He and Anne de Joyeuse acted virtually as prime ministers in the 1580s. His rapacity was notorious, but he also showed great political ability and energy and did much to defend the crown during the civil wars of Henry's reign. Temporarily out of favour with the King, he returned to his side after the murder of Henri, duc de Guise (1588) and advised reconciliation with Henry of Navarre, the future Henry IV of France. When Henry III was murdered (1589), Épernon at first refused to serve Henry IV, who was then still a Protestant, and even made a secret treaty with Spain. When Henry was established as king, however, Épernon appeared at court posing as a loyal subject. He joined in every conspiracy of the reign, without ever being caught, and there are grounds for believing that he helped to arrange the murder of the King by François Ravaillac, who is known to have received money from Épernon's mistress, Catherine du Tillet, and who was kept in protective custody by Épernon for a whole day after the murder (May 14, 1610). Épernon then carried out the minor coup d'etat that made Marie de Médicis regent for Henry's infant son Louis XIII, but she did not include him in her government. He fell into disgrace after Louis came into power (1617), but avenged himself by planning Marie de Médicis' escape from her exile in Blois in 1619 and supporting her in the civil war that ensued. In 1622 he was appointed governor of Guienne, where he lived in wanton luxury punctuated by quarrels with the Archbishop of Bordeaux. Richelieu deprived him of his governorship in 1638 and exiled him to Loches in 1641.

Épernon, engraving by Michel L'Asne, 1632
By courtesy of the Bibliotheque Nationale, Paris

ephah: *see* bat.

ephebus, in ancient Greece, any male who had attained the age of puberty. In Athens it acquired a technical sense, referring to young men aged 18–20. From *c.* 335 BC they un-

derwent two years of military training under the supervision of an elected *kosmetes* and 10 *sōphronistai* ("chasteners"). At the end of the first year each ephebus received a sword and shield from the state; probably at this stage he took the ephebic oath. During their service, ephebi were exempt from civic duties and deprived of most civic rights. During the 3rd century BC, ephebic service ceased to be compulsory and the duration was reduced to one year. The *ephebia* became an institution for the wealthy classes only. By the 1st century BC foreigners were admitted, and the curriculum was expanded to include philosophic and literary studies, although the military character of the *ephebia* was not wholly lost. The system began to decay late in the 3rd century AD. In other Hellenistic cities the term ephebi was applied to youths aged 15–17.

Ephedra, the only genus of the family Ephedraceae, an evolutionally early group of low, straggling, or climbing gymnospermous desert shrubs and the only family in the order Ephedrales. *Ephedra* contains about 40 species, among them the Asiatic plants known as *ma huang,* sources of the decongestant drug ephedrine. The joint pine of the eastern Mediterranean region is *Ephedra fragilis.* The North American species include the plants joint fir and Mormon tea bush, sources of food and medicinals. The leaves, reduced to scales about one centimetre long, are opposite or whorled about the nodes of green branchlets that resemble those of the horsetail. In certain anatomical and reproductive features, the plants are close to the angiosperms.

ephedrine, alkaloid used as a decongestant drug. It is obtainable from plants of the genus *Ephedra,* particularly the Chinese species *E. sinica,* and it has been used in China for more than 5,000 years to treat asthma and hay fever. It is effective when administered orally, and its effects persist for several hours. Since 1927 synthetic ephedrine has been used in the United States as a bronchodilator and nasal decongestant and in controlling urinary incontinence. When its longer duration of action is desirable, ephedrine replaces epinephrine in nonemergency treatment of allergic reactions. Its slow action renders it useless in arresting acute allergic attacks. Ephedrine is usually used in combination with sedatives.

ephemeris, plural EPHEMERIDES, table giving the positions of one or more celestial bodies, often published with supplementary information. Ephemerides were constructed as early as the 4th century BC and are still essential today to the astronomer and navigator.

Modern ephemerides are calculated when a theory (mathematical description) of the motion of a heavenly body has been evolved, based on observations. Heavy computing and careful checking are involved. Until the 20th century, tables of logarithms were the chief aid to computation. The gradual introduction of mechanical calculators increased the speed and accuracy of the work. Of greater effect was the development of electronic calculators and computers. These have made feasible the solution of problems formerly considered impossible because of the tremendous labour involved. The simultaneous integration of the equations of motion of the five outer planets, for every 40th day, from the year 1653 to 2060 is typical.

A number of national ephemerides are published regularly. The oldest is the *Connaissance des temps,* founded in Paris in 1679 as the direct successor to a series of ephemerides originally begun by the German astronomer Johannes Kepler in 1617. The British *Nautical Almanac and Astronomical Ephemeris* commenced through the initiative of Nevil Maskelyne in 1766. *The American Ephemeris and Nautical Almanac* was first published in Washington, D.C., in 1852 for the year 1855. From 1877, under the direction of the astronomer Simon Newcomb, it became the best of the national ephemerides. To avoid duplication of costs, it has since 1960 been unified with the British national publication, which at the same time was renamed *The Astronomical Ephemeris.* The two are of identical content, reproduced separately in each country; the work of computing is shared. Beginning in 1981, both national ephemerides were renamed *The Astronomical Almanac. Ephemerides of Minor Planets,* compiled and published annually by the Institute of Theoretical Astronomy, Leningrad, represents further international cooperation.

Ephemeris Time (ET), the first dynamical time scale in history; it was defined by the International Astronomical Union in the 1950s and was superseded by Barycentric Dynamical Time in 1984. (*See* dynamical time.)

Ephemeris Time could be obtained by observing the orbital position of any planet or satellite and then using an ephemeris, which lists calculated orbital positions as a function of time. The orbital position of the Earth about the Sun, as developed mathematically in the American astronomer Simon Newcomb's tables of the Sun (1898), were selected as the standard to define the numerical measure of Ephemeris Time. (The Earth and Sun are 180° apart; that is, opposite each other in the plane of the ecliptic, so that an observation of the Sun with respect to the stars gives the orbital position of the Earth.) Newcomb's tables were used to form a solar ephemeris, or a table that gives the Sun's coordinates for successive values of Ephemeris Time.

Values of Ephemeris Time were also obtained from observations of the Moon by using the lunar ephemeris for the calculated position. The lunar ephemeris, however, contains an empirical, nongravitational term, which was needed to correct for the effects of tides raised in the Earth by the Moon. The Moon was generally used to determine Ephemeris Time because of its rapid orbital motion. Very accurate positions of the Moon were obtained visually by observations of occultations of stars by the Moon. By the time Ephemeris Time was superseded in 1984, it had served two important purposes: (1) the definition of a second of Ephemeris Time served as the basis for the redefinition in 1967 of the SI second on the atomic time scale, and (2) ET was the reference scale used for comparison with rotational time to determine variations in the Earth's rotational speed from about 700 BC to AD 1955.

ephemeropteran, a member of the insect order Ephemeroptera, comprising the insects commonly known in their winged stages as mayflies, shadflies, dayflies, fishflies, or drakes. During their larval phase in fresh water or occasionally in brackish water they are called nymphs or naiads. There are approximately 2,000 known species, of which about 600 inhabit the North American continent. They are found on all land areas except Antarctica.

A brief treatment of ephemeropterans follows. For full treatment, *see* MACROPAEDIA: Insects.

While fossil records are incomplete, evidence suggests that ephemeropterans were present during the Upper Carboniferous Period (280,000,000 to 325,000,000 years ago). They range in size in the adult phase from 2.5 to 32 millimetres (0.1 to 1.3 inches). The life cycle encompasses four stages: egg, nymph, subimago, and imago.

In the aquatic nymphal stage, ephemeropterans have six legs, each of which ends in a claw. The body is divided into 10 segments, some of which have gills. The body terminates in two or three thin tails. Adaptation in nymphs has produced species with jaws and appendages especially suited for burrowing and species with flattened bodies for mobility through narrow spaces and for minimizing resistance to stream currents. Other species have legs adapted for movement over river bottoms and other surface features and for adhering to aquatic vegetation.

Most ephemeropteran species remain in the nymphal stage for about a year. During this period they shed their external layer (molt) up to 50 times. Once they have matured they molt their last nymphal coat and emerge as winged subimagoes or duns. Unlike all other insects, the mayfly molts again after it has acquired fully developed wings. After a period ranging from several minutes to several days, but usually overnight, the imago molts and emerges as the mature adult, known as the imago or spinner. Both imagoes and subimagoes are characterized by wispy tails, two pairs of thickly-veined wings, and short antennae. Both have compound eyes and are equipped with nonfunctioning mouthparts and digestive apparatus.

Mating behaviour begins shortly after entrance into the imago phase and ends with the death of both male and female following the extrusion of fertilized eggs (oviposition). The entire life span of the adult mayfly is usually only a few hours, although at least one species lives for up to two days. Mating begins with the dance of a swarm of males over water at nightfall. Females soon respond, and mating is carried out in the air. Fertilized eggs, which are produced in clusters of fewer than 50 to more than 10,000, are usually deposited by the females on the surface of water. Some species descend beneath the water to oviposit on submerged surfaces. Once deposited, eggs adhere to a submerged object or fall to the bottom; they generally hatch within two weeks.

Mayflies in all three growth stages are important in the food chains of aquatic ecosystems. As nymphs they consume algae and other aquatic vegetation and the products of organic decay, and they serve as prey for fish and a number of invertebrate carnivores. Predators of subimagoes and imagoes include hornets, dragonflies, bats, birds, beetles, spiders, and mammals; mayflies become food for fish once again as they mate and die at or near the surface of the water.

Ephesians, Letter of Paul to the, New Testament writing once thought to have been composed by Paul in prison but more likely the work of one of Paul's disciples, who probably wrote the text sometime before AD 90 while consulting Paul's letter to the Colossians. The words "in Ephesus" are lacking in the earliest manuscripts and citations. The letter declares that the Christian mystery (gospel) of salvation, first revealed to the Apostles, is the source of true wisdom (perhaps an indirect repudiation of Gnostic claims to esoteric knowledge of the supernatural) and that salvation through Christ is offered to Jews and Gentiles alike. The writer affirms that there is but "one Lord, one faith, one baptism, one God and Father of us all" (4:5–6), who united all things in Christ, through whose death all men are redeemed. The author exhorts his readers—parents and children, masters and slaves—to lead exemplary Christian lives and to arm themselves with the "shield of faith," "the helmet of salvation," and "the sword of the Spirit, which is the Word of God" (6:16–17), in order to resist the wiles of the devil.

Ephesus, Greek EPHESOS, the most important Greek city in Ionian Asia Minor, the ruins of which lie near the modern village of Seljuq in the Izmir *il* (province) of Turkey.

In Roman times it was situated on the northern slopes of the hills Coressus and Pion and south of the Cayster (Küçükmenderes) River, the silt from which has since formed a fertile plain but has caused the coastline to move

ever farther west. The Temple of Artemis, or Diana, to which Ephesus owed much of its fame and which seems to mark the site of the classical Greek city, was probably on the seaboard when it was founded (about 600 BC), one mile east by northeast of Pion (modern Panayir Dağ). In Roman times a sea channel was maintained with difficulty to a harbour well west of Pion. By late Byzantine times this channel had become useless, and the coast by the mid-20th century was three miles farther west. Ephesus commanded the west end of one great trade route into Asia, that along the Cayster valley, and had easy access to the other two, along the Hermus (Gediz) and the Maeander (Büyükmenderes) rivers.

History. Ephesus enters history in the mid-7th century BC, when it was attacked by the Cimmerians. Unlike its neighbour, Magnesia, it survived the attacks. For part of the early 6th century the city was under tyrants. Though allied by marriage to the kings of Lydia, its people could not hold back the Lydian Croesus, who asserted a general suzerainty over the city. He did, however, present many columns and some golden cows for a new and splendid rebuilding of the Artemiseum (Temple of Artemis). At this time, according to Strabo, the Ephesians began to live in the plain; and to this period, too, should be allotted the redrafting of the laws, said to have been the work of an Athenian, Aristarchus. Ephesus soon submitted to Cyrus of Persia. Early in the Ionian revolt (499–493 BC) against the Persians, Ephesus served as a base for an Ionian attack on Sardis; but it is not mentioned again until 494, when the Ephesians massacred the Chiot survivors of the Battle of Lade. The massacre may have occurred because Ephesus was a commercial rival of the chief rebels, Chios and Miletus. Ephesus maintained friendly relations with Persia for about 50 years: in 478 Xerxes, returning from his failure in Greece, honoured Artemis of Ephesus, although he sacked other Ionian shrines, and left his children for safety in Ephesus; and Themistocles landed there in the 460s on his flight to Persia. But after 454 Ephesus appears as a regular tributary of Athens. Great Ephesians up to this time had been Callinus, the earliest Greek elegist (mid-7th century BC), the satirist Hipponax, and the famous philosopher Heracleitus, one of the Basilids.

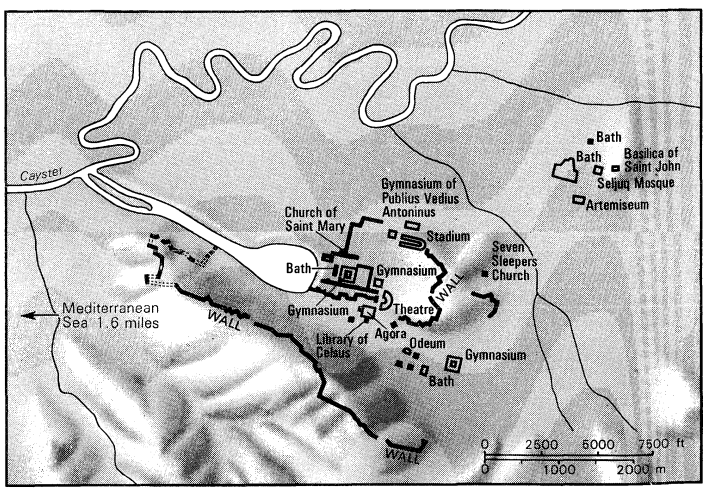
Ephesus shared in a general revolt of 412 BC against Athens, siding with Sparta in the Second Peloponnesian War, and remained an effective ally of Sparta down to the end of the war. Threatened by Persia after 403, Ephesus served in 396 as the headquarters of King Agesilaus of Sparta. In 394 the Ephesians deserted to Conon's anti-Spartan maritime league, but by 387 the city was again in Spartan hands and was handed by Antalcidas to Persia. There followed the pro-Persian tyranny of Syrphax and his family, who were stoned to death in 333 on Alexander the Great's taking the city. After 50 years of fluctuating fortune, Ephesus was conquered by the Macedonian general Lysimachus and resettled around Coressus and Pion (286–281 BC). Lysimachus introduced colonists from Lebedus and Colophon and renamed the city after his wife, Arsinoo—a name soon dropped. This was the beginning of Ephesus' Hellenistic prosperity. It became conspicuous for the abundance of its coinage.

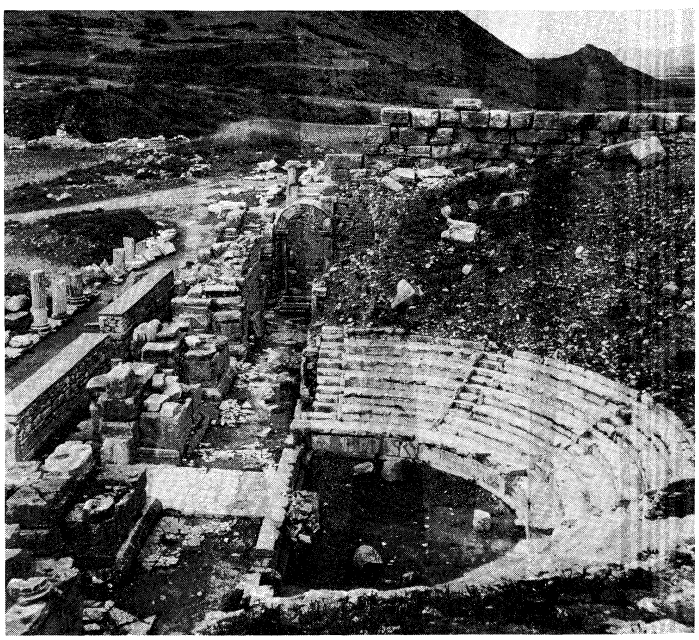
After the defeat of Antiochus the Great, king of Syria, by the Romans in 189 BC, Ephesus was handed over by the conquerors to the king of Pergamum. Attalus III of Pergamum bequeathed Ephesus with the rest of his possessions to the Roman people (133 BC). Thenceforth, Ephesus remained subject to Rome, except for a brief time beginning in 88 BC, when, at the instigation of Mithradates the Great of Pontus, the cities of Asia Minor revolted and killed their Roman residents. The Ephesians even killed those Romans who had fled for refuge to the Artemiseum; notwithstanding which they returned in 86 BC to their former masters. Their claim, preserved on an extant inscription, that in admitting Mithradates they had merely yielded to superior force was rudely brushed aside by Sulla, who inflicted a very heavy fine. Although it twice chose the losing side in the Roman civil wars and although it was stoutly opposed by Pergamum and Smyrna, Ephesus became under Augustus the first city of the Roman province of Asia. The geographer Strabo wrote of its importance as a commercial centre in the 1st century BC. The triumphal arch of 3 BC and the aqueduct of AD 4–14 initiated that long series of public buildings, ornamental and useful, that make Ephesus the most impressive example in Greek lands of a city of imperial times.

Meanwhile the Christian Church began to win converts. A famous protest in the theatre against the teachings of St. Paul, described in Acts 19, is dated about AD 57. According to local belief Ephesus was the last home of the Virgin, who was lodged near the city by St. John and died there. The tradition that St. Luke also died there seems to be less strongly supported. Ephesus was one of the seven churches of Asia to which the Revelation to John was addressed.

The Goths destroyed both city and temple in AD 262, and neither ever recovered its former splendour. The emperor Constantine, however, erected a new public bath, and Arcadius rebuilt at a higher level the street from the theatre to the harbour, named after him, the Arkadiane. A general council of the church, held at Ephesus in 431 in the great double church of St. Mary, condemned Nestorius and justified the cult of the Virgin as Theotokos (Mother of God). A few years later, according to legend, the Seven Sleepers of Ephesus (a group of 3rd-century Christian martyrs) were miraculously raised from the dead. They too became the object of a famous cult. The emperor Justinian built the magnificent basilica of St. John in the 6th century. By the early Middle Ages, the city was no longer useful as a port and fell into decline; late Byzantine Ephesus, conquered by the Seljuqs in 1090, was merely a small town. After brief splendour in the 14th century, even this was deserted, and the true site of the Artemiseum remained unsuspected until 1869.

Excavations and extant remains. J.T. Wood, working at Ephesus for the British Museum between 1863 and 1874, excavated the odeum and theatre. In May 1869 he struck a corner of the Artemiseum. His excavation exposed to view not only the scanty remains of the latest edifice (built after 350 BC) but the platform below it of an earlier temple of





(Top) Principal sites of Hellenistic and Byzantine Ephesus; (bottom) ruins of the odeum, 2nd century AD

(Top) Adapted from J. Keil, *Ephesos* (1964), Austrian Archaeological Institute, Vienna; (bottom) Ara Guler

identical size and plan subsequently found to be that of the 6th century BC, to which Croesus contributed. The sculptured fragments of both temples were sent to the British Museum. In 1904 D.G. Hogarth, heading another mission from the museum, examined the earlier platform and found beneath its centre the remains of three yet older structures. In its earliest known phase the temple was apparently a small platform of green schist, containing a sealed deposit of primitive coins and other objects. These date from *c.* 600 BC.

It is impossible to assign the various architects named by ancient authors to the respective phases of the temple. At best, Chersiphron and Metagenes can be tentatively assigned to the Temple of Croesus, Chirocrates or Dinocrates to that of the 4th century. There had perhaps been some repairs toward 400 BC, associated with the architects Paeonius and Demetrius and with the prize-winning dedicatory hymn of the famous musician Timotheus. The Artemiseum passed rapidly through three phases before *c.* 550 BC. The Temple of Croesus (the fourth phase) was remarkable for its great size (it was more than 300 feet long and 150 feet wide), for the carved figures around the lower drums of its columns (*columnae caelatae*), and for the smaller but elaborate figured friezes along its roof gutter (*sima*). Croesus' temple seems to have been burned down in 356 BC. The new temple built shortly afterward copied the old in its *columnae caelatae,* one of which was by Scopas; but the new *sima,* instead of small, crowded figures, had a more conventional, if vigorous, *rinceau* ornament. The cella contained, among other great works, the Amazons of Polyclitus, Phidias, and Cresilas.

Lysimachean Ephesus has been continuously excavated since 1894 by the Austrian Archaeological Institute, but so solid and extensive is the Roman town that by the early 1960s the Austrians had rarely penetrated to Hellenistic levels.

On the hill of Ayasoluk (Hagios Theologos) is Justinian's church of St. John the Theologian, built around a shrine variously associated in the early Middle Ages with the death or bodily assumption of St. John. The church, uncovered since 1922, is a noble structure but badly restored. On the hill there is also a beautiful Seljuq mosque dedicated in 1375.

The public buildings of the city are arranged in a rectangular street pattern going back to Hellenistic days. They include the theatre, capable of seating nearly 25,000 spectators and completed in its present form under Trajan; the agora (marketplace), surrounded by stoas (sheltered promenades), dating from the time of Severus; the library of Celsus, also Trajanic and well known because of its facade; and an immense array of baths and gymnasiums.

All these buildings are to the west of Pion. On its north side is the stadium and north of this the gymnasium of Publius Vedius Antoninus, relatively small but very complete and with a notable chapel for the cult of Antoninus Pius. South of Pion were the odeum—another gift of Vedius—a roofed semicircular theatre to hold 1,400 persons; also a series of fountains and aqueducts, notably the aqueduct of Gaius Sextilius Pollio, which crossed the valley from Coressus. The unmortared city wall along the crest of Coressus appears to be that of Lysimachus.

Of the early Byzantine city, besides the stretch of curtain wall on Panajir Dağ, there remain the ruined church of the Seven Sleepers to its east and the long double basilica of the Virgin, the scene of the council, to its west. This basilica was rebuilt several times; it was largely around this building, between the great gymnasiums and the stadium of the classical city, that the early Byzantine Ephesians gathered.

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Ephesus, councils of, three assemblies held in Asia Minor to resolve problems of the early Christian Church.

In 190 Polycrates, bishop of Ephesus, convened a synod to establish the 14th of Nisan (the date of the Jewish Passover) as the official date of Easter. Pope Victor I, preferring a Sunday as more convenient and desiring uniformity, repudiated the decision and separated the rebels from Rome.

In 431 Pope Celestine I commissioned Cyril, patriarch of Alexandria, to conduct proceedings against Nestorius, his longtime adversary, whose doctrine of two Persons in Christ the Pope had previously condemned. When the Eastern bishops (more sympathetic to Nestorius) arrived and learned that the council summoned by Emperor Theodosius II had been started without them, they set up a rival synod under John of Antioch and excommunicated Memnon, bishop of Ephesus, along with Cyril. When Pope Celestine pronounced his excommunication of Nestorius and ratified his deposition as bishop of Constantinople, the Emperor abandoned his neutral position and sided with Cyril. Perhaps as a rebuke to the rebels, the council also made the Church of Cyprus independent of the see of Antioch. This council is known as the third ecumenical council of the church.

In 449 Emperor Theodosius II convened a council in Ephesus to uphold the Monophysite Eutyches in his battle against Flavian, who, as patriarch of Constantinople, championed the doctrine of two natures in Christ. Dioscorus (Cyril's successor at Alexandria) supported Eutyches and concurred in the anathematization of Flavian and other bishops over the protests of the papal legate. Dioscorus even attempted to excommunicate Pope Leo I, who referred to the gathering as the "Robber Synod." The Monophysite doctrine of the one nature of Christ was condemned in 451 during the Council of Chalcedon.

Articles are alphabetized word by word, not letter by letter

Ephialtes (d. 461 BC), leader of the radical democrats at Athens in the 460s, who by his reforms prepared the way for the final development of Athenian democracy. His hostility toward Sparta and his advocacy of power for the Athenian common people made him the enemy of the pro-Spartan politician Cimon, who had the support of the nobles. Elected general soon after 465, Ephialtes unsuccessfully opposed (462) the sending of an Athenian contingent under Cimon to assist in putting down a revolt of the helots in Sparta. The Spartans, however, dismissed the Athenian troops sent to relieve them. Outrage over the dismissal swung Athenian opinion in Ephialtes' favour, so that he was able in 462/461 to carry measures stripping the aristocratic court, the Areopagus, of its political power and to establish the dominance of the Ecclesia (the Popular Assembly), the Boule (Council), and law courts. Opposition to these measures resulted in the assassination of Ephialtes, but his political revolution was consolidated.

ephod, also spelled EFOD, part of the ceremonial dress of the high priest of ancient Israel described in the Old Testament (Ex. 28:6–8; 39:2–5). It was worn outside the robe and probably kept in place by a girdle and by shoulder pieces, from which hung the breast piece (or pouch) containing the sacred lots (divinatory objects), Urim and Thummim, whose precise function is now unknown. It is uncertain whether the ephod covered the back, encircling the body like a kind of waistcoat, or only the front. It was not a garment in the ordinary sense, and its association with the sacred lots indicates that the ephod was used for divination.

A similar vestment, made of linen, was worn by persons other than the high priest. Samuel wore the ephod when he served before the tabernacle at Shiloh (I Sam. 2:18), as did David when he danced before the Ark at its entry into Jerusalem (II Sam. 6:14).

ephor (Greek *ephoros*), title of the highest Spartan magistrates, five in number, who with the kings formed the main executive wing of the state. In antiquity, time periods were recorded by the names of the ephors on a list that dated back to 754 BC. The origins of the ephorate are uncertain, however, being variously ascribed to the reforms of Lycurgus and to the necessity of maintaining state authority in the absence of the kings during the Messenian Wars.

Every adult male citizen was eligible for election, which was annual. In classical times an oath was sworn monthly: by the kings that they would observe the laws; by the ephors on behalf of the city that on this condition they would maintain the king's authority. The ephors presided over meetings of the council of elders, or *gerousia,* and assembly, or *apella,* and were responsible for the execution of their decrees. Their extensive police powers allowed them to make the annual declaration of war on the helots and, in emergency, arrest, imprison, and participate in the trial of a king. The most famous of them was Chilon in the middle of the 6th century BC, one of the Seven Wise Men of Greece.

Ephorus (b. *c.* 405 BC, Cyme, Aeolis—d. 330 BC), Greek historian, the author of the first universal history, who, despite his defects, was esteemed in classical times and is considered the best of the historians writing in his period.

According to uncertain tradition, Ephorus was the pupil of Isocrates, whose school rivalled Plato's Academy in fame. Ephorus' *Historiai,* his major work, was completed with a 30th book added by his son Demophilus, who edited the entire work. It begins with the return of the Heracleidae to Peloponnesus and ends with the siege of Perinthus (340) by Philip II of Macedonia, with a further extension in the 30th book which centres on the Second Sacred War of 355–46. Ephorus was the first historian to divide his work into books, to each of which he wrote a preface, and he treated his material under subject headings rather than chronologically. The work shows a critical historical sense: Ephorus usually (though not always) distinguished clearly between the mythical and the historical and recognized that any account of far-distant history that is too detailed should be viewed with some suspicion.

Ephorus' work was used as a source by Diodorus Siculus, whose chronological blunders arise in part from trying to reproduce him in annalistic form. Polybius gave Ephorus credit for knowledge of naval warfare conditions but belittled his descriptions of certain land operations.

Several other works have been attributed to Ephorus, including a treatise on discoveries, another on the history and antiquities of Cyme, and an essay on style.

Ephraem SYRUS, SAINT, Syrian APHREM, also called EPHRAIM THE SYRIAN, DEACON OF EDESSA, OR HARP OF THE HOLY SPIRIT (b. *c.* 306, Nisibis, Mesopotamia—d. June 9, 373, Edessa, Osroëne; Western feast day June

9, Eastern feast day January 28), Christian theologian, poet, hymnist, and doctor of the church who, as doctrinal consultant to Eastern churchmen, composed numerous theological–biblical commentaries and polemical works that, in witnessing to the common Christian tradition, have exerted widespread influence on the Greek and Latin churches. He is recognized as the most authoritative representative of 4th-century Syriac Christianity.

Deacon to Bishop James of Nisibis and tutor in theology, Ephraem went to teach at the academy in Edessa when his native town was ceded to the Persians in 363; his record of these events in verse, *Carmina Nisibena* ("Songs of Nisibis") constitutes a valuable historical source. Declining any higher office in the church (he escaped being consecrated bishop by feigning madness) and tempering his natural irascibility by monastic asceticism, he produced a wealth of theological literature. The 5th-century Byzantine historian Sozomen credits Ephraem with more than 1,000 writings, composed of approximately 3,000,000 lines. As a biblical exegete, Ephraem wrote commentaries on the Old Testament books of Genesis and Exodus and annotated the important 2nd-century Syriac–Greek version of the New Testament, the *Diatessaron.* His favourite literary form was verse, in which he composed treatises, sermons, and hymns; the result, in early Syriac, is often tedious because of expansive metaphor and allegory. Much of his hymnology was directed against the principal heresies of his day, particularly the teachings of Marcion and Bardesanes, 2nd-century Gnostics. Certain hymns attacked Christological heterodoxy, especially Arianism, while others extoll the church as the continuation of Christ on earth, the theology of faith, the moral superiority of virginity, and the phases of Christ's mission in his Passion and Resurrection. According to historians of the 5th century Christians gave enthusiastic prominence to these hymns in their liturgical assemblies. Ephraem further emphasized devotion to the Virgin Mary, particularly her sinlessness and exemplary fidelity. Additional doctrinal themes integrated in his prose and poetry include the Trinitarian teaching on the eternity of Father, Son, and Spirit; the union of divinity and humanity in Christ; the essential function of the Holy Spirit in prayer, especially in rendering Christ's actual Presence in the celebration of Communion; the resurrection of all men, wherein he maintained the traditional Syriac belief that each individual would need to await the end of the world (the Last Judgment) to gain heavenly beatitude. Ephraem's graphic description of heaven and hell contributed to the inspiration of Dante's *Divine Comedy.*

Modern scholars have undertaken the critical reconstruction of Ephraem's original texts, heretofore frequently edited and altered to suit the personal views of the various redactors, many of whose editions are full of defective translations and interpolations in their Greek and Latin versions. The most complete collection in Syriac and Greek is that of J.S. and S.E. Assemani (6 vol., 1732–46), while supplementary material has been supplied by T. Lamy (Malines, Belgium, 1882–1902). English translations of selections from Ephraem's writings are available in his *Hymns and Homilies,* edited by H. Burgess (2 vol., 1835), and in the edition of J. Gwynn in the collection *Nicene and Post-Nicene Christian Fathers* (1898). Pope Benedict XV formally declared Ephraem a doctor of the church in 1920.

Ephraim, one of the 12 tribes of Israel that in biblical times comprised the people of Israel who later became the Jewish people. The tribe was named after one of the younger sons of Joseph, himself a son of Jacob.

After the death of Moses, Joshua, an Ephraimite, led the Israelites into the Promised Land and assigned territory to each of the 12 tribes. Members of his tribe settled in the fertile, hilly region of central Palestine. They gradually gained great power, for the Ephraimites acted as hosts to the tribal assemblies and had within their borders such religiously important centres as Shiloh and Bethel.

In 930 BC the tribe of Ephraim led the 10 northern tribes in a successful revolt against the south and established the Kingdom of Israel, with Jeroboam I, an Ephraimite, as king. The seventh king of Israel, Ahab (reigned *c.* 874–*c.* 853 BC), was also an Ephraimite. His generally peaceful reign was marred by the worship of the Canaanite god Baal by his wife, Jezebel. From about 745 BC, the northern kingdom was often referred to as the Kingdom of Ephraim, a reflection of the tribe's importance. Assyrian conquerors overran the kingdom in 721 BC, dispersing some of the inhabitants and gradually assimilating others, occurrences that account for the eventual disappearance of the tribe of Ephraim along with the nine other northern tribes. They have become known in legend as the Ten Lost Tribes of Israel.

Ephraim THE SYRIAN: *see* Ephraem Syrus, Saint.

Ephrata Community, U.S. Protestant monastic settlement, an offshoot of the Germantown Dunkers, founded in 1732 by Johann Conrad Beissel on Cocalico Creek in Lancaster County, Pa.; the present town of Ephrata grew up around it. Beissel and his followers observed the sabbath on the seventh day and espoused ascetic ideals. In the Ephrata cloisters the members, both men and women, were celibate, worked hard, ate a mainly vegetarian diet, and lived in tiny cells, where they slept on benches with wooden blocks as pillows, interrupting their sleep for lengthy prayer vigils. Frequent hymn singing was part of their regimen. "Outdoor members" were permitted marriage and lived according to a more relaxed discipline.

Ephrata Community cloisters, Ephrata, Pa.
By courtesy of the Pennsylvania Department of Commerce

The community thrived in the mid-18th century, building quarters of a remarkable architectural originality and establishing a gristmill, a papermill, and in 1745 a printing press. Affiliated communities were founded in Germantown and at Snow Hill in Franklin County. After Beissel's death (1768) the community declined, and during the Revolution the community was decimated by smallpox. Although Beissel's followers were pacifists, they extended hospitality to American Revolutionary soldiers and cared for those wounded in the Battle of Brandywine (1777); the community press printed Continental dollars.

In 1786 the community first allowed private ownership of property, and by 1814 the remaining members reorganized themselves as the Seventh Day German Baptists. The Ephrata congregation was dissolved in 1934, but two small congregations continued in central Pennsylvania in the late 1970s.

Epi, formerly TASIKO, or VOLCANO, island of Vanuatu, in the southwestern Pacific Ocean. Volcanic in origin, it is 27 mi (43 km) long and 11 mi wide, with an area of 171 sq mi (444 sq km), and rises to 2,733 ft (833 m). Although it is fertile, Épi's copra plantations are deteriorating. There is a Presbyterian hospital at Vaémali, on the north coast. Pop. (1979 prelim.) 2,304.

EPI (navigation): *see* loran.

epic, long narrative poem in an elevated style celebrating heroic achievement and treating themes of historical, national, religious, or legendary significance. It is to be distinguished from the briefer heroic lay, the less elevated, less ambitious folktale and ballad, and the more consistently extravagant and fantastic medieval romance, though in the narrative poetry of Ariosto, Boiardo, and Spenser the categories tend to merge. One may also distinguish "primary" or traditional epic, shaped from the legends and traditions of a heroic age, from "secondary" or literary epic self-consciously produced by sophisticated poets adapting aspects of traditional epic for specific literary and ideological purposes. Homer's *Iliad* and *Odyssey* are primary epics; Virgil's *Aeneid* and Milton's *Paradise Lost* are secondary epics.

A brief treatment of the epic poem follows. For full treatment, *see* MACROPAEDIA: Literature, The Art of.

While the Mesopotamian verse-narratives of Gilgamesh, dating from the 3rd millennium BC, have claims to constitute the earliest epic, the Homeric poems, which assumed their final form in the period 900–750 BC, are usually regarded as the first important epics and the main source of epic conventions and characteristics in the secondary epics of western Europe. It is now generally agreed that such Homeric features as descriptive set-pieces, stock epithets, and formulaic phrases and lines for recurring elements of the poem are attributable to narrative and metrical convenience in improvised oral composition and transmission.

The main aspects of epic convention are the centrality of a hero, sometimes semidivine, of military, national, or religious importance; an extensive, perhaps even cosmic, geographical setting; heroic battle; extended and often exotic journeying; and the involvement of supernatural beings in the action. Epics usually begin with a statement of the theme, invoking the assistance of a muse, and then plunge into the middle of the story, filling in the earlier stages later on with retrospective narrative by figures within the poem. Since epic subject matter tends to be familiar and traditional, this permits immediate dramatic involvement without bewildering the audience. Catalogs and processions of heroes, often associated with specific localities, are common, and when such heroes speak it is often in set speeches delivered in formal circumstances. Epic narrative is often enriched by extended epic similes that go beyond an initial point of correspondence to elaborate a whole scene or episode drawn from a different area of experience.

The self-consciousness of literary epic and its cultural context in a post-heroic age encourage an element of criticism, ironic deployment, or even parody of standard epic materials and conventions. This is already present in the *Aeneid,* in which epic battle may be brutal and degrading as well as heroic, and Milton

in *Paradise Lost* attributes to his villain Satan many of the characteristics of the old warring hero of epic tradition. The heroic world with its formal conventions, supernatural "machinery," and epoch-making events may be used as a framework to recount trivial, squalid, or irreverent matters for satiric purposes in poems such as Pope's *Rape of the Lock* and *The Dunciad* and Byron's *Don Juan.* Fielding exploited the dignity and structure of epic and a sense of its incongruity with contemporary experience with comic effect in *Tom Jones,* while later novels such as Joyce's *Ulysses* have achieved epic stature by recreating Homeric materials. Wordsworth's autobiographical poem *The Prelude* aspires to epic seriousness and uses the blank-verse medium of Milton's *Paradise Lost* for its portrait of an evolving poetic imagination.

Primary epics registering heroic experience in the vernacular languages of Europe continued to appear long after Virgil popularized secondary epic. The Spanish *Poema de mio Cid* celebrates the hero of the wars against the Moors in the 11th century; the French *Chanson de Roland* (12th century) commemorates an 8th-century battle in the Pyrenees between Charlemagne's army and the Saracens; the 13th-century German *Nibelungenlied* recounts a story deriving ultimately from the war between the Burgundians and the Huns in the 5th century, and the Anglo-Saxon *Beowulf* refers to historical characters and events of the 6th century as it describes Beowulf's struggles against the monsters that threaten the heroic fellowship of the mead-hall. But long before these poems assumed the form in which they now exist, the historical elements in them had passed into myth and attracted other legendary materials and themes from other periods and traditions. The *Kalevala* ("Land of Heroes"), the Finnish national poem, is a synthetic primary epic (first published in 1835) composed by Elias Lönnrott, who incorporated ancient orally-transmitted lays into a single narrative structure.

The epic poem was generally regarded as a superseded form in the 20th century, but the scope and majesty of the genre were occasionally suggested by works in other forms, such as Frank Norris' unfinished trilogy of novels *The Epic of the Wheat* (1901–03) and Sergei Eisenstein's film *Ivan the Terrible* (1944–46). The fantasy trilogy *The Lord of the Rings* (1954–55), a prose work by the Oxford University philologist J.R.R. Tolkien, reflected the flavour and forms of Norse saga and Anglo-Saxon poetry in its epic narrative of adventures and quests in the realm of Middle Earth.

epic theatre, German EPISCHES THEATER, form of drama presenting a series of incidents without reference to the traditional methods of dramatic construction (such as time, suspense, reversals, surprises, and revelations). Epic theatre is now most often associated with the dramatic theory and practice evolved by the playwright-director Bertolt Brecht in Germany from the 1920s onward. Its dramatic antecedents include the episodic structure and didactic nature of plays by the 19th-century German Georg Büchner; the pre-Expressionist drama of the German Frank Wedekind; and the Expressionist theatre of the German directors Erwin Piscator (with whom Brecht collaborated in 1927) and Leopold Jessner, both of whom made exuberant use of the technical effects that came to characterize epic theatre.

Brecht's perspective was Marxian, and his intention was to appeal to his audience's intellect in presenting moral problems and reflecting contemporary social realities on stage. He wished to block their emotional responses, and to hinder their tendency to empathize with the characters and to get caught up in the action. To this end, he used "alienating" or "distancing" effects to cause the audience to stop feeling with the play and to think objectively about it, to reflect on its argument, understand it, and pass intellectual judgment upon it. (*see* alienation effect.)

Brecht's epic theatre was in direct contrast to that encouraged by the Russian director Konstantin Stanislavsky, in which the audience was persuaded—by staging methods and naturalistic acting—to believe that the action onstage was "real." Influenced by conventions of Chinese theatre, Brecht instructed his actors to keep a distance between themselves and the characters they portrayed. They were to disregard inner life and emotions while emphasizing stylized external actions as signs of social relationships. Gesture, intonation, facial expression, and grouping were all calculated to reveal overall attitudes of one character toward another. *Compare* Stanislavsky method.

epicanthic fold, also called EPICANTHAL FOLD, or MONGOLIAN EYEFOLD, inward fold of the upper eyelid across the inner corner of the eye (canthus). The epicanthal fold produces the eye shape characteristic of persons of Asian (Mongoloid) geographical race; it is also seen in some American Indians and occasionally in Europeans (*e.g.*, Scandinavians and Poles).

epicentre, point on the surface of the Earth that is directly above the source of crustal disturbance (called the focus) that produced an earthquake. There the effects of the earthquake usually are most severe. The epicentre can be located by constructing arcs from each of three or more seismic observatories, with the arcs' radii equal to the distance from each station to the focus of the earthquake. The point of intersection of the arcs marks the epicentre.

Epicharmus (b. *c.* 530 BC—d. *c.* 440 BC), Greek poet who, according to the *Suda* lexicon of the 10th century AD, was the originator of Sicilian (or Dorian) comedy. He was born in a Dorian colony, either Megara Hybaea or Syracuse, both on Sicily, or Cos, one of the Dodecanese islands. He has been credited with more than 50 plays written in the Sicilian dialect; titles of 35 of his works survive, but the remains are scanty.

Many of Epicharmus' plays were obviously mythological burlesques in which even the gods were satirized. Major features of his works were set debates, and the stock characters, such as the parasite and the rustic, were later characteristic of Middle and New Comedy. Some of his titles suggest parodies of tragedies. Though they seem to have had some musical accompaniment, the plays had no chorus.

Epicharmus' style was lively, and his comedies seem more akin to mime and to New Comedy than to the Old Comedy of his time. They were apparently short and largely farcical but contained an admixture of philosophical moralizing in the form of gnomic maxims. These maxims were later collected separately and sometimes forged; hence, perhaps, his posthumous reputation in antiquity as a philosopher. Ancient authorities also attributed to him works on ethics and medicine, and tradition made him a pupil of Pythagorus.

epiclesis (Greek: "invocation"), in the Christian eucharistic prayer (*anaphora*), the special invocation of the Holy Spirit; in most Eastern Christian liturgies it follows the words of institution—the words used, according to the New Testament, by Jesus himself at the Last Supper—"This is my body . . . this is my blood" and has a clearly consecratory character. The epiclesis specifically asks that bread and wine be made the body and blood of Christ, and the actual change (Greek *metabolē*) is attributed to the Holy Spirit. It reflects the prevailing sacramental theology of the Eastern Church, which interprets the effectiveness of the sacraments as an answer of God to the prayer of the church rather than as a result of the vicarious powers of a priest pronouncing the appropriate formula. The epiclesis also maintains the trinitarian character of the eucharistic prayer, which is addressed to the Father, commemorates the saving action of the Son, and invokes the power of the Spirit.

In the 14th century the epiclesis became an issue in the polemics between Greeks and Latins, because all Eastern eucharistic prayers included an invocation of the Holy Spirit while the Roman canon of the mass did not. Most modern scholars agree that there had been an epiclesis, in the original Eucharist of the early church of Rome, in addition to the other Latin eucharistic prayers. Medieval Latin theology, however, allowed for the disappearance of the epiclesis since it was believed that the consecration of bread and wine and their transubstantiation into the body and blood of Christ took place when the priest pronounced the words of institution.

The question of the epiclesis was debated at the Council of Ferrara-Florence (1438–45), but no formal definition was made. The medieval Latin view was then endorsed by the Council of Trent (1545–63), but the liturgical reforms adopted in Roman Catholicism after the second Vatican Council (1962–65) have included the introduction of an epiclesis in the canon of the mass. This epiclesis, however, is placed before the words of institution so that the consecratory function of the latter can still be maintained.

Epictetus (fl. *c.* 520–500 BC), Greek potter and painter who worked in Athens. His work is praised for its care, grace, vitality, delicate line, and fine draftsmanship. He signed his works as both maker and decorator.

Epictetus is most frequently mentioned in connection with a series of medallions on plates in the British Museum and the Cabinet

"Barbarian Archer in Scythian Costume," Athenian plate by Epictetus, late 6th century BC; in the British Museum

By courtesy of the trustees of the British Museum

des Médailles in Paris. The medallion paintings represent a "Young Man on His Horse" (London), and a "Man" (possibly Silenus) on his way home from a banquet (Paris).

A kylix (drinking cup), found in Vulci and now in the British Museum, is signed "Python made [it]; Epictetus painted [it]." It is from *c.* 520–510 BC. The paintings on it are of a "Flute Player and Dancer," on the inside, and of "Heracles Slaying Busiris" (King of Egypt), on the outside.

Epictetus (b. *c.* AD 55, probably at Hierapolis, Phrygia—d. *c.* 135, Nicopolis, Epirus), philosopher associated with the Stoics, remembered for the religious tone of his teachings, which commended him to numerous early Christian thinkers.

His original name is not known; *epiktētos* is the Greek word meaning "acquired." As a boy he was a slave but managed to attend lectures by the Stoic Musonius Rufus. He later became a freedman and lived his life lame and in ill health. In AD 90 he was expelled from Rome with other philosophers by the emperor Domitian, who was irritated by the favourable reception given by Stoics to opponents of his tyranny. The rest of his life Epictetus spent at Nicopolis.

As far as is known, Epictetus wrote nothing. His teachings were transmitted by Arrian, his pupil, in two works: *Discourses,* of which four books are extant; and the *Encheiridion,* or *Manual,* a condensed aphoristic version of the main doctrines. In his teachings Epictetus followed the early rather than the late Stoics, reverting to Socrates and to Diogenes, the philosopher of Cynicism, as historical models of the sage. Primarily interested in ethics, Epictetus described philosophy as learning "how it is possible to employ desire and aversion without hindrance." True education, he believed, consists in recognizing that there is only one thing that belongs to an individual fully—his will, or purpose. God, acting as a good king and father, has given each being a will that cannot be compelled or thwarted by anything external. Men are not responsible for the ideas that present themselves to their consciousness, though they are wholly responsible for the way in which they use them. "Two maxims," Epictetus said, "we must ever bear in mind—that apart from the will there is nothing good or bad, and that we must not try to anticipate or to direct events, but merely to accept them with intelligence." Man must, that is, believe there is a God whose thought directs the universe.

As a political theorist, Epictetus saw man as a member of a great system that comprehends both God and men. Each human being is primarily a citizen of his own commonwealth, but he is also a member of the great city of gods and men, of which the political city is only a poor copy. All men are the sons of God by virtue of their rationality and are kindred in nature with the divinity. Thus, man is capable of learning to administer his city and his life according to the will of God, which is the will of nature. The natural instinct of animated life, to which man also is subject, is self-preservation and self-interest. Yet men are so constituted that the individual cannot secure his own interests unless he contributes to the common welfare. The aim of the philosopher, therefore, is to see the world as a whole, to grow into the mind of God, and to make the will of nature his own.

Epicureanism, in a strict sense, the philosophy of the ancient Greek Epicurus (341–270 BC); and in a broad sense, a system of ethics embracing every conception or form of life traceable to the principles of his philosophy. Epicureanism espouses, in physics, Atomism and a largely mechanical conception of causality, with the gods remaining extraneous; and, in ethics, the identification of good with pleasure and the absence of pain, utility and the limitation of desire, and a withdrawn and quiet life enriched by the company of friends.

A brief treatment of Epicureanism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines.

After having taught in a number of cities in Asia Minor, Epicurus established his permanent home in Athens and founded a school of philosophy, teaching his pupils in his garden, which he bequeathed to the school under his will. As the society that he gathered round him included women as well as men, it frequently met with public scandal and even persecution. Nonetheless communities modelled on the original garden were founded throughout the Mediterranean world. In modern philosophy, the most significant revival of Epicureanism was the Christian interpretation developed by Pierre Gassendi in the 17th century.

Ethics. The philosophic outlook of Epicurus was fundamentally ethical, and his concern with other studies seems to have been small. Even his interest in physics is purely subsidiary to the ethical end; *i.e.,* to obtaining a theory of life that shall ensure "quietude of mind and a steadfast faith."

For Epicurus the sole criterion of good and evil is sensation; so that "we declare pleasure to be the beginning and end of the blessed life." However, while every pleasure is in itself good, not all pleasures are to be chosen, since certain pleasures are produced by means which entail annoyances many times greater than the pleasures themselves. Thus pleasure as contemplated by Epicurus is not so much active enjoyment as the absence of pain.

Physics. The Epicurean doctrine of atoms and the void is derived directly from that of Democritus. The universe is said to consist of bodies and the space (void) in which they move. Bodies are either compound or the elements of which greater bodies are compounded. These elements are indivisible (*atoma,* atoms) and unchangeable. The number of atoms, the extent of the void, and the universe itself are all regarded as infinite.

The atoms vary in size but are not of all sizes; otherwise some would be visible. They are in perpetual motion, moving all with the same velocity, swift as thought. Because of an inherent "swerve" (this, of course, is a necessary postulate) the atoms collide and rebound to a lesser or greater distance, thus forming compound bodies of greater or lesser density.

Psychology. According to Epicurus, the soul is a material body of fine parts and is distributed through the whole bodily structure. So long as it is protected by the body, it is capable of sensation and of communicating sensation to the body. When it leaves the body, it is dissipated; the body, on the other hand, is no longer capable of sensation.

Sensory perception is a purely material process. From the surface of all bodies there are continually being discharged images, hollow films of exceedingly fine texture, which in shape are exact replicas of the bodies. Sensation of such images is the sole source of knowledge, and all sensuous perceptions are true. Error can arise only when, beyond what is given in sensation, the mind forms an opinion that is afterward contradicted or unconfirmed.

Theology. Epicurus holds that there can be no life to come, since the soul is of such a nature as to be dissolved immediately on leaving the body into the primordial atoms of which it was compounded; thus, death is not to be feared. As for fear of the gods, it too can be avoided through adopting the true teachings of philosophical theology. Epicurus does not deny the existence of the gods: rather he holds that "their existence is known to us by immediate apprehension." Fashioned of finer stuff than humankind, they dwell afar in the intermundial spaces, neither troubling human affairs nor troubled by them. The more one is at peace to receive the images emanating from the gods, the more easily will one win participation in the serenity of the heavenly beings.

Epicurus (b. 341 BC, Samos, Greece—d. 270, Athens), Greek philosopher, author of an ethical philosophy of simple pleasure, friendship, and retirement. He founded schools of philosophy that survived directly from the 4th century BC until the 4th century AD.

Early life and training. Epicurus was born on the island of Samos of Athenian parents who had gone there as military settlers. His father, a schoolteacher, was named Neocles, his mother Chairestrate; both were of the same village, the deme Gargettos. According to his own report, Epicurus began his study of philosophy at the age of 14. One account has

Epicurus, bronze bust from a Greek original, *c.* 280–270 BC; in the Museo Archeologico Nazionale, Naples

By courtesy of the Soprintendenza alle Antichita della Campania, Naples

him turning to philosophy when his schoolmaster could not explain the concept of chaos in Hesiod, an early Greek philosophical poet. His first master is said to have been the Platonist Pamphilus of Samos. Much more significant, however, is the report that Epicurus was for three years (327–324) a student in the Ionian city of Teos, where his teacher was Nausiphanes, a disciple of the naturalistic philosopher Democritus. It may have been from this source that Epicurus' atomistic theory came, which he used not as a means of studying physics but as the basis for a philosophical system that ultimately sought ethical ends.

At the age of 18, Epicurus went to Athens to perform the two years of military training required for Athenian citizenship. While there he may have heard Xenocrates, second in succession after Plato as head of his Academy, and Aristotle, who was then in Athens. One year later Epicurus rejoined his parents at Colophon, where they had gone as exiles when, at the close of the Lamian War, Athens lost Samos to the Macedonians. For the next 10 years, there is virtually no record. It seems probable that Epicurus travelled and studied, and it is reasonable to suppose that this was the period during which he developed his philosophical outlook and confirmed it in exchanges with the Platonists and Aristotelians. A letter written by him from Teos, addressed to his mother, was preserved by Diogenes of Oenoanda. At the age of 32, Epicurus began to teach, first at Mytilene and subsequently at Lampsacus, a period that lasted from 311/310 to 307/306.

In various places Epicurus met the disciples who were destined to follow him to Athens and to become of great significance as vehicles through whom the Epicurean school would achieve its mature development: at Mytilene, he met his first disciple, Hermarchus, who eventually succeeded him as head of the Athenian school; and at Lampsacus, he met Metrodorus and Polyaenus, whose death preceded the master's and whose sons Epicurus provided for in his will; Metrodorus' brother, Timocrates; Leonteus and his wife, Themista, who had been a hetaera (an independent courtesan); Colotes, whom Epicurus flattered with the pet name Colotarion; and Idomeneus and his wife, Batis, sister of Metrodorus.

Thus, apart from his two years in Athens, Epicurus spent the first 35 years of his life in Asia. This need not mean, however, that he

developed an aversion to the literary circles in Athens. Instead, his Asiatic ties, which he continued to cultivate intensely all his life (including two or three actual journeys to Asia Minor) seem to have been reflected mainly in his choice of words and style and, more significantly, in the ecumenical scope of his philosophy.

The schools at Athens and elsewhere. When Epicurus and his followers came to Athens in 306, he bought a house and, in the garden, established a school, which came to be known as Ho Kepos (The Garden). At this time in Athens, cultural life was dominated by the Academy of Plato and the Lyceum of Aristotle, both of which had passed into the hands of successors. These schools attracted both the best theoretical students and those concerned with the application of philosophy to politics and public life. Therefore, any school that hoped to endure through this period had to enter into direct rivalry with the Academy and the Lyceum by establishing itself—as did the Stoa a few years later—in the city of Athens.

What Epicurus brought to Athens was more a way of life than a school or a community. Unlike both of the famous schools, it admitted women, and even one of Epicurus' slaves, named Mouse. It taught the avoidance of political activity and of public life, although, when one follower from a school outside Athens rose to political power and then fell, he was succoured by the school. Quite different from the usual connotations borne by the term epicurean today, life in the house and garden was simple. Water was the usual drink, although a half-pint daily ration of wine was allowed, and barley bread was eaten. During a famine Epicurus saved his students by doling out a few numbered beans daily. There was no communal property, as was the case in Pythagorean schools. Whereas the relationships of the members of the school were not platonic, in either the contemporary or any later sense, there are only the attacks of Stoic opponents to support any idea of sexual irregularity. Epicurus wrote clearly but in no highly organized way. There was much correspondence with students in Athens and at other schools, some letters being concerned with doctrinal matters but many seeming to be merely social and friendly.

On the day in his 72nd year that Epicurus died painfully of prostatitis, he dictated an affectionate and touching letter to Idomeneus—probably intended, in fact, for all of his friends in Lampsacus—which displayed the spirit in which he had remained true to his philosophy of repose and serenity even in the throes of pain. Epicurus' will left the house, garden, and some funds to trustees of the school. Remaining funds were left to honour Epicurus' deceased family and to celebrate his birthday annually and his memory monthly. His slaves were freed, and provision was made that the daughter of Metrodorus should be wed to someone in the Athenian school, with the approval of Hermarchus.

Writings and assessment. Diogenes Laërtius described Epicurus as a most prolific writer and preserved three of his letters and the *Kyriai doxiai* ("Principal Doctrines"). The three letters are (1) *To Herodotus,* dealing with physics; (2) *To Pythocles* (probably a disciple's abridgement), on meteorology; and (3) *To Menoeceus,* on ethics and theology. The *Kyriai* consists of 40 short aphoristic statements. Another major source is the papyri from the Casa dei Papiri discovered at Herculaneum (1752–54), which include not only parts of his great work *Peri physeōs* ("On Nature"), originally in 37 books, but also numerous fragments of correspondence with his friends.

Many of Epicurus' methods made him comparable to a religious figure. The breadth of his appeal in Rome during the 1st century BC is indicated by the fact that the poet-philosopher Lucretius based his work on Epicurus (Lucretius in fact held Epicurus in reverential awe), by the references to his thought by the statesman-moralist Cicero, and by the detailing by the biographer Plutarch of how Cassius soothed the mind of Brutus with his Epicurean ideas. Epicurus' atomistic theory was revived in the 17th century by Pierre Gassendi, a French philosopher-scientist.

(C.D.)

Epidaurus, in ancient Greece, important commercial centre on the eastern coast of the Argolid in the northeastern Peloponnese; it is famed for its 4th-century-BC temple of Asclepius, the god of healing. Excavations of the sacred precinct reveal that it contained temples to Asclepius and Artemis, a theatre, stadium, gymnasiums, baths, a *tholos,* a hospital, and an *abaton,* an area where patients slept. Inscriptions record divine medical cures. Originally Ionic, Epidaurus became Doric under the influence of Argos, to which it owed religious allegiance; politically it remained independent.

epidemic, an occurrence of disease that is temporarily of high prevalence. An epidemic occurring over a wide geographical area is called a pandemic. The rise and decline in epidemic prevalence of an infectious disease is a probability phenomenon dependent upon transfer of an effective dose of the infectious agent from an infected individual to a susceptible one. After an epidemic has subsided, the affected host population contains a sufficiently small proportion of susceptible individuals that reintroduction of the infection will not result in a new epidemic. Since the parasite population cannot reproduce itself in such a host population, the host population as a whole is immune to the epidemic disease, a phenomenon termed herd immunity.

Following an epidemic, however, the host population tends to revert to a condition of susceptibility because of: (1) the deterioration of individual immunity; (2) the removal of immune individuals by death; and (3) the influx of susceptible individuals by birth. In time the population as a whole again becomes susceptible. The time elapsing between successive epidemic peaks is variable and differs from one disease to another.

By the late 20th century the definition of epidemic had been extended to include outbreaks of any chronic disease (*e.g.*, heart disease or cancer) influenced by the environment.

The term epidemic is sometimes reserved for disease among human beings; in such instances the term used for animals other than man is epizootic.

epidemic parotitis: *see* mumps.

epidemiology, branch of medical science that studies the distribution of disease in human populations and the factors determining that distribution, chiefly by the use of statistics. Unlike other medical disciplines, epidemiology concerns itself with groups of people rather than individual patients and is frequently retrospective, or historical, in nature. It developed out of the search for causes of human disease in the 19th century, and one of its chief functions remains the identification of populations at high risk for a given disease, so that the cause may be identified and preventive measures implemented.

Epidemiologic studies may be classified as descriptive or analytic. In descriptive epidemiology, demographic surveys are used to determine the nature of the population affected by the disorder in question, noting factors such as age, sex, ethnic group, and occupation among those afflicted. Other descriptive studies may follow the occurrence of a disease over several years to determine changes or variations in incidence or mortality; geographic variations may also be noted. Descriptive studies also help to identify new disease syndromes or suggest previously unrecognized associations between risk factors and disease.

Analytic studies are conducted to test the conclusions drawn from descriptive surveys or laboratory observations. These studies divide a sample population into two or more groups, selected on the basis of suspected causal factor (for example, cigarette smoking) and then monitor differences in incidence, mortality, or other variables. One form of analytic study is the prospective-cohort study, in which members of a population are followed over time to observe differences in disease incidence.

In addition to providing clues to the causes of various diseases, epidemiologic studies are used to plan new health services, determining the incidence of various illnesses in the population to be served, and to evaluate the overall health status of a given population. In most countries of the world, public-health authorities regularly gather epidemiologic data on specific diseases and mortality rates in their populaces.

Epidendrum, genus of tropical orchids, family Orchidaceae, with about 1,000 species that are distributed from southeastern North America to central South America. *Epidendrum* species are primarily epiphytic (supported by other plants and having aerial roots exposed to the humid atmosphere), but some grow on rocks or in soil. Flowers are usually borne on a terminal spike.

Epidendrum ibaguense
A-Z Botanical Collection—EB Inc.

Some species have large pseudobulbs (swollen stems) with two or three leathery leaves; other species lack pseudobulbs and have long, thin stems. The only *Epidendrum* species native to nontropical North America is the greenfly orchid (*E. conopseum*), which has clusters of purplish-green flowers.

epidermal tooth, any of several hard, horny projections analogous to but not homologous with true teeth (*q.v.*). Epidermal teeth are found in the jawless fish (*e.g.*, lampreys), on the edges of the jaws of tadpoles (larval frogs and toads), in the mouth of the platypus, where horny plates replace the true teeth before birth, and in sirenians (*e.g.*, sea cows) accompanying true teeth.

epidermis, in zoology, protective outermost portion of the skin. There are two layers of epidermis, the living basal layer, which is next to the dermis, and the external stratum corneum, or horny layer, which is composed of dead, keratin-filled cells that have migrated outward from the basal layer. The melanocytes, responsible for skin colour, are found in the basal cells. The epidermis has no blood supply and depends on diffusion from the dermal cells for its metabolic needs. The dead-cell layer of the stratum corneum provides the protection from water loss that

allows vertebrates to dwell on land. Keratin, produced in migrating epidermal cells, forms the basis of nails, feathers, beaks, and other epidermal derivatives. In humans, epidermal fragments are constantly shed, but the "skin," or stratum corneum, of a snake is ordinarily shed all at once in a period of ecdysis.

epidermis, in botany, outermost, protoderm-derived layer of cells covering the stem, root, leaf, flower, fruit, and seed parts of a plant. The epidermis and its waxy cuticle provide a protective barrier against mechanical injury, water loss, and infection. Various modified epidermal cells regulate transpiration, increase water absorption, and secrete substances.

epididyme, either of a pair of elongated crescent-shaped structures attached to each of the two male reproductive organs, the testes (*see* testis). Sperm cells produced in the testes are transported to the epididymes, where they mature and are stored. Each epididymis has three regions, called, respectively, the head, body, and tail. The head is the uppermost and largest part of the epididymis; it lies on the top surface of the testis. The body is attached to the anal side of the testis and extends the length of the gland. The smallest region is the tail, which begins at the point of separation of the epididymis from the testis. Sperm cells mature primarily in the head and body of the epididymis and are stored in the tail.

The epididymis receives sperm from the tubules in the mediastinum testis, the region in the testis in which all its sperm-producing tubules converge and empty. Leading from the mediastinum to the head of the epididymis are 15–20 small, tightly coiled ducts called the ductuli efferentes. The cells lining the ductuli have pigment granules, secretory granules, and cilia (hairlike structures). In the head region of the epididymis, all the ductuli efferentes connect to one large vessel, the ductus epididymidis. This duct is also extremely coiled, being about 4 to 5 m (13 to 16 feet) long when stretched out. The ductus epididymidis extends through both the body and the tail region of the epididymis. In the tail region it becomes thicker, less coiled, and larger in diameter. As it emerges from the end of the epididymis, it straightens out to form the ductus deferens (*q.v.*).

During ejaculation, sperm are propelled through the ductuli efferentes and ductus epididymidis in two ways. First, the muscle tissue, by contracting, narrows the ducts, propelling the sperm. Second, the cilia located in the ductuli efferentes can propel sperm by their continual swaying motions. As sperm pass through the various ducts, they acquire small amounts of fluids that help to keep them alive. These secretions include high concentrations of potassium, sodium, and a substance known as glycerylphosphorylcholine, which is an energy source for sperm.

Consult the INDEX *first*

epidote, any of a group of colorless to green or yellow-green silicate minerals with the general chemical formula $A_2B_3(SiO_4)(Si_2O_7)O(OH)$, in which A is usually calcium (Ca), though manganese (Mn) or cerium (Ce) is sometimes substituted; and B is generally aluminum (Al), with the main substitution being ferric iron (Fe^{+3}). Structurally the epidote group consists of chains of AlO_6 and $Al_4(OH)_2$ octahedra linked by independent SiO_4 and Si_2O_7 groups. The A atoms are in eight-fold coordination between the chains. Members of the epidote group include epidote (A = Ca, B = Al,Fe); clinozoisite (A = Ca, B = Al, monoclinic); zoisite (A = Ca, B = Al, orthorhombic); piedmontite (A = Ca, B = Al,Mn,Fe); allanite (A = Ca,Mn, Ce, B = Fe,Al).

The epidote group occurs as secondary minerals in low-grade regionally metamorphosed rocks where its occurrence is used as an indicator of metamorphic grade. Members of the group are also produced during retrograde metamorphism of basic igneous rocks. In some cases, they may occur as a product of hydrothermal alteration of plagioclase feldspar. Manganese-rich piedmontite is associated with manganese deposits of metasomatic origin. For detailed physical properties, *see* silicate mineral (table).

Epidote from Dauphiné, France

By courtesy of Illinois State Museum, Springfield; photograph, John H. Gerard—EB Inc.

epidote-amphibolite facies, one of the major divisions of the mineral-facies classification of metamorphic rocks, the rocks of which form under moderate temperature and pressure conditions (250°–400° C [500°–750° F] and up to 1 or 2 kilobars [1 kilobar equals about 15,000 pounds per square inch]). This facies grades into the greenschist facies under less intense metamorphic conditions and into the amphibolite facies with greater temperature and pressure. Minerals typical of the rocks of the epidote-amphibolite facies include biotite, almandite garnet, plagioclase, epidote, and amphibole. Chlorite, muscovite, staurolite, and chloritoid may also occur. Biotite, which can be identified easily, is used to identify the lower boundary of this facies; amphibole may also be used as an index mineral to identify the facies. Depending upon the composition of plagioclase, this facies may be subdivided into two subfacies, the albite-epidote-amphibolite subfacies and the oligoclase-epidote-amphibolite subfacies.

epigram, originally an inscription suitable for carving on a monument, but since the time of the Greek Anthology (*q.v.*) applied to any brief and pithy verse, particularly if astringent and purporting to point a moral. By extension the term is also applied to any striking sentence in a novel, play, poem, or conversation that appears to express a succinct truth, usually in the form of a generalization. Catullus (*c.* 84–*c.* 54 BC) originated the Latin epigram, and it was given final form by Martial (AD 40–103) in some 1,500 pungent and often indecent verses that served as models for French and English epigrammatists of the 17th and 18th centuries.

The epigram was revived by Renaissance scholars and poets, such as the French poet Clément Marot, who wrote epigrams in both Latin and the vernacular. In England the form took shape somewhat later, notably in the hands of Ben Jonson and his followers, among whom was Robert Herrick, writer of such graceful examples as the following:

I saw a Flie within a Beade
Of Amber cleanly buried:
The Urne was little, but the room
More rich than *Cleopatra's* Tombe.

As the century progressed, the epigram became more astringent and closer to Martial in both England and France. The *Maximes* (1665) of François VI, Duke de La Rochefoucauld marked one of the high points of the epigram in French, influencing such later practitioners as Voltaire. In England, John Dryden, Alexander Pope, and Jonathan Swift produced some of the most memorable epigrams of their time.

Samuel Taylor Coleridge (1772–1834), writing at the beginning of the 19th century, produced an epigram that neatly sums up the form:

What is an Epigram? A dwarfish whole,
Its body brevity, and wit its soul.

The *Sinngedicht,* or sententious epigram, engaged German taste in the 18th and early 19th centuries, culminating in J.W. von Goethe's *Zahme Xenien* (1820; "Gentle Epigrams"). Among the more recent masters of the English epigram were Oscar Wilde and George Bernard Shaw. Wilde became famous for such remarks as "A cynic is a man who knows the price of everything and the value of nothing." Shaw, in his *Annajanska* (1919), commented that "All great truths begin as blasphemies."

epigraphy, the study of written matter recorded on hard or durable material. It is a prime tool in recovering much of the firsthand record of antiquity.

A brief treatment of epigraphy follows. For full treatment, *see* MACROPAEDIA: History, The Study of.

Epigraphy is the study of inscriptions from the earliest civilizations through the present day, their interpretation and their classification. Preserved in materials that range in durability from papyrus to stone, inscriptions are often the only surviving records of ancient historical events and of extinct cultures, their languages, and their systems of writing. Epigraphy attracted the interest of historians as early as Polybius (204–122 BC) and Thucydides, and the renewed study that was begun during the Renaissance has culminated in comprehensive editions by modern scholars that gather inscriptions from virtually every major source.

Epigraphs are classified as either monumental, those intended for preservation; archival, those intended as records; and incidental, as in graffiti. Because present techniques of historiography are of relatively late origin, inscriptions of all three types are frequently invaluable in separating historical fact and chronology from the personal and legendary accounts of other written documents.

Inscriptions from ancient Mesopotamia show the processes of cultural evolution from the earliest Sumerian communities through the later periods of Assyrian and Babylonian domination. From the Sumerians, surviving documents include a chronology of kings, legendary songs that supplied the traditional material for the Akkadian *Epic of Gilgamesh,* and a number of prayers, proverbs, prophecies, and other ritual and literary texts. Other inscriptions from this region include records of commercial transactions and legal proceedings, and the monumental legal code on the stela of Hammurabi, dating from about 1750 BC.

Cuneiform Akkadian inscriptions are also important as the primary international medium of writing during the most crucial epochs of Egyptian civilization. The bulk of Egyptian epigraphy consists of personalized historical accounts, of which many survive from as early as the 4th dynasty (2613–2494 BC). These documents became increasingly prominent during the large-scale expansionist campaigns of the 18th dynasty, and their eventual decline parallels Egypt's replacement as a major power by the kingdoms of Babylonia and Assyria. Extant religious texts consist of detailed records of dramatic ritual, ceremonies for the dead, and numerous prophetic and magical writings. Narratives of the creation

myths of Atum and Ptah, hymns to the gods, and amatory and other secular lyrics are also preserved in inscriptions.

Elsewhere in the ancient Near East, historical inscriptions are plentiful from the height of the Hittite Empire (preserved at Boğazköy in Asia Minor), and the period following the decline of the Hittites can be traced through later Syrian and Palestinian inscriptions, which also mark the replacement of cuneiform with Hittite and Semitic systems of writing. Persian epigraphs from the Achaemenid Empire of the 6th century BC that survive in several different languages are of particular value for linguistic analysis and for comparison with Greek historical accounts of the same era.

An important body of epigraphs also survives from ancient India, though the absence of a lineal conception of history and the mixture of legend and myth make them unreliable as historical documents. However, the reign of Aśoka over most of India, beginning in the 3rd century BC, has left inscriptions whose historicity is supported by references to foreign political events of known date. Farther east, the veracity of Chinese inscriptions from the Hsia, Shang, and Chou and Ch'in eras (2205–206 BC) has been established through comparisons with archaeological evidence and nonepigraphic documents. A strong Chinese influence is detectable through epigraphs from the Central Asian Turk dynasty of the 8th century AD.

The recent decipherment of the long-unintelligible Minoan Linear B script has provided conclusive proof that the spoken language of Cretans and Mycenaeans during the 2nd millennium BC was a form of Greek. Though these inscriptions consist primarily of inventories, they supply direct evidence of social and economic structures and demonstrate the Mycenaean origin of classical Greek religion. The production of epigraphs in later Greece shows an increase that parallels the spread of literacy, though inscriptional historiography is minimal and is rivalled by a sophisticated literary tradition.

The epigraphs that have survived from the Roman Empire, though highly standardized, exhibit wide stylistic and linguistic variations. Besides Latin, they were commonly written in Greek and Oscan, and their extensive use of abbreviations and of Etruscan dialect often make interpretation problematic. Roman epigraphs of historical significance were not produced before the 2nd century BC; and, although that era has left important legal inscriptions, most Roman law was recorded in nonepigraphic media. More common are inscriptions that record ritual practices of both sanctioned and cultic religions, as well as epitaphs.

In northern Europe, where writing was a late development, inscriptions are few, though some of Celtic origin survive. Runic messages, carved in a Germanic alphabet or in one of its European derivatives and dating from around 200 BC, are often commemorative or dedicatory or take the form of epitaphs.

Because epigraphs are generally executed soon after the occasions they commemorate, the dating of the inscription itself through radiocarbon or stratigraphic analysis or through paleographic analysis of the script and style often provides a key to the chronology of historical events. In many instances they are the only available evidence, while in others they may help to reinforce or refute the assertions of ancient historiographers. Their records of extinct and obsolete languages are often crucial in tracing the origin, evolution, and migration of ancient cultural and linguistic families and in determining the relationships among them.

epilepsy, sudden and recurrent disturbances in mental function, state of consciousness, sensory activity, or movements of the body, caused by paroxysmal malfunction of cerebral nerve cells. Epilepsy includes generalized convulsions in which there is sudden unconsciousness with falling and shaking of limbs (grand mal; *q.v.*), momentary lapses of awareness (petit mal; *q.v.*), and local movements and sensations in parts of the body (focal seizure; *q.v.*), as well as other types of activity that may include bizarre automatic behaviour, strange memories, illusory and hallucinatory experiences, and changes in mood. Epilepsy is not a specific disease but rather a complex of symptoms that results from any of a number of conditions that excessively excite nerve cells of the brain. The terms cerebral seizure and convulsive disorder are synonymous with epilepsy.

Epilepsy is a relatively common disorder (estimated incidence: 0.5 percent of the population) that is slightly more prevalent among males than females (about 10:8). More than 70 percent of patients have their first attack before age 20.

Type of seizures. The most frequently used nomenclature for the categories of epilepsy are grand mal, petit mal, psychomotor, infantile spasms, and epileptic equivalents; but many patients have more than one type. Each case of epilepsy should be classified, if possible, in three ways: clinical patterns, originating locus in the brain, and cause of the disorder in brain function.

The forms of epilepsy that appear to involve all or most of the brain at once are generalized convulsions without focal onset (originating in a specific area of the brain), short absences of consciousness, massive spasms in infancy and early childhood, generalized muscle jerks, and loss of muscle tone, with falling. Seizures that originate in local areas of the brain and may spread are of six main types: focal motor, focal sensory, psychomotor, aphasic, visceral, and psychical seizures. In more than 50 percent of persons with generalized convulsions, there is some evidence of a beginning in a local area. Focal onset may be manifested by localized movements or sensations of a part of the body or by subjectively experienced warnings, called auras, that last from a fraction of a second to a few seconds. Auras arising from specific areas of the brain include illusions that the environment is strangely familiar, auditory or visual hallucinations, ringing in the ears, and unpleasant odours or tastes. Although part of the seizure proper, auras are considered warnings of an impending attack.

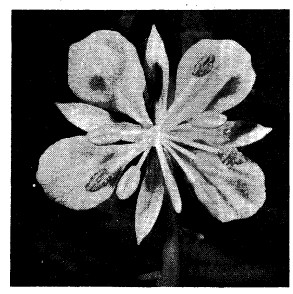
Diagnosis. A person with recurrent seizures is considered to have epilepsy. Diagnosis is based on the clinical description of recurring episodes of changes in consciousness and involuntary movements. It is important to determine whether a curable condition is responsible. A complete history, general physical and neurological examination, and certain laboratory studies are required. X-rays of the skull and studies of the blood and spinal fluid are often needed. Both the electroencephalogram and echoencephalogram help to confirm the diagnosis, locate the site, and assist in discovering the cause of the attack.

Other methods used in the search for brain lesions responsible for seizures include brain-scanning with radioisotopes, cerebral angiography, and pneumoencephalography.

Treatment. Causes that are sometimes correctable include brain tumours, infections, metabolic and endocrine abnormalities, and the formation of epileptogenic brain tissue as a result of trauma. Surgical removal of epileptiform brain tissue is indicated in a limited number of patients, particularly those in whom the lesions are contained in a single, surgically accessible area. In most patients, however, the brain damage cannot be reversed, and the control of seizures will depend on attempts at prevention of attacks by medicinal means and the handling of problems of social adjustment. The most effective treatment is anticonvulsant medication. Approximately 20 useful anticonvulsants are available. It is usually necessary to continue medication for several years after seizures are fully controlled.

Epilepsy in domestic animals. Epilepsy occurs in many animals, most often in the dog, especially in highly inbred breeds. Convulsions usually appear in the second year. A predisposition to epilepsy is apparently inherited. The illness may become chronic and controllable with drugs, or the brain may be gradually destroyed and treatment unavailing. Canine hysteria, or psychomotor epilepsy, attributed to a variety of causes, is characterized by longer seizures of fright, restlessness, and barking and running fits.

Epilobium, genus of about 200 plants, in the evening primrose family (Onagraceae), native to most temperate regions. It includes fireweed (*q.v.*; E. angustifolium), which rapidly covers newly burned areas. The young parts of some species can be cooked and eaten as potherbs. The plants are sometimes cultivated in wild gardens but must be carefully confined.



Flower of *Epilobium angustifolium*
Rutherford Platt

The hairy willow herb, or codling-and-cream (*E. hirsutum*), up to 2 metres (6 feet) high, is similar to fireweed but has hairy leaves and stalks and notched flower petals; it is found in waste places in eastern North America. Rock fringe (*E. obcordatum*) is a prostrate form from the western U.S.; it has rose-purple flowers. Two alpine species are *E. dodonaei* and *E. fleischeri*, with almost needlelike leaves and purplish-red flower spikes. *E. nummulariifolium*, from New Zealand, has whitish flowers and brownish-red leaves; it is grown in rock gardens for its attractive matlike growth. *E. montanum*, with pale-pink flowers, is found in temperate-zone woods.

epilogue: *see* prologue and epilogue.

Epimenides (fl. 6th century BC?), Cretan seer, reputed author of religious and poetical writings. He conducted purificatory rites at Athens *c.* 500 according to Plato (*c.* 600 according to Aristotle). All surviving fragments, including a line quoted by St. Paul (Tit. 1:12), are attributable to other sources. Stories of his advanced age (157 or 299 years), his miraculous sleep of 57 years, and his wanderings outside the body have led some scholars to regard him as a legendary figure of a shamanistic type.

Epimenides' paradox: *see* liar paradox.

Épinal, town, capital of the Vosges *département,* Lorraine region, eastern France, on the Moselle River, south-southeast of Nancy. The town, located on two arms of the Moselle, is divided into four parts. The town proper, known as the *grande ville* ("large town") or *vieille ville* ("old town"), stands on the right bank of the main river. The *petite ville* ("little town") is on an island between the two branches. On the left bank of the smaller branch, called the Canal des Grands Moulins, stands the Quartier de la Gare (the Station Quarter), divided by the railway line from the Quartier de Chantraine to the west. The

town lies between forests to the west and lush meadows to the east.

The Place des Vosges in the *grande ville* has preserved its ancient arcades and some old houses. Nearby stands the basilica of Saint-Maurice, parts of which date from the 11th century. The town originally developed around a 10th-century monastery. It passed to Charles VII, king of France from 1422 to 1461, and was then ceded to the dukes of Lorraine in 1465. It was incorporated into France in 1766. The town became famous in the 18th and 19th centuries for making coloured picture prints, and the museum houses a collection of them. In the 20th century Épinal became a centre for the manufacture of cotton goods, rubber, and synthetic fibres. Pop. (1982) 37,228.

Épinay, Louise-Florence-Pétronille Tardieu d'Esclavelles, dame de La Live d', by-name MADAME D'ÉPINAY (b. March 11, 1726, Valenciennes, Fr.—d. April 17, 1783, Paris), a distinguished figure in advanced literary circles in 18th-century France. Though she wrote

Mme d'Épinay, detail of a pastel by Jean Étienne Liotard, *c.* 1759; in the Musée d'Art et d'Histoire, Geneva

By courtesy of the Musee d'Art et d'Histoire, Geneva

a good deal herself, she is more famous for her friendships with three of the outstanding French writers and thinkers of her day, Denis Diderot, Baron Friedrich de Grimm, and Jean-Jacques Rousseau.

Mme d'Épinay interested herself in literature and the welfare of men of letters after the breakdown of her marriage to Denis-Joseph de La Live d'Épinay, a financier. She set up a congenial salon in her country house at La Chevrette, near Montmorency, and offered hospitality to the Philosophes, the leading intellectual figures of the period immediately prior to the French Revolution. Her friendship with Grimm was long and untroubled, and Mme d'Épinay collaborated with him on his famous correspondence. Her association with Rousseau, on the other hand, was brief and stormy: in 1756 he accepted her offer of accommodation in the "Hermitage," a small dwelling near her country house, and wrote his novel *La Nouvelle Héloïse* there. But then he quarreled with his hostess, and the two became implacable foes. Mme d'Épinay was the author of several novels and works on education, but her writings are of interest now chiefly for their autobiographical revelations.

Épinay-sur-Seine, town, northern suburb of Paris, Seine-Saint-Denis *département,* Paris region, north-central France, on the Seine River. Épinay originated from a Gallic-Roman settlement called Spinogelum (Place of Thorns and Gorse), and in the Middle Ages it was the site of La Brache, a castle of the Frankish kings. During the Franco-German War a battle was fought there (Nov. 30, 1870). The town has a chemical industry and film studios. Pop. (1982) 50,280.

epinephrine and norepinephrine, also called ADRENALINE and NORADRENALINE, two separate but related hormones secreted by the medulla of the adrenal glands (*q.v.*). They are also produced at the ends of sympathetic nerve fibres, where they serve as chemical mediators for conveying the nerve impulses to effector organs. Chemically, the two compounds differ only slightly; and they exert similar pharmacological actions, which resemble the effects of stimulation of the sympathetic nervous system. They are, therefore, classified as sympathomimetic agents. The active secretion of the adrenal medulla contains approximately 80 percent epinephrine and 20 percent norepinephrine; but this proportion is reversed in the sympathetic nerves, which contain predominantly norepinephrine.

The actions of epinephrine and norepinephrine are generally similar, although they differ from each other in certain of their effects. Norepinephrine constricts almost all blood vessels, while epinephrine causes constriction in many networks of minute blood vessels but dilates the blood vessels in the skeletal muscles and the liver. Both hormones increase the rate and force of contraction of the heart, thus increasing the output of blood from the heart and increasing the blood pressure. The hormones also have important metabolic actions. Epinephrine stimulates the breakdown of glycogen to glucose in the liver, which results in the raising of the level of blood sugar. Both hormones increase the level of circulating free fatty acids. The extra amounts of glucose and fatty acids can be used by the body as fuel in times of stress or danger where increased alertness or exertion is required. Epinephrine is sometimes called the emergency hormone because it is released during stress and its stimulatory effects fortify and prepare an animal for either "fight or flight."

The purified, active compounds are used clinically and are obtained from the adrenal glands of domesticated animals or prepared synthetically. Epinephrine may be injected into the hearts of victims of cardiac arrest to stimulate heart activity. It also dilates the bronchioles and in this way is an aid to respiration for asthma sufferers. Epinephrine is also useful in acute allergic disorders, such as drug reactions, hives, and hay fever. Norepinephrine is administered by intravenous infusion to combat the acute fall in blood pressure associated with certain types of shock. Norepinephrine is formed in the body from the amino acid tyrosine, and epinephrine is in turn formed from norepinephrine.

epinicion, also spelled EPINIKION, plural EPINICIA, or EPINIKIA, choral lyric ode honouring a victor in the great Hellenic games, performed as part of the celebration on his triumphal return to his city. The epinicion had a basis in improvised celebration, but the form as it has survived is highly literary. One of the earliest examples extant is that of Simonides of Ceos, an ode for an Olympic victory in 520 BC.

Though the epinicion's structure is not fixed, there is a certain uniformity in content and arrangement. The occasion demands a reference to the victor and the nature and place of his victory; to this may be added reference to victories of members of his family or a compliment to his trainer. Generally there is a myth, more or less elaborate and relevant to the occasion. There is also a gnomic element of wise sayings and reflections on life.

The epinicion ode did not use traditional lines or stanzas, but the metre was formed afresh for each poem and was never used again in exactly the same form. The strophes, or stanzas, either single or in systems of three, were repeated through the poem, and often their form was related to the accompanying dance. Its performance required a trained choir and musicians skilled in the lute and the lyre. The form reached its zenith in the odes of Pindar (518 or 522 to after 446 BC). Those of his younger contemporary, Bacchylides, signaled the end of its popularity. *See also* ode.

Epiphanius OF CONSTANTIA, SAINT (b. *c.* 315, Palestine—d. May 403, at sea; feast day May 12), bishop noted in the history of the early Christian Church for his struggle against beliefs he considered heretical. His chief target was the teachings of Origen, a major theologian in the Eastern Church. The harsh attacks by Epiphanius, who considered Origen more a Greek philosopher than a Christian, did much to discredit Epiphanius' principles.

Epiphanius studied and practiced monasticism in Egypt and then returned to his native Palestine, where near Eleutheropolis he founded a monastery and became its superior. In 367 he was made bishop of Constantia (Salamis) in Cyprus. He spent the rest of his life in that post, spreading monasticism and campaigning against heretics. His orthodox views conflicted with those of the Roman emperor Valens, who governed in the East from 364 to 378 and who had embraced Arianism, but Epiphanius was protected by the veneration in which men held him for his sanctity.

In 403 Epiphanius went to Constantinople to campaign against the bishop there, St. John Chrysostom, who had been accused of sheltering four monks expelled from Alexandria for their Origenistic views. Becoming convinced of the falsity of this and related charges made by Bishop Theophilus of Alexandria (who wanted to depose John), Epiphanius set sail for Cyprus but died en route.

A zealous bishop and a revered ascetic, Epiphanius was lacking in moderation and judgment. These defects are reflected in his writings, of which the chief work is the *Panarion* (374–377), an account of 80 heresies including Greek philosophical schools, Jewish sects, and Samaritans; it ends with a statement of orthodox doctrine. His *Ancoratus* (374) is a compendium of the teachings of the church. His works are valuable as a source for the history of theological ideas.

Epiphany (from Greek *epiphaneia,* "manifestation"), festival celebrated on January 6; it is one of the three principal and oldest festival days of the Christian Church (including Easter and Christmas). It commemorates the first manifestation of Jesus Christ to the Gentiles, represented by the Magi, and the manifestation of his divinity, as it occurred at his Baptism in the Jordan River and at his first miracle at Cana in Galilee.

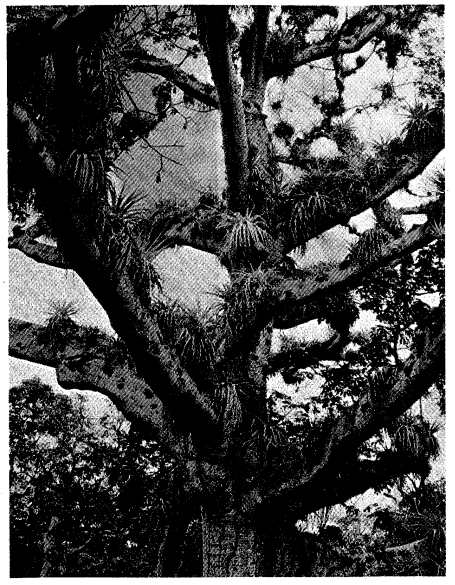
The festival originated in the Eastern Church, where it at first included a commemoration of Christ's birth. In Rome, by 354, Christ's birth was being celebrated on December 25, and later in the 4th century the church in Rome began celebrating Epiphany on January 6. In the Western Church the festival primarily commemorates the visit by the Magi to the infant Jesus. In the East it primarily commemorates the Baptism of Jesus.

In the West the evening preceding Epiphany is called Twelfth Night.

epiphyseal ischemic necrosis (disorder): *see* osteochondrosis.

epiphysis cerebri: *see* pineal gland.

epiphyte, any plant that grows upon or is in some manner attached to another plant or object merely for physical support. Epiphytes are primarily tropical in distribution and are often known as air plants because they have no attachment to the ground or other obvious nutrient source. They obtain water and minerals from rain and also from debris that collects on the supporting plants. Orchids, ferns, and members of the pineapple family are common tropical epiphytes. Lichens, mosses, liverworts, and algae are epiphytes of temperate regions. Mistletoes, which are partly parasitic



Epiphytes on limbs of jungle tree
Harrison Forman

on their host plants, are sometimes considered to be epiphytes.

Epirus, Modern Greek ÍPIROS, coastal region of northwestern Greece and southern Albania. It extends from Valona Bay (Gji i Vlorës) in Albania (northwest) to the Gulf of Arta (southeast); its hinterland extends eastward to the watershed of the Pindus Mountains. The *nomoi* (departments) of Árta, Ioánnina, Préveza (*qq.v.*), and Thesprotía make up the Greek part of Epirus. The Pindus Mountains separate Epirus from the Greek regions of Macedonia and Thessaly to the east. The principal town in Greek Epirus is Ioánnina, and the largest settlement in Albanian Epirus is Gjirokastër.

Epirus is largely made up of great limestone ridges oriented northwest–southeast and north–south; they reach up to 8,600 feet (2,600 m) in height and fall off more steeply to the west. These ridges generally parallel the coast and are so steep that the valley land between them is mostly suitable only for pasture, though northern Epirus has more plains and cereal production. Much of Epirus lies on the windward side of the Pindus Mountains and hence receives the prevailing winds off the Ionian Sea, with the result that it receives more rainfall than does any other region of mainland Greece.

Poor-quality soils, faulty farming practices, and fragmented landholdings have kept the region's agricultural productivity low. Sheep and goats are raised, and corn (maize) is the chief crop. Olives and oranges are also cultivated, and tobacco is grown around Ioánnina. There is also some dairying and fishing. Wheat and vegetables must be imported.

Epirus has few resources and industries, and its population has been depleted by emigration. The population is concentrated in the area around Ioánnina, which has the largest number of manufacturing establishments.

In the Neolithic period Epirus was populated by seafarers along the coast and by shepherds and hunters from Albania and southern Yugoslavia who brought with them the Greek language. These people buried their leaders in large mounds containing shaft graves. Similar burial chambers were subsequently used by the Mycenean civilization, suggesting that the founders of Mycenae may have come from Epirus and central Albania. Epirus itself remained culturally backward during this time, but Mycenean remains have been found at two religious shrines of great antiquity in the region: the Oracle of the Dead on the Acheron River, familiar to the heroes of Homer's *Odyssey,* and the Oracle of Zeus at Dodona, to whom Achilles prayed in the *Iliad.*

After the Mycenaean civilization declined, Epirus was the launching area of the Dorian invasions (1100–1000 BC) of Greece. The region's original inhabitants were driven southward by the Dorians, and out of the ensuing migrations three main clusters of Greek-speaking tribes emerged in Epirus: the Thesproti of southwestern Epirus, the Molossi of central Epirus, and the Chaones of northwestern Epirus. They lived in clusters of small villages, in contrast to most other Greeks, who lived in or around city-states.

In the 5th century Epirus was still on the periphery of the Greek world. To the 5th-century historian Thucydides, the Epirotes were "barbarians." The only Epirotes regarded as Greek were the Aeacidae, who were members of the Molossian royal house and claimed descent from Achilles. From about 370 BC on, the Aeacidae were able to expand the Molossian state by incorporating tribes from the rival groups in Epirus. The Aeacidae's efforts gained impetus from the marriage of Philip II of Macedon to their princess, Olympias. In 334, while Alexander the Great, son of Philip and Olympias, crossed into Asia, his uncle, the Molossian ruler Alexander, attacked southern Italy, where he was eventually checked by Rome and killed in battle in about 331. Upon Alexander the Molossian's death, the Epirote tribes formed a coalition on an equal basis but with the Molossian king in command of their military forces. The greatest Molossian king of this coalition was Pyrrhus (319–272); he and his son Alexander II ruled as far south as Acarnania and to central Albania in the north. Pyrrhus' military adventures overstrained his state's military resources, but they also brought great prosperity to Epirus. He built a magnificent stone theatre at Dodona and a new suburb at Ambracia (now Árta), which he made his capital.

After the Aeacid monarchy ended in 232, the Epirote alliance was transformed from a coalition of tribes into a federal state, the Epirote League, with a parliament (*synedrion*). The league steered an uneasy course during the conflicts between Rome and Macedonia, and in 170 BC, during the Third Macedonian War (171–168), the league split apart, the Molossians supporting Macedonia, the Chaones and Thesproti siding with Rome. Molossia was taken in 167 by victorious Rome, and 150,000 of its inhabitants were enslaved.

Central Epirus did not recover until the Byzantine period, but the coastal areas continued to prosper as part of a Roman province. When the Roman Empire split in AD 395, Epirus was the westernmost province of the Eastern Empire. When the Byzantine Empire became fragmented, an independent kingdom was maintained in Epirus (*see* Epirus, Despotate of) after 1204 AD, but in 1318 Serbs and Albanians overran the area, and in 1430 the Ottoman Turks annexed it. Under Turkish rule, the region suffered from overcultivation and deforestation that caused soil erosion and depopulation. In the 18th century Turkish sovereignty over Epirus was threatened by a Turko-Albanian despot, Ali Paşa Tepelenë, who was recognized in 1778 by Turkey as pasha of Ioánnina. His oppressive rule was extended by 1810 to most of the Peloponnese, central Greece, and parts of western Macedonia and was a leading cause of the War of Greek Independence (1821–29).

Much of northern Epirus was united with Greece in 1913, leaving minorities on both sides of the Greek-Albanian frontier. In 1939 Italy annexed all of Albania but in 1940, after attempting to invade Greece, was pushed out of Greek Epirus by the Greek army and lost much of northern Epirus until the German attack on Greece. The German occupation followed (1940–44) until the Allies restored the Greek-Albanian frontier.

Epirus, Despotate of (1204–1337), Byzantine principality in the Balkans that was a centre of resistance for Byzantine Greeks during the western European occupation of Constantinople (1204–61).

The despotate was founded in what is now southern Albania and northwestern Greece by Michael Angelus Ducas, a member of the dethroned Byzantine imperial house. His half brother and successor, Theodore Ducas, extended his rule eastward to Thessalonica in 1222 and claimed the title of Byzantine emperor.

Theodore's rivals, John III Vatatzes, emperor of Nicaea, and John Asen II of Bulgaria, attacked him from the east and north; John Asen II defeated and captured Theodore in 1230 at the Battle of Klokotnitsa (now in Bulgaria).

Under Michael II (reigned 1236–71), Epirus was greatly reduced, and in 1264 Michael was forced to recognize the suzerainty of Michael VIII Palaeologus, who had expelled the Latins from Constantinople and restored the Byzantine Empire.

In the 13th century Epirus promoted a revival of classical studies that contributed to the development of Renaissance Italy. The principality was reannexed to the Byzantine Empire in 1337.

episcopacy, in some Christian churches, the office of a bishop and the system of church government based on the three orders, or offices, of the ministry: bishops, priests, and deacons. The origins of episcopacy are obscure, but by the 2nd century AD it was becoming established in the main centres of Christianity. It was closely tied to the idea of apostolic succession, the belief that bishops can trace their office in a direct, uninterrupted line back to the Apostles of Jesus.

A 2nd-century bishop was charged with the spiritual welfare of his congregation; he was the chief liturgical minister, and he baptized, celebrated the Eucharist, ordained, absolved, controlled finances, and settled matters of dispute. With state recognition of Christianity in the 4th century, the bishop came to be regarded not only as a church leader but also as an important figure in secular affairs.

As the bishops' duties increased and congregations grew in size and number, it became necessary either to have more bishops or to delegate some of their functions to others. Congregations in an area (diocese) were entrusted to presbyters (priests), assisted by deacons, under the supervision of a bishop. It was this system of church government that became established throughout the church. The bishop retained as his exclusive right the power to confirm church members, ordain priests, and consecrate other bishops.

As the Middle Ages advanced, the system of delegation of duties became excessively organized, and an ecclesiastical bureaucracy came into being. A complex hierarchy of subordinate officials acted on the bishop's behalf. Although bishops made important contributions to the medieval state, this activity interfered with the office of church leader.

During the Reformation in the 16th century, episcopacy was repudiated by many Protestant churches, partly on the grounds of its corruption but also because many believed the system was not based on the New Testament. The Roman Catholic, Eastern Orthodox, Anglican, Old Catholic, Swedish Lutheran, and some other churches have the episcopal form of church government. Abuses of the system that developed during the medieval period were eliminated after the Reformation.

In the 20th-century ecumenical movement, episcopacy has been problematic for churches seeking reunion. Some maintain its necessity

to the church, others think it beneficial to the church, and still others consider it neither necessary nor beneficial. Most Christians agree that *episkopos* in its original Greek sense of "overseer" is essential to the church, but they differ as to the functions of the overseer. *See also* ministry; bishop.

Episcopal Church: *see* Protestant Episcopal Church.

Episcopal Church in Scotland, independent church within the Anglican Communion that developed in Scotland out of the 16th-century Protestant Reformation.

The development of Protestantism in Scotland went through confusing periods, with control alternating between the Presbyterian Party (those who believed in the presbyterian form of church government) and the Episcopal Party (those who believed the church should be governed by bishops). After the Restoration of the monarchy in 1660, the two parties merged into a modified episcopacy, which might have united the church and nation if the two parties had not again separated after the accession of William and Mary (1689). Since the Episcopalians had taken an oath of allegiance to King James II, they felt they could not in good conscience transfer their allegiance to William and Mary when James was deposed. Thus, Presbyterianism was established as the national religion (1690) of Scotland. The Episcopal Church in Scotland is the direct descendant of those churches that remained loyal to the episcopal tradition, and its bishops are the direct successors of those consecrated to Scottish sees after the Restoration.

In the 18th century the Episcopal Church in Scotland suffered because of involvement in the rebellions of 1715 and 1745 of the Jacobites (those who remained loyal to James II, the exiled Stuart king, and his heirs). Penal laws against the church almost eliminated it. Repeal of the laws in 1792 marked a turning point, and the church began to revive. It subsequently supported foreign missions, especially in South Africa and India, and social-welfare work at home.

The Scottish Communion Office, based on the liturgy in the service book imposed on Scotland by Charles I in 1637, was prepared in 1764. In the 1920s a revision of the entire prayer book was begun, and the complete Scottish prayer book was produced in 1929. This was essentially a revision of the English *Book of Common Prayer* of 1662.

The church is divided into seven dioceses, each headed by a bishop. The seven bishops elect one of their number as primus (presiding bishop). Lay members take an active part in the church through the Representative Church Council, which handles financial matters, and through the Provincial Synod, authorized in 1961 and presided over by the presiding bishop, which considers liturgical and canonical matters.

Episcopius, Simon, also called SIMON BISCOP, BISCHOP, or BISSCHOP (b. Jan. 8, 1583, Amsterdam, Dutch Republic [now in The Netherlands]—d. April 4, 1643, Amsterdam), Dutch theologian and systematizer of Arminianism, a liberal reaction to the Calvinist doctrine of predestination.

He studied theology at Leiden and in 1610 became a pastor at Bleiswyk. He was made a professor at Leiden in 1612, succeeding the strict Calvinist Franciscus Gomarus. Episcopius was one of the Remonstrants, who placed more emphasis on freedom of the will than orthodox Calvinism allowed. With 12 others he was banished from the Netherlands after the Synod of Dort (1618–19) and lived in Paris, Antwerp, and Rouen until 1626. In 1634 he became head of the Remonstrant seminary in Amsterdam. In his *Institutiones theologicae* (1650–51), he attempted to provide a systematic basis for Remonstrant doctrine, asserting that God's sovereignty and man's free will are compatible.

episcopus vagans, plural EPISCOPI VAGANTES, in Christianity, a bishop without authority or without recognition in any major Christian church. Such bishops may have been properly consecrated but were not assigned to a diocese or were deprived of their diocese for some reason or were excommunicated by their church; or they may have received an irregular consecration by another bishop.

In the early Christian church, wandering bishops were a problem, primarily because some bishops were consecrated but were not given jurisdiction over a diocese. In addition, theological controversies in the 4th and 5th centuries often resulted in bishops being deprived of their sees; they retained their consecration as bishops but had to wander to make a livelihood. In later times, the number of *episcopi vagantes* was increased by bishops driven out of their dioceses by war, especially in Spain, or by bishops consecrated for dioceses controlled by Muslims who would not allow Christian bishops to take up residence. The activities of *episcopi vagantes* were not restricted in the Roman Catholic church until after the Council of Trent (1545–63).

In modern times, however, many *episcopi vagantes* have appeared who are outside the control of any ecclesiastical authority. Most of these wandering bishops trace their succession to one of three men consecrated in the late 19th and early 20th centuries. The first of these was Jules Ferrette, a former Roman Catholic priest who was consecrated in 1866 by the Jacobite bishop of Homs (Emesa) in Syria; he worked in England and the United States. Joseph René Vilatte, a lapsed French Catholic who had worked in the Protestant Episcopal Church in Wisconsin, was consecrated in 1892 by the Metropolitan of the Independent Catholic Church of Ceylon, Goa, and India; he worked in the United States. Arnold Harris Mathew, a former Roman Catholic priest, was consecrated in 1908 in Utrecht, Neth., by Old Catholic bishops. His consecration was later described as having been obtained by misrepresentation, and he was repudiated by the Old Catholics. He tried unsuccessfully to create an Old Catholic movement in England.

episome, in bacteria, one of a group of extrachromosomal genetic elements called plasmids, consisting of deoxyribonucleic acid (DNA) and capable of conferring a selective advantage upon the bacteria in which they occur. Episomes may be attached to the bacterial cell membrane (such a cell is designated F^+) or become integrated into the chromosome (such a cell is designated Hfr). F^+ and Hfr cells act like males during conjugation, a mating process in certain bacteria (*e.g., Escherichia, Salmonella, Serratia, Pseudomonas*). During conjugation, cells lacking the episome (called F^- cells) may receive either the episome (from an F^+ cell) or the episome plus the genes to which it is attached (from an Hfr cell). Experiments involving gene transfers from Hfr cells have been used to determine the locations of genes on the chromosome of Hfr cells.

Some bacterial viruses, called temperate phages, carry DNA that can act as an episome. A bacterial cell into whose chromosome the viral DNA has become integrated is called a prophage. *See* lysogeny.

epistaxis (medicine): *see* nosebleed.

epistemology, the study of the origin, nature, and limits of human knowledge. The name is derived from the Greek words *epistēmē* ("knowledge") and *logos* ("reason"). Epistemology has had a long history spanning the time of the pre-Socratic Greeks up to the present. Along with metaphysics, logic, and ethics, it is one of the four main fields of philosophy, and nearly every great philosopher has contributed to the literature on this topic.

A brief treatment of epistemology follows. For full treatment, *see* MACROPAEDIA: Epistemology.

The major issue with respect to the origins of knowledge is whether all knowledge is derived from experience. There are two sharply opposed traditions: empiricism, which affirms this view, and rationalism, which rejects it. Rationalists believe there are innate ideas (*i.e.,* concepts man has independent of experience), such as the notion of equality, which are not found in experience. Some rationalists contend that these notions derive from the structure of the human mind, others that they exist independently of the mind and are apprehended by the mind when it reaches a certain degree of sophistication. Empiricists, by contrast, deny that there are any concepts that exist prior to experience, and accordingly they assert that all knowledge is a product of human learning in which perception plays the main role. Perception itself is problematic, however, since visual illusions and hallucinations show that perception cannot always depict the world as it actually is. Another problem for empiricists is the status of mathematical theorems whose truth conditions do not depend on experience and seem to be known a priori (*i.e.,* prior to experience). The empiricist response to this claim is that mathematical theoerems are empty of cognitive content and merely express the relationship of certain concepts to one another.

The great achievement of the 18th-century German philosopher Immanuel Kant was to have worked out a compromise between these competing views. He argued that human beings do have knowledge that is prior to experience and yet is not devoid of cognitive significance, the principle of causality being one such example. Kant's view can be summarized in the maxim that there are a priori synthetic concepts.

The issues about the origins of knowledge are connected with questions about its limits. Many empiricists, such as David Hume, and nonempiricists, such as Kant, agree that the human mind has the capacity to generate questions that no possible appeal to experience could answer, such as whether there is a God, whether the world has a first cause or is uncaused, and whether there is a reality behind that apprehended by the senses. Kant labeled such questions transcendental (*i.e.,* going beyond the limits of rational inquiry), and in the 20th century, so-called logical positivists, such as Moritz Schlick, Rudolf Carnap, and A.J. Ayer, have declared such questions to be metaphysical and devoid of cognitive significance.

Questions about the nature of knowing span a wide range, including inquiries as to whether knowledge is a type of belief or is different from belief, and whether knowledge is a special faculty in the mind or is a disposition to act in certain ways. There is some measure of agreement in dealing with such questions. Thus it is generally accepted that any analysis of knowledge must satisfy the conditions that if a person A can truly be said to know that *p,* where *p* is a proposition, *p* must be true, and A cannot be mistaken. This characterization connects knowledge with certitude and thus with issues raised by ancient and modern Skeptics, such as whether a person can achieve certitude about the world, about the past, about the mind of another person, or about oneself.

epistilbite, hydrated sodium and calcium aluminosilicate mineral in the zeolite family. It forms piezoelectric crystals of monoclinic symmetry and platy habit; the latter property has caused epistilbite to be assigned to a

group typified by heulandite (*q.v.*). More recently, X-ray diffraction studies have shown that the three-dimensional structure of epistilbite's aluminosilicate framework has features in common with that of mordenite (*q.v.*), which forms equant crystals. The chemical composition of the crystallographic unit cell (the smallest repeated component of the three-dimensional lattice) of epistilbite is approximately $(Ca,Na_2)_3Al_6Si_{16}O_{48} \cdot 16H_2O$. Isolated specimens of the mineral have been found in New York, on the island of Jersey, and—with other zeolites—in Hawaii.

epistolary novel, a novel told through the medium of letters written by one or more of the characters. Originating with Samuel Richardson's *Pamela: or, Virtue Rewarded* (1740), the story of a servant girl's victorious struggle against her master's attempts to seduce her, it was one of the earliest forms of novel to be developed and remained one of the most popular up to the 19th century. The epistolary novel's reliance on subjective points of view makes it the forerunner of the modern psychological novel.

The advantages of the novel in letter form are that it presents an intimate view of the character's thoughts and feelings without interference from the author and that it conveys the shape of events to come with dramatic immediacy. Also, the presentation of events from several points of view lends the story dimension and verisimilitude. Though the method was most often a vehicle for sentimental novels, it was not limited to them. Of the outstanding examples of the form, Richardson's *Clarissa* (1748) has tragic intensity, Tobias Smollett's *Humphry Clinker* (1771) is a picaresque comedy and social commentary, and Fanny Burney's *Evelina* (1778) is a novel of manners. Rousseau used the form as a vehicle for his ideas on marriage and education in *La Nouvelle Héloïse* (1761), and Goethe used it for his statement of Romantic despair, *The Sorrows of Young Werther* (1774). The letter novel of Choderlos de Laclos, *Les Liaisons dangereuses* (1782; *Dangerous Acquaintances*, 1924), is a work of penetrating and realistic psychology.

Some disadvantages of the form were apparent from the outset. The servant girl Pamela's remarkable literary powers and her propensity for writing on all occasions were cruelly burlesqued in Henry Fielding's *Shamela* (1741), which pictures his heroine in bed scribbling, "I hear him coming in at the Door," as her seducer enters the room. From 1800 on, the popularity of the form declined, though novels combining letters with journals and narrative were still common. In the 20th century letter fiction was often used to exploit the linguistic humour and unintentional character revelations of such semi-literates as the fatuous ballplayer hero of Ring Lardner's *You Know Me Al* (1916).

epitaph, an inscription in verse or prose upon a tomb; and, by extension, anything written as if to be inscribed on a tomb. Probably the earliest surviving are those of the ancient Egyptians, written on the sarcophagi and coffins. Ancient Greek epitaphs are often of considerable literary interest, deep and tender in feeling, rich and varied in expression, and epigrammatic in form. They are usually in elegiac verse, though many of the later epitaphs are in prose.

Among the most familiar epitaphs are those, ascribed to Simonides of Ceos (*c.* 557/556–469 BC), on the heroes of Thermopylae, the most famous of which has been translated thus:

> Go tell the Spartans, thou that passest by
> That here, obedient to their laws, we lie.

Roman epitaphs, in contrast to the Greek, contained as a rule nothing beyond a record of facts with little variation. An inscription commonly found is "may the earth lie light upon thee." A satirical inversion of this is seen in the epitaph by Abel Evans (1679–1737) on the architect Sir John Vanbrugh:

> Lie heavy on him, Earth! for he
> Laid many heavy loads on thee.

Many Roman epitaphs included a denunciation on any who should violate the sepulchre; a similar later denunciation is found on Shakespeare's tomb:

> Good friend, for Jesus's sake forbear
> To dig the dust enclosed hear;
> Blest be the man that spares these stones,
> And curst be he that moves my bones.

The oldest existing British epitaphs are those of the Roman occupiers and are, of course, in Latin, which continued for many centuries to be the preferred language for epitaphs. The earliest epitaphs in English churches are usually a simple statement of name and rank, with a *hic jacet* ("here lies"). In the 13th century, French came into use (on, for example, the tomb of Henry III at Westminster). The use of English began around the middle of the 14th century, but as late as 1776, Dr. Johnson, asked to write an English epitaph for Oliver Goldsmith, replied that he would never consent to disgrace the walls of Westminster Abbey with an English inscription. A familiar 18th-century epitaph was the one of 12 lines ending Thomas Gray's "Elegy Written in a Country Church Yard." Perhaps the most noted modern epitaph was that written by William Butler Yeats for himself in "Under Ben Bulben":

> Cast a cold eye
> On life, on death.
> Horseman, pass by!

Most of the epitaphs that have survived from before the Reformation were inscribed upon brasses. By Elizabethan times, however, epitaphs upon stone monuments, in English, became much more common and began to assume a more literary character. Thomas Nashe tells how, by the end of the 16th century, the writing of verse epitaphs had become a trade. Many of the best known epitaphs are primarily literary memorials, not necessarily intended to be placed on a tomb. Among the finest are those by William Browne, Ben Jonson, Robert Herrick, John Milton, and Robert Louis Stevenson. Alexander Pope wrote several epitaphs; they inspired one of the few monographs on the subject—Samuel Johnson's examination of them in *The Universal Visiter* for May 1756.

Semi-literacy often produces epitaphs that are comic through grammatical accident—for example, "Erected to the memory of / John MacFarlane / Drowned in the Water of Leith / By a few affectionate friends." Far more common, though, are deliberately witty epitaphs, a type abounding in Britain and the U.S. in the form of acrostics, palindromes, riddles, and puns on names and professions. Benjamin Franklin's epitaph for himself plays on his trade as a printer, hoping that he will "appear once more in a new and more beautiful edition, corrected and amended by the Author"; and that of the antiquary Thomas Fuller has the inscription "Fuller's Earth." Many offer some wry comment, such as John Gay's

> Life is a jest, and all things show it;
> I thought so once, and now I know it.

The epitaph was also seen as an opportunity for epigrammatic satire, as in the Earl of Rochester's lines on Charles II: "He never said a foolish thing / Nor ever did a wise one."

epitaxy, the deposition of a substance, usually in a thin layer, upon the surface of a single crystal (*q.v.*) of another; the process does not involve a chemical reaction between the two materials, but the crystalline structure of the epitaxial layer is controlled by that of the surface upon which it forms. Several kinds of solid-state electronic devices, such as high-speed transistors and integrated circuits, are fabricated by production of an epitaxial layer of one semiconductor on a wafer of another that has a different type of electrical conductivity.

One technique used in preparing epitaxial layers is to expose the clean surface of a semiconducting single crystal, commonly silicon or germanium, to the action of a vaporized mixture of a compound of the semiconductor and a compound of another element, called a dopant (*q.v.*) or doping element, often gallium or arsenic. The vapours condense and decompose on the surface, forming an orderly crystalline layer in which a small proportion of the sites in the atomic lattice of the major elemental component are occupied by atoms of the dopant.

epithalamium, also spelled EPITHALAMION, or EPITHALAMY, song or poem to the bride and bridegroom at their wedding. In ancient Greece, the singing of such songs was a traditional way of invoking good fortune on the marriage and often of indulging in ribaldry. By derivation, the epithalamium should be sung at the marriage chamber; but the word is also used for the song sung during the wedding procession, containing repeated invocations to Hymen (Hymenaeus), the Greek god of marriage. No special metre has been associated with the epithalamium either in antiquity or in modern times.

The earliest evidence for literary epithalamiums are the fragments from Sappho's seventh book (*c.* 600 BC). The earliest surviving Latin epithalamiums are three by Catullus (84–54 BC). In the most original, Catullus tried to fuse the native Fescennine verse (a jocular, often obscene form of sung dialogue sometimes used at wedding feasts) with the Greek form of marriage song.

Epithalamiums based on classical models were written during the Renaissance by Tasso in Italy and Pierre de Ronsard in France. Among English poets of the same period, Richard Crashaw, John Donne, Sir Philip Sidney, and Ben Jonson used the form. Edmund Spenser's *Epithalamion*, written for his second marriage in 1595, is considered by some critics to be the finest example of the form in English.

Anonymous 17th-century epithalamiums are extant. In the 19th century, epithalamiums were written by Gerard Manley Hopkins and Edmund Gosse; and in the 20th, by Witter Bynner, A.E. Housman, and Dannie Abse. *See also* Fescennine verses.

epithelioma, a cancerous growth or tumour consisting of tissue derived from the skin or mucous membrane (epithelium)—a type of carcinoma (*q.v.*). Various types of epitheliomas occur, related to the different types of epithelial cells that exist, such as basal cell epitheliomas, involving the inner layers of the skin, and squamous cell epitheliomas, involving the scalelike outer cells of the skin. Epitheliomas may spread into adjoining tissues, but only rarely do they metastasize; *i.e.*, send cancerous cells (through the body cavities, bloodstream, or lymphatic system) to distant parts of the body.

epithelium, in anatomy, layer of cells closely bound to one another to form continuous sheets covering surfaces that may come into contact with foreign substances. Epithelium occurs in both plants and animals.

In animals, outgrowths or ingrowths from these surfaces form structures consisting largely or entirely of cells derived from the surface epithelium. In this way the central nervous system, the sensitive surfaces of spe-

cial sense organs, glands, hair, nails, and other structures all originate. The epithelial cells possess typical microscopical characteristics: the cell outline is clearly marked, and the nucleus large and spherical or ellipsoidal. The cytoplasm of the cell is usually large in amount and often contains large numbers of granules.

Epithelium may be protective, absorptive, or secretory. It may produce special outgrowths (hairs, nails, horns on animals), and manufacture chemical material (*e.g.*, keratin), in which case the whole cell becomes modified. In other instances it contains fat droplets, granules of various kinds, protein, mucin, watery granules, or glycogen. In a typical absorbing cell, granules of material are absorbed. A secreting cell forming specific substances stores them until they are utilized—*e.g.*, fat, in sebaceous and mammary glands; enzymes in salivary and gastric glands; and various excretory substances in the renal epithelium of the kidney.

The cells forming an epithelial membrane are of various types: columnar, cubical, squamous (flattened), irregular, or ciliated (*i.e.*, with hairlike projections). The membranes formed by these cells may be only one cell thick, as in the major part of the gastrointestinal tract, or consist of several layers, as in the epidermis of the skin. Columnar epithelium covers the intestinal tract from the end of the esophagus to the beginning of the rectum. It also lines the ducts of many glands. A typical form covers the villi (nipple-like projections) of the small intestine. Cubical epithelium is found in many glands and ducts (*e.g.*, the kidney), the middle ear, and the brain. Squamous, or flattened, epithelial cells, very thin and irregular in outline, occur as the covering epithelium of the alveoli of the lung and of the glomeruli and capsule of the kidney. Ciliated epithelium lines the trachea, bronchi of the lungs, parts of the nasal cavities, the uterus and oviduct of the female, and the vas deferens and epididymis of the male. A single projection from the exposed surface of a cell, usually large and long, is called a flagellum. Flagellated cells are common on the surface of many simple animals.

When the cells of an epithelial surface are several layers deep, various epithelial types can be distinguished: stratified, stratified ciliated, and transitional epithelium. In stratified epithelium, which is found in the epithelium of the skin and of many mucous membranes (*e.g.*, mouth, esophagus, rectum, conjunctiva, vagina), the surface cells are flattened, those of the middle layer are polyhedral, and those of the lowest layer are cubical or columnar. This type of epithelium covers surfaces exposed to friction. The surface cells are constantly being rubbed off and are replaced by new cells growing up from below. Hence, the deepest layer is formative, and successive stages upward reveal a gradual transformation into scaly cells that no longer show any sign of being alive.

In stratified ciliated epithelium the superficial cells are ciliated and columnar. This epithelium lines parts of the respiratory passages, the vas deferens, and the epididymis. Transitional epithelium lines the urinary bladder; its appearance depends upon whether the bladder is contracted or distended.

epoch, unit of geological time during which a rock series is deposited. It is a subdivision of a geological period (*q.v.*) and the word is capitalized when employed in a formal sense (*e.g.*, Pleistocene Epoch). Additional distinctions can be made by appending relative time terms, such as early, middle, and late. The use of "epoch" is usually restricted to divisions of the Tertiary and Quaternary periods.

epochē, in Greek philosophy,"suspension of judgment," a principle originally espoused by nondogmatic philosophical Skeptics of the ancient Greek Academy who, viewing the problem of knowledge as insoluble, proposed that, when controversy arises, an attitude of noninvolvement should be adopted in order to gain peace of mind for daily living.

The term has been employed in the 20th century by Edmund Husserl, the founder of Phenomenology, who saw it as a technique, more fundamental than that of abstraction and the examination of essences, that serves to highlight consciousness itself. The philosopher should practice a sort of Cartesian doubt, methodic and tentative, in regard to all commonsensical beliefs; he should put them, and indeed all things of the natural-empirical world, in "brackets," subjecting them to a transcendental suspension of conviction—to *epochē*. Without ceasing to believe in them, he should put his belief out of action in order to focus upon the sheer appearances of houses, trees, and men, which then become tantamount to the existence of his awareness of them. Thus, consciousness itself is immune from the *epochē* that dissolves its objects. The *epochē* has done its work, however, as soon as consciousness has been made manifest to his inner perception, for only then can consciousness be subjected to the same generalizing abstraction and examination of essence that had been applied to its objects. Thus, a pure phenomenology is produced that supplements the ontologies (theories of being) for special areas and explains how their objects appear or are given.

Eporedia (ancient Roman district and town, Italy): *see* Ivrea.

EPP (biology): *see* end-plate potential.

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

Epping Forest, district, county of Essex, England, at the northeastern edge of Greater London. The original forest was a royal hunting ground that was gradually enclosed; only through opposition by holders of common rights was it in part saved in the Epping Forest Act of 1871. The remaining 5,600 ac (2,300 ha) passed to the care of the Corporation of the City of London.

The present district extends over 133 sq mi (345 sq km). The market town of Epping serves the area as a prosperous suburban shopping centre. Other modern suburbs within the district include Chigwell, Waltham Holy Cross, and Ongar. Pop. (1982 est.) 115,100.

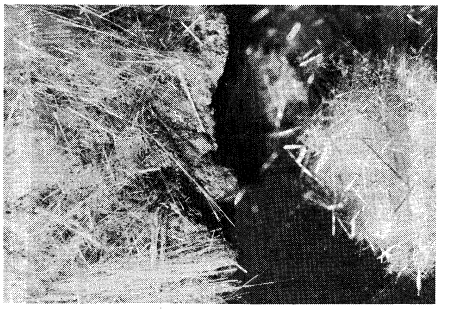
EPR: *see* electron paramagnetic resonance.

Epsilon Aurigae, binary star system including one of the largest known stars and having one of the longest periods (27 years) among eclipsing binaries. The diameter of Epsilon Aurigae B, a cool yellow star, has been estimated as thousands of times that of the Sun; if Epsilon Aurigae B occupied the Sun's place at the centre of the solar system, the Earth and even the remote planet Saturn would lie within the star.

Epsilon Aurigae A, a yellow-white star, is measured at about 200 solar diameters. The maximum apparent magnitude of the combination is about 3.0.

Epsom and Ewell, district (borough), county of Surrey, England, at the foot of the North Downs, on the western periphery of Greater London. It has an area of 13 sq mi (34 sq km). It became important with the discovery (*c.* 1618) of mineral springs (from which Epsom salts were named). Horse racing began there as early as the residence of James I (1603–1625) at Nonsuch Park, becoming permanent in 1730. The famous Epsom meeting, at which the main races are the Derby (1780) and the Oaks (1779), takes place in the first week of June. Many racing stables also use the chalk downs. The market town is now the shopping centre of a large suburban area. Pop. (1982 est.) 69,400.

epsomite, a common sulfate mineral, hydrated magnesium sulfate ($MgSO_4 \cdot 7H_2O$). Its deposits are formed by evaporation of mineral waters, as at Epsom, Surrey, Eng., where it was discovered in 1695. It also is found as crusts and efflorescences in coal or metal mines, in limestone caves, and in the oxidized zones of sulfide ore deposits. The purified compound is used in medicine as Epsom salts. For detailed physical and mineralogic properties, *see* sulfate mineral (table).



Epsomite from Hungary

By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard—EB Inc.

EPSP (biology): *see* excitatory postsynaptic potential.

Epstein, Sir Jacob (b. Nov. 10, 1880, New York City—d. Aug. 21, 1959, London), one of the leading portrait sculptors of the 20th century whose work, though seldom innovative, is widely heralded for its perceptive depiction of character and its modelling technique.

Epstein, 1949

EB Inc.

Epstein's early ambition was to be a painter, and he spent his adolescence sketching the teeming ghetto life of New York City, showing even then the obsession with human personality that distinguishes much of his mature work. Faulty eyesight forced him to abandon painting for sculpture, and after studying two years in Paris, he set up a sculpture studio in London in 1905. He soon began to make his way as a portrait sculptor, despite the public scandals caused by the nudity of his so-called Strand Statues (1907–08; destroyed 1937) and the debauched-looking angel on his memorial (1912) for the English writer Oscar Wilde.

In 1913, Epstein became a founding member of the London Group, a loose association of artists and writers promoting modern art in

England. Over the next two years, he developed a mildly experimental style that yielded some of his most powerful works, characterized by their extreme simplification of forms and calm surfaces. Most of these pieces were carved from stone, but the strongest work of the period, "The Rock Drill" (1913; Tate Gallery, London), was modeled in plaster, and its robotlike form reflects his short-lived interest in sleek, abstract design.

With the dissolution of the London Group in 1916, Epstein began to work in the two modes for which he is best-known. Works of the first mode, mostly religious and allegorical figures such as "Genesis" (1930) and "Ecce Homo" (1934–35), consisted of crude, brutal-looking forms carved directly into a megalith, often revealing the shape of the original block. The second mode, a multitude of bronzes cast from modeled clay, forms the bulk of his work. These brilliantly executed studies of the rich and the celebrated are characterized by subtle treatment of planes and richly agitated surfaces. At first used to accentuate the play of light on bronze, the rough surfaces were later exaggerated to such an extent that they bore little relationship to the sculptural mass and became merely decorative. Occasionally, he also made monumental bronzes, such as "St. Michael and the Devil" (1958; Coventry Cathedral, Coventry, Eng.). In his later years, Epstein became a vehement opponent of abstract sculptors. He was knighted in 1954.

Epstein–Barr virus, also called EB VIRUS, or EBV, a herpes virus that is the major cause of acute infectious mononucleosis, a common syndrome characterized by fever, sore throat, extreme fatigue, and swollen lymph glands.

EBV was first reported by British scientists M.A. Epstein, Y.M. Barr, and B.G. Achong, who found viruslike particles in cells grown from tissues involved with a newly described lymphatic cancer. The Epstein–Barr virus is known to be able to infect only two different types of cells in the body: some salivary gland cells and one special type of white blood cell. Virus that grows in the salivary gland cell is carried into the mouth in the stream of saliva. Saliva is the only bodily fluid that has been proved to contain infectious EBV particles. The type of white blood cell called the B lymphocyte can also carry Epstein–Barr virus. These highly specialized cells manufacture antibodies to help fight infections. Within the salivary gland the virus growth cycle is completed and infectious virus particles are generated; within the B lymphocytes, however, the virus growth cycle is abortive, and the EBV persists in the B lymphocyte in a partially replicated state for the life of the cell.

Even though the virus growth in the B cell is incomplete, the lymphocyte is permanently altered by the infectious process—*i.e.,* B cells take on growth characteristics that resemble those of cancerous lymphocytes. The affected B lymphocytes can multiply excessively to produce a cancer of the lymphatic system.

In the less-developed nations, infection with EBV occurs in almost all children before the age of five and is not associated with any symptoms, or certainly none typical of infectious mononucleosis. In industrialized nations about half of the people successfully avoid EBV infection through their late teens or early 20s. When EBV infection is delayed until the teenage or early adult years, the body seems to respond to it differently. In about two-thirds of these cases infection is asymptomatic or very mild. In the remaining one-third of the cases, infection causes infectious mononucleosis.

Other, rarer disorders have also been linked with Epstein–Barr virus. These include the African lymphoid cancer called Burkitt's lymphoma; nasopharyngeal carcinoma, a cancer of the nasal sinuses and throat that is common in southern China, Southeast Asia, northern Africa, and among Eskimos; and certain uncommon but severe neurological illnesses, including encephalitis (inflammation of the brain) and paralyses of various nerve groups (for example, Bell's palsy, which affects the facial nerve).

Recent scientific evidence suggests that some individuals who develop EBV infection do not recover within the usual time of days to weeks that is typical of acute infectious mononucleosis. They may partially recover but continue to experience fatigue, intermittent sore throats, tender lymph nodes, and feverishness. The association of this disorder—sometimes called chronic mononucleosis, chronic fatigue syndrome (CFS), or chronic Epstein–Barr virus (CEBV)—with the Epstein–Barr virus is still hypothetical.

There are no specific treatments for any form of EBV infection, and no vaccines have yet been developed.

epyllion, brief narrative poem in dactylic hexameter of ancient Greece, usually dealing with mythological and romantic themes. It is characterized by lively description, scholarly allusion, and an elevated tone similar to the elegy. Such poems were especially popular during the Greek Alexandrian period (*c.* 4th–3rd century BC), as seen in the works of Callimachus and Theocritus, although the term epyllion was not applied to them until the 19th century. Late Republican and early Augustan Latin poetry, such as Catullus' poem on the marriage of Pythius and Thetis and Ovid's *Metamorphoses* (*c.* AD 1–8), reflect the influence of the epyllion, as do the troubadour songs of the Middle Ages and modern Greek Klephtic songs.

equal-field system, Chinese (Wade–Giles romanization) CHÜN-T'IEN, Pinyin JUNTIAN, official institution of land distribution and tax collection in traditional China and Japan. The system originated in China in AD 485 by order of the emperor Hsiao-wen ti of the Northern Wei dynasty. It provided for the assignment of agricultural lands to all adult peasants and thereby slowed the accumulation of lands by wealthy families. During the Northern Wei a man and wife were entitled to a total of about 140 *mou* (about 20 acres [8 hectares]), of which a small part was irrevocably held by them; the remaining land was returned to the government upon their deaths. During the Sui and T'ang periods (581–907) the system was enforced throughout the country and became the most important fiscal institution of the central government. Each adult between the ages of 21 and 59 was given 100 *mou* (about 15 acres [6 hectares]), of which one-fifth was permanently owned. A fixed amount of produce from the land was subsequently paid as tax in kind to the government. The greatest allotment of land was limited to 100 *ch'ing* (10,000 *mou*) and was reserved only for the most highly ranked of the great families. The system gradually declined with the swift growth in population (early 8th century), as most peasants increasingly inherited less than 100 *mou,* and most landholdings came to be permanently held and not redistributed. Most of the better lands were then acquired by wealthy families, and the original per capita tax system declined rapidly. After the collapse of the system during Hsüan-tsung's reign (712–756), it was not reinstituted except on a local scale.

The equal-field system was applied in Japan as a result of the Taika reforms (AD 646) but declined in the Nara period (710–784), when both nobles and monasteries were given additional land allotments and tax-free status.

equal protection, in U.S. law, the constitutional guarantee that no person or group will be denied that protection under the law which is enjoyed by similar persons or groups—*i.e.,* persons similarly situated must be similarly treated. Equal protection is extended when the rules of law are applied equally in all like cases and when persons are exempt from obligations greater than those imposed upon others in like circumstances. In the United States, the Fourteenth Amendment to the Constitution, one of three post-Civil War amendments, prohibits states from denying any person "the equal protection of the laws."

Traditionally, until the 1960s, the Supreme Court held that the postwar amendments had but one purpose: to guarantee "the freedom of the slave race . . . and the protection of the newly-made freeman and citizen from the oppressions of those who had formerly exercised unlimited domination over him." Thus, the equal-protection clause of the Fourteenth Amendment was applied minimally, except in cases of racial discrimination. As late as 1927, in *Buck* v. *Bell,* Justice Oliver Wendell Holmes referred to equal protection as "the usual last resort of constitutional arguments."

In the 1960s, however, the court under Chief Justice Earl Warren dramatically transformed the concept of equal protection, applying it to cases involving welfare benefits, exclusionary zoning, municipal services, and school financing. Equal protection became a prolific source of constitutional litigation. Under Chief Justice Warren E. Burger the court added considerably to the list of situations that might be adjudicated under the doctrine of equal protection, including sexual discrimination, status and rights of aliens, and legitimacy of birth.

Equal Rights Amendment (ERA), a proposed but unratified amendment to the U.S. Constitution that was designed mainly to invalidate many state and federal laws that discriminate against women; its central underlying principle was that sex should not determine the legal rights of men or women.

The text of the proposed amendment stated that "Equality of rights under the law shall not be denied or abridged by the United States or by any State on account of sex" and further that "the Congress shall have the power to enforce, by appropriate legislation, the provisions of this article." The amendment was first introduced to Congress in 1923, shortly after women in the United States were granted the right to vote, and it was finally approved by the U.S. Senate 49 years later, in March 1972. It was then submitted to the state legislatures for ratification within seven years but, despite a deadline extension to June 1982, was not ratified by the requisite majority of 38 states. It would have become the 27th Amendment to the Constitution.

Although the ERA gained ratification of 30 states within one year of its Senate approval, mounting intense opposition from conservative religious and political organizations effectively brought ratification to a standstill. The main objections to the ERA were based on fears that women would lose privileges and protections such as exemption from compulsory military service and combat duty and economic support from husbands for themselves and their children.

Advocates of the ERA, led primarily by the National Organization for Women (NOW), maintained, however, that the issue was mainly economic. NOW's position was that many sex-discriminatory state and federal laws perpetuated a state of economic dependence among a large number of women and that laws determining child support and job opportunities should be designed for the individual rather than for one sex. Many advocates of the ERA believed that the failure to adopt the measure as an amendment would cause women to lose many gains and would give a negative mandate to courts and legislators regarding feminist issues.

equal temperament, also called WELL-TEMPERED TUNING, in music, tuning system in which the octave is divided into 12 semitones of equal size. Because it enables keyboard instruments to play in all keys, the system replaced earlier tuning systems in France and Germany by the late 18th century and in England by the 19th; before its use on keyboard instruments, it was used for fretted instruments, such as the lute.

Although Andreas Werckmeister, a German organist and theorist, is usually credited with devising the system in about 1700, he was preceded by the physicist Marin Mersenne in 1685 and, outside Europe, by the Chinese prince Chu Tsai-yü in 1596. The Florentine music theorist Vincenzo Galilei (father of the astronomer Galileo) proposed a very similar system in 1581. In addition, equal temperament was approximated in various degrees in the minor tuning adjustments made by organ tuners and harpsichordists. Johann Sebastian Bach's *The Well-Tempered Clavier* (1722, 1744) may well have been written for such a "practical tuner's" system.

In equal temperament, each semitone is measured at 100 cents (1 cent = $^1/_{1200}$ octave). Because tuning is calculated by dividing up the octave into smaller units, equal temperament is a divisive system; earlier European systems were cyclic—*i.e.,* they calculated new intervals by adding together previously determined intervals. In equal temperament, a fifth, such as C–G, is imperceptibly narrower than the fifth found in the natural harmonic series (*see* overtone) by 2 cents; but it is not as much smaller than the fifth used in the previous tuning system, meantone temperament. The interval of a third in meantone tuning is pure, or natural; in equal temperament, it is noticeably wider (14 cents). *Compare* meantone temperament.

equation of ———: *see under* substantive word (*e.g.,* state, equation of).

equator, great circle around the Earth that is everywhere equidistant from the geographic poles and lies in a plane perpendicular to the Earth's axis. This geographic, or terrestrial, equator divides the Earth into the Northern and Southern hemispheres and forms the imaginary reference line on the Earth's surface from which latitude is reckoned; in other words, it is the line with 0° latitude.

In astronomy, the celestial equator is the great circle in which the plane of the terrestrial equator intersects the celestial sphere; it consequently is equidistant from the celestial poles. When the Sun lies in its plane, day and night are everywhere of equal length, a twice-per-year occurrence known as equinox.

equatorial convergence zone (meteorology): *see* intertropical convergence zone.

equatorial countercurrent, current phenomenon noted near the equator, an eastward flow of oceanic water in opposition to and flanked by the westward equatorial currents of the Atlantic, Pacific, and Indian oceans. Lying primarily between latitude 3° and 10° N, the countercurrents shift south during the northern winter and north during the summer. To either side the trade winds blow constantly and push great volumes of water westward in the equatorial currents, raising the sea level in the west. Within the doldrums, where strong constant winds are absent, the higher western sea levels flow downslope to the east. The Pacific Equatorial Countercurrent is very strong and is definable year-round. The Atlantic Equatorial Countercurrent is strongest off the coast of Ghana (Africa), where it is known as the Guinea Current. The countercurrent of the Indian Ocean flows only during the northern winter and only south of the equator.

equatorial current, ocean current flowing westward near the equator, predominantly controlled by the winds. Characteristically, equatorial-current systems consist of two westward-flowing currents approximately 600 miles (1,000 km) wide (North and South equatorial currents) separated by an eastward-flowing countercurrent only 300 miles (480 km) wide. Usually flowing at depths of less than 1,650 feet (500 m), equatorial currents travel at rates of 10 to 40 inches per second (25 to 100 cm per second). Equatorial undercurrents, centred on the equator at depths of 160 to 500 feet (49 to 152 m), flow eastward at rates up to 5 feet/s (1.5 m/s) and are approximately 1,000 feet (305 m) deep and 640 miles (1,030 km) wide.

The Pacific South Equatorial Current, flowing approximately between latitude 5° N and 15°–20° S, is propelled westward by the Southeast Trade Winds to about longitude 180° E. There it splits, part turning north to blend with the countercurrent and the rest veering south to become the East Australian Current and a flow passing east of New Zealand. The latter feeds the South Pacific Current and West Wind Drift, which move eastward to the Peru Current. The Peru Current flows north as a source of the Pacific South Equatorial Current.

The Pacific North Equatorial Current is given a westward impetus by the Northeast Trade Winds (latitude 10°–25° N). Upon reaching the Philippines, the current divides, with the lesser part turning south and then east to start the Pacific Equatorial Countercurrent, and the greater part flowing north. This flow, known as the Kuro Current, moves north as far as Japan, then east as the North Pacific Current (West Wind Drift), part of which then turns south as the California Current, which joins the equatorial countercurrent to form the Pacific North Equatorial Current.

The Atlantic South Equatorial Current is pushed westward by the Southeast Trade Winds (latitude 0°–20° S). Approaching Cape St. Roque, Brazil, it divides. One stream goes north as the Guiana Current, which in turn feeds the Caribbean Current, the equatorial countercurrents, and the Guinea Current. The other, moving south as the Brazil Current, turns east off the Río de la Plata (as the South Atlantic Current) then pushes to the African coast, where it veers north as the Benguela Current. This joins the Guinea Current to reform the Atlantic South Equatorial Current.

The Atlantic North Equatorial Current is pushed westward by the Northeast Trade Winds between latitude 10° and 20° N. Fed in part by the South Atlantic Equatorial, it turns north as the Antilles, Caribbean, and Florida currents, which eventually become the Gulf Stream. Some of the Gulf Stream's waters eventually arc southward as the Azores and Canary currents, which swing west to join upwelling water off the west coast of North Africa. This gives birth to the Atlantic North Equatorial, which, as it crosses the Mid-Atlantic Ridge, jogs north only to bend south beyond the ridge.

In the Indian Ocean the place of a north equatorial current is taken by the Monsoon Current. There is, however, an Indian South Equatorial Current. Flowing westerly with the trades north of latitude 22° S, it divides to form the East Africa Coastal Current, moving northward, and a south-flowing stream. The latter passes by Madagascar as the Mozambique (west) and Mascarene currents, which become the Agulhas Current. At the Cape of Good Hope this feeds east into the South Indian Current, which supplies the West Australian Current. The latter is a source of the Indian South Equatorial Current.

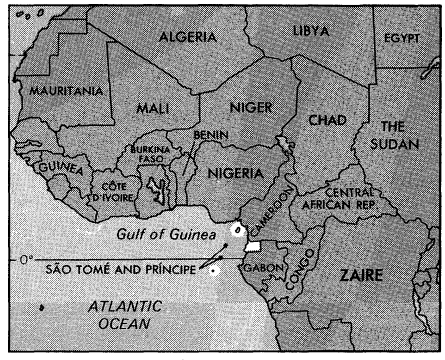
The equatorial currents have similar climatic effects upon continental shores they touch, bringing warmth and higher humidity to the east coasts and dry conditions to the west.

Equatorial Guinea, officially REPUBLIC OF EQUATORIAL GUINEA, Spanish REPÚBLICA DE GUINEA ECUATORIAL, republic on the west coast of equatorial Africa, covering a total land area of 10,830 square miles (28,051 square km), including the island of Bioko (Fernando Po). Bordered by Cameroon to the north and Gabon to the east and south, Equatorial Guinea's continental region, called Río Muni, is separated by the Bight of Biafra (the innermost bay of the Gulf of Guinea) from the country's main island area of Bioko to the northwest. The capital, Malabo (formerly Santa Isabel), is on Bioko. The population in 1990 was estimated to be 351,000.

A brief treatment of Equatorial Guinea follows. For full treatment, *see* MACROPAEDIA: Western Africa.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. The coastal plain (12 miles [20 km] wide) of the continental region abuts coastal hills leading to inland plateaus that rise eastward toward the frontier with Gabon. The continental region is divided by the Benito River, which runs generally from east to west. The coast consists of a long stretch of beach with low cliffs toward Kogo to the south. The island of Bioko consists of three extinct vol-



Equatorial Guinea

canic cones and has several crater lakes and rich lava soils; in the north, one of the extinct volcanoes rises to an elevation of 9,869 feet (3,008 m). The southern part of the island consists of rugged ranges indented by torrents having unexploited hydroelectric potential.

Both the mainland region and Bioko have a humid tropical climate and a modest dry season. The rainfall of the coastal continental region ranges between about 95 and 180 inches (2,400 and 4,600 mm) a year; less rain falls in the interior and during the months from June to August. Bioko has a very rainy, debilitating climate with a slightly drier period from November to March. The remainder of the year on Bioko is wet, cloudy, and very warm. The average yearly temperature in the country is a constant 79° F (26° C).

Dense tropical-rain-forest vegetation prevails throughout the continental region and includes okume (*Aucoumea klaineana*), African walnut, and various mahoganies. Animal life, including gorilla, chimpanzee, monkey, leopard, elephant, and crocodile, has been decimated by overhunting. Bioko has mangrove swamps along the coast and no big game.

The people. The majority of the population are the Bantu-speaking Fang people. They represent nearly nine-tenths of the population on the mainland and a growing number on Bioko. The original inhabitants of Bioko are the Bubi, descendants of Bantu migrants from the mainland. In addition to these two main groups, there are a number of smaller Bantu-speaking tribes along the coast of the mainland and also, on Bioko, the descendants of former slaves liberated by the British during the 19th century.

Spanish is the official language of Equato-

rial Guinea. Pidgin English is used in local commerce and is spoken widely on Bioko, and each ethnic group also speaks its own language. About four-fifths of the population is nominally Roman Catholic; however, the Bubi retain traditional forms of worship. The only Muslims are a few Hausa traders.

More than three-fourths of the population of Equatorial Guinea lives in the continental region and is generally evenly dispersed. The population of Bioko is predominantly urban, most people living in Malabo. Bata is the chief urban centre of the continental region.

Equatorial Guinea's population is growing more slowly than that of most other countries in western Africa; the country's birth rate is somewhat lower, and its death rate is somewhat higher. Because of political repression, substantial emigration from the country also occurred during the 1970s, including most of the numerous Nigerian migrant workers employed on the cocoa plantations on Bioko. It is estimated that about one-third of the country's total population now lives in exile.

Economy. Equatorial Guinea has a mixed, developing economy based largely on agriculture. Economic conditions, seriously deteriorated in the late 1970s, improved somewhat after the ouster of a dictatorial president in 1979. Severe shortages of both skilled labour and capital are major obstacles to economic recovery, however. The gross national product (GNP) per capita, which dropped considerably in the late 1970s from an already low level, is one of the lowest in Africa.

Agriculture accounts for more than half of the GNP and employs some 85 percent of the labour force. Cacao, timber, and coffee are the country's only exports, with cacao accounting for the major share. Cacao was grown by Europeans (mainly Spaniards) and Nigerian contract workers on Bioko prior to independence, and, after the expulsion or departure of most foreigners in the early and mid-1970s, production declined drastically. The heavily mechanized timber industry on the mainland also suffered with the departure of European investment funds and management skills. Cacao and timber output increased substantially after the 1979 coup because of the new government's revitalization efforts, but neither has returned to the production levels before independence. Coffee is grown mainly along the Cameroon border on the mainland. Other crops are bananas grown on Bioko, palm oil from the continental region, and cassava.

The fishing industry, which was formerly Soviet-controlled, is being developed by Spain, Nigeria, and Morocco under agreements negotiated in the early 1980s. Petroleum was discovered offshore of the mainland, and commercially exploitable quantities of gold, iron ore, manganese, and uranium are thought to exist inland.

Industry accounts for only a tiny percentage of the country's GNP and is limited to the processing of agricultural products. Electricity shortages have been recurrent since independence. The country's fairly extensive road network is not well kept up. Malabo, the main harbour, has been rehabilitated by a French firm and has regular services to Europe. Bata harbour on the mainland was also modernized by French contractors. International air service is provided by Iberia and Cameroon airlines.

Despite the headway made since 1979, Equatorial Guinea remains heavily dependent on international aid, primarily from the International Monetary Fund, Spain, and France. Signs of political instability have effectively blocked foreign investment and foreign labour despite government efforts to attract them, and the country's economic progress hinges mainly on its good relations with Spain and France.

Government and social conditions. Equatorial Guinea is a western African republic governed by a 17-member Supreme Military Council following a 1979 coup. A new constitution was drafted by a government commission with assistance from the United Nations and was adopted in 1982. It created an elected National Assembly vested with legislative responsibility, a Council of State, and a National Council for Economic and Social Development. The Council of State approves candidates for presidential elections. Equatorial Guinea's military force, recently reorganized into an army, navy, and air force, receives aid and training from Spain.

Health conditions of Equatorial Guinea are generally poor; average life expectancy is about 44 years for males and 48 years for females. The infant mortality rate is above average for sub-Saharan Africa. Malnutrition is common, and most of the people suffer from malaria at some point during their lives. These health problems are aggravated by poor sanitary conditions and a severe shortage of medical personnel in the country. In the early 1980s, massive preventive health measures were initiated in primary schools and towns.

Equatorial Guinea's education system offers compulsory education for children between 6 and 14 years of age. It is estimated, however, that only about 70 percent of the school-age children attend primary school and only a small percentage advance to secondary school. The Spanish National University of Distant Education operates centres for higher education at Malabo and Bata. Additionally, some Equatorial Guineans go abroad (primarily to Spain and France) to pursue higher education.

The government controls the news media, including several daily (Spanish-language) newspapers, radio stations, and a television station.

Cultural life. Despite a veneer of Spanish culture and Roman Catholic religion, Equatorial Guineans' lives are largely influenced by traditional customs that have undergone a revival since independence. Among the Fang of the continental region, witchcraft, traditional music, and storytelling are important parts of their lives.

History. The first inhabitants of the mainland region appear to have been Pygmies. The now-prominent Fang and Bubi reached to the mainland region and Bioko (then Fernando Po), respectively, in the 17th- and 19th-century migrations of Bantu-speaking peoples. Equatorial Guinea was within the vast area ceded by the Portuguese to the Spanish in the late 18th century; it was frequented by slave traders, as well as by British, German, Dutch, and French merchants.

Bioko was administered by British authorities from 1827 to 1858 before the official takeover by the Spanish. The mainland (Río Muni) was not effectively occupied by the Spanish until 1926.

Through the early and mid-20th century, Spanish Guinea, as it was then called, was exposed to the paternalism of the Spanish government and the Roman Catholic church. The contribution of foreign workers enabled the colony to become an important cocoa and timber producer.

Independence was declared in 1968, followed by a reign of terror and economic chaos engendered by the dictatorial president Macías Nguema, who was overthrown in 1979 and later executed. Equatorial Guinea, under its new leadership, is attempting to develop democratic social and political norms and its economy.

eques (Latin: "horseman"), plural EQUITES, in ancient Rome, a knight, originally a member of the cavalry and later of a political and administrative class as well as of the equestrian order. In early Rome the equites were drawn from the senatorial class and were called *equites equo publico* ("horsemen whose mounts were provided for by the public"). They were the most influential members of the voting assembly called the Comitia Centuriata. From the beginning of the 4th century BC, nonsenators were enlisted in the cavalry; they provided their own horses (*equites equo privato*). By the 1st century BC, foreign cavalry tended to replace them in the field and thus to restrict the equestrian order to posts as officers or members of the general's staff. By this time the equites had become a class distinct from the senators. Unlike senators they were legally free to enter the fields of commerce and finance. Known as *publicani,* those who were businessmen enriched themselves by securing contracts to supply the army and to collect taxes and by exploiting public lands, mines, and quarries in the provinces. In this way the equites became a prosperous business and landowning class, eventually forming a third political group, along with the *optimates* and *populares,* whom they occasionally rivaled in the growing power struggle in Rome.

Augustus, the first emperor (reigned 27 BC–AD 14), reorganized the equestrian order as a military class, thus removing it from the political arena. The emperor appointed its members (under the republic they had been appointed by the censor). Qualifications for membership were free birth, good health and character, and sufficient wealth. Senators' sons were eligible by right of birth but lost this title on admittance to the Senate. In an equestrian career a number of subordinate military posts were obligatory, although dependent on nomination by the emperor. A purely civil career became possible in the 1st century AD as the equites expanded into the imperial household much like modern civil servants. Their business background and connection with public finances seemed particularly to qualify them for the role of imperial agents in the financial administration of the provinces. They also held military authority in Egypt and in some of the smaller provinces.

Equiano, Olaudah (b. *c.* 1750, Benin, kingdom of Benin—d. April/May 1797, England), west African sold into slavery and later freed, whose autobiography, *The Interesting Narrative of the Life of Olaudah Equiano, or Gustavus Vassa, the African* (1789), with a strong abolitionist stance and an interesting and detailed description of life in Benin, was so popular that by 1794 it had run through eight English editions and one in the United States.

Captured at age 12, Equiano was taken to the West Indies, where he traveled widely with his master and received some education before he was freed. Once in England he became an active abolitionist, agitating and lecturing against the cruelty of British slave owners in Jamaica, and in 1787 he was appointed commissary aboard the *Vernon,* which was carrying 500 to 600 freed slaves to Freetown, Sierra Leone, to establish a settlement there. Publication of his autobiography was aided by British abolitionists who were collecting evidence on the sufferings of slaves. In that book and in later *Miscellaneous Verses . . .*, he idealizes his African past and shows a great pride in his race while attacking those Africans who trafficked in slavery (a perspective further shown by his setting forth not only the injustices and humiliations of his fellow slaves but also the kindness of his own master and of English women who befriended him). As a whole, Equiano's work shows both broad human compassion and realism. His autobiography was reissued in 1966 with an introduction and detailed notes.

equilibrium, in physics, condition in which the resultant or vector sum of all forces acting upon a particle is zero. A rigid body (by definition distinguished from a particle in having the property of extension) is considered to be

in equilibrium if, in addition, the algebraic sum of the moments of the force components, both translational and rotational, along or about each of three mutually perpendicular axes chosen with respect to the body, is equal to zero. Thus, the body in equilibrium experiences neither linear acceleration nor angular acceleration and, unless disturbed by an outside force, will continue in that condition indefinitely. An equilibrium is said to be stable if small, externally induced displacements from that state produce forces that tend to oppose the displacement and return the body or particle to the equilibrium state. Examples include such systems as a pendulum or a brick lying on a level surface. An equilibrium is unstable if the least departures produce forces tending to increase the displacement. An example is furnished by a ball bearing balanced on the edge of a razor blade.

equilibrium, chemical: *see* chemical equilibrium.

equine, one of the mammal family of Equidae (order Perissodactyla) that includes the modern horses, zebras, and asses, as well as more than 60 species known only from fossils.

All six modern members of the family are placed in the genus *Equus.* Only the races of *E. caballus* (including the myriad domestic strains) are called horses; three species (*E. zebra, E. burchelli,* and *E. grevyi*) are called zebras; and two (*E. asinus* and *E. hemionus*) are usually called wild asses.

Wild horses once inhabited much of northern Eurasia, primarily in open areas. They were rather small, short-legged animals, compared with their domesticated descendants, standing only about 120 to 130 cm (47 to 51 inches) at the shoulder. In the two millennia BC, horses from many wild populations were domesticated; often the remainder of the wild individuals were exterminated. By the early 19th century, two races were still extant: the tarpan (*E. caballus caballus*), found in eastern Europe until the middle of the century, and Przewalski's horse (*E. caballus przewalskii,* often considered a distinct species, *E. przewalskii*), which inhabited the remote steppe region between China and Mongolia.

The North American wild horses are descendants of domestic horses that escaped or were released during the early colonial days. *See also* ass; horse; Przewalski's horse; tarpan; zebra.

equine encephalitis, also called EQUINE ENCEPHALOMYELITIS, severe viral disease of horses and mules. It sometimes affects birds, reptiles, and humans.

Of the several strains of the virus, the most prevalent are the A group, which includes the Eastern, Western, and Venezuelan strains, and the B group, which includes the Japanese and St. Louis strains. The virulent Western type has a mortality as high as 90 percent in horses and 10 percent in humans.

Immunity lasting one year is conferred by recovery from the disease or by vaccination with killed vaccine. Birds appear to harbour the disease but do not exhibit any definite symptoms. The mosquito transmits the virus from birds to horses, mules, or humans. Other animals may be infected in the same way but not show symptoms. Sheep and cats appear to be resistant.

Symptoms in horses include disturbances in equilibrium, high fever, incoordination, and paralysis; those in humans include headache, drowsiness, sweating, and mental confusion. Because of the symptoms the disease is often mistakenly called sleeping sickness. Treatment is aimed at making the victim comfortable. The disease can cause permanent brain damage. Control centres on eradication of mosquito carriers and the use of vaccines against the Eastern and Western strains.

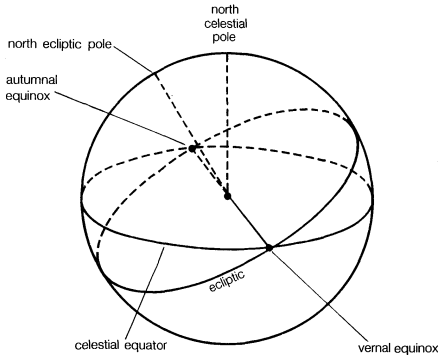
equine infectious anemia (EIA), also called SWAMP FEVER, viral disease of horses. Symptoms, which appear about two weeks after exposure, include fever and rapid breathing; the animal shifts its weight from one leg to another because of weakness during an attack. An attack lasts three to five days. In the chronic form the fever recurs at intervals that vary from days to months. The affected animal is apt to have a shaggy coat, to be thin, weak, and sluggish, and to have legs swollen with dropsy. An asymptomatic animal may carry the virus. Human infection, although rare, has been reported.

equine plague: *see* African horse sickness.

equine respiratory disease, a complex of infections of viral origin, including equine viral rhinopneumonitis (viral abortion), equine viral arteritis, equine influenza and parainfluenza, and equine rhinovirus infection. The diseases are clinically indistinguishable. All cause fever, coughing, and respiratory difficulty; some cause abortion in mares. Treatment includes rest and supportive care. Secondary infections from bacteria, which may create more serious illness, can be prevented by use of drugs.

equinoctial storm, severe storm that, in the United Kingdom and North America, is popularly believed to accompany the vernal and autumnal equinoxes. The equinoxes do not actually cause any storms, but sometimes unusually violent weather does occur at those times of the year, caused by the seasonal northward or southward shifts of air masses. The belief also may have originated with sailors who observed that West Indian hurricanes occur most often around the autumnal equinox.

equinox, either of the two moments in the year when the Sun is exactly above the equator and day and night are of equal length; also, either of the two points in the sky where the ecliptic (the Sun's annual pathway) and the celestial equator intersect. The vernal equinox, marking the beginning of spring in the Northern Hemisphere, occurs about March 21, when the Sun moves north across the celestial equator. The autumnal equinox falls about September 23, as the Sun crosses the celestial equator going south.



Celestial sphere showing the positions of the equinoxes

Some astronomical coordinates—*e.g.,* right ascension and celestial longitude—are measured from the vernal equinox. It is sometimes called the first point of Aries because it was at the beginning of that constellation some 2,000 years ago. The term is still used, though precession of the equinoxes has moved the vernal equinox into Pisces.

equinoxes, precession of the, motion of the equinoxes along the ecliptic (the plane of the Earth's orbit) caused by the cyclic precession of the Earth's axis of rotation.

In compiling his famous star catalog (completed in 129 BC), the Greek astronomer Hipparchus noticed that the positions of the stars were shifted in a systematic way from earlier Babylonian (Chaldean) measures. This indicated that it was not the stars that were moving but rather the observing platform—the Earth. Such a motion is called precession and consists of a cyclic wobbling in the orientation of the Earth's axis of rotation with a period of almost 26,000 years. Precession was the third-discovered motion of the Earth, after the far more obvious daily rotation and annual revolution. Precession is caused by the gravitational influence of the Sun and the Moon acting on the Earth's equatorial bulge. To a much lesser extent, the planets exert influence as well.

The projection onto the sky of the Earth's axis of rotation results in two notable points at opposite directions: the north and south celestial poles. Because of precession, these points trace out circles on the sky. Today, the north celestial pole points to within just 1° of the arc of Polaris. It will point closest to Polaris in AD 2017. In 12,000 years the north celestial pole will point about 5° from Vega. Presently, the south celestial pole does not point in the vicinity of any bright star.

Also moving with this wobble is the projection onto the sky of the Earth's equator. This projection, a great circle, is called the celestial equator. The celestial equator intersects another useful great circle, the ecliptic. As the Earth orbits the Sun, the constantly changing direction from which we view the Sun causes it to trace out the ecliptic. The celestial equator is inclined at a 23.5° angle to the ecliptic (the so-called obliquity of the ecliptic). The celestial equator and the ecliptic intersect at two points called the equinoxes (vernal and autumnal). During the course of the year, as the Earth orbits the Sun, the latter is seen crossing the equator twice, in March moving from the Southern Hemisphere into the Northern Hemisphere and in September moving in the opposite direction. The equinoxes drift westward along the ecliptic at the rate of 50.2 arc-seconds annually as the celestial equator moves with the Earth's precession.

equipartition of energy (mathematics): *see* energy, equipartition of.

Equisetum (plant genus): *see* horsetail.

equites (ancient Rome): *see* eques.

equity, in Anglo-American law, the custom of courts outside the common law or coded law. In origin, equity provided remedies in situations in which precedent or statutory law might not apply or be equitable.

By the end of the 13th century the English king's common-law courts had largely limited the relief available in civil cases to the payment of damages and to the recovery of the possession of property. They had refused to extend and diversify their types of relief so as to meet the needs of new and more complex situations. Disappointed litigants had turned to the king with petitions for justice because the courts had afforded either no remedy or one that was ineffective. These petitions were referred to the lord chancellor, who was the king's principal minister. By the early years of the 14th century the petitions were going directly to the chancellor, and by the middle of that century the Chancery was recognized as a new and distinct court.

The developments thus initiated resulted in the fashioning by the chancellor of new equitable remedies. The following are representative: specific performance of contract, whereby the victim of a breach might compel the exact performance promised if damages would be a poor substitute, as in contracts to sell land and unique chattels; the enforcement of trusts, where one who had been given title to property in order to manage it for another was

required to fulfill his fiduciary obligations; injunction to prevent threatened or continuing wrong, such as destruction of the plaintiff's invaluable shade trees; restitution of benefits wrongfully acquired, by compulsory surrender of the ill-gotten gains, in order to prevent unjust enrichment; the correction and cancellation of written instruments for mistake and misrepresentation; and the equity of redemption, which enabled a defaulting mortgagor to reclaim his land if he tendered principal and interest within a reasonable time after forfeiture and before foreclosure. Such new equitable remedies contrasted with the narrow rigidity of the common-law remedies.

The full growth of the equitable remedies was retarded, however, by political pressures from the judges and Parliament not to trespass upon the province of the separate law courts. As a result, the chancellor was forced to agree not to hear any case in which there was an adequate remedy (usually damages) at law. In some situations (*e.g.*, the trust) the courts of law afforded no remedy. Where they did, as in cases of breach of contract and tort (wrongs other than breach of contract and crime), specific relief could not be obtained unless the remedy at law was inadequate or the threatened injury would be irreparable.

Another restrictive influence was the development in the Chancery of a system of precedent. For generations the chancellors had not considered themselves bound by precedents or rules of law; emphasis had been put mainly upon the discretionary treatment of needs of the individual case. From the mid-16th century on, however, the chancellors were usually common lawyers, who began shaping equity into an established set of rules. By the middle of the 17th century the equity administered by the Court of Chancery had become a recognized part of the law of the land: equity gave justice according to law rather than executive justice. Finally, by the Judicature Act of 1873, the competitive, separate law and equity courts, with their attendant delays, expense, and injustices, were abolished and their work combined in a single, departmentalized Supreme Court of Judicature.

Courts of equity also developed early in the United States; but in the late 19th and early 20th centuries most U.S. courts similarly abolished the distinctions between actions at law and suits in equity and fused their administration in one procedural system, with but one civil action, in the same court.

Modern equity has been much assisted by legislation. The old notion that equity protects only property rights has been virtually abandoned. Now an employee, for example, can be barred from competing with his employer after discharge or resignation. Statutes have facilitated specific performance of cooperative-marketing contracts and agreements to arbitrate future commercial or labour disputes. An injunction may now be had, where other factors of appropriateness permit, against threatened injury to interests of personality, such as civil liberties, privacy, reputation, and domestic relations. Enabling legislation has immensely increased the resort to injunction by government agencies, especially to prevent violation of regulatory statutes, notwithstanding criminal penalties.

equivalence, also called EQUIVALENCE OF PROPOSITIONS, in logic and mathematics, the formation of a proposition from two others which are linked by the phrase "if, and only if." The equivalence formed from two propositions p and q also may be defined by the statement "p is a necessary and sufficient condition for q."

equivalence principle, fundamental law of physics that states that gravitational and inertial forces are of a similar nature and often indistinguishable. In the Newtonian form it asserts, in effect, that, within a windowless laboratory freely falling in a uniform gravitational field, experimenters would be unaware that the laboratory is in a state of nonuniform motion. All dynamical experiments yield the same results as obtained in an inertial state of uniform motion unaffected by gravity. This was confirmed to a high degree of precision by an experiment conducted by the Hungarian physicist Lóránt Eötvös. In Einstein's version, the principle asserts that in free-fall the effect of gravity is totally abolished in all possible experiments and general relativity reduces to special relativity, as in the inertial state.

equivalent weight, in chemistry, the quantity of a substance that exactly reacts with, or is equal to the combining value of, an arbitrarily fixed quantity of another substance in a particular reaction. Substances react with each other in stoichiometric, or chemically equivalent, proportions, and a common standard has been adopted. For an element the equivalent weight is the quantity that combines with or replaces 1.00797 grams (g) of hydrogen or 7.9997 g of oxygen; or, the weight of an element that is liberated in an electrolysis (chemical reaction caused by an electric current) by the passage of 96,500 coulombs of electricity. The equivalent weight of an element is its gram atomic weight divided by its valence (combining power). Some equivalent weights are: silver (Ag), 107.868 g; magnesium (Mg), 24.312/2 g; aluminum (Al), 26.9815/3 g; sulfur (S, in forming a sulfide), 32.064/2 g. For compounds that function as oxidizing or reducing agents (compounds that act as acceptors or donors of electrons), the equivalent weight is the gram molecular weight divided by the number of electrons lost or gained by each molecule; *e.g.*, potassium permanganate ($KMnO_4$) in acid solution, 158.038/5 g; potassium dichromate ($K_2Cr_2O_7$), 294.192/6 g; and sodium thiosulfate ($Na_2S_2O_3 \cdot 5H_2O$), 248.1828/1 g. For all oxidizing and reducing agents (elements or compounds) the equivalent weight is the weight of the substance that is associated with the loss or gain of 6.023×10^{23} electrons. The equivalent weight of an acid or base for neutralization reactions or of any other compound that acts by double decomposition is the quantity of the compound that will furnish or react with or be equivalent to 1.00797 g of hydrogen ion or 17.0074 g of hydroxide ion; *e.g.*, hydrochloric acid (HCl), 36.461 g; sulfuric acid (H_2SO_4), 98.078/2 g; sodium hydroxide (NaOH), 74.09/2 g; sodium carbonate (Na_2CO_3), 105.9892/ 2 g.

The equivalent weight of a substance may vary with the type of reaction it undergoes. Thus, potassium permanganate reacting by double decomposition has an equivalent weight equal to its gram molecular weight, 158.038/1 g; as an oxidizing agent under different circumstances it may be reduced to the manganate ion (MnO_4^{2-}), to manganese dioxide (MnO_2), or to the manganous ion (Mn^{2+}), with the equivalent weights of 158.038/1 g, 158.038/3 g, and 158.038/5 g, respectively. The number of equivalent weights of any substance dissolved in one litre of solution is called the normality of that solution.

Equus przewalskii: *see* Przewalski's horse.

era, a very long span of geological time; in formal usage, a portion of geological time of the greatest magnitude. Three eras are recognized: Paleozoic Era, Mesozoic Era, and Cenozoic Era. Because of the difficulties involved in establishing accurate chronologies, the Precambrian, or earliest, eras are classified independently. An era is composed of one or more geological periods. The stratigraphic, or rock, term that corresponds to "era" is "erathem."

ERA: *see* Equal Rights Amendment.

Era of ———: *see under* substantive word or words (*e.g.*, Good Feeling[s], Era of).

Érard, Sébastien (b. April 5, 1752, Strasbourg, Fr.—d. Aug. 5, 1831, near Passy), French piano and harp maker whose improvements in both instruments were largely responsible for their modern forms.

The son of a cabinetmaker, Érard was apprenticed to a harpsichord builder in Paris; there, about 1775, he invented a mechanical harpsichord and earned the patronage of the Duchess of Villeroi. At a workshop on her estate he made the first French square piano (1777; a piano with a rectangular case and horizontal stringing). Thereafter, with his brother Jean-Baptiste, he opened his first shop, and success led to the opening of a London branch in 1786.

Eventually the business passed to Sébastien's nephew Pierre, who continued to enhance the firm's reputation with mechanical innovations. Among the Érard inventions were a novel grand piano action (key mechanism) that allowed quicker repetition of notes (1809), a double-action pedal harp that allowed greater ease of changing key while playing (1801–10), and new methods of constructing harp and piano frames. The firm had produced about 100,000 instruments by the end of the 19th century and pioneered in building harpsichords in the early 20th century.

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

eraser, piece of rubber or other material used to rub out marks made by ink, pencil, or chalk. The modern eraser is usually a mixture of vegetable oil, fine pumice, and sulfur bonded with rubber. The mix is processed, extruded, and vulcanized in rubber-processing equipment. In 1752 the *Proceedings* of the French Academy reported a suggestion for using caoutchouc, a vegetable gum produced by certain South American trees, to erase black lead marks. Caoutchouc was named rubber in 1770 by the English chemist Joseph Priestley, because it was used to rub out marks. The first patent on an integral pencil and eraser was issued in the United States to Joseph Rechendorfer of New York City on March 30, 1858.

Erasistratus OF CEOS (fl. *c.* 250 BC), Greek anatomist and physician in Alexandria, regarded by some as the founder of physiology.

Known especially for his studies of the circulatory and nervous systems, Erasistratus noted the difference between sensory and motor nerves, but thought that the nerves were hollow tubes containing fluid. He believed that air entered the lungs and heart and was carried through the body in the arteries, and that the veins carried blood from the heart to the various parts of the body. He correctly described the function of the epiglottis and the valves of the heart, including the tricuspid, which he named.

Erasistratus was the first major exponent of pneumatism, which was based on the premise that life is associated with a subtle vapour called the pneuma.

Erasmus, SAINT, also called ELMO (d. 303?, Formia, Italy; feast day June 2), early Christian bishop, martyr, and one of the patron saints of sailors, who is romantically associated with Saint Elmo's fire (the glow accompanying the brushlike discharges of atmospheric electricity that appears as a tip of light on the masts of ships during stormy weather) as the visible sign of his guardianship over them. Erasmus is one of the Fourteen Holy Helpers, a group of saints conjointly venerated in medieval Germany.

He is reported to have been bishop of Formia,

where he was martyred, probably during the persecution of Christians by the Roman emperor Diocletian. According to Pope Gregory I (reigned 590–604), his relics were kept in the Cathedral of Formia. After the Saracens destroyed Formia in 842, Erasmus' body was transferred to Gaeta, Italy, where he is honoured as patron saint.

Several spurious acta have embellished his legend. According to these, he was a bishop in Syria who miraculously endured tortures under Diocletian in Lebanon, after which he was guided by an angel to Formia, where he performed many miracles. He has been confused with the Syrian St. Erasmus of Antioch; some scholars propose that they are the same person. Later legends attest that he was martyred by being disemboweled; thus, as a Holy Helper, he was invoked by those suffering from intestinal maladies. Elmo is an Italian corruption (through Sant' Ermo) of St. Erasmus; other derivations include Ramus, Erasmus, Ermus, Ermo, and Telmo. His legendary narrative is in *Acta Sanctorum;* R. Flahault's *S. Erasme* appeared in 1895.

Erasmus, Desiderius (b. Oct. 27, 1469, Rotterdam, Holland [now in The Netherlands]—d. July 12, 1536, Basel, Switz.), humanist who was the greatest scholar of the northern Renaissance, the first editor of the New Testament, and also an important figure in patristics and classical literature.

A brief treatment of Desiderius Erasmus follows; for full treatment, *see* MACROPAEDIA: Erasmus.

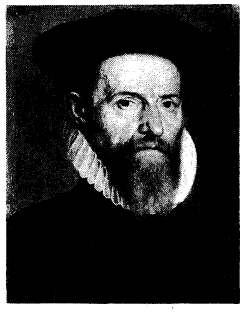
The son of Roger Gerard, a priest, and Margaret, a physician's daughter, Erasmus was reared in schools at Gouda, Deventer, and Utrecht, Holland. Later he was educated under the influence of the pietist *devotio moderna,* became an Augustinian canon, and was ordained a priest in 1492. Studies in Paris confirmed his dislike of Scholastic theology and brought him into contact with humanist groups. He visited England (1499–1500, 1505–06, 1509–14, and 1517), lectured at the universities of Oxford and Cambridge, and became well-acquainted with Thomas More, John Fisher, and John Colet, who inspired him to study the Bible. Erasmus began to study Greek and visited Italy, where he widened his humanist contacts. He also spent four years at Louvain, Belg., six years at Freiberg, Ger., and the rest of his life in Basel, Switz.

The writings of Erasmus, covering a wide variety of topics, rank him as one of the greatest scholars of his time. The *Adagia,* published in Venice in 1508 and containing more than 3,000 proverbs collected from the works of the classical authors, established his reputation, and the *Encomium moriae* (1509; *The Praise of Folly,* 1549) and his edition of the New Testament (1516) ensured it.

Erastianism, doctrine that the state is superior to the church in ecclesiastical matters. It is named after the 16th-century Swiss physician and Zwinglian theologian Thomas Erastus, who personally never held such a doctrine. He opposed excommunication as unscriptural, advocating in its stead punishment by civil authorities. The state, he held, had both the right and the duty to punish all offenses, ecclesiastical as well as civil, wherever all the citizens adhered to a single religion. The power of the state in religious matters was thus limited to a specific area. Erastianism acquired its present meaning from Richard Hooker's defense of secular supremacy in *Of the lawes of ecclesiasticall politie* (1593–1662) and as a result of debates held during the Westminster Assembly of 1643.

Erastus, Thomas, original name THOMAS LÜBER, LIEBER, or LIEBLER (b. Sept. 7, 1524, Baden, Switz.—d. Dec. 31, 1583, Basel), Swiss physician and religious controversialist whose name is preserved in Erastianism, a doctrine of church–state relationship that he himself never taught.

A student of philosophy and medicine for nine years, Erastus was invited in 1557 by the elector Otto Heinrich of the Palatinate to be professor of therapeutics in the new faculty



Erastus, portrait by Tobias Stimmer, 1582; in the Kunstmuseum, Basel, Switz.

By courtesy of the Offentliche Kunstsammlung, Basel, Switz.

of medicine at the University of Heidelberg. There he quickly achieved a favourable reputation as a physician and a teacher. As a supporter of the church reforms advocated by the Swiss theologian Huldrych Zwingli, Erastus became closely associated with the introduction of Reformed Protestantism into the Palatinate during the electorate of Frederick III (1559–76). In debates over the Eucharist, the sacrament deriving from the Lord's Supper, he defended the Zwinglian view that Christ's body is present in the sacramental bread only symbolically, in contrast to Luther's view that his body is really present.

The central controversy in Erastus' life came to a head after he had opposed efforts by Calvinists in the Palatinate to impose the system of church discipline that had been established by John Calvin at Geneva and elsewhere. When in 1568 a set of theses was presented at Heidelberg by the English Puritan George Withers, who affirmed both the presbyterian system of church government (assemblies of elected representatives) and the practice of excommunication, Erastus drew up 100 theses (later reduced to 75) to refute him. Erastus maintained that excommunication is unscriptural, that the sacraments should not be withheld from anyone genuinely wishing to receive them, and that in a Christian society—and Erastus explicitly limited his argument in this manner—the punishment of sins is in the hands of the civil magistrates. Because the Calvinists had the support of the elector, however, the presbyterian system was established by electoral decree in 1570.

For his opposition to the new order and also for alleged tendencies away from the doctrine of the Trinity toward Unitarianism, Erastus was excommunicated for two years. He was forced to leave Heidelberg when Lutheranism was reinstituted under the elector Louis VI (1576–83). On his return to Basel, he was appointed professor of medicine there in 1580 and of ethics in 1582. The term Erastian evidently came into use first in 1643 in England; Presbyterians used it as a term of abuse for those who urged state supremacy.

The significance of Erastus' theses, which were published posthumously in 1589 under the title *Explicatio gravissimae quaestionis . . . ,* was reflected by their numerous translations: in 1659 as *The Nullity of Church Censures,* in 1682 as *A Treatise of Excommunication,* and in 1844 in a Scottish edition. Erastus also wrote several medical and scientific treatises in which he attacked such popular superstitions as the belief in astrology and in alchemical transmutation of metals. He himself, however, shared the contemporary belief in witchcraft, which he opposed in his *Repetitio disputationis de lamiis seu strigibus* (1578; "Repetition of the Disputation Against Witches"), a defense of the use of the death penalty against witches and sorcerers. A biography that treats Erastus' life and work is *Thomas Erastus* (1954) by R. Wesel-Roth.

Erato, in Greek religion, one of the nine Muses, the patron of lyric poetry or hymns. She was traditionally the mother of the Thracian poet Thamyris, who, after boasting that he could surpass the Muses in song, was at once struck blind and dumb by them.

Eratosthenes OF CYRENE (b. *c.* 276 BC, Cyrene, Libya—d. *c.* 194, Alexandria), Greek scientific writer, astronomer, and poet, the first man known to have calculated the Earth's circumference.

At Syene (now Aswān), some 800 km (500 miles) southeast of Alexandria in Egypt, the Sun's rays fall vertically at noon at the summer solstice. Eratosthenes noted that at Alexandria, at the same date and time, sunlight fell at an angle of about 7° from the vertical. He correctly assumed the Sun's distance to be very great; its rays therefore are practically parallel when they reach the Earth. Given travelers' estimates of the distance between the two cities, he was able to calculate the circumference of the Earth. The exact length of the units (stadia) he used is doubtful, and the accuracy of his result is therefore uncertain; it may have varied by 0.5 to 17 percent from the value accepted by modern astronomers. He also measured the degree of obliquity of the ecliptic (in effect, the tilt of the Earth's axis) with great accuracy and compiled a star catalog. His mathematical work is known principally from the writings of Pappus of Alexandria.

After study in Alexandria and Athens, Eratosthenes settled in Alexandria in about 255 BC and became director of the great library there. He worked out a calendar that included leap years, and he tried to fix the dates of literary and political events since the siege of Troy. His writings include a poem inspired by astronomy, as well as works on the theatre and on ethics. Eratosthenes was afflicted by blindness in his old age, and he is said to have committed suicide by voluntary starvation.

Eratosthenes, sieve of, systematic procedure for finding prime numbers (numbers not divisible by an integer greater than one, except themselves) with all the natural numbers arranged in order. After striking out the number 1, one simply strikes out every second number following the number 2, every third number following the number 3, and continues in this manner to strike out every *n*th number following the number *n.* The remaining numbers, from 2 on, will be prime numbers. The procedure is named for the 3rd-century-BC Greek astronomer-mathematician Eratosthenes of Cyrene.

Erbil (Iraq): *see* Irbīl.

erbium (Er), chemical element, rare-earth metal of transition Group IIIb of the periodic table. Erbium, as a grayish silver element or as a series of pink compounds, has very few commercial uses. It has been employed as a constituent of infrared-absorbing glass and as an activator in certain phosphorescent materials.

The element was discovered (1843) as an oxide by Carl Gustaf Mosander, who originally called it terbia. In the confusion arising from the similarity in the properties of the rare-earth elements, the names of two, terbium and erbium, became interchanged (*c.* 1860). The element occurs in many rare-earth minerals, among the more important being xenotime and euxenite. Erbium occurs also in the products of nuclear fission. Commercial

purification is accomplished by ion-exchange methods. The metal itself has been prepared by thermoreduction of the anhydrous fluoride with calcium. It is slowly oxidized by oxygen and water. At low temperatures the element is antiferromagnetic and at very low temperatures, ferromagnetic and superconductive. Natural erbium is a mixture of six stable isotopes: erbium-162 (0.136 percent), erbium-164 (1.56 percent), erbium-166 (33.41 percent), erbium-167 (22.94 percent), erbium-168 (27.07 percent), and erbium-170 (14.88 percent).

Erbium behaves as a typical trivalent rare-earth element, forming compounds such as the pink oxide Er_2O_3. The Er^{3+} ion is pink in solution and is strongly paramagnetic because of the presence of unpaired electrons.

atomic number	68
atomic weight	167.260
melting point	1,522° C
boiling point	2,510° C
specific gravity	9.045 (25° C)
valence	3
electronic config.	2-8-18-30-8-2 or $(Xe)4f^{12}5d^{0}6s^{2}$

Erchomenos (two cities, ancient Greece): *see* Orchomenus.

Ercilla y Zúñiga, Alonso de (b. Aug. 7, 1533, Madrid—d. Nov. 29, 1594, Madrid), Spanish soldier and poet, author of *La Araucana* (1569–89), the most celebrated Spanish Renaissance epic poem and the first epic poem about America.

Ercilla y Zúñiga received an excellent literary education before going to the New World in 1555. He distinguished himself in Chile in

Ercilla y Zúñiga, oil painting attributed to El Greco; in the Hermitage, Leningrad

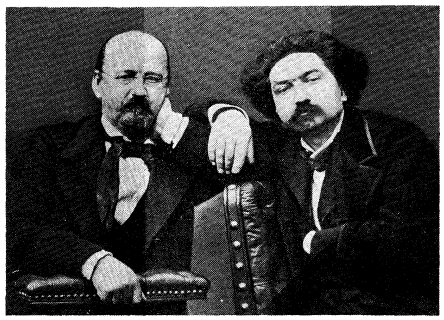
Archivo Mas, Barcelona

the wars against the Araucanian Indians and began the poem based on his experiences, which he finished after his return to Spain in 1563. *La Araucana* appeared in three installments in 1569, 1578, and 1589 and consisted of 37 cantos; two further cantos were added in 1590. The poem is weak in form, unity, relevance, and versification, but it excels in graphic descriptions, particularly of fighting. It shows great sympathy for the brave resistance of the Araucanians.

Ercker, Lazarus (b. *c.* 1530, Annaberg, Saxony—d. *c.* 1594, Prague), important German writer on early metallurgy.

Ercker studied at the University of Wittenberg (1547–48) and in 1554 was appointed assayer at Dresden, the first of a number of such positions he held in the state bureaucracy of Saxony. After 1567 he became control tester of coins at Kutná Hora, near Prague. In his great work, *Beschreibung allerfürnemisten mineralischen Ertzt und Berckwercksarten* (1574; "Description of Leading Ore Processing and Mining Methods"), he presented a systematic review of the techniques then in use for testing alloys and minerals of silver, gold, copper, antimony, mercury, bismuth, and lead; of obtaining and refining such metals; and of extracting acids, salts, and other compounds. It may be regarded as the first manual of analytical and metallurgical chemistry.

Erckmann-Chatrian, pseudonym of ÉMILE ERCKMANN and LOUIS-ALEXANDRE CHATRIAN (respectively b. May 20, 1822, Phalsbourg, Fr.—d. March 14, 1899, Lunéville; b. Dec. 18, 1826, Soldatenthal, Fr.—d. Sept. 3, 1890, Paris), two of the first French regionalist novelists in the 19th century. They decided early in life to work in collaboration and remained



Erckmann (left) and Chatrian

H. Roger-Viollet

friends almost until the end of their lives: the partnership broke up in 1889 with a lawsuit over alleged slander. Their first joint publication was a collection of short stories, *Contes fantastiques* (1847). Without any great literary pretensions, they won a reputation with their homely regional novels, several of which were translated into English. The setting is usually Alsace, and after the Franco-Prussian War (1870–71) the patriotic strain became more pronounced in their work. They often portray military life—*e.g.*, in *L'Histoire d'un Conscrit de 1813* (1864), about a man called to the colours toward the end of the Napoleonic Wars, and in *Waterloo* (1865), in which they grasp the opportunity to decry the horror of war and to advance their own pacifist views.

Ercolano, formerly RESINA, town, Napoli province, Campania region, southern Italy, at the western foot of Mt. Vesuvius, on the Bay of Naples, just southeast of Naples city. The medieval town of Resina was built on the lava stream left by the eruption of Vesuvius (AD 79) that destroyed the ancient city of Herculaneum, from which the present name is derived. A bathing resort and the starting point for excursions to the excavations of Herculaneum and for the ascent of Vesuvius by electric railway, Ercolano manufactures leather goods, buttons, glass, and the wine known as Lacrima Christi (Tears of Christ). Pop. (1981 prelim.) mun., 57,495.

Erdebil (Iran): *see* Ardabīl.

Erebuni, ancient Urartian palace-fortress probably built by King Argishti I in the first quarter of the 8th century BC; it was located on the hill of Arin Berd, near modern Yerevan in the Armenian Soviet Socialist Republic. Russian excavations at Erebuni have centred on the palace and temple; both buildings contained important wall paintings (done primarily in dark blue and red on a white background) that show distinct similarities to Assyrian wall paintings. Of particular interest was a room containing 30 columns, regarded by some scholars to be the forerunner of the Achaemenian columned hall.

Erech, Sumerian URUK, Greek ORCHOË, modern TALL AL-WARKĀʾ, ancient Mesopotamian city located northwest of Ur (Tall al-Muqayyar) in Dhi Qār *muḥāfaẓah* (governorate), Iraq. The site has been excavated from 1928 onward by the Deutsche Orientgesellschaft and the Deutsches Archäologisches Institut. Uruk, which was one of the greatest cities of Sumer, was enclosed by brickwork walls about six miles in circumference, which according to legend were built by the mythical hero Gilgamesh. Within the walls excavations traced successive cities that date from the prehistoric Ubaid period, perhaps before 5000 BC, down to Parthian times (126 BC–AD 224). Urban life in what is known as the Uruk-Jamdat Nasr period (*c.* 3500–*c.* 2900 BC) is more fully illustrated at Erech than at any other Mesopotamian city.

The two principal Sumerian divinities worshipped in ancient Uruk appear to have been Anu (An), a sky god, and the goddess Inanna (Queen of the Sky). One of the chief landmarks of the city is the Anu ziggurat crowned by the "White Temple" of the Jamdat Nasr period, which was one of great prosperity—gold, silver, and copper were skillfully worked, and seals and amulets reflected a brilliant miniature craftsmanship.

The temenos (sacred enclosure) of Eanna, another ziggurat, bore witness to the attention of many powerful kings, including Ur-Nammu (reigned 2112–2095 BC), first king of the 3rd dynasty of Ur. Ur-Nammu also did much for the layout of the city, which then benefitted from a Neo-Sumerian revival. Various architectural developments were associated with the Isin-Larsa period (*c.* 2017–1763) and with the Kassite period (*c.* 1595–*c.* 1157). After the Kassite period, Assyrian, Neo-Babylonian, and Achaemenian rulers, including Cyrus the Great and Darius the Great, left the imprint of their architectural activity, especially in the district of Eanna.

The city continued to prosper in Parthian times, when the last of an ancient school of learned scribes was still editing documents (*c.* 70 BC) in the cuneiform script.

Erechim, city, northern Rio Grande do Sul state, Brazil, lying in the Uruguay River Basin, at 2,520 ft (768 m) above sea level. It was founded in 1909 as Boa Vista do Erechim and was called José Bonifácio from 1939 to 1944. The hinterland of Erechim (meaning "small field" in the Tupí-Guaraní Indian language) yields grains (especially wheat), flax, and hogs; the city's industrial activities include distilling and meat processing. Erechim, north-northwest of Pôrto Alegre, the state capital, is accessible by railroad, road, and air. Pop. (1980 prelim.) 46,927.

Erechtheum, Ionic temple of Athena, built during 421–405 BC on the Acropolis at Athens, famous largely for its complexity and for the exquisite perfection of its details. The Ionic capitals are the most beautiful that Greece produced, and the distinctive porch, supported by Caryatid (*q.v.*) figures, is unequalled in Classical architecture.

Erechtheum, on the Acropolis, Athens

Alison Frantz

The name, of popular origin, is derived from a shrine dedicated to the Greek hero Erichthonius. It is believed by some that the temple was erected in honour of the legendary king Erechtheus. The architect was probably Mnesicles. In the early 19th century, Lord Elgin took several sections of the temple to

London. Later, in the early 20th century, it was somewhat restored.

Erechtheus, legendary king and probably also a divinity of Athens. According to the *Iliad,* he was born from the corn land and raised by the goddess Athena, who established him in her temple at Athens. In later times only a great snake was thought to share the temple with Athena, and there is evidence that Erechtheus was or became a snake; that is, an earth or ancestor spirit.

The earliest Athenian kings tended to have similar names suggesting a connection with the earth (*chthōn; e.g.,* Erichthonius, Erysichthon), to have been born of the earth, raised by Athena, and to have something serpentine about them. Snakes were often earth or ancestor spirits, so that Athena's sharing her temple with Erechtheus, whom she herself nurtured, may have been the mythical way of expressing her guardianship of the ancient royal house of Athens and of the land itself and its fertility, with which ancient kingship was intimately connected.

In his lost play *Erechtheus,* Euripides gave that king three daughters, one of whom was appropriately named Chthonia. At war with neighbouring Eleusis and its ally King Eumolpus, Erechtheus learned from the god Apollo that Athens would win if he sacrificed his daughter. He sacrificed Chthonia and won but apparently gained little by it, for he was destroyed by Poseidon or by a thunderbolt from Zeus.

erection, also called PENILE ERECTION, enlargement, hardening, and elevation of the male reproductive organ, the penis. Internally, the penis has three long masses of cylindrical tissue, known as erectile tissue, that are bound together by fibrous tissue. The two identical areas running along the sides of the penis are termed corpora cavernosa; the third mass, known as the corpus spongiosum, lies below the corpora cavernosa, surrounds the urethra—(a tube that transports either urine or semen),—and extends forward to form the tip (or glans) of the penis. All three masses are spongelike; they contain large spaces between loose networks of tissue. When the penis is in a flaccid, or resting, state, the spaces are collapsed and the tissue is condensed. During erection, blood flows into the spaces, causing distention and elevation of the penis. The amount of blood entering the penis can be increased by physical or psychological stimulation. As blood enters, there is a temporary reduction in the rate and volume of blood leaving the penis. The arteries carrying blood to the penis dilate; this, in turn, causes tissue expansion. The veins leading from the penis have funnel-shaped valves that reduce the outflow of blood. As the erectile tissue begins to enlarge, the additional pressure causes the veins to be squeezed against the surrounding fibrous tissue, and this further diminishes the outflow of blood. Essentially, blood becomes temporarily trapped in the organ.

The corpus spongiosum does not become as erect as the corpora cavernosa. The veins are more peripherally located, so that there is a continual outflow of blood in this region. This constant circulation prevents the urethra from being collapsed by the adjacent tissue, which would prevent release of the semen.

The penis returns to its flaccid state when the arteries relax and begin to contract. Blood flow is once again reduced to its usual rate and volume. As blood drains from the erectile tissue spaces, pressure is reduced on the veins, and flow continues at its normal pace. *See also* ejaculation.

erector spinae, a deep muscle of the back; it arises from a tendon attached to the crest along the centre of the sacrum (the part of the backbone at the level of the pelvis, formed of five vertebrae fused together). When it reaches the level of the small of the back, the erector divides into three columns, each of which has three parts. The muscle system extends the length of the back and functions to straighten the back and to rotate it to one side or the other.

Ereğli, chief town of Ereğli *ilçe* (district), Konya *il* (province), south central Turkey. It stands near the foot of the central Taurus Mountains on the northern approach to the Cilician Gates, a major pass. A frontier fortification of the Byzantine Empire, then known as Heraclea Cybistra, the town lay in the way of invading armies and was captured by the Arabs in 806 and again in 832. Near the end of the 11th century, it came under the Seljuq Turks; after their decline it was occupied by Mongols (13th century). The Turkmen Karaman dynasty followed the Mongols until their principality was annexed to the Ottoman Empire *c.* 1466. The Ulu Cami (Great Mosque) and a caravansary (hostelry), said to have been designed by the 16th-century court architect Sinan, are still standing. About 10 mi (16 km) south of Ereğli, near İvriz, is a famous Hittite rock-cut bas-relief depicting the god Tarhun dispensing grain and grapes while being worshipped by the King of Tuvanuva (Tyana; modern Bor). Modern Ereğli lies on the Konya–Adana railway and is linked by road with both cities. It is a centre of cotton-textile manufacture based on cotton grown in the Adana plain. Pop. (1980) town, 56,931; *ilçe,* 118,919.

Ereğli, formerly BENDER-EREGLİ, or KARADENİZ EREGLİSİ, chief town of Ereğli *ilçe* (district), Zonguldak *il* (province), northern Turkey, on the Black Sea coast. The town was founded *c.* 560 BC as Heraclea Pontica by a colony of Megarians who soon subjected the native Mariandynians and extended their control over most of the coast. In 74 BC it sided with the Pontic king Mithridates VI the Great against the Romans, who captured and burned the town. Although rebuilt by the Romans, it did not recover its former prosperity. Taken by the Turks *c.* AD 1360, it developed as a trading centre of the Genoese, who settled there in large numbers. A ruined citadel on a height overlooking the town is a remnant of that period. In the vicinity of Ereğli are three grottoes mentioned by Xenophon: through one of them, according to legend, Hercules descended into Hades to bring out Cerberus, the monstrous, three-headed watchdog of the lower world.

Ereğli basin lies in the richest coal-mining area of Turkey; some of the high-grade coal is exported through the town's port. Since 1965, with the completion of the first stage of giant integrated iron and steel mills, the town has become a centre of heavy industry. It is expected to satisfy all domestic demand for hot- and cold-rolled sheets, steel strips, and tin and to allow exports. Ereğli is linked by road with Zonguldak and by steamer with Istanbul. Pop. (1980) town, 50,105; *ilçe,* 162,853.

Eremita, Johannes: *see* Cassian, Saint John.

eremitic monasticism: *see* idiorrythmic monasticism.

Ereshkigal, in Mesopotamian religion, goddess in the Sumero-Akkadian pantheon who was Lady of the Great Place (*i.e.,* the abode of the dead) and in texts of the 3rd millennium BC wife of the god Ninazu (elsewhere accounted her son); in later texts she was the wife of Nergal (*q.v.*). Ereshkigal's sister was Inanna (Akkadian Ishtar), and between the two there was great enmity. In the rendezvous of the dead, Ereshkigal reigned in her palace, on the watch for lawbreakers and on guard over the fount of life lest any of her subjects take of it and so escape her rule. Her offspring and servant was Namtar, the evil demon, Death. Her power extended to earth where, in magical ceremony, she liberated the sick possessed of evil spirits.

Ereshkigal's cult extended to Asia Minor, Egypt, and southern Arabia. In Mesopotamia the chief temple known to be dedicated to her was at Cuthah.

Eretna DYNASTY, dynasty that succeeded the Mongol Il-Khanid rulers in central Anatolia and ruled there from *c.* 1343 to 1380.

The dynasty's founder, Eretna, was an officer of Uighur (Uyghur) origin in the service of Demirtaş, the Il-Khanid governor of Anatolia, who revolted (1326) against the Il-Khanid ruler Abū Sa'ıd and escaped to Egypt. Eretna then became governor of Anatolia under the suzerainty of Ḥasan the Elder, ruler of Azerbaijan. After Ḥasan the Elder was defeated by Ḥasan the Younger, son of Demirtaş, Eretna in 1337 received the protection of the Mamlūk sultan of Egypt. In 1343, however, Eretna defeated Ḥasan the Younger and emerged as an independent ruler over territories that included Niğde, Ankara, Amasya, Tokat, Samsun, and Erzincan; he made Sivas and later Kayseri his capital. Eretna was a scholarly man and a just ruler, whose people called him Köse Peygamber (Prophet with the Scanty Beard).

Under Eretna's successors, local rulers rebelled; the principality lost territories in the west to the Ottomans and the Karamans and in the east to the Turkmen Ak Koyunlu state. In 1380 Mehmed II, the last Eretna ruler, was killed, and Kadi Burhaneddin, a former vizier, proclaimed himself sultan over Eretna lands.

Eretria, ancient Greek coastal town of the island of Euboea. Jointly with its neighbour Chalcis, it founded Cumae in Italy (*c.* 750 BC), the first of the Greek colonies in the west; it then established colonies of its own in Chalcidice and Macedonia. Inter-city cooperation became competition, then conflict—the Lelantine War (*q.v.*; *c.* 700). Though it lost influence in the West, Eretria may have emerged from the war the stronger power, but by the classical period Chalcis had become the leading city of Euboea. In 499–498 five Eretrian triremes sailed to support the Ionian revolt against Persia, for which act Darius destroyed the city (490) and deported the population. The city was soon rebuilt, but under Macedonian and Roman rule it subsided into insignificance.

Excavations at the site (1890–95, 1900) have revealed a theatre, with much of the stage and several rows of seats preserved, a temple of Dionysus, an altar, a gymnasium, and a temple of Apollo Daphnephoros. The wall of the acropolis remains to the height of eight courses.

The modern village Néa Psará, which occupies the site, was populated by inhabitants of Psará, off Khíos, in 1821.

Erevan (Armenian S.S.R.): *see* Yerevan.

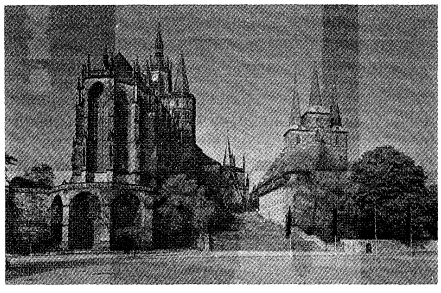
Erewash, district (borough), county of Derbyshire, England. It has an area of 37 sq mi (96 sq km). Its eastern boundary with Broxtowe (Nottinghamshire) is the River Erewash, from which the borough takes its name. It is bounded on the south by the Rivers Trent and Derwent, and to the west it extends as far as Derby and the River Derwent at Duffield. A major motorway passes through the borough, and there is a large railway freight terminal at Toton.

The domestic stocking and knitting industries of Ilkeston declined in the 18th century, but by the mid-19th century both hosiery and lace factories were in operation and the town was growing rapidly. In the same period coal mining expanded. The annual fair, granted by a charter of 1252, is held at Ilkeston in

October. Long Eaton was an agricultural community until the 19th century, when the development of a canal and later railways helped the growth of industry, particularly lace making (which collapsed in 1921). Today there is a wide range of industry, from heavy engineering, including one of the largest producers of cast iron and other types of pipes, to light crafts, scattered throughout the borough. Pop. (1982 est.) 103,000.

Erfurt, until 1990 a *Bezirk* (district) of southwestern East Germany, formed in 1952 from parts of Thuringia and Saxony-Anhalt. With an area of 2,837 square miles (7,349 square km) and drained primarily by the Unsrut River and its tributary the Gera River, it occupied much of the fertile inner Thüringer Basin between the Harz Mountains in the north and the Thüringer Forest in the south. Wheat, barley, sugar beets, alfalfa, and market vegetables are grown. The principal industries are metalworking, precision machinery, and the manufacture of electrotechnical equipment and textiles. The chief towns were Erfurt (the capital), Gotha, Weimar, Eisenach, Nordhausen, Mühlhausen, and Arnstadt (*qq.v.*). Pop. (1989 est.) 1,240,394.

Erfurt, city, Thuringia *Land* (state), central Germany, located in the Thüringer Basin, on the Gera River. It was first mentioned in 724 as Erpesfurt, the site of an abbey and a royal residence at a ford (*Furt*) on the Gera (originally named Erpf) River. St. Boniface founded a bishopric there in 742. By 805 it was



The cathedral and the Church of St. Severus in Erfurt, Ger.

W. Krammisch—Bruce Coleman Inc./EB Inc.

a military strong point and an administrative and commercial centre on the eastern border of the Frankish Empire. It was granted municipal rights about 1250 by the Archbishop of Mainz and controlled extensive territories in the Middle Ages. Joining the Hanseatic League in the 15th century, it was until *c.* 1600 a great commercial centre for woad, a plant then used for its blue dye extract. Its university, opened in 1392, was suppressed in 1816. Occupied by a Swedish garrison during the Thirty Years' War (1618–48), the city became part of the electorate of Mainz in 1664. It passed to Prussia in 1802, forming part of Prussian Saxony until 1945, except for a period of French domination (1806–13). In 1808 Napoleon and Alexander I of Russia, with the kings of Bavaria, Saxony, Westphalia, and Württemberg, met at the Congress of Erfurt, and in 1850 a conference of the short-lived Prussian Union took place there.

The city is dominated by the cathedral and the Church of St. Severus, which stand side-by-side atop a hill called Domberg. The cathedral (1154–1476) contains 15th-century glass and numerous notable works of art. Other buildings of interest in Erfurt include the Augustinian monastery where Martin Luther was a monk (1505–08), now an orphanage; the Krämerbrücke (1325; Merchant Bridge), lined with houses and shops; the Anger Museum of Art and History in a former merchant's house (1705–11); the palace of the governor of the electorate of Mainz (1711–20); the Teaching Institute (1953–59); and the Medical Academy (1954–59). There is a scientific library containing the Amplonian collection of 1400 and earlier, as well as a library of municipal archives, a natural history museum, the Thuringian Social History Museum, and an aquarium.

Erfurt is an important road and railway junction and a commercial centre, with an airport 3 miles (5 km) north. Industries include metalworking and the manufacture of electrical apparatus, shoes, and clothing. Known for the cultivation of a wide variety of flowers and vegetables—an industry that originated in the large gardens attached to the monasteries—it exports seeds and processed foods. Pop. (1989 est.) 220,016.

Erfurt Union Parliament, German ERFURTER UNIONSPARLAMENT (March 20–April 29, 1850), conference called by Prussia to form a union of German states headed jointly by Prussia and Austria. Opposed by Austria, the plan failed to win the adherence of the other large German states and had to be renounced by Prussia in the Punctation of Olmütz on November 29.

The revolution of 1848–49 had forced the dissolution of the old Austrian-dominated German Confederation. In 1850 Prussia's chief minister, Joseph Maria von Radowitz, suggested the formation of a new union, in which Austria and Prussia would share leadership, and called a meeting of German states at Erfurt on March 20 to discuss the plan. Saxony and Hanover at first backed Prussia but withdrew when Bavaria and Württemberg failed to send representatives to the parliament. Meanwhile, Austria, which had no wish to accord Prussia equality with itself, sidetracked the Prussian plan by declaring the old confederation reconstituted. The Prussian rout was complete when Austria forced King Frederick William IV of Prussia to replace Radowitz with the more pro-Austrian Baron Otto von Manteufel and to sign the Punctation (agreement) of Olmütz (November 29), withdrawing its proposal.

Prussia's humiliation began an intense rivalry between the two German powers that ended with Austria's defeat in 1866.

erg, also called SAND SEA, in a desert region, area of large accumulation of sand, generally in the bottom of a huge basin in which a former river piled up alluvium. Ergs are areas of actively shifting dunes, "fossilized" dunes, or extensive sand sheets. The sand is generally loose and is extremely difficult to cross. In the Sahara between Beni Abbès and Ghudāmis, Algeria, the Great Western and Great Eastern ergs are the most difficult of all Saharan areas and are avoided by modern trans-Saharan routes as far as possible. The Libyan Desert is another extensive area of unmitigated sandy waste.

erg, unit of energy or work in the centimetre–gram–second system of physical units used in physics; to lift a pound weight one foot requires 1.356×10^7 ergs. It equals the work done by a force of one dyne acting through a distance of one centimetre and is equal to 10^{-7} joule, the standard unit of work or energy.

ergonomics: *see* human-factors engineering.

ergosterol, organic compound belonging to the steroid family and occurring in yeast and other fungi. It is converted by ultraviolet irradiation into ergocalciferol, or vitamin D_2, a nutritional factor promoting proper bone development in all animals except birds, which require vitamin D_3. The formula is $C_{28}H_{44}O$.

Its relationship to vitamin D was discovered in 1927, following earlier demonstrations that irradiated ergosterol can be used to alleviate rickets, a deficiency disease of bone caused by lack of vitamin D in the diet. The chemical structure of ergosterol was established in 1933 and that of vitamin D_2 in 1948.

Commercially, the sterol is produced from yeast, and it is then converted into the vitamin for use as a food supplement. *See also* vitamin D.

ergot, fungal disease of grasses, especially rye. It induces the transformation of the grain into enlarged, hard, brown to black spurlike structures that constitute the source of the drug ergot, used in obstetrics to control postpartum hemorrhage. Poisoning may occur from eating ergot in flour; the condition, marked by convulsions and death, is called ergotism or, sometimes, St. Anthony's Fire. Ergot is also the source of the powerful synthetic hallucinogen *d*-lysergic acid diethylamide, or LSD (*q.v.*).

The causal agent, *Claviceps purpurea,* is an ascomycete, or sac fungus. In the ear of rye infected with ergot, a sweet, yellowish mucus is exuded for a time. The ear then loses its starch and ceases to grow, and its ovaries become permeated by the mycelium, a mass of filaments, of the fungus, which forms the sclerotium, a compact mass of hardened mycelium containing reserve food, in autumn. *See also* ergosterol.

Ergun He (China): *see* Argun River.

erh-hu, Pinyin ERHU, also called NAN-HU, Chinese vertical fiddle, consisting of two strings, commonly tuned a fifth apart, which are stretched over a wooden drum resonator. A vertical post with no fingerboard goes through the resonator, and the bow is moved between the strings. Bowing is done horizontally, with right-hand fingering techniques for altering the bow tension and for crossing strings, while the instrument is held in an upright position on the thigh. In addition to its orchestral role, it is also a solo instrument. Its performance is characterized by subtle contrasts in bowing strength, powerful vibrato, and glissandos. A higher pitched version with a smaller resonator surface is the *kao-hu.* In southern China, the *kao-hu* is often the first bowed-string instrument in orchestras, with the *erh-hu* being the second. Several bass-range versions are also popular.

Erh Lake, Wade-Giles romanization ERH HAI, Pinyin ER HAI, lake in western Yunnan province, China. It lies in a deep basin at the eastern foot of the snow-covered Tien-ts'ang range between the upper waters of the Yangtze River, there called the Chin-sha River, and the Mekong River. Erh Lake is the last remnant of a larger lake, which formed the extensive alluvial plain surrounding it, particularly on the west side. It is drained from the southern end by the Yang-pi River, which flows into the Mekong. The lake is about 30 miles (50 km) long from north to south but only 6 to 10 miles wide from east to west. In early times the Chinese called it the Western Erh Ho (Erh Ho was the old name of the Yang-pi) and by other names; the name Erh Hai dates from the 15th century. The lake is about 6,365 feet (1,940 m) above sea level.

Erh Lake contains a number of islands. The south of the basin has comparatively easy communications to eastern Yunnan and to Szechwan province and is on the main route southwestward to Myanmar (Burma). The surrounding area was first brought under Chinese control during the Yüan dynasty in the late 13th century, before which the Erh Lake basin had been the centre of the independent states of Nanchao and, later, Ta-li.

Erh-lien-hao-t'e, Pinyin ERLIANHAOTE, city, Inner Mongolian Autonomous Region (*tzu-chih-ch'ü*), China, in the Gobi Desert near the border with the Mongolian Peoples Republic. It is a prefecture-level municipality (*shih*) located in Wu-lan-ch'a-pu League (*meng*) on the Trans-Mongolian railway. The town was

elevated to city status in 1966 following the transfer of railroad wheel-change operations (necessary because of the different gauges used in Mongolia and China) from Chi-ning on the Peking–Pao-t'ou railway line to the south. The city is a frontier settlement and a transshipment centre about 400 mi (640 km) southeast of Ulaanbaatar, Mongolia. Pop. (mid-1970s est.) 50,000–100,000.

Erhard, Ludwig (b. Feb. 4, 1897, Fürth, Ger.—d. May 5, 1977, Bonn), economist and statesman who, as economics minister (1948–63), was the chief architect of West Germany's post-World War II economic recovery. From 1963 to 1966 he was chancellor of the Federal Republic of Germany.

As a trained economist, untainted by Nazi associations, Erhard was entrusted by the post-war Allied occupation authorities with the reconstruction of industry in the Nürnberg-Fürth area and thereafter served successively as economics adviser in Middle and Upper Franconia, economics minister for Bavaria (1945–46), director of the Advisory Committee for Money and Credit (1947–48), and director of the economic council for the joint Anglo-U.S. occupation zone (1948–49). By the end of 1948 the currency reforms that he had instituted the preceding summer had already somewhat buoyed the prostrate German economy. From September 1949, as economics minister of the new Federal Republic of Germany under Chancellor Konrad Adenauer, he was commissioned to continue his policies of reconstruction. In the following years he applied his "social market system" to the problems of economic renewal with phenomenal results, achieving what has often been called the German "economic miracle." He was appointed federal vice chancellor in 1957 and succeeded Adenauer as chancellor in October 1963. His government was troubled by economic difficulties and Cabinet defections, and in 1966 he was forced to resign. In 1967 he was named honorary chairman of the Christian Democratic Party.

erhu (musical instrument): *see* erh-hu.

Eric (personal name): *see under* Erik.

Ericales, order of flowering plants that belongs to the class called dicotyledon (*q.v.*; characterized by two seed leaves). It is comprised of 10 families, 135 genera, and about 2,700 species of mostly shrubs and small trees distributed in all areas of the world, with significant concentrations of individuals and species in tropical and subarctic regions. The Ericales include azaleas, rhododendrons, and heath plants, all prized for their flowers and abundant growth.

A brief treatment of Ericales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

The most common characteristic of the Ericales is the single integument of the ovule, the outer layer that becomes the seed coat. Other features, less constant in this order, include the shrub habit, simple and leathery leaves, perfect flowers (male and female components in the same flower), and pollen that is shed in the four-grouped form.

Bogs and peaty soils with a high sand content are favourite habitats for many members of the Ericales; when planted in rock gardens, well-drained, most soil with a high organic content is required. Rhododendrons and many members of the heath family (Ericaceae) do not thrive on clay soils or on limestone.

The Ericaceae family is widely distributed, extending into the subarctic and along mountain chains through the tropics. It is by far the most important family of the Ericales; of its 80 genera and 1,900 species, more than 40 genera are under cultivation. Of the 800 species of *Rhododendron* (which includes the azaleas), at least 377 are validly recognized; they are among the choicest broad-leaved evergreens in the plant kingdom. Many Himalayan species, in a variety of beautiful colours, are now grown in warmer temperate regions.

Although azaleas, with funnel-form flowers, can be distinguished visually from taller rhododendrons, with bell-shaped flowers and evergreen leaves, no clear distinction between these two groups is possible on the basis of floral and vegetative analyses. The azaleas are included in a conservative system of classification, which defines 8 natural subgenera and 17 sections in the genus *Rhododendron.* Other ornamental genera include *Calluna* (heather of northern climates), *Erica* (heaths of southern climates), *Kalmia* (mountain laurel), and *Pieris* ("andromeda").

Cultivars (horticultural varieties) of the genus *Vaccinium,* derived largely from the highbush blueberries *V. corymbosum* and *V. ashei,* support a major industry in the eastern United States. In New England and maritime Canada native populations of the low-growing blueberries cover marginally productive lands. Periodic burning of plants in the winter stimulates the growth of flower-producing stems to increase fruiting.

The other nine families of the Ericales have distinctive distributions and contain a wide variety of species. They include the Actinidiaceae family, known primarily for a vine (*Actinidia chinensis*) that produces an edible berry, the Kiwi fruit, or Chinese gooseberry; the Pyrolaceae family, comprised of evergreen herbs suited for wildflower gardens and colonization of woods; and the Indian pipe family (Monotropaceae), which is almost entirely saprophytic, living off decaying vegetable matter with the aid of fungi.

Thread-like cells (hyphae) of soil fungi belonging to the mushroom and related groups of molds envelop the roots of the Monotropaceae and many other members of the Ericales. Outer layers of roots, changed in structure by this association with fungi, are known as mycorrhizae. This arrangement aids in the absorption of mineral nutrients and organic substances by the host plants; the fungi benefit also.

One method of propagation in the Ericaceae is apparent when fields of blueberries are seen to consist of discrete colonies. These arise when rhizomes (underground horizontal stems) spread from a parent plant and send up young stems that eventually become independent. The production of seeds, however, is the chief method of reproduction in the Ericales.

Inflorescences are usually borne at the ends of branches in elongate, often branched clusters. Species of many families bear a single flower just above the juncture of leaf and stem. A generalized flower of the Ericales possesses sepals, white- or pink-coloured petals, stamens, and a pistil within the same flower. The ovary is superior (flower parts arise below the ovary). Five sepals are joined basally to form a green calyx, and the five petals of the corolla are separate from each other. Stamens occur in two whorls when they number 10. The ovary of the pistil contains many ovules in each of the five chambers; a single style and stigma arise above the ovary.

Erice, formerly (until 1934) MONTE SAN GIULIANO, town, Trapani province, northwestern Sicily, Italy; it lies at 2,464 ft (751 m) above sea level on the top of Monte San Giuliano (also called Monte Erice), just northeast of Trapani city. The town originated as a settlement of the Elyrir (an ancient Sicilian tribe) and was fortified by the Phoenicians and contested by the Carthaginians and Romans. It was famous throughout the Mediterranean for the temple dedicated to the nature deity Venus Erycina. Later occupied by the Saracens, it was conquered in the 11th century by the Norman count Roger I of Sicily, who called it Monte San Giuliano. Ancient remains include cyclopean walls with Phoenician inscriptions and fragments of the celebrated temple in the medieval castle, but the town is primarily medieval in character. The principal church is the Chiesa Matrice (1314), with a portico from 1426 and a detached tower from 1312.

Local occupations are stockbreeding and vine cultivation. Pop. (1981 prelim.) mun., 25,274.

Ericson, Leif: *see* Leif Eriksson.

Ericsson, John (b. July 31, 1803, Långbanshyttan, Swed.—d. March 8, 1889, New York City), Swedish-born U.S. naval engineer and inventor who built the first armoured turret warship and developed the screw propeller.

Ericsson, detail of an oil painting by Charles Loring Elliott; in the Science Museum, London

By courtesy of the Science Museum, London

After serving in the Swedish Army as a topographical surveyor, Ericsson went to London in 1826 and constructed a steam locomotive, the "Novelty," for a railway competition at Rainhill, Lancashire, in 1829. The prize was won by George Stephenson's "Rocket." Ericsson also devised a plan for placing warship engines below the waterline to protect them against shell fire. In 1833 he exhibited his caloric engine, on which he worked the rest of his life, and in 1836 he patented a screw propeller, first used in 1837 on the "Francis B. Ogden," built in London. Capt. Robert F. Stockton, of the U.S. Navy, ordered a small iron vessel, the "Princeton," to be fitted by Ericsson with engines and screw; it reached New York in May 1839.

A few months later, Ericsson emigrated to the U.S. and lived the rest of his life in New York, becoming a naturalized citizen in 1848. During the Civil War, Ericsson's proposal to the Navy Department for a novel warship was accepted, and the "Monitor" was launched on Jan. 30, 1862. Wholly steam-powered and with a screw propeller, the vessel, with its armoured revolving turret, set a revolutionary pattern for warships that continued into the 20th century. On March 9 the "Monitor" fought the celebrated action with the Confederate ironclad "Virginia" (formerly "Merrimack"), leading the federal government to place an order with Ericsson for many more monitor-type vessels that played an important role in the blockade of the Confederacy and in other naval operations. In later years he developed a torpedo and investigated solar-powered motors.

Eridu, ancient Sumerian city south of modern Ur (Tall al-Muqayyar) in Dhi Qār *muḥāfaẓah* (governorate), Iraq. The city was revered as the most ancient in Sumer according to the king lists, and its patron god was Ea or Enki, "lord of the sweet waters that flow under the earth." The site, located at a mound called Abū Shahrayn, was excavated principally between 1946 and 1949 by the Iraq Antiquities Department; it proved to be one of the most important of the prehistoric urban centres in

southern Babylonia. Founded on sand dunes probably in the 5th millennium BC, it fully illustrated the sequence of the preliterate Ubaid civilization, with its long succession of superimposed temples portraying the growth and development of an elaborate mud-brick architecture.

The city continued to be occupied to about 600 BC but was less important in historic periods.

Eridu Genesis, in Mesopotamian religious literature, ancient Sumerian epic primarily concerned with the creation of the world, the building of cities, and the flood. According to the epic, after the universe was created out of the primeval sea and the gods were given birth, the deities in turn fashioned man from clay to cultivate the ground, care for flocks, and perpetuate the worship of the gods.

Cities were soon built and kingship was instituted on Earth. For some reason, however, the gods determined to destroy mankind with a flood. Enki (Akkadian Ea), who did not agree with the decree, revealed it to Ziusudra (Utnapishtim), a man well known for his humility and obedience. Ziusudra did as Enki commanded him and built a huge boat, in which he successfully rode out the flood. Afterward, he prostrated himself before the gods An (Anu) and Enlil (Bel), and, as a reward for living a godly life, Ziusudra was given immortality.

Erie, Iroquoian-speaking North American Indians who inhabited most of what is now northern Ohio, parts of northwestern Pennsylvania, and western New York; they were often referred to as the Cat Nation. Little is known of their social or political organization, but early Jesuit accounts record that the Erie had many permanent, stockaded towns, practiced agriculture, and comprised several divisions. Erie traditions told of numerous wars with tribes of the Iroquois confederacy; the final conflict occurred between 1653 and 1656, with the Erie being forced to capitulate when their bows and poisoned arrows were unable to withstand the guns supplied to the Iroquois by Dutch and English traders. Some of the surviving Erie fled to other tribes, but most were captured by the Iroquois and adopted as a constituent tribe.

Erie, city, seat (1803) of Erie County, northwestern Pennsylvania, U.S., port of entry on Lake Erie. Named for the Erie Indians, it was the site of the Fort-Presque-Isle built by the French (1753) on a 6-mi (10-km) peninsula (now Presque Isle State Park) enclosing a fine natural harbour. Abandoned to the British in 1759, the fort was destroyed by Indians during the Pontiac Conspiracy of 1763. The area remained a wilderness until after the American Revolution when it was purchased by Pennsylvania from the federal government. A U.S. Ft. Presque Isle was built in 1795, and at the same time the town was laid out by Gen. Andrew Ellicott, U.S. surveyor general, and Gen. William Irvine. Naval yards established on Presque Isle Bay built most of the fleet used by Commo. Oliver H. Perry to defeat the British at the Battle of Lake Erie (Sept. 10, 1813). The restored hull of Perry's flagship, USS "Niagara," lies at the foot of State Street.

Economic development began with the opening (1844) of the Erie and Pittsburgh Canal and railway construction in the 1850s. Erie is Pennsylvania's only port on the St. Lawrence Seaway and is a strategic shipping point for lumber, coal, petroleum, grain, chemicals, and iron. Early industries were largely agricultural. Erie's first iron foundries used bog ore from the bay swamps. Manufactures are now well diversified and include electrical equipment, construction machinery, ships, paper, railroad equipment, aluminum forgings, clothing, chemicals, plastics, and rubber products. Erie is the seat of Gannon (1944), Mercyhurst (1926), and Villa Maria (1925) colleges, and the Behrend College campus of Pennsylvania State University.

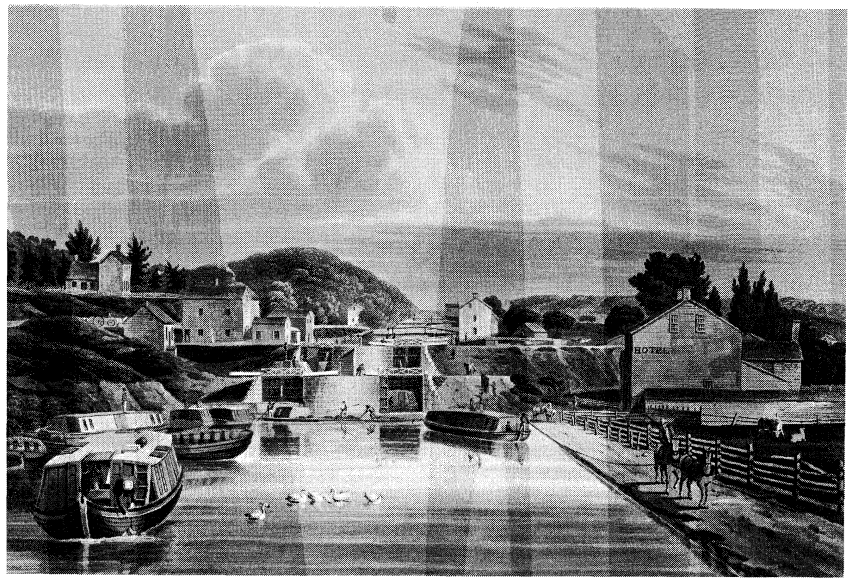
The Perry Memorial House and Dickson Tavern (1809) was a station on the Underground Railroad for runaway slaves; it was restored in 1963. The Wayne Blockhouse on the grounds of the Pennsylvania Soldiers' and Sailors' Home is a replica of the one in which Gen. Anthony ("Mad Anthony") Wayne died on Dec. 15, 1796; a flagpole marks the spot where he was buried (his remains were later removed to Radnor, near Philadelphia). Fort-Le-Boeuf, the last French outpost in the French and Indian Wars, is 16 mi south. Inc. borough, 1805; city, 1851. Pop. (1970) city, 129,265; metropolitan area (SMSA), 263,654; (1980) city, 119,123; SMSA, 279,780.

Erie, Lake, fourth largest of the five Great Lakes of North America. It forms the boundary between Canada (Ontario) to the north and the United States (Michigan, Ohio, Pennsylvania, and New York) to the west, south, and east. The major axis of the lake extends from west-southwest to east-northeast for 241 mi (388 km), and the lake has a maximum width of 57 mi. The total area of the lake's drainage basin is 22,690 sq mi (58,770 sq km), exclusive of surface area, which is 9,910 sq mi. The lake's principal tributary rivers are the Detroit (carrying the discharge of Lake Huron), Huron, and Raisin rivers of Michigan; the Maumee, Portage, Sandusky, Cuyahoga, and Grand rivers of Ohio; the Cattaraugus Creek of New York; and the Grand River of Ontario. The lake discharges at its eastern end through the Niagara River, and its western end contains all of the islands, the largest being Pelee Island, Ont. With a mean surface height of 570 ft (170 m) above sea level, Erie has the smallest mean depth (58 ft) of the Great Lakes, and its deepest point is 210 ft. Storms frequently cause short-period fluctuations in lake level that can amount to several feet at the ends of the lake. It is an important link in the St. Lawrence Seaway. The New York State Barge Canal has an outlet at Tonawanda, N.Y., on the Niagara River, and one of its branches enters Lake Erie at Buffalo.

Originally, a few harbours on the lake were formed by natural bays, but most of them are at the mouths of streams that were improved by protective piers and breakwaters and by dredging to accommodate the large lake vessels. The industrial economy of the lakeshore area depends heavily upon water transportation. The important steel industry (notably, to the south at Pittsburgh) depends upon the movement of iron ore and limestone across the Great Lakes to Lake Erie ports (mostly to the Ohio ports of Cleveland, Ashtabula, and Conneaut). The port at Toledo, Ohio, handles soft-coal shipments, and Buffalo is an important grain port. Other prominent ports are Sandusky, Huron, Lorain, and Fairport Harbor (in Ohio), Erie (in Pennsylvania), and Port Colborne (in Ontario). Intense pollution of the lake resulted in the closing of many beaches and resorts in the 1960s, but by the late 1970s the environmental damage had begun to be arrested. The Point Pelee National Park lies on the northwestern shore in southern Ontario.

The first European to see Lake Erie, when the Iroquois Indians inhabited the region, was probably the French-Canadian explorer Louis Jolliet, in 1669, although some credit the French man Étienne Brûlé with its exploration as early as 1615. The British, allied with the Iroquois, developed trade along Lake Erie in the late 17th century. British pressure led to the takeover of two strategic French forts, in 1759 (Fort-Conti, thereafter Ft. Niagara) and in 1760 (Fort-Pontchartrain-du-Détroit, thereafter Ft. Detroit). Many British Loyalists then moved north of the lake into Ontario, and the American shores were not settled until after 1796. In the Battle of Lake Erie, an important engagement of the War of 1812, U.S. commodore Oliver H. Perry defeated a British squadron at Put-in-Bay, Ohio, and secured the Northwest for the United States. The lake was named after the Erie Indians who once inhabited the shores.

Erie Canal, historic waterway of the United States connecting the Great Lakes with New York City via the Hudson River. By the beginning of the 19th century the desirability of a transportation link between the Atlantic coast and the trans-Allegheny region was evident. Gov. DeWitt Clinton of New York saw the potential in the proposal for a canal from Buffalo, on the eastern shore of Lake Erie, to Albany, on the upper Hudson, passing through the gap in the mountains in the Mohawk Valley region. In 1817 he induced the state legislature to authorize the expenditure of $7,000,000 for construction of a canal 363 mi long, 40 ft wide, and 4 ft deep (584 km long, 12 m wide, and 1.2 m deep). To cross the 500-ft rise in elevation west of Troy, the work required 82 locks. No roads ex-



"Junction of the Erie and Northern Canals," aquatint by John Hill, *c.* 1830–32

By courtesy of the New-York Historical Society, New York City

isted for supply; horse and man power alone were available. Streams were crossed on aqueducts; in several places rock was blasted with black-powder charges. Despite all difficulties, the canal was opened on Oct. 25, 1825, by the canal boat *Seneca Chief.*

The effect of the canal on the growth of the upper Midwest was rivaled only by its effect on the growth of New York City. Settlers poured west (many using the canal) into Michigan, Ohio, Indiana, and Illinois, whence they could ship back farm produce via the Erie Canal to be marketed in the East; in return, bargeloads of manufactured goods and supplies went west. Freight rates from Buffalo to New York City, which had been $100 a ton by land, were only $10 a ton by the canal; in nine years the tolls exceeded the cost of construction, and by 1882, when the tolls were abolished, the canal had paid for the cost of several feeder canals and contributed to the general revenue of the state.

Enlarged to 70 feet (21 m) in width and 7 feet (2.1 m) in depth, the canal successfully resisted competition from the railroads and, despite suffering a period of neglect late in the 19th century, was the central artery in the 20th-century development of New York canals that connected Lake Champlain, Lake Ontario, and the Finger Lakes. The canal is capable of accommodating barges of up to 2,200 tons (1,996 metric tons) capacity. *See also* New York State Barge Canal System.

Erie Railroad Company, U.S. railroad running between New York City, Buffalo, and Chicago, through the southern counties of New York state and skirting Lake Erie. It was incorporated in 1832 as the New York and Erie Railroad Company, to build from Piermont, N.Y., on the west bank of the Hudson River, to Dunkirk on Lake Erie. The track was completed in 1851.

The Erie became known as "the scarlet woman of Wall Street" in the mid-19th century when it was the object of financial struggles between Daniel Drew, Jay Gould, James Fisk, and Cornelius Vanderbilt. Drew became a director of the Erie in 1857 and used his position to manipulate the value of Erie stock to his own advantage. In 1868 Vanderbilt tried to gain control of the line by cornering its stock. Drew, in an alliance with Gould and Fisk, manufactured 50,000 shares of Erie stock and dumped them on the market. When a court ordered their arrest, they fled to a hotel in Jersey City. Gould was able to bribe legislators in Albany to secure passage of a bill legalizing what they had done. After making peace with Vanderbilt, Gould and Fisk were left in control of the Erie. They used it as a base for new exploits in stock watering and financial chicanery that led to the panic of 1869.

The Erie went bankrupt four times in its history. It had the disadvantage of competing with other railroads between the Midwest and the east coast. In the 1870s a fierce rate war took place between the Erie, the Baltimore and Ohio, the Grand Trunk, the New York Central, and the Pennsylvania railroads, ending in bankruptcy for the Erie.

The line passed through a number of reorganizations until it merged with the Delaware, Lackawanna and Western Railroad Company in 1960 to become the Erie Lackawanna Railway Company. Before merger, the Erie had operated 2,300 miles (3,700 km) of track. The merger eliminated duplicating track, resulting in a 2,900-mile road. Despite this, the Erie Lackawanna became bankrupt in 1972 and was taken over by Consolidated Rail Corporation (*q.v.*; Conrail) in 1976.

Erigena, John Scotus, also called JOHANNES SCOTUS ERIUGENA (b. 810, Ireland—d. *c.* 877), theologian, translator, and commentator on several earlier authors in works centring on the integration of Greek and Neoplatonist philosophy with Christian belief.

From about 845, Erigena lived at the court of the West Frankish king Charles II the Bald, near Laon (now in France), first as a teacher of grammar and dialectics. He participated in theological disputes over the Eucharist and predestination and set forth his position on the latter in *De predestinatione* (851; "On Predestination"), a work condemned by church authorities. Erigena's translations of the works of Pseudo-Dionysius the Areopagite, St. Maximus the Confessor, St. Gregory of Nyssa, and St. Epiphanius, commissioned by Charles, made those Greek patristic writings accessible to Western thinkers.

Erigena's familiarity with dialectics and with the ideas of his theological predecessors was reflected in his principal work, *De divisione naturae* (862–866; "On the Division of Nature"), an attempt to reconcile the Neoplatonist doctrine of emanation with the Christian tenet of creation. The work classifies nature into (1) that which creates and is not created; (2) that which creates and is created; (3) that which does not create and is created; and (4) that which does not create and is not created. The first and the fourth are God as beginning and end; the second and third are the dual mode of existence of created beings (the intelligible and the sensible). The return of all creatures to God begins with release from sin, physical death, and entry into the life hereafter. Man, for Erigena, is a microcosm of the universe because he has senses to perceive the world, reason to examine the intelligible natures and causes of things, and intellect to contemplate God. Through sin man's animal nature has predominated, but through redemption man becomes reunited with God.

Though highly influential upon Erigena's successors, notably the Western mystics and the 13th-century Scholastics, *De divisione naturae* eventually suffered condemnation by the church because of its pantheistic implications. The works of Erigena are in J.-P. Migne's *Patrologia Latina*, Vol. 122.

Erigone, in Greek mythology, daughter of Icarius, the hero of the Attic deme (township) of Icaria. Her father, who had been taught by the god Dionysus to make wine, gave some to several shepherds, who became intoxicated. Their companions, thinking they had been poisoned, killed Icarius and buried him under a tree. Erigone, guided by her dog Maera, found his grave and hanged herself on the tree. Dionysus sent a plague on the land, and all the maidens of Athens, in a fit of madness, hanged themselves. Icarius, Erigone, and Maera were set among the stars as Boötes (or Arcturus), Virgo, and Procyon, and to propitiate Icarius and Erigone, the festival called Aiora (the Swing) was instituted. During this festival various small images (Latin *oscilla*) were swung from trees, and offerings of fruit were made. The story of Erigone was probably intended to explain the origin of the *oscilla.*

Erik, also spelled ERIC, name of rulers grouped below by country and indicated by the symbol •.

Foreign-language equivalents:

Danish	Erik
Norwegian	Erik, or Eirik

DENMARK

• **Erik V,** byname ERIK GLIPPING, or KLIPPING (b. *c.* 1249, Denmark—d. Nov. 22, 1286, Finderup, Den.), king of Denmark (1259–86) whose reign saw the expansion of the power of the great nobles and prelates, formalized by the royal charter of 1282, and the restoration of Danish sovereignty in Schleswig (southern Jutland).

The son of Christopher I, Erik succeeded to the throne in 1259 after the murder of his father during a power struggle with Archbishop Jakob Erlandsen. In 1261 the royal army was defeated by forces in Schleswig and Holstein organized by Erlandsen, and Erik and the queen mother were taken prisoner. Released in 1264 through the intervention of the pope and of German princes, he was declared of age in 1266.

After the death of his cousin Erik, Duke of Schleswig, in 1272, Erik gained control of Schleswig and in 1276, against the opposition of the magnates, had his son Erik VI Menved recognized as his successor. The great nobles, however, steadily increased their power, and in 1282 they forced Erik to grant Denmark's first royal charter, the *haandfaestning,* which protected the nobility from arbitrary imprisonment and forced the king to call a yearly meeting of the nobles' and prelates' assembly, the *hof* (Latin *parlamentum*), which had been meeting periodically since the reign of Valdemar II 50 years earlier. The *haandfaestning,* Denmark's first written constitution, marked a loss of power for the peasantry and for the provincial *things* (assemblies) and enabled the magnates to carry out sweeping reforms in domestic and foreign policy in the remaining years of Erik's reign. He was murdered in 1286.

• **Erik VI,** byname ERIK MENVED (b. 1274, Denmark—d. Nov. 13, 1319, Denmark), king of Denmark (1286–1319) under whom the conflict between church and monarchy, which had first arisen during the rule of his grandfather Christopher I, reached its peak and was tenuously resolved. Erik's attempts to renew Danish conquests along the southern Baltic coast greatly weakened the country's finances and aroused opposition to his rule.

The son of Erik V, Erik succeeded to the Danish throne in 1286 after the murder of his father. His rule was soon challenged by several magnates who had been found guilty—probably unjustly—of killing his father and had been outlawed in 1287. These outlaws, who were aided by the Norwegian king and soon joined by Duke Valdemar of Schleswig and the new archbishop, Jens Grand, raided the Danish coasts. Erik defeated Valdemar and reached an agreement with Norway in 1295, but he continued to feud with Grand, whose imprisonment led to a papal interdict of the king in 1297.

Erik's settlement with Pope Boniface VIII (1303) enabled him to resume Danish conquests along the northern border of the Holy Roman Empire, and in 1304 the emperor Albert I ceded to Denmark all lands north of the Elbe River. Toward the end of his reign, Erik lost the allegiance of most of his German vassals and retained only Rostock and Rügen. The final years of his reign were plagued by renewed conflict with Norway and Sweden and growing opposition from the church, peasants, and nobles, including his brother and successor, Christopher. The financing of Erik's military campaigns almost bankrupted Denmark, and Erik was forced to mortgage large areas of the kingdom to raise funds. He died childless.

• **Erik VII,** also called ERIK OF POMERANIA, Danish ERIK AF POMMERN, Swedish and Norwegian ERIK AV POMMERN (b. *c.* 1381, Pomerania—d. *c.* June 1459, Rügenwalde, Pomerania [now Darłowo, Pol.]), king of the united realms of Denmark, Norway (as Erik III), and Sweden (as Erik XIII) from 1397 to 1439; his autocratic rule and foreign wars eventually lost him the throne in all three of his dominions.

The son of Duke Vratislav VII of Pomerania and the great-nephew of Margaret, queen of the three united Scandinavian realms, Erik was adopted by Margaret in 1387. Her skillful diplomacy won him the throne of the three

realms (the Kalmar Union) in 1397, but she continued as effective ruler until her death in 1412.

Erik soon set out to establish a powerful Scandinavian Baltic empire, based in Denmark. Supported by the Danish diet (1413) and the German king Sigismund (1424), he launched two wars (1416–22, 1426–35) against the counts of Holstein to regain control of Schleswig. The Holsteiners were joined in 1426 by the north German trading towns of the Hanseatic League, whose trading interests were threatened by Erik's preferential policy toward Danish merchants and artisans. Although Schleswig was completely lost to the Holstein-Hanseatic coalition by 1432, Erik defeated Hanseatic fleets and imposed the first tolls (1428) on ships plying the strait between Denmark and Sweden.

Erik's favouritism toward Danes in his official appointments and his war financed by heavy taxes meanwhile had aroused opposition in Norway and Sweden and among the Danish peasants. When a Hanseatic blockade stopped Swedish exports of iron and copper in 1434, Swedish miners revolted. Leading Swedish nobles exploited the conflict and won the support of the Danish council of state in demanding that Erik institute a new union with constitutional forms of government. When Erik refused, he was deposed in Denmark, Sweden (1439), and Norway (1442) and was succeeded by Christopher III of Bavaria in all three of his realms. From his exile on the Baltic island of Gotland, Erik tried to regain the throne until 1449, when he withdrew to Pomerania.

NORTHUMBERLAND

- **Erik:** *see* Erik I (Norway).

NORWAY

- **Erik I,** byname ERIK BLOODAX, Norwegian EIRIK BLODØKS (d. 954, Stainmore, Eng.), king of Norway (*c.* 930–935) and later king of Northumberland (948, 952–954). On the death of his father, Harald I Fairhair, first king of united Norway, Erik attempted to make himself sole king of Norway, defeating and slaying two of his brothers to whom vassal kingdoms had been assigned by their father; but his tyranny fostered the reaction which naturally set in against the strong rule of Harald. Another son, Haakon, who had been brought up in England, was invited to Norway by dissident nobles and succeeded in ejecting Erik.

Much later Erik turned up in Northumbria, once a Viking stronghold but at this time under English overlordship; there he established himself as king in 948 but was driven out the same year. In 952 he returned, only to be expelled again in 954, when King Eadred of England took the Northumbrian kingdom into his own hands. Erik was slain the same year at Stainmore. With his expulsion, the line of Norse kings in York ended.

- **Erik III:** *see* Erik VII (Denmark).

SWEDEN

- **Erik XIII:** *see* Erik VII (Denmark).

- **Erik XIV** (b. Dec. 13, 1533, Stockholm—d. Feb. 26, 1577, Örbyhus, Swed.), king of Sweden (1560–68) who expanded the powers of the monarchy and pursued an aggressive foreign policy that led to war against Denmark, the Seven Years' War of the North (1563–70).

Succeeding his father, Gustav I Vasa, in 1560, Erik soon obtained passage of the Articles of Arboga (1561), curtailing the powers of his half brothers, who had been granted large duchies by Gustav I. He consolidated his authority by establishing a special royal court of appeal and installing a new constitution (1562) that defined the nobility's military obligations.

Erik XIV; detail from a portrait by S. von der Meulen, 1561; in Gripsholm Castle, Swed.

By courtesy of the Svenska Portrattarkivet, Stockholm

Erik's major foreign policy objective was to free Sweden's Baltic Sea trade from Danish control. He first sought allies in western Europe, unsuccessfully bidding for the hand of Elizabeth I of England. Realizing the advantage of controlling ports on the eastern Baltic coast, he obtained sovereignty (1561) over Reval (now Tallinn, Estonian S.S.R.), and its adjacent territories. Meanwhile, his half brother John, duke of Finland, also sought a foothold in the east and signed a treaty with Sigismund II Augustus, king of Poland, agreeing to marry the King's daughter against Erik's wishes. Erik imprisoned John and his wife the following year.

Erik's acquisitions in Estonia alarmed Frederick II, king of Denmark and Norway, who allied with Lübeck and Poland and declared war in 1563, initiating the Seven Years' War of the North. The Swedish king led his forces with moderate effectiveness and was able to gain a stalemate with Denmark in the first years of the war. His fear of treason caused his judgment to break down in 1567, and he ordered the killing of the powerful Sture family's leading members. His adviser, Jöran Persson, was imprisoned for the crime.

After regaining his mental composure, Erik restored the hated Persson; he then had his commoner mistress, Karin Månsdotter, crowned queen over the objections of the nobility. Duke John (later king as John III), liberated in 1567, joined with his brother, the future Charles IX of Denmark and Norway, and deposed Erik in 1568. Erik died in prison.

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

Erik THE RED, byname of ERIK THORVALDSON, Norwegian EIRIK RAUDE, or EIRIK TORVALDSSON (fl. late 10th century, Norway), founder of the first European settlement on Greenland (*c.* 986) and the father of Leif Eriksson, one of the first Europeans to reach North America.

As a child, Erik left his native Norway for western Iceland with his father, Thorvald, who had been exiled for manslaughter. In the Scandinavian style of the time he was known as Erik Thorvaldson and in his youth was nicknamed Erik the Red. When Erik was similarly exiled from Iceland *c.* 980, he decided to explore the land to the west (Greenland). That land, visible from the mountaintops of western Iceland, lay across 175 miles of water; it had been skirted by the Norwegian Gunnbjörn Ulfsson earlier in the 10th century. Erik sailed in 982 with his household and livestock but was unable to approach the coast because of drift ice. The party rounded the southern tip of Greenland and settled in an area near present Julianehåb (Qaqortoq). During the three-year period of Erik's exile, the settlers encountered no other people, though they explored to the northwest, discovering Bear Island (now Disko).

Erik returned to Iceland in 986. His descriptions of the territory, which he named Greenland, convinced many people anxious for more habitable land to join a return expedition. Of the 25 ships that sailed from Iceland, only 14 ships and 350 colonists are believed to have landed safely at an area later known as Eystribygo (Eastern Colony). By the year 1000 there were an estimated 1,000 Scandinavian settlers in the colony, but an epidemic in 1002 considerably reduced the population. Erik's colony, commemorated in the Icelandic *Eiríks saga* ("Saga of Erik"), gradually died out; but other Norse settlements in Greenland continued and maintained contact with Norway until the 15th century, when communications stopped for more than 100 years.

Erikson, Erik H(omburger) (b. June 15, 1902, Frankfurt am Main), German-born U.S. psychoanalyst whose writings on social psychology, individual identity, and the interactions of psychology with history, politics, and culture influenced professional approaches to psychosocial problems and attracted widespread interest among laymen.

As a young man, Erikson attended art school and travelled around Europe. In 1927, when he was invited by the psychoanalyst Anna Freud to teach art, history, and geography at a small private school in Vienna, he entered psychoanalysis with her and underwent training to become a psychoanalyst himself. He became interested in the treatment of children and published his first paper in 1930, before completing psychoanalytic training and being elected to the Vienna Psychoanalytic Institute in 1933. The same year, he emigrated to the United States, where he practiced child psychoanalysis in Boston and joined the faculty of the Harvard Medical School. He became interested in studying the way the ego, or consciousness, operates creatively in sane, well-ordered individuals.

Erikson left Harvard in 1936 to join the Institute of Human Relations at Yale. Two years later he began his first studies of cultural influences on psychological development, working with Sioux Indian children at the Pine Ridge Reservation in South Dakota. These studies, and later work with the anthropologist Alfred Kroeber among the Yurok Indians of northern California, eventually contributed to Erikson's theory that all societies develop institutions to accommodate personality development but that the typical solutions to similar problems arrived at by different societies are different.

Erikson moved his clinical practice to San Francisco in 1939 and became professor of psychology at the University of California, Berkeley, in 1942. During the 1940s he produced the essays that were collected in *Childhood and Society* (1950), the first major exposition of his views on psychosocial development. The evocative work was edited by his wife, Joan Serson Erikson. Erikson conceived eight stages of development, each confronting the individual with its own psychosocial demands, continuing into old age. Personality development, according to Erikson, takes place through a series of crises that must be overcome and internalized by the individual in preparation for the next developmental stage.

Refusing to sign a loyalty oath required by the University of California in 1950, Erikson resigned his post and that year joined the Austen Riggs Center in Stockbridge, Mass. He then returned to Harvard as a lecturer and professor (1960–70) and professor emeritus (from 1970).

In *Young Man Luther* (1958), Erikson combined his interest in history and psychoanalytic theory to examine how Martin Luther was able to break with the existing religious establishment to create a new way of looking

at the world. *Gandhi's Truth on the Origins of Militant Nonviolence* (1969) was another attempt at psychohistory. In the 1970s Erikson was particularly interested in the ethical and political problems of modern man, presenting his views in a collection of essays, *Life History and the Historical Moment* (1975), which links psychoanalysis to history, political science, philosophy, and theology. His later works include *The Life Cycle Completed: A Review* (1982) and *Vital Involvement in Old Age* (1986).

Erikson, Leif, ERIKSON also spelled ERIKSSON: *see* Leif Eriksson.

Erinna (fl. end of 4th century BC?), Greek poet of the Aegean island of Telos, known in antiquity for "The Distaff," a hexameter poem of lament for a friend, written in the local Dorian dialect. Surviving fragments of her work include three epigrams. She is said to have died at the age of 19.

Erinys, plural ERINYES (Greco-Roman mythology): *see* Fury.

Eriocaulales, the pipewort order of monocotyledonous flowering plants comprising the family Eriocaulaceae, with 13 genera of small, tufted herbs with grasslike leaves that grow in aquatic and marshy habitats, mostly in tropical and subtropical regions, especially in South America.

The plants are characterized by inconspicuous flowers that are borne in small but often showy clusters, resembling superficially those of a sunflower. The flowers are either male or female, but the heads may contain flowers of only one sex or of both sexes together.

The order is considered to have a common evolutionary origin with the spiderwort order (Commelinales) from an ancestor in the lily order (Liliales). The chief genera are *Paepalanthus* (485 species), *Eriocaulon* (400 species), *Syngonanthus* (195 species), and *Leiothrix* (65 species). About 30 species of *Eriocaulon* occur outside the tropics in Japan, about 8 occur in eastern North America as far north as Newfoundland, and only one (*E. septangulare*) is known in Europe.

erionite, hydrated sodium-potassium-calcium aluminosilicate mineral in the zeolite family, one of the most abundant zeolites present in sedimentary rocks. Its chemical composition is approximately represented by the formula $(Na_2,K_2,Ca)_{4.5}Al_9Si_{27}O_{72} \cdot 27H_2O$. It forms wooly, fibrous crystals that have an internal molecular structure similar to that of chabazite. Erionite is the principal mineral present in several tuff deposits in the American states of Oregon, California, Nevada, and Arizona; a few of these have been quarried for building stone since the 19th century. The dehydrated mineral is useful as a molecular sieve that can remove hydrogen chloride, water, and carbon dioxide from gas streams.

Eris, Roman DISCORDIA, in Greco-Roman mythology, the personification of strife, daughter of Nyx, and sister and companion of Ares, or the Roman Mars. Eris is best-known for her part in starting the Trojan War. When she alone of the gods was not invited to the marriage of Peleus and Thetis, she threw among the guests a golden apple inscribed "For the most beautiful." Hera, Athena, and Aphrodite each claimed it, and Zeus assigned the decision to Paris. Paris awarded the apple to Aphrodite, who then helped him win Helen of Troy. In the war that resulted, Hera and Athena remained implacable enemies of Troy.

eristic (from Greek *eristikos,* "fond of wrangling"), argumentation that makes successful disputation an end in itself rather than a means of approaching truth. Such argumentation is dialectical in form, uses indirect refutations, and reduces philosophical inquiry to a rhetorical exercise. Eristic argument is closely associated with the Sophists and was ridiculed by Plato in his dialogue *Euthydemus.* The term is often used more broadly to characterize arguments that rely on subtle and specious processes of clever or cunning thought.

Eritrea, historic region of northern Ethiopia, extending about 600 miles (950 km) from Cape Kasar to Cape Dumeira in the Strait of Bāb el-Mandeb and bounded on the northeast by the Red Sea, on the southeast by the Republic of Djibouti, on the south by other Ethiopian regions, and on the northwest by The Sudan. It consists of a northward extension of the Ethiopian high plateau, bordered by lower plains to the east and west. The eastern plain (10–50 miles [16 to 80 km] wide) includes the Danakil region and the northern end of the Kobar Sink (nearly 381 feet [116 m] below sea level) and is sharply delimited by the fault line of the plateau escarpment. To the west, the plateau slopes gradually toward The Sudan and is dissected by the valleys of westward-flowing rivers whose eroding action has formed steep-sided, flat-topped formations. Climatic conditions vary. Mitsiwa (at sea level) has an annual average temperature of 86° F (30° C) and an annual rainfall of 8 inches (200 mm), while Asmera, only about 40 miles (about 65 km) distant from Mitsiwa, but at an elevation of 7,628 feet [2,325 m], has 62° F (17° C) and 20 inches (508 mm).

Because of unreliable rainfall and locusts, Eritrea is agriculturally poor, although irrigation has significantly increased production. Industry, based in Asmera, is mainly concerned with food products, textiles, and leather goods. Salt is produced in the Kobar Sink and at Mitsiwa and Aseb. Airlines serve Asmera and Aseb, and a road system links Eritrea with The Sudan and the remainder of Ethiopia. A steep mountain railroad (191 miles [307 km]) goes from Mitsiwa up to Asmera and down again to Bisha (about 3,000 feet [914 m] above sea level) in the west.

The varied population includes Tigrinya-speaking Coptic Christians in the southern highlands, Tigre-speaking Muslims on the northern slopes, and Saho- and Danakili-speakers in the coastal desert plain. Many inhabitants along the coast and the border with The Sudan speak Arabic, and many of those around Asmera also speak Italian.

As the site of part of the Aksumite empire (flourished 4th–6th century AD), the region was linked to the beginnings of the Ethiopian kingdom (*c.* AD 950), but it retained much of its independence until it fell under Ottoman rule in the 16th century. From the 17th to the 19th century, control of the territory was disputed among Ethiopia, the Ottomans, the kingdom of Tigrai, Egypt, and Italy. The Treaty of Uccialli (1889), between Italy and Menelik II of Ethiopia, recognized Italian possessions on the Red Sea, and the colony, created on Jan. 1, 1890, was named by the Italians after the Mare Erythraeum (Latin: "Red Sea") of the Romans. Used as the main base for the Italian invasions of Ethiopia (1896 and 1935–36), Eritrea became one of the six provinces of Italian East Africa. In 1941 the area came under British administration and remained so until Eritrea was federated as an autonomous unit to Ethiopia in 1952. Many Eritreans who initially favoured union with Ethiopia were embittered by Ethiopian efforts to undermine regional autonomy.

On Nov. 14, 1962, Eritrea became part of the Ethiopian Empire. The same year, a guerrilla group known as the Eritrean Liberation Front was formed, and later several offshoots, representing differing political ideologies, came into being. They led a movement for independence from Ethiopia, fighting an inconclusive, rather sporadic guerrilla war against Emperor Haile Selassie's forces. After the emperor was deposed by a military coup in 1974, active warfare between the secessionists and the new regime erupted in early 1975 and continued intermittently into the 1980s.

Eritrean Liberation Front (ELF), nationalist Eritrean secessionist movement dedicated to liberating the historic region of Eritrea (now the northernmost province of Ethiopia) from Ethiopian control and establishing an independent Eritrean nation.

The ELF was founded in 1958 and grew in membership when Ethiopian ruler Haile Selassie abolished Eritrea's autonomous status in 1962. Beginning in the late 1960s, the ELF mounted a systematic campaign of guerrilla warfare against the Ethiopian government. The ELF took control of the rural areas of Eritrea, set up an administrative system in those areas, and managed to capture several Eritrean towns. In the 1970s, however, various factions split off from the ELF to form the Eritrean Liberation Front-Popular Liberation Forces (ELF-PLF) and the larger Eritrean People's Liberation Front (EPLF). Together the three organizations subsequently fought among themselves at the expense of their campaign for Eritrean independence. By the 1980s the EPLF had emerged as the principal Eritrean guerrilla movement, and it carried on the war against the Ethiopian government.

Erlander, Tage (Fritiof) (b. June 13, 1901, Ransäter, Swed.—d. June 21, 1985, Huddinge, near Stockholm), politician and statesman, prime minister of Sweden for 23 years (1946–68), who was the major architect of its welfare state.

Erlander graduated from Lund University in 1928 and was an editor for the encyclopaedia *Svensk Uppslabok* from 1928 to 1938. He entered the Riksdag (parliament) as a Social Democrat in 1933 and served as minister for social affairs (1938–44) and minister without portfolio (1944–45). In the Social Democratic government of Per Albin Hansson (1945–46) he headed the Ministry of Education and Church Affairs. He became prime minister and chairman of the Social Democratic Party following the death of Hansson in 1946 and remained in both posts until his retirement in 1968. In 1970 he was elected to the new single-chamber Riksdag that his government had championed since 1955.

During Erlander's long tenure as head of government, Sweden increased its social-welfare legislation with the passage of greater old-age benefits, child allowances, and rent subsidies. His educational reforms included extending compulsory education to nine years and increasing higher-educational opportunities. In foreign policy he maintained Sweden's neutrality during the Cold War.

After his retirement Erlander wrote four volumes of memoirs, *Tage Erlander* (1972–76).

Erlangen, city, Bavaria *Land* (state), southern Germany, at the junction of the Schwabach and Regnitz rivers, just north of Nürnberg. Founded in the 8th century, it was transferred from the bishopric of Würzburg to that of Bamberg in 1017 and was sold to the king of Bohemia in 1361. Chartered in 1398, it passed to the Hohenzollern burgraves of Nürnberg in 1402 and to Bavaria in 1810. It owes the foundations of its prosperity chiefly to the French Protestant (Huguenot) refugees who settled in 1686 in "Christian Erlang," which united with Erlangen in 1824.

Erlangen is divided into an Altstadt ("Old Town") and a Neustadt ("New Town"), Christian Erlang. Notable buildings include the town hall (1731) and the former palace (1700–04) of the margraves of Kulmbach-Bayreuth, now the main building of the Friedrich-Alexander University of Erlangen-Nürnberg (founded in 1742 at Bayreuth and moved to Erlangen in 1743).

The production of gloves, hats, and drapery dates back to the Huguenots. Modern industry includes the manufacture of electromedical apparatus. The city has a port on the Rhine-Main-Danube-Kanal. Pop. (1983 est.) 102,730.

Erlanger, Joseph (b. Jan. 5, 1874, San Francisco—d. Dec. 5, 1965, St. Louis, Mo., U.S.), U.S. physiologist, who received (with Herbert Gasser) the Nobel Prize for Physiology or Medicine in 1944 for discovering that fibres in the same nerve cord possess different functions.

Erlanger's research into nerve function was the product of a profitable collaboration with Gasser, one of his students at the University of Wisconsin, Madison (1906–10). Soon after Erlanger's appointment as professor of physiology at Washington University, St. Louis (1910–46), Gasser joined him there, and they began studying ways in which the recently developed field of electronics could be applied to physiological investigations.

By 1922 they were able to amplify the electrical responses of a single nerve fibre so that they could analyze them by the use of a cathode-ray oscilloscope. The characteristic wave pattern of an impulse generated in a stimulated nerve fibre, once amplified, could then be seen on the screen and the components of the nerve's response studied.

In 1932 Erlanger and Gasser found that the fibres of a nerve conduct impulses at different rates, depending upon the thickness of the fibre, and that each fibre has a different threshold of excitability—*i.e.,* each requires a stimulus of different intensity to create an impulse. They also found that different fibres transmit different kinds of impulses, represented by different types of waves.

Erlanger Loan, in U.S. history, most famous attempt of the Confederate government to raise funds abroad during the American Civil War.

In 1863 the Confederacy entered into an arrangement with the French banking house of Emile Erlanger & Company. Erlanger agreed to market $15,000,000 worth of Confederate bonds backed by cotton. He could receive the bonds at 77 (*i.e.*, $77 per $100 face value) and sell them in foreign financial markets at 90. In addition, he received a 5 percent commission for selling the bonds.

The bonds were attractive to speculators because they could be exchanged for cotton after the war at a price well below the current market value. The bonds fluctuated wildly during the course of the war, however, as Confederate military fortunes waxed and waned. The bonds became worthless when the South finally collapsed, but by that time Erlanger had reaped enormous profits. He held no bonds by the time their value disintegrated, and although Erlanger had taken much of the sale price, the South wound up receiving over $6,000,000 to aid in their war effort.

Erlangga, also spelled AIRLANGGA (b. 991, Bali—d. 1049?, Java), early Indonesian ruler who succeeded in reuniting the empire of eastern Java.

Erlangga was married to the daughter of Dharmavamsa, the earliest Javanese historical figure for whom clear information is available and who created an empire centred on his capital in eastern Java between *c.* 985 and 1006, until its destruction by the Sumatran kingdom of Śrivijaya. Erlangga escaped to the jungle, however, and immediately began work to reunite Dharmavamsa's possessions. By 1019 he had become the ruler of the Pasuran area, with his capital at a hermitage at Wonogiri. Military actions between 1028 and *c.* 1035 gave him effective control of eastern Java. During his reign, which lasted until 1049, a court poet named Mpu Kanwa composed the Javanese epic *Arjunavivāha,* a modification of the Indian *Mahābhārata* that was an allegory of Erlangga's own life.

According to the Javanese chronicles, Erlangga in *c.* 1045 prepared for the succession by dividing his kingdom between his sons. Although this action substantially weakened central control, one portion, Kadiri, remained a major sea power and controlled a substantial territory through the 12th century and into the early years of the 13th.

Erlau (Hungary): *see* Eger.

Erlianhaote: *see* Erh-lien-hao-t'e.

Erlingsson, Thorsteinn (b. Sept. 27, 1858, Fljótshlíd, Ice.—d. Sept. 28, 1914, Reykjavík), Icelandic poet whose satirical and rebellious writing was always softened by his own humanity.

Erlingsson was a farmer's son. At the University of Copenhagen, he spent 13 years dabbling in philology and Old Norse, but never took a degree. He lived in poverty and finally went back to Iceland as a provincial journalist. He settled in Reykjavík and eked out a writer's pension by private teaching. Living at a time when the Danish regime imposed great hardship on the Icelanders, Erlingsson rebelled against the establishment, both religious and secular, but he was essentially a gentle poet.

His two major publications were *Thyrnar* (1897; "Thorns") and *Eidurinn* (1913; "The Oath"); *Thyrnar* is a collection of poems ranging from love lyrics to political satire. *Eidurinn* is a moving poem sequence that interprets the 17th-century tragic love story of Ragnheidur, the defiant daughter of Bishop Brynjólfur Sveinsson of Skálholt, who gives birth to the child of a lover she has been forced to forswear.

Erlon, Jean-Baptiste Drouet, comte d' (French marshal): *see* Drouet, Jean-Baptiste.

Ermak Timofeyevich (Cossack leader): *see* Yermak Timofeyevich.

Ermanaric (d. between 370 and 376), king of the Ostrogoths, the ruler of a vast empire in the Ukraine. Although the exact limits of his territory are obscure, it evidently stretched south of the Pripet Marshes between the Don and Dnestr rivers.

The only certain facts about Ermanaric are that his great deeds caused him to be feared by neighbouring peoples and that he committed suicide because he despaired of successfully resisting the Huns, who invaded his territories in the 370s. His kingdom was thereupon destroyed and his people became subject to the Huns for about 75 years.

At an early date Ermanaric became the centre of popular tradition. According to the 6th-century historian Jordanes, the King put to death a woman named Sunilda by tying her to two wild horses and driving them apart, because her husband had treacherously deserted him. Thereupon her two brothers, Sarus and Ammius, severely wounded Ermanaric. Variations of this legend had a profound effect upon medieval Germanic literature, including that of England and Scandinavia. The form of Ermanaric's name differs with different authors and dialects: it occurs as Ermenrichus in Ammianus Marcellinus (whose book 31 is the chief source for the King's career), as Hermanaricus in Jordanes, as Jörmunrekr in the Norse writers, and as Eormenric in the Anglo-Saxon.

Ermelo, *gemeente* (municipality), Gelderland *provincie* (province), central Netherlands, near Veluwe Lake, comprising the villages of Ermelo, Nunspeet, and Elspeet. First mentioned in 855, it has ruins of the monastery of the Knights of St. John and a church with an 11th-century Romanesque steeple and a 14th-century choir. The main economic activities are poultry and dairy farming and dye, plastic, and metal industries. Pop. (1982 est.) 24,626.

Ermengem, Frédéric van: *see* Hellens, Franz.

ermetismo (poetic movement): *see* Hermeticism.

ermine, any of several northern weasel (*q.v.*) species of the genus *Mustela,* called by this name especially during the winter-white colour phase; this white coat is the ermine of the fur trade. The species that furnished the ermine for robes of royalty in Europe was *M. erminea,* the stoat (*q.v.*).

ermine moth, any of several species of insects belonging to the family Yponomeutidae (order Lepidoptera). Ermine moths are widely distributed in the Northern Hemisphere. The hairy caterpillars feed on dandelions and other weeds, cultivated shrubs, and trees, particularly fruit trees. Ermine moths have a wingspan of three to five centimetres. Adult females have brilliant white or cream-coloured wings with dark fleck marks, and a fluffy thorax, resembling a stoat's winter ermine coat, hence the common name.

Ermine Street, major Roman road in England between London and York. It ran north from Bishopsgate, London, through Ware, Royston, Godmanchester, and Ancaster to Lincoln (Lindum) and thence to York (Eboracum), crossing the River Humber at Brough. As the London–York road, it remained one of the great roads of England until modern times. The Saxon name Ermine Street is also applied to the Roman road from Silchester (Calleva Attrebatum) to Cirencester (Corinium) and Gloucester (Glevum), crossing the River Thames just below Cricklade and descending the Cotswold escarpment at Birdlip.

Ermoúpolis (Greece): *see* Hermoúpolis.

Ernākulam, district, Kerala state, southwestern India, extending from the Arabian Sea (west) to the Western Ghāts (east). The district has an area of 918 sq mi (2,377 sq km). Along the coastal region are many backwaters, the largest being Vembanād Lake, which extends south into Alleppey district; the main river is the Periyār. Cardamom (grown in the Cardamom Hills in the southeast), rubber, and coir are among the principal products. The area between Alwaye and Cochin (*q.v.*) is sometimes called the "Ruhr of Kerala" because of its heavy industrialization.

Cochin, one of India's most important ports, was the site of the first European settlement in India, dating from the 16th century; the region still has an unusual mixture of peoples, cultures, and architecture. There are interesting Hindu temples and palaces at Tripunittura; the Veliyattanparambil temple is at Narakal. Ernākulam town, the district's administrative headquarters, and Mattāncheri form part of Cochin urban agglomeration. Pop. (1981) 2,535,294.

Erne, Lough, Irish LOCH ÉIRNE, lake in Fermanagh district (established 1973), formerly County Fermanagh, Northern Ireland. It is 40 mi (64 km) long and has an average width of 5 mi and a maximum depth of 200 ft (60 m). The lake consists of the shallow Upper Lough Erne, 12 mi long, and Lower Lough Erne, 18 mi long, linked by a 10-mi strait that is part of the River Erne. The lakes lie in an almost level carboniferous limestone plateau. Although formed by the solution of limestone, their basins are blanketed with heavy boulder clays. The level in the upper lake is subject to fluctuations because of the constricted flow produced by these glacial features. Numerous islands dot the lakes and provide recreation facilities.

A flood-relief project, completed in 1959, was designed to control the water supply to

hydroelectric power stations at Ballyshannon and Cliff. As a result, about 29,000 ac (11,700 ha) of land around the upper lake have been freed from summer flooding and excessive waterlogging.

Ernest, German ERNST, name of rulers grouped below by country and indicated by the symbol •.

SAXE-COBURG-GOTHA

• **Ernest I** (b. Jan. 2, 1784, Coburg, Ger.—d. Jan. 29, 1844, Gotha), duke of Saxe-Coburg-Saalfeld (as Ernest III) from 1806 and then, from 1826, duke of Saxe-Coburg-Gotha. He was the uncle of Queen Victoria and the father of her husband, Prince Albert.

When Ernest succeeded to the Duchy of Saxe-Coburg-Saalfeld on the death of his father (Francis) in 1806, the duchy was occupied by Napoleon, and Ernest did not recover it until the peace of Tilsit (July 1807). He commanded the Saxon V army corps in 1813–14 and reduced Mainz by blockade; he also took part in the campaign of 1815. At the Congress of Vienna he received the principality of Lichtenberg, which he sold to Prussia in 1834.

In 1826, after the death of his brother-in-law Frederick, the last duke of Saxe-Gotha (1825), Ernest gave up Saalfeld and received Gotha, becoming Ernest I of Saxe-Coburg-Gotha. In 1821 he had given a constitution to Coburg, but he did not change the traditional system of estates in Gotha. He married twice: (1) in 1817, Louise of Saxe-Gotha, whom he divorced in 1826; (2) in 1832, Mary of Württemberg. Of his sons, Ernest (b. 1818) succeeded him, and Albert (b. 1819) married Queen Victoria of Great Britain. His brother Leopold (1790–1865) became king of the Belgians and his sister Victoria (1786–1861) was Queen Victoria's mother.

• **Ernest II** (b. June 21, 1818, Coburg, Ger.—d. Aug. 22, 1893, Reinhardsbrunn, Thuringia), duke of Saxe-Coburg-Gotha, brother of Prince Albert (consort of Queen Victoria of England), and a strong supporter of German unification.

Ernest II, detail from a lithograph by C. Baugniet after a portrait by H. Thorburn, 1844

By courtesy of the Kunstsammlungen Veste Coburg, West Germany

He succeeded his father, Duke Ernest I, in 1844. In 1852 he gave Gotha a new constitution, which in part coordinated the administration of his two duchies. In 1861 Ernest concluded a military agreement with Prussia. About this time he became patron of the *Nationalverein* and allowed his court to become the centre of nationalist agitation. During the Seven Weeks' War of 1866, after vainly trying to mediate between Prussia and Austria, he put his troops under Prussian direction. His role in politics outside his own duchies ended when the German empire was formed. Because Ernest had no children, his title was inherited by his nephew Alfred, duke of Edinburgh.

SAXE-GOTHA-ALTENBURG

• **Ernest I,** byname ERNEST THE PIOUS, German ERNST DER FROMME (b. Dec. 25, 1601, Altenburg, Saxony—d. March 26, 1675, Gotha, Saxe-Gotha), duke of Saxe-Gotha-Altenburg, who, after the ravages of the Thirty Years' War, sought to rebuild and reform his country.

An ardent Lutheran, he allied himself with the Swedes from 1631, fighting in the battles of Lech, Nürnberg, Lützen, and Nördlingen. In 1635 he signed the Peace of Prague and turned to the governing of his duchy, making it eventually one of the most prosperous areas of Germany. His educational reforms—made with the help of Veit Ludwig von Seckendorf and Andreas Reyher (a disciple of Comenius)—were so fundamental that he might be called the real founder of the modern common school system in Germany. A set of school regulations entitled *Schulmethodus* ("School Method"; 1642; revised 1648, 1658, 1662, 1672), compiled under his direction, instituted such ideas as compulsory education, grading, and an enlarged curriculum to embrace sciences, civics, and other "useful" subjects. He also established the ducal library of Gotha and generally, through his patronage, set the stage for the German Enlightenment.

Ernest Augustus, German ERNST AUGUST, name of electors and kings of Hanover, grouped below chronologically and indicated by the symbol •.

• **Ernest Augustus** (b. Nov. 30 [Nov. 20, old style], 1629, Schloss Herzberg am Harz, Hanover—d. Feb. 2 [Jan. 23, O.S.], 1698, Schloss Herrenhausen), duke (from 1679) and elector (from 1692) of Hanover, father of George Louis, who became George I, king of Great Britain.

The Protestant bishop of Osnabrück from 1661, Ernest Augustus succeeded his elder brother as ruler of the Duchy of Lüneburg-Calenburg (which became known as the duchy and then electorate of Brunswick-Lüneburg or, more popularly, because of its capital city, the duchy and electorate of Hanover). He made skillful use of the emperor Leopold I's difficulties; and in 1692, in return for lavish promises of assistance to the Empire and the Habsburgs, the Emperor granted him the rank and title of elector of Brunswick-Lüneburg (*i.e.*, Hanover). Indignant protests followed this proceeding. A league was formed to prevent any addition to the electoral college; France and Sweden were called upon for assistance, and the constitution of the Empire was reduced to chaos. This agitation, however, soon died away, and his son was confirmed as elector by the imperial diet in 1708.

Ernest Augustus took a step of great importance in the history of Hanover and Great Britain when, in 1658, he married Sophia, daughter of the elector palatine Frederick V and granddaughter of James I of Great Britain; for their son became, by the terms of the Act of Settlement of 1701, king of Great Britain and Ireland in 1714.

• **Ernest Augustus,** also called (1799–1837) PRINCE ERNEST AUGUSTUS, DUKE OF CUMBERLAND, DUKE OF TEVIOTDALE, EARL OF ARMAGH (b. June 5, 1771, Kew, Surrey, Eng.—d. Nov. 18, 1851, Herrenhausen, Hanover), king of Hanover, from 1837 to 1851, the fifth son of George III of England.

He studied at Göttingen, entered the Hanoverian army, and served as a leader of cavalry when war broke out between Great Britain and France in 1793. When Hanover withdrew from the war in 1795 he returned to England, being made lieutenant general in the British army in 1799. In the same year he was created duke of Cumberland.

In 1810 he was severely injured by an assailant, probably his valet Sellis, who was found dead; subsequently two men were imprisoned for asserting that the Duke had murdered his valet. Recovering from his wounds, Cumberland again proceeded to the seat of war; as a British field marshal, he was in command of the Hanoverian army during the campaigns of 1813 and 1814. Back in England in 1815, however, the Duke's strong Toryism made him unpopular. The Duke resented the refusal of Parliament to increase his allowance and retired for some years to Berlin. On the accession of George IV he returned to England but he ceased to play an important part in politics after the accession of Wiliam IV (1830).

When William died in June 1837, the crowns of Great Britain and Hanover were separated; and Ernest, as the nearest male heir of the late king, became king of Hanover. He cancelled the constitution that William had given in 1833, and the constitution that he sanctioned in 1840 was characteristic of his own illiberal ideas. His reign was a stormy one, and serious trouble between king and people had arisen when he died. He was succeeded by his son, George V.

• **Ernest Augustus (II),** also called DUKE OF CUMBERLAND, HERZOG VON BRAUNSCHWEIG-LÜNEBURG (b. Sept. 21, 1845, Hannover, Hanover—d. Nov. 14, 1923, Gmünden, Austria), only son of George V of Hanover and pretender to the Hanoverian throne from 1878 to 1913.

After his father was deposed as a result of the events of the Seven Weeks' War between Prussia and Austria (in which Hanover had sided with losing Austria), Ernest Augustus lived mainly in Austria; on his father's death (1878), however, he maintained his claim to the Hanoverian throne. In 1884 on the death, without issue, of his kinsman William, the last sovereign duke of Brunswick, he also claimed that duchy. Inspired by Chancellor Otto von Bismarck, the German Federal Council rebutted him naming Prince Albert of Prussia as regent of Brunswick. After the latter's death the duke was again excluded (1907), and the regency continued.

In 1902 Ernest Augustus had told the German emperor William II that he was prepared to accept the imperial regime in Germany; and in May 1913 the Guelph-Hohenzollern feud was healed by the marraige of his son Ernest Augustus (1887–1953) to William II's only daughter, Victoria Louise. Ernest Augustus then renounced his rights in favour of his son, the Federal Council lifted its veto, and the young prince became a sovereign ruler as Ernest Augustus, duke of Brunswick (Nov. 1, 1913). He abdicated with other German princes, on Nov. 8, 1918. A Titles Deprivation Act in 1917, followed by an order in council in 1919, deprived father and son of all their titles and honours in the United Kingdom.

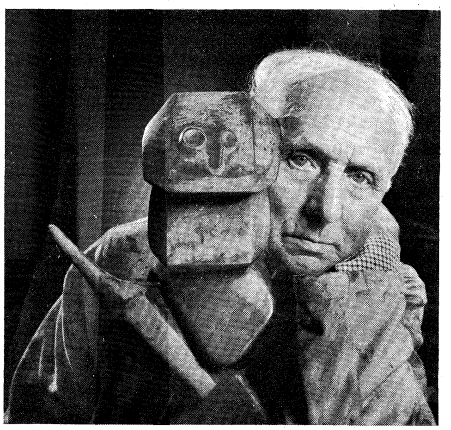
Ernest Louis, German in full ERNST LUDWIG KARL ALBRECHT WILHELM (b. Nov. 25, 1868, Darmstadt, Hesse-Darmstadt—d. Oct. 9, 1937, near Darmstadt), grand duke of Hesse-Darmstadt from 1892 until his abdication in 1918, at the end of World War I. His father was the grand duke Louis IV, whom he succeeded on March 13, 1892; his mother was Princess Alice, daughter of Queen Victoria of England and the prince consort, Albert.

Ernest Louis was best known as a patron of the arts. In 1899 he founded the Darmstadt Artists' Colony for architects, designers, sculptors, and craftsmen, most of the buildings of which were designed by the Viennese architect Joseph Maria Olbrich. Much of the work done under the patronage of Ernest Louis was a reaction against the Jugendstil movement, the German version of Art Nouveau. The Grand Duke himself wrote poems, plays, essays, and piano music.

Ernestine duchies: *see* Saxon duchies.

Ernst (Danish, German, etc., personal name): *see under* Ernest, except as below.

Ernst, Max (b. April 2, 1891, Brühl, Ger.—d. April 1, 1976, Paris), German painter, sculptor, one of the leading advocates of irrationality in art and an originator of the



Max Ernst, photograph by Yousuf Karsh, 1965
© Karsh—Woodfin Camp and Associates

Automatism movement of Surrealism. His youthful interests were psychiatry and philosophy, but he abandoned his studies at the University of Bonn for painting.

After serving in the German Army during World War I, Ernst was converted to Dada (*q.v.*), a nihilistic art movement, and formed a group of Dada artists in Cologne; with the artist-poet Jean (Hans) Arp, he edited journals and created a scandal by staging a Dada exhibit in a public rest room. More important, however, were his Dada collages and photomontages, such as "Here Everything Is Still Floating" (1920; Museum of Modern Art, New York City), a startlingly illogical composition made from cutout photographs of insects, fish, and anatomical drawings ingeniously arranged to suggest the multiple identity of the things depicted.

In 1922 Ernst moved to Paris, where, two years later, he became one of the founding members of the Surrealists, a group of artists and writers whose work grew out of fantasies evoked from the unconscious. To stimulate the flow of imagery from his unconscious mind, Ernst began in 1925 to use the techniques of frottage (pencil rubbings of such things as wood grain, fabric, or leaves) and decalcomania (the technique of transferring paint from one surface to another by pressing the two surfaces together). Contemplating the accidental patterns and textures resulting from these techniques, he allowed free association to suggest images he subsequently used in a series of drawings ("Histoire naturelle," 1926) and in numerous paintings such as "The Great Forest" (1927; Kunstmuseum, Basel, Switz.) and "The Temptation of St. Anthony" (1945; Wilhelm-Lehmbruck-Museum, Duisburg, W. Ger.). These vast, swamplike landscapes stem ultimately from the tradition of nature mysticism of the German Romantics.

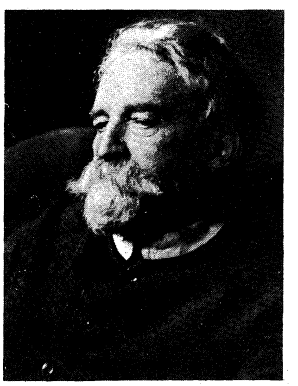
After 1934 Ernst's activities centred increasingly on sculpture, using improvised techniques in this medium just as he had in painting. "Oedipus II" (1934; private collection, New York City), for example, was cast from a stack of precariously balanced wooden pails to form a belligerent-looking phallic image.

At the outbreak of World War II, Ernst moved to the U.S., where he joined his third wife, the collector and gallery owner Peggy Guggenheim, and his son, the U.S. painter Jimmy Ernst. While living on Long Island, N.Y., and after 1946 in Sedona, Ariz. (with his fourth wife, the U.S. painter Dorothea Tanning), he concentrated on such sculptures as "The King Playing with the Queen" (1944; Museum of Modern Art, New York City), which shows African influence. After his return to France in 1949, his work became less experimental: he spent much time perfecting his modelling technique in traditional sculptural materials.

Ernst, Paul (Karl Friedrich) (b. March 7, 1866, Elbingerode, Saxony—d. May 13, 1933, Sankt Georgen, Austria), German poet, essayist, fiction writer, and dramatist known for his short stories and for hundreds of essays on philosophical, economic, and literary problems.

Ernst studied for the ministry but quickly became disillusioned with theology. He became a militant Marxist and the editor of the *Berliner Volkstribüne* ("Berlin People's Tribune"). He severed his Marxist connections at the turn of the century, however, and repudiated the doctrine in *Der Zusammenbruch des Marxismus* (1919; "The Collapse of Marxism"). He had already expressed his antagonism toward Naturalism in art and called for a return to classicism in his essay *Der Weg zur Form* (1906; "The Road to Form"). His search for eternal truths led him through German Idealist philosophy back to a form of Christianity that he dramatized in what he called redemption drama, best exemplified by *Ariadne auf Naxos* (1912).

Ernst's conception of classicism is best illustrated in the tragedy *Brunhild* (1909). Although he believed his greatest literary contribution was in the theatre, he became popular through his novels and won critical acclaim only in his short stories. The autobiographical novel *Der schmale Weg zum Glück* (1904; "The Narrow Road to Happiness") passed through more than 10 editions and *Jugenderinnerungen* (1930; "Recollections of Youth") and *Grün aus Trümmern* (1933; "Green Out of Ruins"), of folkloric inspiration, were almost as popular. His most famous collection of short stories is *Komödianten- und Spitzbubengeschichten*



Paul Ernst
Bavaria-Verlag

(1920, "Tales of Comedians and Rogues"). *Erdachte Gespräche* (1921; "Imagined Conversations") is his best known essay collection, and *Das Kaiserbuch* (1923–28; "The Book on the Emperor"), an epic of some 100,000 verses, is his most important poetical work.

Ernst August (German personal name): *see under* Ernest Augustus.

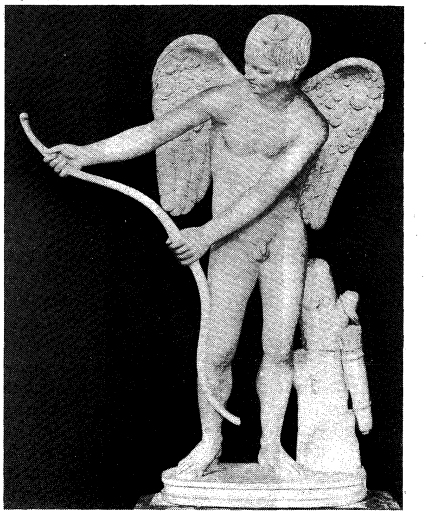
Ernst Ludwig (German personal name): *see under* Ernest Louis.

Erode, town, administrative headquarters of Periyār district, Tamil Nādu state, southeastern India, on the Cauvery River. Temple inscriptions indicate the prominent role played by the town as early as the 10th century AD. Its name is associated with a Cōla temple (907–1279) and means "wet skull." Though successively destroyed by Marāṭhā, Mysore Muslim, and British armies, the surrounding fertile soils assisted in Erode's quick recovery as an agricultural trade centre.

Erode is a railway hub for lines leading northeast, southeast, and southwest and is the junction for the Pykāra and Mettūr hydroelectric schemes. Industries include cotton ginning and the manufacture of transport equipment. It has industrial schools and four colleges affiliated with the University of Madras. Pop. (1981) town, 142,252; metropolitan area, 275,999.

Eromanga (Vanuatu): *see* Erromango.

Eros, in Greek religion, god of love. In the *Theogony* of Hesiod (fl. 700 BC), Eros was a primeval god, son of Chaos, the original



Eros, Roman replica of a 4th-century-BC sculpture by Lysippus; in the Louvre
Alinari—Art Resource/EB Inc.

primeval emptiness of the universe; but later tradition made him the son of Aphrodite, goddess of sexual love and beauty, by either Zeus (the king of the gods), Ares (god of war and of battle), or Hermes (divine messenger of the gods). Eros was god not simply of passion but also of fertility. His brother was Anteros, the god of mutual love, who was sometimes described as his opponent. The chief associates of Eros were Pothos and Himeros (Longing and Desire). Later writers assumed the existence of a number of Erotes (like the several versions of the Roman Amor). In Alexandrian poetry he degenerated into a mischievous child. In archaic art he was represented as a beautiful winged youth but tended to be made younger and younger until, by the Hellenistic period, he was an infant. His chief cult centre was at Thespiae in Boeotia, where the Erotidia were celebrated. He also shared a sanctuary with Aphrodite on the north wall of the Acropolis at Athens. *See also* Cupid.

Eros, first asteroid found to travel mainly inside the orbit of Mars. It was discovered Aug. 13, 1898, by Carl Gustav Witt at the Urania Observatory in Copenhagen. About 24 kilometres (15 miles) long and about 6.4 kilometres (4 miles) wide, its rotation period is 5 hours 16 minutes, it displays large variations in brightness, and its period of revolution is 642 days. Since Eros can approach Earth as closely as 22,500,000 kilometres (14,000,000 miles), its observation was used (before the development of radar methods) in determining by parallax the distance of Earth from the Sun. Study of its approaches to Mercury and Venus has been helpful in calculating the masses of those planets.

erosion, removal of surface material from the Earth's crust, primarily soil and rock debris,

and the transportation of the eroded materials by natural agencies from the point of removal.

A brief treatment of erosion follows. For full treatment, *see* MACROPAEDIA: Geomorphic Processes.

The broadest application of the term erosion embraces the general wearing down and molding of all landforms on the Earth's surface, including the weathering of rock in its original position, the transport of weathered material, and erosion caused by wind action, fluvial processes, marine processes, and glacial processes. This broad definition is more correctly called denudation, or degradation, and includes mass-movement processes. A narrow and somewhat limiting definition of erosion excludes the transport of eroded material by natural agencies, but the exclusion of the transport phenomenon makes the distinction between erosion and weathering very vague. Erosion, therefore, includes the transportation of eroded or weathered material from the point of degradation, but not the deposition of material at a new site. The complementary actions of erosion and deposition or sedimentation operate through the geomorphic processes of wind, moving water, and ice to alter existing landforms and create new landforms.

Erosion will often occur after rock has been disintegrated or altered through weathering. Weathered rock material will be removed from its original site and transported away by a natural agent. With both processes often operating simultaneously, the best way to distinguish erosion from weathering is by observing the transportation of material.

Moving water is the most important natural erosional agent. The wastage of the sea coast, or coastal erosion, is brought about in the main by the action of sea waves but also, in part, by the disintegration or degradation of sea cliffs by atmospheric agents such as rain, frost, and tidal scour. Sea-wave erosion is accomplished primarily by hydraulic pressure, the impact of waves striking the shore, and by the abrasion of sand and pebbles agitated incessantly by the water. Wave impact and hydraulic action is usually most devastating to human-made coastal features such as a breakwater or mole. The impact and hydraulic action of storm waves are the most significant upon shores composed of highly jointed or bedded rock, which are vulnerable to quarrying, the hydraulic plucking of blocks of rock. The abrasive action of sand and pebbles washed against shorelines is probably the most significant wave erosional activity. Particles are dragged back and forth by wave action, abrading the bedrock along the coast and abrading each other, gradually wearing pebbles into sand. Wave erosion creates retrograde, or retreating, shorelines with sea cliffs, wave-cut benches at the base of the sea cliffs, and sea arches—arcuate or rectangularly shaped archways that result from different rates of erosion due to varied bedrock resistence. Besides the back-and-forth transportation of materials by wave action, sediments are transported by the lateral movement of waves after they wash ashore (beach drifting) or by shallow-water transport just offshore, known as longshore currents. These transportational movements lead to deposition and the formation of prograde, or advancing, shorelines, bars, spits, bayhead beaches, and barrier beaches.

In rivers and estuaries the erosion of banks is caused by the scouring action of the moving water, particularly in times of flood and, in the case of estuaries, also by the tidal flow on the ebb tide when river and tidewater combine in their erosive action. This scouring action of the moving water entrains and transports sediments within the river or stream load. These entrained sediments become instruments of erosion as they abrade one another in suspended transport or as they abrade other rock and soil as they are dragged along the river bottom, progressively entraining additional sediments as long as the river's volume and velocity of the stream continues to increase. As the velocity of the river decreases, the suspended sediments will be deposited, creating landforms such as broad alluvial fans, floodplains, sandbars, and river deltas. The land surface unaffected by rivers and streams is subjected to a continuous process of erosion by the action of rain, snowmelt, and frost, the resulting detritus and sediment being carried into the rivers and thence to the ocean.

Glacial erosion occurs in two principal ways: through the abrasion of surface materials as the ice grinds over the ground (much of the abrasive action being attributable to the debris embedded in the ice along its base); and by the quarrying or plucking of rock from the glacier bed. The eroded material is transported until it is deposited or until the glacier melts.

In some arid and desert tracts, wind has an important effect in bringing about the erosion of rocks by driving sand, and the surface of sand dunes not held together and protected by vegetation is subject to erosion and change by the drifting of blown sand. This eolian action erodes material by deflation, the removal of small loose particles, and by sandblasting of landforms by wind-transported material. Continued deflation of loose particles from landforms leaves behind larger particles, more resistant to deflation. Wind action transports eroded material above or along the surface of the Earth either turbulently, particles moving in all directions, or by laminar flow, in which adjacent sheets of air slip past one another. The transportation of wind-eroded material continues until the velocity of the wind can no longer sustain the size particle being transported or until the wind-blown particles collide with or cling to a surface feature.

erosion, cycle of: *see* geomorphic cycle.

Erramala Range, range of hills in western Andhra Pradesh state, southern India. The hills are situated on the Deccan Plateau and are composed of quartzites and slates of the Cambrian period (570 million to 505 million years ago) with interbedded lavas of a younger age. The range trends northeast to southwest, and tributaries of the Kunderu River have divided it into longitudinal hills and valleys.

erratic, glacier-transported rock fragment that differs from the local bedrock. Erratics may be embedded in till or occur on the ground surface and may range in size from pebbles to huge boulders weighing thousands of tons. The distance of transportation may range from less than 1 km (0.6 mile) to more than 800 km (500 miles); those transported over long distances generally consist of rock resistant to the shattering and grinding effects of glacial transport. Erratics composed of unusual and distinctive rock types can be traced to their source of origin and serve as indicators of the direction of glacial movement. Studies making use of such indicator erratics have provided information on the general origins and flow paths of the major ice sheets and on the locations of important mineral deposits. Erratics played an important part in the initial recognition of the last ice age and its extent. Originally thought to be transported by gigantic floods or by ice rafting, erratics were first explained in terms of glacial transport by the Swiss-American naturalist and geologist J.L.R. Agassiz in 1840.

Erroll, Francis Hay, 9th earl of, LORD HAY OF ERROLL, Erroll also spelled ERROL (baptized April 30, 1564—d. July 16, 1631, Slains, Aberdeen, Scot.), Scottish nobleman, a leader of the militant Roman Catholic party in Scotland.

Erroll was converted to Roman Catholicism at an early age and succeeded to the earldom in 1585. Between 1588 and 1597 he and his associates were involved in a series of treasonable activities the object of which was the restoration of Roman Catholicism in Scotland, and ultimately in England, by the aid of Spanish money and arms. Twice, in 1589 and 1594, they engaged in armed rebellion, but both rebellions dispersed when King James VI took the field in person. From 1595 to 1596 Erroll was in exile in Holland. On several occasions Erroll and his friends were forced to make a nominal submission to the Reformed Kirk; but in spite of their uniform lack of success and the alarmed hostility of the English government, James VI's determination to preserve a Roman Catholic party as a counterpoise to the ministers of the kirk, and his fear of endangering the English succession by alienating Roman Catholic opinion, prevented any violent retribution overtaking the earls. After 1597 Erroll played little part in public affairs. His religious convictions remained unchanged, and from 1608 to 1611 he was imprisoned as an "obstinate papist."

Erromango, also spelled EROMANGA, volcanic island of Vanuatu, in the southwestern Pacific Ocean. The island, with an area of 376 square miles (975 square km), rises in the interior to about 2,900 feet (885 m) at Santop Peak. It had a sandalwood trade beginning in 1825. There are significant stands of timber on Erromango, primarily kauri pine and assorted hardwoods, but commercial development has been retarded by the lack of shipping facilities. The island has no adequate harbours, and the only good anchorage is Cook Bay on the east coast. There are two airstrips. Copra is produced. Pop. (1979) 941.

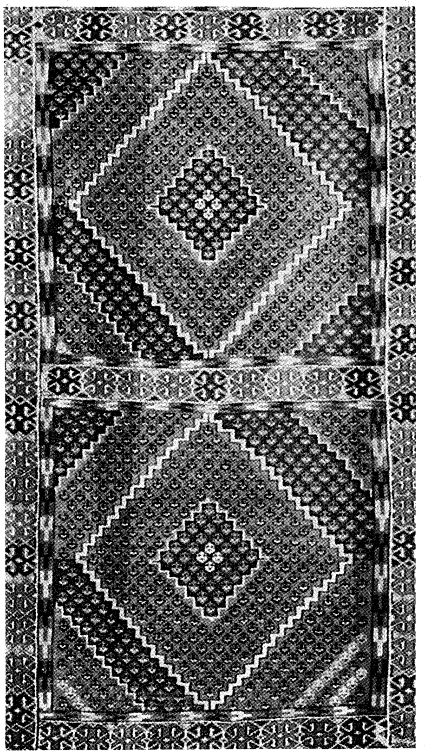
error, in applied mathematics, the difference between a true value and an estimate, or approximation, of that value. In statistics, a common example is the difference between a population mean and the mean of a sample drawn from that population. In numerical analysis, round-off error is exemplified by the difference between the true value of the irrational number π and the value of rational expressions such as 22/7, 355/113, 3.14, or 3.14159. Truncation error results from ignoring all but a finite number of terms of an infinite series. For example, the exponential function e^x may be expressed as the sum of the infinite series

$$1 + x + x^2/2 + x^3/6 + \ldots + x^n/n! + \ldots;$$

stopping the calculation after any finite value of n gives an approximation to the value of e^x that will be in error, though this error can be made as small as desired by making n large enough.

The relative error is the numerical difference divided by the true value; the percentage error is this ratio expressed as a percent. The term random error is sometimes used to distinguish the effects of inherent imprecision from so-called systematic error, which may originate in faulty assumptions or procedures.

Ersari carpet, any of a colourful variety of floor coverings handmade by Ersari Turkmens of the Turkmen S.S.R. and Uzbek S.S.R. Contrary to the custom of the other Turkmens, the Ersaris have no proper gul, or specific tribal motif; consequently, their carpets may have lattices of stepped diamonds, grids of rectangular panels rather like a Garden carpet, diagonal rows of small motifs, much-distorted arrangements of Chinese cloud bands, rows of stylized palm trees, or degenerate imitations of Persian *herāti* and *mina khani* patterns. Ersari carpets make more use of yellow than do rugs made by other tribes, and often, in backgrounds, two shades of blue blend or are merged with dark brown in a characteristic fashion. Prayer rugs differ from those of the other Turkmens in having frank prayer-niche designs, the arch (to indicate the direction of Mecca, the holy city) constricted at the head.



Stepped diamond motif, detail of an Ersari carpet from Russian Turkistan, 19th century; in the Textile Museum, Washington, D.C.

Textile Museum Collection, Washington, D.C.; photograph, Otto E. Nelson—EB Inc.

These Ersari prayer rugs are among the most attractive Turkmen products. Ersari carpets are more loosely woven than those of the other Turkmens, with softer wool in coarser knotting.

Erse language: *see* Irish language; Scottish Gaelic language.

Erskine, John (b. 1509, Dun, near Montrose, Scot.—d. March 12 or June 17, 1591), Scottish lord of Dun and Calvinist Reformer.

Erskine came of a wealthy and powerful family. His grandfather, father, and two other near relatives were killed at the battle of Flodden in 1513. He studied at King's College, Aberdeen, and travelled for a number of years in Europe. Although a layman, he played a prominent part in the ecclesiastical history of Scotland. He was a friend of John Knox, George Wishart, and other Scottish Reformers but was less extreme in his views than some. He was one of the principals in the negotiations between the Reformers and Mary Stuart, the Roman Catholic queen of Scotland (reigned 1542–67). His wealth and influence made him important to both sides. In 1560 the Reformed Church appointed him superintendent for the districts of Angus and Mearns. He was moderator of several church assemblies and helped formulate the Church of Scotland's Presbyterian doctrine and government in the *Second Book of Discipline* (1578). In 1579 he was named to the king's council.

Erskine, John: *see* Mar, John Erskine, 1st (and 18th) earl of; Mar, John Erskine, 2nd (and 19th) earl of; Mar, John Erskine, 6th earl of.

Erskine, John (b. Oct. 5, 1879, New York City—d. June 2, 1951, New York City), U.S. educator, musician, and novelist noted for energetic, skilled work in several different fields.

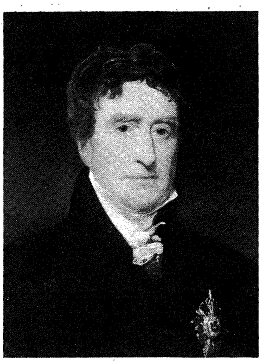
Erskine received his Ph.D. from Columbia University in 1903 and taught there from 1909 to 1937, earning a reputation as a learned, witty teacher and lecturer specializing in Elizabethan literature.

In 1925, when Erskine was in his 40s, his first novel was published. Soon after that, he appeared as a piano soloist for the New York Philharmonic, beginning a distinguished career as a concert pianist. He also served as president of the Juilliard School of Music, director of the Juilliard Musical Foundation, and director of the Metropolitan Opera Association.

Erskine wrote more than 45 books. He was particularly successful with his early satirical novels, which are legends retold with updated views on morality and society. These works include *The Private Life of Helen of Troy* (1925) and *Adam and Eve* (1927), the story of how Adam adjusts to his newfound social life with two women. Erskine also co-edited the *Cambridge History of American Literature,* 3 vol. (1917–19). He described various facets of his life in *The Memory of Certain Persons* (1947), *My Life as a Teacher* (1948), and *My Life in Music* (1950).

Erskine (of Restormel), Thomas Erskine, 1st Baron (b. Jan. 10, 1750, Edinburgh—d. Nov. 17, 1823, Almondell, Linlithgowshire, Scot.), British Whig lawyer who made important contributions to the protection of personal liberties. His defense of various politicians and reformers on charges of treason and related offenses acted to check repressive measures taken by the British government in the aftermath of the French Revolution. He also contributed to the law of criminal responsibility. He was raised to the peerage in 1806.

Early life and career. Erskine was the youngest son of Henry David Erskine, 10th earl of Buchan. Upon completion of his preliminary education, though he wanted to enter a learned profession because of the straitened financial circumstances of his family, he sought a career in the Royal Navy instead. He became a midshipman in 1764 but left the service in 1768 and purchased a commission in a regiment of the 1st Royals. He added to his



Thomas Erskine, detail of an oil painting by Sir William Charles Ross; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

education by extensive reading, particularly in English literature. His unsigned pamphlet, "Observations on the Prevailing Abuses in the British Army" (1772), gained a wide audience. Finding opportunities for advancement in the British army no more favourable than in the navy and encouraged by the friendly interest of Lord Mansfield, Erskine decided to enter the law. He was admitted to Lincoln's Inn in 1775, and in 1778 he received an honorary M.A. degree from Trinity College, Cambridge, after which he was called to the bar.

Professional life. Within a few months, his future was assured by his defense of Capt. Thomas Baillie, lieutenant governor of Greenwich Hospital, who had published charges of corruption in the administration of the hospital. Those accused instituted a proceeding to show cause why Baillie should not be prosecuted for criminal libel. Erskine was retained by Baillie as his junior counsel and in his first appearance at the bar vindicated his client with remarkable eloquence and courage. He very quickly rose to the leading position in the English bar. In the following year, he successfully assisted the defense in the court-martial of Adm. Augustus Keppel. His successful defense of Lord George Gordon on the charge of high treason for instigating the anti-Catholic riots of 1780 substantially destroyed the English legal doctrine of constructive treason—*i.e.*, treason imputed to a person from his conduct or course of actions, though none of his separate actions amounts to treason. Erskine appeared in most of the major cases that arose out of the disruption of commercial relations with France, which had entered the U.S. War of Independence against Britain in 1778.

In 1784 he unsuccessfully represented a clergyman defending a charge of criminal libel, but his contention that it is for the jury, not the judge, to determine whether a publication is libellous was vindicated by the passage of the Libel Act of 1792. In 1789 he won an acquittal for a bookseller who was charged with criminal libel for selling a pamphlet criticizing the trial of Warren Hastings, a former governor general of India who was impeached for alleged misconduct. Erskine's speech on that occasion is one of the monuments in the literature of English freedom. His unsuccessful defense of Thomas Paine, whom William Pitt, the prime minister, had caused to be indicted for treason for publishing *The Rights of Man,* cost him his position as attorney general to the Prince of Wales.

His defense of various politicians and reformers on charges of treason and related offenses placed a powerful check on the repressive measures taken by the ministry of William Pitt in response to the insecurity and hysteria engendered in England by the French Revolution and its aftermath. In 1800, by establishing the defendant's insanity, he successfully defended James Hadfield, who had attempted to assassinate George III. Erskine's argument at the trial is an important contribution to the law of criminal responsibility.

Erskine, who was an intimate of the Whig leaders Charles James Fox and Richard Brinsley Sheridan, the playwright, sat in the House of Commons from 1783 to 1784 and from 1790 until he became a peer in 1806. His undistinguished parliamentary career was almost wholly devoid of the forensic triumphs that marked his legal practice. In 1806 he became lord chancellor during the so-called Ministry of All the Talents. Erskine was not well qualified for the position either by training or experience. At the same time, his tenure of 14 months in office was not sufficiently long to permit any outstanding contribution.

His latter years were marked by private sorrows and misfortunes, which caused him almost completely to withdraw from public affairs. Toward the close of his life, however, he again achieved widespread prominence by his role in defense of Queen Caroline, whom her husband, George IV, had brought to trial before the House of Lords for adultery in order to deprive her of her rights and title.

Erskine's published works include his pamphlet "The Unconditioned Freeness of the Gospel in Three Essays" (1778); a student declamation published in 1794 in a pamphlet entitled "Sketch of Erskine, with Anecdotes: A View of the Causes and Consequences of the Present War with France" (1797); *Armata, a Fragment* (1817), written in the style of *Gulliver's Travels*; a burlesque of Gray's "Bard" entitled "The Barber" in *Poetical Works* (1823).

Numerous collections of Erskine's courtroom speeches have been published, the most useful of which include a collection edited by James Ridgway in 1847 and another edited by James L. High in 1874.

Erskine excelled principally as a jury lawyer. His courtroom speeches are characterized by vigour, cogency, and lucidity and often by great literary merit. (F.A.A.)

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Articles are alphabetized word by word, not letter by letter

Erté, byname of ROMAIN DE TIRTOFF (b. Nov. 23, 1892, St. Petersburg, Russia—d. April 21, 1990, Paris, Fr.), fashion illustrator of the 1920s and creator of visual spectacle for French music-hall revues. His designs included dresses and accessories for women; costumes and sets for opera, ballet, and dramatic productions; shopwindow displays; perfume bottles; playing cards; furniture; posters; and domestic interiors. (His byname was derived from the French pronunciation of his initials, R.T.)

Afternoon dress of black and white satin designed by Erté for *Harper's Bazaar,* 1924

© Sevenarts Limited

Erté was brought up in St. Petersburg. In 1912 he went to Paris, where he briefly collaborated with Parisian couturier Paul Poiret. He then became a costume designer and began selling his pen-and-ink and gouache fashion illustrations to American fashion houses. From 1916 to 1937 he was under contract to the American fashion magazine *Harper's Bazaar.* (A collection of *Harper's Bazaar* illustrations was published in *Designs by Erté* [1976] with text by Stella Blum.) His highly stylized illustrations depicted models in mannered poses draped in luxurious jewels, feathers, and soft, flowing materials against a background of interiors in the Art Deco style.

The same lavish style marked Erté's theatrical set and costume designs. Each detail of the design contributed to a dramatic visual impact. For 35 years he designed elaborately structured opening tableaus, finale scenes, and costumes for the French theatre. He worked for the Folies-Bergère in Paris from 1919 to 1930. During the 1920s he costumed the performers appearing in such American musical revues as the *Ziegfeld Follies* and *George White's Scandals.* In the 1960s Erté produced lithographs, serigraphs, and sheet-metal sculptures. His autobiography, *Things I Remember,* was published in 1975.

Ertebølle industry, tool industry of the coastal regions of northern Europe, dating from about 9000 to 3500 BC. The Ertebølle industry, named after Ertebølle, Den., where it was first recognized, is classed as a Mesolithic (Middle Stone Age) industry because its people used chipped, rather than polished, stone tools and because they were hunters and fishers rather than agriculturists, who used polished stone tools in the developing agriculture of the Neolithic period (New Stone Age). The Ertebølle industry had in many ways, however, borrowed from Neolithic industries of central Europe, which were partly contemporaneous with it. The Ertebølle culture, known from its kitchen middens, or garbage heaps, had pottery, chisel-shaped arrowheads, flat and radial flaking techniques for working flint, and, toward the end of the period, some agriculture and stock raising—all Neolithic skills.

ERTS: *see* Landsat.

Ervin, Samuel J(ames), Jr. (b. Sept. 27, 1896, Morganton, N.C., U.S.—d. April 23, 1985, Winston-Salem, N.C.), U.S. senator best known as chairman of the Select Committee on Presidential Campaign Activities (the "Ervin Committee"), which investigated the Watergate Scandal during the administration of Richard M. Nixon.

The son of a lawyer, Ervin was graduated from the University of North Carolina in 1917 and earned a law degree from Harvard University in 1922. He returned to North Carolina to practice law and later held several state judicial posts, including justice of the North Carolina Supreme Court. In 1954 Ervin won election to the U.S. Senate and quickly established a reputation as an expert on—and defender of—the Constitution. He sat on the Senate committee that censured Senator Joseph McCarthy, and he helped investigate labour racketeering in the late 1950s. During the 1960s he led Southern filibusters against civil-rights laws, while simultaneously acting as one of the leading champions of civil liberties.

Ervin supported President Nixon on the war in Vietnam but disagreed vehemently with Nixon's refusal to spend funds authorized by Congress for social programs. Chosen to head the seven-member committee investigating the Watergate Scandal, he became something of a folk hero for his unceasing pursuit of evidence against White House claims of executive privilege. His earthy humour, distinctive accent, and unfailing charm made him a popular figure throughout the televised hearings.

After more than 20 years in the Senate, Ervin declined to run for reelection in 1974 and returned to his hometown of Morganton, N.C., the next year to resume private legal practice. In 1976 he received the Distinguished Service Award of Former Members of Congress. Ervin wrote two books: *The Whole Truth: The Watergate Conspiracy* (1980), his version of the eventual triumph of the U.S. Constitution in the Watergate ordeal, and *Humor of a Country Lawyer* (1983).

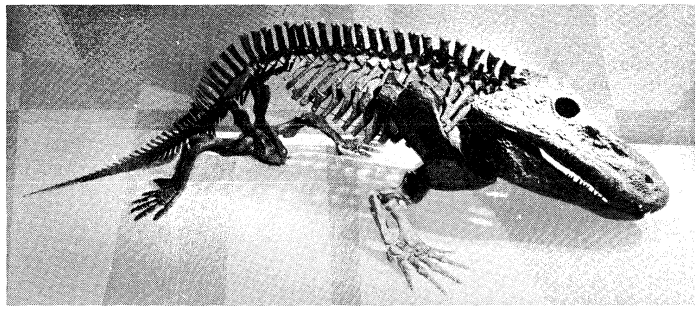
Ervine, Saint John (Greer) (b. Dec. 28, 1883, Belfast, Ire.—d. Jan. 24, 1971, London, Eng.), British playwright, novelist, and critic who was one of the first to write dramas in the style of local realism fostered by the Irish literary renaissance.

Ervine's best-known plays are *Mixed Marriage* (first performed 1911) and the domestic tragedies *Jane Clegg* (1913) and *John Ferguson* (1915). Later plays included such comedies as *The First Mrs. Fraser* (1928), a rousing London success; *Robert's Wife* (1937); and a reactionary play on nationalization, *Private Enterprise* (1947). In 1915 he became associated with the Abbey Theatre. After World War I, Ervine settled in London and was a drama critic for *The Observer.* He wrote such books on drama as *The Organized Theatre* (1924) and *The Theatre in My Time* (1933).

Ervine also wrote biographies of Salvation Army general William Booth, Oscar Wilde, and George Bernard Shaw. His novels include *Francis Place, The Tailor of Charing Cross* (1912), and *Alice and a Family* (1915).

Erymandrus (river, Afghanistan and Iran): *see* Helmand River.

Eryops, genus of extinct primitive amphibians found as fossils in Permian rocks in North America (the Permian period occurred from 286 to 245 million years ago). *Eryops* was a massive animal more than 2 m (6 feet) long. Its large skull had thick and uneven bones, with wrinkles. The eye sockets were large and directed upward. Large and pointed teeth grew along the margins of the jaws and on the palate. The strength and size of the vertebral column and the skeletal limb elements indicate that *Eryops* was well suited to moving about on land. Although short, the limbs were very broad, and the shoulder and hip girdles were massive. The skin bore bony nodules that probably provided a sort of protective armour against predators. *Eryops* was a predator that subsisted to a large extent upon fish, although it probably preyed upon land vertebrates as well.



Eryops

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

erysipelothrix infection, any of several infectious diseases caused by the widespread bacterium *Erysipelothrix insidiosa,* found in water, soil, and decaying matter. Among the distinct diseases it causes are swine erysipelas (including diamond-skin disease), nonsuppurative arthritis in lambs and calves, post-dipping lameness in sheep, blood poisoning in poultry, and erysipeloid in humans. The bacterium is resistant to many common antiseptics but is destroyed by caustic soda and hypochlorites. Antibiotics, especially penicillin, afford control of these infections in livestock and poultry.

Erysipeloid, wound infection with *E. insidiosa,* is a hazard to veterinarians, farmers, and animal handlers; it also yields to antibiotics.

erythema, redness of the skin produced by congestion of capillaries, which may result from a variety of causes and give rise to a variety of lesions. There are more than 50 different types of erythematous conditions. From a medical point of view, the two major erythemas are erythema multiforme and erythema nodosum. Erythema multiforme is characterized by the sudden eruption of crops of red or violet flat spots, wheals, papules (small solid elevations), vesicles (blisters), and large vesicles, or bullae, the characteristic lesion often having a concentric, or target, pattern; the skin (usually the skin on the palm of the hand) and the mucous surfaces, especially the mouth and eyelids, are commonly involved. Erythema multiforme is believed to be a symptom complex that is secondary to a variety of underlying disease states brought on by virus, bacteria, fungus, parasites, drugs, food additives, physical factors, pregnancy, or cancers. It may run a severe course and become life-threatening; in mild cases, the eruption is prone to recur. Variable success is obtained with the use of corticosteroid hormones.

Erythema nodosum is a hypersensitivity reaction most commonly associated with streptococcal infection, drugs (particularly oral contraceptives), and sarcoidosis (a systemic disease characterized by the formation of granulation, or scarlike, tissue). It is marked by the sudden onset of multiple, red, painful nodules in the deeper layer of the skin and underlying tissue on the external surface of the lower legs. It affects primarily young adults, and principally females. The nodules usually disappear spontaneously over a period of several weeks. Recurrences are uncommon. Treatment is usually of the underlying cause and may include complete bedrest, oral salicylates, and—in treatment of sarcoidosis—systemic corticosteroids. Those erythematous conditions that are directly caused by specific agents include endemic erythema, or pellagra, due to a dietary deficiency of the vitamin niacin; and erythema ab igne, due to nonburning exposure to radiant heat.

erythema arthriticum epidemicum: *see* streptobacillary fever.

erythema pernio: *see* chilblain.

erythermalgia, also called ERYTHROMELALGIA, or ERYTHRALGIA, rare disease in which the blood vessels of the hands and feet go through spasms of expansion (vasodilatation) and constriction associated with burning pain, increased skin temperature, and redness.

The disease may be either primary or secondary. It may be brought on by external heat and exercise. Attacks may be aborted by rest, elevation of the legs and arms, and cold applications. Aspirin can be used to relieve pain.

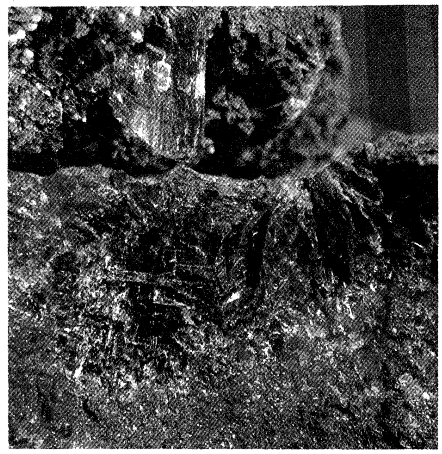
Erythrae, ancient Ionic city on the Mimas (now Kara Burun) peninsula in Turkey. The original site of traditionally Cretan and later Ionian settlement is uncertain, but from the 4th century BC the city was located at modern Ildir, where traces of the wall circuit, theatre, and citadel are visible.

About 453 BC Erythrae, refusing to pay tribute, seceded from the Delian League. A garrison and a new government restored the union, but late in the Peloponnesian War (412 BC) it revolted again with Chios and Clazomenae. Freed from Persian rule by Alexander in 334, it supported the *diadochos* Antigonus I Monophthalmus. A free city in the Roman province of Asia, Erythrae was noted for its wine, goats, timber, and millstones, as well as its prophetic sibyls, Herophile and Athenais.

Erythraean languages: *see* Hamito-Semitic languages.

erythrasma, a superficial skin infection marked by reddish brown scaly patches and attributed to the bacterium *Corynebacterium minutissimum.* The lesions are generally seen on the inner sides of the thighs, in the scrotum, in the toe webs, and in the armpits. Erythrasma is more likely to occur in a warm climate. It is usually effectively treated with broad-spectrum antibiotics, but (on the foot) only extensive washings with antibacterial soap may be effective.

erythrite, also called COBALT BLOOM, arsenate mineral in the vivianite group, hydrated cobalt arsenate [$Co_3(AsO_4)_2 \cdot 8H_2O$]. Erythrite,



Erythrite from Morocco (top) on skutterudite and (bottom) with cobalt ore

By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard—EB Inc.

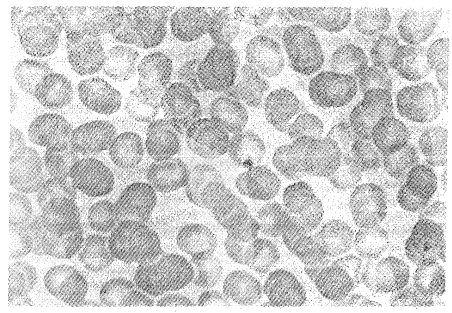
used as a guide to the presence of cobalt–nickel–silver ores because of its crimson or peach-red colour, occurs as radiating crystals, concretions, or earthy masses in the oxidized zone of cobalt and nickel deposits. It forms a complete solid-solution series with annabergite, in which nickel replaces cobalt in the erythrite structure. As the nickel content increases, the colour lightens to white, gray, or pale green. Erythrite occurs in Schneeberg, Ger.; Allemont, Fr.; Cornwall and Cumberland, Eng.; Chile; Morocco; and the southwestern United States. For detailed physical properties, *see* arsenate mineral (table).

erythroblastosis fetalis, also called HEMOLYTIC DISEASE OF THE NEWBORN, type of anemia caused by an antigen–antibody reaction in fetuses and newborn infants that occurs when the child inherits a blood factor from the father that is absent in the mother. Infant red blood cells are destroyed when antibodies from the mother's circulation reach the circulation of the child; thus, until the mother has developed antibodies, disease will not occur in the child. Blood-group systems in which incompatibility of mother and fetus most often give rise to erythroblastosis fetalis include rhesus (when the father and child are Rh-positive, the mother Rh-negative), ABO (especially if the father and child are type A, the mother type O), Kell, Diego, and Duffy.

In the case of Rh incompatibility, until the third or fourth pregnancy, disease normally will not occur in the fetus unless the mother has been previously immunized by a transfusion of Rh-positive blood. Antibodies to the ABO blood group, on the other hand, are present throughout life, and incompatibility reactions may therefore affect even the first child; the disorder produced is relatively mild. Unborn infants of parents incompatible on both ABO and Rh blood-group systems are protected from the more severe Rh hemolytic disease, because, as their red blood cells reach the maternal circulation, they are destroyed by ABO antibodies before sensitivity in the mother to the Rh blood type can develop. Erythroblastosis fetalis develops in only a fraction of cases; the reasons for this are unknown.

Erythroblastosis fetalis develops before birth and is expressed in the first few days of life by findings including hemolytic anemia, with the presence of many immature red cells (erythroblasts) in the circulation, enlarged liver and spleen, and jaundice. In the uncommon hydrops form, edema (abnormal accumulation of serous fluid) is present, and the child is usually stillborn or dies soon after birth. A severe complication of hemolytic anemia is kernicterus, in which bilirubin (breakdown product of hemoglobin from red blood cells) stains brain cells. If the child survives, there may remain permanent neurologic damage, such as deafness or mental retardation. Exchange transfusions, in which the blood of the newborn child is removed and completely replaced by compatible blood, have helped raise the recovery rate in anemic infants to 84 percent of cases; kernicterus has become extremely rare. In the late 1960s exchange transfusions could also be carried out on the fetus in utero. Prevention of Rh-induced erythroblastosis fetalis can be achieved by administering an anti-Rh serum to the Rh-negative mother immediately after each Rh-positive pregnancy. This serum destroys any fetal red blood cells that have entered the mother's circulation before her body can become sensitized to them. The use of this serum has dramatically reduced the incidence of Rh-induced erythroblastosis fetalis.

erythrocyte, also called RED BLOOD CELL, or RED CORPUSCLE, component of blood, millions of which in the circulation of vertebrates give the blood its characteristic colour and carry oxygen from the lungs to the tissues. The mature human erythrocyte is small, round, and biconcave; it appears dumbbell-shaped in profile. The cell is flexible and assumes a bell shape as it passes through extremely small blood vessels. It is covered with a membrane composed of lipids and proteins, lacks a nucleus, but contains hemoglobin—a red, iron-rich protein that binds oxygen.



Human red blood cells (erythrocytes)

Manfred Kage—Peter Arnold

The function of the red cell and its contained hemoglobin is to carry oxygen from the lungs or gills to all the body tissues and to carry carbon dioxide, a waste product of metabolism, back to the lungs, where it is excreted. In invertebrates, oxygen-carrying pigment is carried free in the plasma; its concentration in corpuscles in vertebrates, so that oxygen and carbon dioxide are exchanged as gases, is more efficient and represents an important evolutionary development. The mammalian erythrocyte is further adapted by lacking a nucleus—the amount of oxygen required by the cell for its own metabolism is thus very low, and most oxygen carried can be freed into the tissues. The biconcave shape of the cell allows oxygen exchange at a constant rate over the largest possible area.

The erythrocyte develops in bone marrow in several stages: from a multipotential cell in the mesenchyme, a hemocytoblast, it becomes an erythroblast (normoblast); during two to five days of development, the erythroblast gradually fills with hemoglobin, and its nucleus and mitochondria (particles in the cytoplasm that

provide energy for the cell) disappear. In a late stage the cell is called a reticulocyte, which ultimately becomes a fully mature erythrocyte. The average red cell lives 100–120 days in man; there are some 5,200,000 red cells per cubic millimetre of blood in the adult human.

Though red cells are usually round, a small proportion are oval in the normal person, and in certain hereditary states a higher proportion may be oval. Some diseases also display red cells of abnormal shape—*e.g.*, oval in pernicious anemia; crescent-shaped in sickle-cell anemia; and with projections giving a thorny appearance in the hereditary disorder acanthocytosis. The number of red cells and the amount of hemoglobin vary among different individuals and under different conditions; it is higher, for example, at high altitudes and in the disease polycythemia. At birth the red cell count is high; it falls shortly after birth and gradually rises to the adult level at puberty. Red cells are formed continuously by the body, mostly in the bone marrow in the adult, and are stored in the spleen.

erythromelalgia (medicine): *see* erythermalgia.

erythromycin, antibiotic synthesized by a soil organism, *Streptomyces erythraeus*. This drug, which interferes with the synthesis of certain vital proteins in some micro-organisms, may be either bacteriostatic (*i.e.*, inhibits bacterial reproduction but does not kill bacterial cells) or bactericidal (*i.e.*, kills bacteria by direct action), depending on its concentration and the type of micro-organism against which it is used. Among the disease-causing agents susceptible to erythromycin are *Staphylococcus aureus* (the pus-producing bacterium), several species of *Streptococcus* (bacteria that cause throat infections), and pneumococcus (bacteria that cause pneumonia).

Erythronium, genus of about 20 species of spring-blooming plants of the family Liliaceae, commonly known as dog's tooth violet, all native to North America except for the purple- or pink-flowered dog's tooth violet of Europe (*E. dens-canis*). The nodding flowers, usually one to a plant or in small clusters, range in colour from white to purple. The two leaves,

Dog's tooth violet (*Erythronium*)
Nelson Groffman

borne at the base of the plant, often are covered with white or brown spots. The fruit is a pod.

The common dog's tooth violet, or adder's tongue, of North America is *E. americanum*. It has yellow flowers and brown-mottled leaves. Several species of *Erythronium* are grown as rock-garden ornamentals.

Erzberger, Matthias (b. Sept. 20, 1875, Buttenhausen, Württemberg, Ger.—d. Aug. 26, 1921, Black Forest, Baden), leader of the left wing of the Roman Catholic Centre Party in Germany and signatory of the Armistice of World War I.

Erzberger, 1918
Archiv fur Kunst und Geschichte, Berlin

The son of a craftsman, Erzberger turned from schoolteaching to journalism with the Centre newspaper, *Deutsches Volksblatt*, working his way up in the Württemberg Centre Party. He became a member of the Reichstag in 1903 and gradually established himself as the leader of the party's left wing. His sensational attack on Bülow's government over conditions in Germany's African colonies forced the dissolution of the Reichstag in December 1906. During World War I, although Erzberger at first favoured extensive annexations by Germany, he was decisively involved in the Reichstag resolution of July 19, 1917, proposing a negotiated peace with no territorial gains, and also in the events leading to the resignation of Chancellor Theobald von Bethmann Hollweg, whom he wanted replaced by Bülow. As leader of the new Reichstag majority (Centre, Social Democrats, Progressive People's Party), he aimed at democratic constitutional reform. While approving the Treaty of Brest-Litovsk (1918), he demanded opportunities for self-determination for east Europeans. Even during the war, in his book *Der Völkerbund* (1918), he supported the idea of a League of Nations. He led the German deputation to the Truce Commission of Compiègne, Fr., where, on November 11, he signed the Armistice.

He served under Philipp Scheidemann in Germany's first republican government and vigorously pressed for acceptance of the Versailles Treaty. From June 1919 to March 1920 he was vice chancellor and finance minister under Gustav Bauer. His fiscal reforms were opposed both by the former propertied classes and by the federalists, who regarded them as steps toward a unitary state.

As a signatory of the Armistice and a protagonist of the republican-democratic system, Erzberger became the victim of a slander campaign from the extreme right. In March 1920 he won a lawsuit against Karl Helfferich, who accused him of political corruption, but receiving only paltry damages, Erzberger resigned his ministry. The Centre did not give Erzberger adequate support during these attacks upon him, and after his resignation he was neglected by the party. While on holiday in the Black Forest he was shot dead by members of a nationalist organization. Further information may be found in Klaus Epstein's *Matthias Erzberger and the Dilemma of German Democracy* (1959; with bibliography).

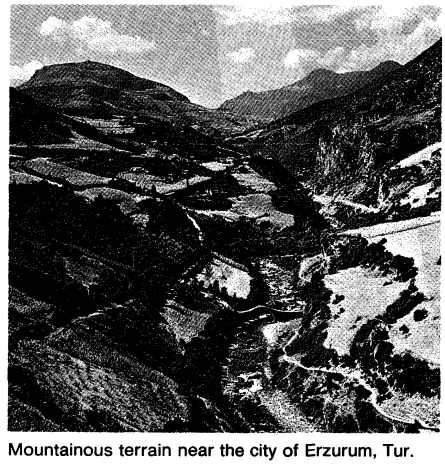
Erzebet (Hungarian personal name): *see under* Elizabeth.

Erzgebirge (Czechoslovakia–Germany): *see* Ore Mountains.

Erzincan, city, capital of Erzincan *il* (province), eastern Turkey, on the northern bank of the Euphrates River in a fertile plain, 3,900 ft (1,200 m) above sea level, enclosed by snowcapped mountains. It was taken by the Seljuq Turks from Byzantium in 1071, fell to the Mongols in 1243, and, after the collapse of the Mongol empire, was ruled by various local Turkmen dynasties until its final incorporation into the Ottoman Empire in the early 16th century. At the end of the 19th century, with its woollen-textile and leather industries, Erzincan was an important centre of eastern Anatolia, but its industries and population suffered from Armenian riots and occupation by Russian forces during World War I. Erzincan has frequently been damaged by severe earthquakes, most recently in 1939. Its industries include cotton and silk textiles, copper utensils, and medicines. The city occupies an important position on the rail line and highway from the Caucasus to central Anatolia and from Ankara to Erzurum; it is also linked by air with Ankara and Erzurum.

Erzincan *il*, 4,697 sq mi (12,165 sq km) in area, is bordered by lofty mountains and has severe winters, warm summers, and numerous sulfur springs. The well-watered, fertile plain produces cotton, cereals, and fruits, and stock raising is important. Pop. (1980) city, 70,982; (1983 est.) *il*, 281,100.

Erzurum, city, capital of Erzurum *il* (province), eastern Turkey, at an elevation of 6,400 ft (1,950 m) above sea level in a fertile plain surrounded by high mountains. Situated on a caravan route from Anatolia to Iran, it has been an important commercial and military



Mountainous terrain near the city of Erzurum, Tur.
H. Knaus—Bavaria-Verlag

centre since antiquity and is now a major rail station on the route between Ankara and Iran.

Although its foundation was probably much earlier, it achieved real importance as Theodosiopolis, a 5th-century-AD Byzantine fortress that fell to the Arabs in 653. Thereafter it was disputed among the Byzantines, Arabs, and Armenians until taken by the Seljuq Turks in 1071; it prospered in the early 13th century under Seljuq sultans. The Arabs and the Turks called it Arzan ar-Rūm, or Arz ar-Rūm (Land of the Romans), from which its present name is derived. It came under Ottoman control in 1515. The city was occupied by Russian forces in 1829, 1878, and 1916–18. It was in Erzurum, in July 1919, that Mustafa Kemal (later Atatürk) presided over the first Turkish nationalist congress, leading to the establishment of the Turkish Republic.

Historically important buildings include Seljuq theological colleges (1253 and 1308), the Great Mosque (12th century), and royal mausoleums (12th and 13th centuries). There is a local archaeological museum. Erzurum is the seat of Atatürk University (1957). It is important as a centre for trade in livestock, but it

has little industry other than a sugar-beet factory; local craftsmen still excel in metalwork and saddlery. The city has a large Kurdish population.

Erzurum *il,* 10,263 sq mi (26,582 sq km) in area, is drained by the Karasu River, a headstream of the Euphrates, and the Aras and Çoruh rivers. In winter the province undergoes blizzards and temperatures that average about 16° F (−9° C), while summer temperatures rarely exceed 68° F (20° C). Agricultural products include wheat, barley, millet, sugar beets, and vegetables. Pop. (1980) city, 190,-241; (1983 est.) *il,* 833,400.

es-Salt (Jordan): *see* Salṭ, as-.

es-Suweida (Syria): *see* Suwaydā', as-.

Esagila, most important temple complex in ancient Babylon, dedicated to the god Marduk (*q.v.*), the tutelary deity of that city. The temple area was located south of the huge ziggurat called Etemenanki; it measured 660 feet (200 metres) on its longest side and its three vast courtyards were surrounded by intricate chambers. The whole complex reflects centuries of building and rebuilding by the Babylonian kings, especially Nebuchadrezzar II (reigned 604–562 BC). The tremendous wealth of Esagila was recorded by the Greek historian Herodotus, who is believed to have visited Babylon in the 5th century BC. Babylon was excavated in 1899–1917 by the Deutsche Orient-Gesellschaft; few objects of value, however, were found in Esagila, which had been thoroughly plundered in antiquity.

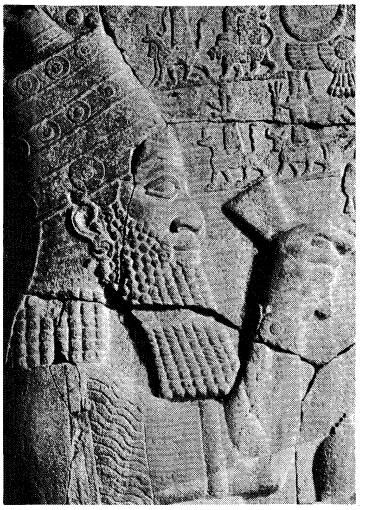
Esaki, Leo, original name ESAKI REIONA (b. March 12, 1925, Ōsaka), Japanese solid-state physicist and researcher in superconductivity who shared the Nobel Prize for Physics in 1973 with Ivar Giaevar and Brian Josephson.

Esaki was a 1947 graduate in physics from Tokyo University and immediately joined the Kobe Kogyo company. In 1956 he became chief physicist of the Sony Corporation, where he conducted the experimentation that led to the Nobel Prize. In 1959 he received his Ph.D. from Tokyo University.

Esaki's work at Sony was in the field of quantum mechanics and concentrated on the phenomenon of tunnelling, in which the wavelike character of matter enables electrons to pass through barriers that the laws of classical mechanics say are impenetrable. He devised ways to modify the behaviour of solid-state semiconductors by adding impurities, or "doping" them. This work led to his invention of the double diode, which became known as the Esaki diode. It also opened new possibilities for solid-state developments that his co-recipients of the 1973 prize exploited separately. In 1960 Esaki was awarded an IBM (International Business Machines) fellowship for further research in the United States, and he subsequently joined IBM's research laboratories in Yorktown, N.Y. He retained his Japanese citizenship.

Esarhaddon, also spelled ESSARHADDON, Assyrian ASSUR-AKH-IDDINA (Ashur Has Given Me a Brother), king of Assyria 680–669 BC, a descendant of Sargon II. Esarhaddon is best known for his conquest of Egypt in 671.

Although he was a younger son, Esarhaddon had already been proclaimed successor to the throne by his father, Sennacherib, who had appointed him governor of Babylon some time after Sennacherib sacked that city in 689. Sennacherib was murdered (681) by one or more of Esarhaddon's brothers, apparently in an attempt to seize the throne. Marching quickly from the west, Esarhaddon encountered the rebel forces in Hanigalbat (western Assyria), where most of them deserted to him, and their leaders fled. Esarhaddon continued on to Nineveh, where he claimed the throne without opposition.



Esarhaddon, detail of a tablet from Zincirli Hüyük, in Turkey; in the Vorderasiatisches Museum, Berlin

By courtesy of the Vorderasiatisches Museum, Staatliche Museen zu Berlin

In southern Babylonia, meanwhile, the leader of a Chaldean tribe took advantage of the revolt and attacked the Assyrian governor at Ur. When Esarhaddon sent troops against the chieftain, he fled northeastward, expecting to find asylum in Elam. Instead the new Elamite king summarily executed him. The rebel's brother, however, escaped to Assyria and submitted to Esarhaddon, who appointed him a local ruler in his dead brother's place. This rare instance of Assyrian mercy bore rich dividends, for he remained loyal throughout Esarhaddon's reign.

The cities of northern Babylonia, which had suffered severely under Sennacherib, were shown particular favour under Esarhaddon. He restored land to displaced citizens who could make good their claims, and in 678 he took military action against a Chaldean tribe which had encroached on the lands of Borsippa and Babylon.

Farther north the pressure of Cimmerians and Scythians was being increasingly felt. Esarhaddon is said to have made a marriage alliance with the Scythians to strengthen his position there. The pressure of the Cimmerians continued, however, and Esarhaddon finally lost control of much of the northwestern provinces of Cilicia and Tabal.

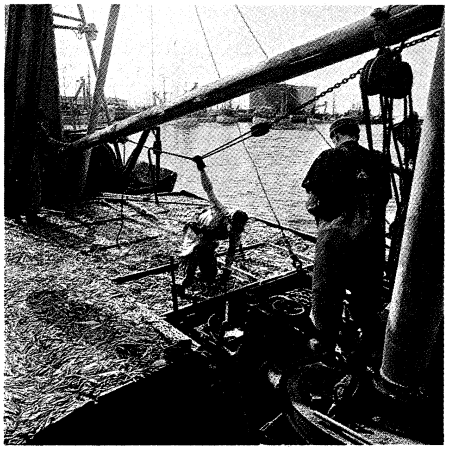
When Egypt inspired a revolt of the Phoenician city of Tyre, Esarhaddon attacked Egypt (675); he had little success until 671, when he seized Memphis and defeated the Egyptian king Taharqa, who fled south, leaving the entire country to Esarhaddon. For the first time a Mesopotamian ruler included "king of Egypt" among his royal titles. After the withdrawal of the Assyrian army, Taharqa emerged and attracted a considerable following. Esarhaddon was marching to put down the rebellion in 669 when he died. In 672 Esarhaddon had proclaimed detailed instructions for the succession of two of his sons to the thrones of Assyria and Babylonia, and at his death, the successions were carried out smoothly. Works on Esarhaddon's reign include Riekele Borger's *Inschriften Asarhaddons, König von Assyrien* (1956) and D.J. Wiseman's *Vassal-Treaties of Esarhaddon* (1958).

Esau, also called EDOM, in the Old Testament (Gen. 25:19–34; 27; 28:6–9; 32:3–21; 33:1–16; 36), son of Isaac and Rebekah, elder twin brother of Jacob, and in Hebrew tradition the ancestor of the Edomites.

At birth, Esau was red and hairy, and he became a wandering hunter, while Jacob was a shepherd. Although younger, Jacob dominated him by deception. At one time, when Esau returned from an unsuccessful hunt and was hungry, Jacob bought Esau's birthright (*i.e.,* the rights due him as the eldest son) for some red pottage (soup). When Isaac was dying, Jacob, with Rebekah's help, cheated Esau out of his father's blessing. Esau would have killed Jacob, but Jacob fled; when he returned 20 years later, Esau forgave him.

The story reflects the relationship of Israel and Edom. It sought to explain why Israel (in the time of the United Monarchy) dominated the kingdom of Edom, although the latter was older.

Esbjerg, city, Ribe *amtskommune* (county), southwestern Jutland, Denmark, opposite Fanø Island on the North Sea. Founded in 1868, after the loss of North Slesvig (Schleswig) to Germany, to provide a new export outlet for Jutland's agricultural produce, it grew rapidly after the harbour was completed in 1874 and was chartered in 1899. Esbjerg is Denmark's largest fishing port with 6 mi (10 km) of quay as well as shipbuilding facilities. In addition to fish products, large quantities of meat and dairy products are exported, chiefly to Great Britain. The city has teachers', technical, and commercial colleges; a folk high school; the



Landing a fish catch in the harbour of Esbjerg, Den.

Wedigo Ferchland

National Marine and Fishery School; and a small airport. On the northwestern outskirts are the graves of nearly 300 Allied airmen shot down over Denmark during World War II. Pop. (1981) city, 70,220; (1982 est.) mun., 80,053.

Esbo (Finland): *see* Espoo.

Escalante, (Francisco) Silvestre Vélez de (fl. 1768–79), Spanish Franciscan missionary-explorer, who in 1776–77 with his superior Francisco Domínguez, while seeking a route to Monterey in California from Santa Fe (now in New Mexico), rediscovered the Grand Canyon (Arizona). He explored what is now western Colorado and made the first Spanish penetration of what is now Utah (in which he recommended colonization), before returning, unsuccessful in his route search, to Santa Fe.

escalator, moving staircase used as transportation between floors or levels in subways, buildings, and other mass pedestrian areas.

An inclined belt, invented by Jesse W. Reno of the United States in 1891, provided transportation for passengers riding on cleats attached to the belt, which was inclined at an angle of only 25°; the handrail was stationary, but an improved version with a moving handrail was introduced the same year.

The name escalator was first applied to a moving stairway shown at the Paris Exposition

of 1900. Originally a trademark of the Otis Elevator Company, the word was adjudged in 1949 to have become public property through popular use.

Escalator
By courtesy of the Montgomery Elevator Company

Modern escalators are usually inclined at 30°, limited in rise to about 60 feet (18 metres), with floor-to-floor rise of about 12 feet. They are electrically powered, driven by chain and sprocket, and held in the proper plane by two tracks. As the treads approach the top landing, they pass through a comb device; a deflection switch is actuated to cut off power if an object becomes jammed between the step and the comb.

Escalators rise at a rate of up to 120 feet (36 metres) per minute; larger types have a capacity of 6,000 passengers per hour. If a chain breaks, the release of tension stops the escalator. A safety switch also halts the device if a handrail is broken or comes loose or if a side panel is deflected.

Moving ramps or sidewalks, sometimes called travelators, are specialized forms of escalators developed to carry people and materials horizontally or along slight inclines. Ramps may have either solid or jointed treads or a continuous belt. Ramps can move at any angle from 0° to 15°; beyond this incline the slope becomes too steep, and escalators are favoured.

Escalloniaceae, family of evergreen trees and shrubs, in the order Saxifragales, comprising 7 genera and about 170 species of evergreen trees and shrubs, distributed throughout tropical and southern temperate areas of the world. Shiny-leaved shrubs of the South American genus *Escallonia* are cultivated for their attractive, often aromatic, clusters of white, pink, or red flowers. Other ornamental genera of the family include *Abrophyllum, Anopterus, Carpodetus, Corokia, Quintinia,* and *Valdivia.*

Escallonia langleycensis 'Apple Blossom'
Valerie Finnis

escallop (mollusk): *see* scallop.

Escanaba, city, seat (1861) of Delta County, southern Upper Peninsula of Michigan, U.S., and a port on Little Bay de Noc, an inlet of Green Bay, 54 mi (87 km) north-northeast of Menominee. Lumber operations began in the 1830s. The community, named Escanaba (Chippewa Indian: "red buck" or "flat rock") developed rapidly after 1863, when the Chicago and North Western Railway Company built the first iron-ore dock; the only one on Lake Michigan, it became important with the growth of the Chicago steel industry. The city has timber-based industries and is a distribution centre with facilities for storage and shipment of coal and petroleum products. The Upper Peninsula State Fair is an annual (August) event. Escanaba is the headquarters of Hiawatha National Forest and is the site of Bay de Noc Community College (1963). Inc. city, 1883. Pop. (1980) 14,355.

escape velocity, in astronomy and space exploration, the velocity that once attained is sufficient for a body to escape from a gravitational centre of attraction without undergoing any further acceleration. Escape velocity decreases with altitude, and is equal to the square root of 2 (or about 1.414) times the velocity necessary to maintain a circular orbit at the same altitude. At the surface of the Earth, if atmospheric resistance could be disregarded, escape velocity would be about 11.2 kilometres (6.95 miles) per second. The velocity of escape from the less massive Moon is about 2.4 kilometres (1.5 miles) per second at its surface. A planet (or satellite) cannot long retain an atmosphere if the planet's escape velocity is low enough to be near the average velocity of the gas molecules making up the atmosphere.

escapement, in mechanics, ratchet device that permits motion in steps in one direction only; also the mechanism that causes a piano hammer to rebound after striking. In a watch or clock it is the mechanism that controls the transfer of energy from the power source to the counting mechanism. The classic form for a timepiece, which made the mechanical clock possible, was the verge escapement invented in 14th-century Europe. This consists of a notched crown wheel (*i.e.,* a gear wheel shaped like a crown) driven by a weight or pendulum and repeatedly checked by the retarding action of a pair of metal leaves that alternately catch in successive notches. The leaves are mounted on a vertical shaft, and their speed of oscillating back and forth is governed by a crossbar at the top with two small weights; moving the weights outward from the shaft slows the oscillations. The anchor escapement was an improved escapement invented in England in the 17th century. In this the wheel is braked by a flat device in the shape of an inverted anchor, lying in the same plane as the wheel. Various improvements have since been made in escapements, but the principle remains unchanged.

Escaut River (Europe): *see* Scheldt River.

Esch-sur-Alzette, town, southern Luxembourg, on the upper Alzette River, southwest of Luxembourg city, near the French border. A small village until 1870, it has become the second-largest town in Luxembourg, largely because of the local phosphoric iron ore. The centre of the country's iron and steel industry, it has several large steelworks located on its outskirts and in the surrounding area. Slag fertilizer is a by-product. There is also an important foodstuffs industry. Pop. (1981 est.) 25,142.

eschar (glacial landform): *see* esker.

eschatology, the doctrine of last things, especially in Judaism and Christianity, concerning beliefs about the end of history, the resurrection of the dead, the Last Judgment, and related matters. Similar concepts are found in other Western religions (Islām and Zoroastrianism) and in the religions of nonliterate peoples, ancient Mediterranean and Middle Eastern cultures, and Eastern civilizations.

A brief treatment of eschatology follows. For full treatment, *see* MACROPAEDIA: Doctrines and Dogmas, Religious.

By and large, eschatologies have appeared in two radically divergent forms, distinguished by their attitude toward time and history. In mythical eschatologies, so called after their characteristic representations of the eternal struggle between cosmos (order) and chaos (disorder), the meaning of history is found in a celebration of the eternity of the cosmos and the repeatability of the origin of the world. Historical eschatologies, on the other hand, are grounded not in a mythical primal happening but in historically datable events that are perceived as key experiences fundamental for the progress of history.

Eschatological motives are found in almost all religions of the world. Buddhist eschatology is revealed in the yearning for redemption from the suffering inherent in the cycle of rebirth, whereby all creatures are reborn continually in forms dependent on the moral content of their past deeds. Redemption is achieved through the attainment of the condition of eternal peace known as Nirvāṇa ("bliss," or enlightenment). Hinduism posits a similar redemption from endless cycles of existence, rebirth, and suffering, in this case through the soul's recognition of its eternal core, or essence (an awareness that has vanished from consciousness because of the soul's imprisonment in matter) and its consequent identification and union with absolute and eternal being.

Historical eschatology is basic to the Old Testament and thus enters into the structure of faith of those religions, primarily Judaism, Christianity, and Islām, that stem from it. Old Testament eschatology consists in the conviction that the catastrophes that beset the people of Israel and threatened their destruction were due to the Jewish people's disobedience to the laws and will of God. Subsequent conformity to the will of God would result in a return for the Jews to a final condition of righteousness and moral and material renewal in which God's purpose would at last be fulfilled. Old Testament eschatology is closely bound to the concept of a redemptive history, in which the Jewish people are viewed as God's chosen instrument for the carrying out of his purpose and in which, upon the fulfillment of God's promises, the Jewish people would be the vehicle for both their own salvation and that of the rest of the world.

If for Judaism the peculiar eschatological event lies in the future, this future of God, according to the New Testament, has already begun with Christ. Christian eschatology is centred in the figure of Christ as the anticipation of the future kingdom of God. Jesus is viewed as the Messiah of God, through whom and by whom the new age of God's redemption has at last been opened. The historical development of Christianity was subsequently marked by widely differing interpretations and degrees of acceptance of this original eschatology, however. Distinctions can be made between the hopes of messianism (directed toward a salvatory or vindicating figure to come), millenarianism (directed toward the prophesied 1,000-year Kingdom of Christ), and apocalypticism (directed toward the cataclysmic intervention of God in history). The diverse strands of 20th-century Christian theology are in agreement perhaps only in that

they regard faith itself, in its ultimate anticipation of God's redemption of creation, as being innately eschatological.

escheat, in feudal English land law, the return or forfeiture to the lord of land held by his tenant. There were generally two conditions by which land would escheat: the death of the tenant without heirs or the conviction of the tenant for a felony. In case of felony, the land would lose its inheritability and escheat to the lord, who would then hold the land subject to the crown's right to exploit the felon's lands for a year and a day. In time, this exploitation right of the crown was commuted in return for a money payment or service rendered to the crown by the lord. In the case of a tenant convicted of high treason, however, his land escheated directly to the crown, and the lord forfeited all rights he had in that tenant's lands completely. The escheat of lands for felony was abolished by statute in England in 1870; and by a statute enacted in 1925, no longer does land escheat to its former owner solely for failure of heirs. In the United States, laws passed in all states provide that land will escheat to the state (county or city) if an owner dies without a valid will and if no heirs can be found. *See also* attainder.

Escher, Alfred (b. Feb. 20, 1819, Zürich—d. Dec. 6, 1882, Zürich), dominant figure in 19th-century Zürich politics and legislator of national prominence who, as a railway magnate, became a leading opponent of railway nationalization.

Quickly rising in cantonal political affairs, Escher had by 1848 become president of the Zürich government. Elected the same year to the Nationalrat (national assembly), he was four times its president, notably during the Neuchâtel crisis with Prussia (1856–57). Often a voice for moderation against the advocacy of radical measures by Jakob Stämpfli, he tempered passions in the Neuchâtel affair and urged peaceful accommodation in the controversy arising from the cession of Savoy to France (1860).

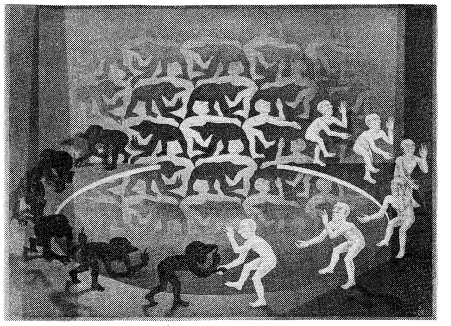
Between 1850 and 1870 Escher was probably the most influential of all Swiss legislators. The head of a railway company, he championed private construction of railroads and opposed the nationalization program of Stämpfli (1862). The driving force behind the construction of the Gotthard line, he helped secure the necessary German and Italian cooperation for the project in 1869–71, and in 1871–78 he presided over its direction.

Escher (von der Linth), Hans Conrad (b. Aug. 24, 1767, Zürich—d. March 9, 1823, Zürich), Swiss scientist and politician who was president of the Great Council of the Helvetic Republic (1798–99) and who was an outspoken opponent of federalism. He directed the canalization of the Linth River.

With his friend and political colleague Paul Usteri, Escher founded the *Schweizer Republikaner,* a journal of moderately reformist opinion. Elected to the parliament of the fledgling Helvetic Republic in 1798, he was named president of the Great Council in the autumn of that year. Although a supporter of cantonal autonomy, he continued to hold high offices throughout the successive struggles between partisans of centralization and advocates of cantonal independence.

Following the reconstruction of the Swiss government by Napoleon (1803), Escher largely retired from the political arena but continued to participate in matters benefiting the public weal. He conceived the plan for canalization of the Linth River, the floodwaters of which frequently created pestiferous conditions, and superintended the subsequent canal construction (1808–22), later serving as a consultant for similar projects.

Escher, M(aurits) C(ornelius) (b. June 17, 1898, Leeuwarden, Neth.—d. March 27, 1972, Laren, Neth.), Dutch graphic artist, known for his prints that use realistic detail to achieve bizarre optical and conceptual effects.



"Encounter," lithograph printed in black by M.C. Escher, 1944 (34.29 cm × 46.67 cm)

Collection, The Museum of Modern Art, New York City; gift of the International Graphic Arts Society

Escher studied at the School of Architecture and Decorative Arts in Haarlem. Growing interested in graphics, he spent a number of years traveling and sketching throughout Europe. His works from this period treated landscape and natural forms in a fantastic fashion using conflicting perspectives. Escher's mature style as a printmaker emerged after 1937 in a series of prints that combined a meticulous realism with paradoxical visual and perspective effects. He exercised great technical virtuosity to portray unexpected metamorphoses of mundane objects. His images were of equal interest to mathematicians, cognitive psychologists, and the general public, and were widely reproduced in the mid-20th century.

Escher, Rudolf (George) (b. Jan. 8, 1912, Amsterdam—d. March 17, 1980, Texel, Neth.), Dutch composer and music theoretician especially noted for his chamber works.

Escher studied at the Rotterdam Conservatory from 1931 to 1937, but most of his early compositions were lost in the bombing of Rotterdam during World War II. During 1945 and 1946 he worked as a music editor for *De Groene Amsterdammer.* He held a variety of editorial and teaching posts from 1946 to 1964, at which time he began teaching contemporary music at the University of Utrecht. He is noted for his excellent essays on Claude Debussy and Maurice Ravel.

The first composition for which Escher received wide notice was an orchestral piece, *Musique pour l'esprit en deuil* (1943). Several instrumental and orchestral pieces followed, and in the 1950s and following years he composed a number of interesting vocal works, including *Strange Meeting* (1952; to words by Wilfred Owen), *Le vrai visage de la paix* (1953; to words by Paul Éluard), and *Songs of Love and Eternity* (1955; to words by Emily Dickinson). His chamber piece *Le tombeau de Ravel* (1952) was very well received. His later works include *Univers de Rimbaud* (1970), for orchestra and voices; *Sinfonia* for 10 instruments (1973–76); and *3 Poems* (1975; to words by W.H. Auden) for chamber chorus.

Eschweiler, city, North Rhine-Westphalia *Land* (state), western Germany, on the edge of the Eifel Mountains. First mentioned in the 9th century, it belonged to the duchy of Jülich until the French Revolutionary Wars and was annexed by Prussia in 1815. The chief city of the Aachen coal basin, its chief products include coal, iron, steel, limestone, textiles, and plastics. Pop. (1989 est.) 53,516.

Escobar y Mendoza, Antonio (b. 1589, Valladolid, Spain—d. July 4, 1669, Valladolid), Spanish Jesuit preacher and moral theologian who was derided for his support of probabilism, the theory according to which when the rightness or wrongness of a course of action is in doubt, any probable right course may be followed, even if an opposed course appears more probable. The issue of probabilism became important in the 17th century, when social and cultural developments, such as banking, came into conflict with traditional moral precepts, resulting in many difficult tests of conscience.

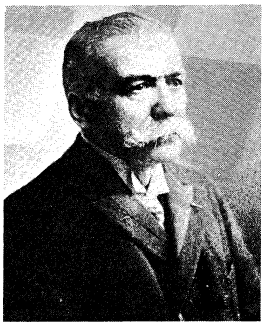
Escobar entered the Society of Jesus in 1597 and became a distinguished scholar and noted preacher. His principal detractor over his support of probabilism was Blaise Pascal, French scientist and religious philosopher. Escobar is quoted with derision and indignation in Pascal's *Provincial Letters,* nos. v–ix. An opponent of the Jesuits, Pascal ridiculed Escobar and his confreres as teachers of lax moral principles who believed that the end justifies the means. He was also attacked by such noted French authors as Molière and Jean de La Fontaine. Some scholars find that these attacks are unfounded if Escobar's words are taken in context. His collected writings comprise 32 volumes on biblical, sacred, and moral subjects.

Escobedo, Juan de (d. March 31, 1578), Spanish politician, secretary to Don Juan of Austria.

Escobedo began his political life in the household of Ruy Gómez de Silva, prince of Eboli, but, after the Battle of Lepanto, entered the service of the victorious Don Juan and was with him when he became governor of Flanders (1576). In 1577 Escobedo went to Spain, probably with complaints to King Philip II about leakages of information from dispatches to Flanders involving the king's secretary, Antonio Pérez. For this reason, it is thought, Pérez made several attempts to murder Escobedo and finally, with the king's consent, succeeded in having him killed by bravos on the night of Easter Monday, 1578.

Escoffier, (Georges-)Auguste (b. Oct. 28, 1846, Villeneuve-Loubet, Fr.—d. Feb. 12, 1935, Monte Carlo), French culinary artist known as "the king of chefs and the chef of kings," who earned a worldwide reputation as director of the kitchens at the Savoy Hotel (1890–99) and afterward at the Carlton Hotel, both in London.

Escoffier began his career at the age of 12, and when he retired from the Carlton Hotel at the age of 74, he counted 62 years of active service, a span considered a record in his profession. The name of Escoffier became of worldwide repute when in 1890 he was given the direction of the kitchens of the newly opened Savoy Hotel, and he created the *pêche Melba* (peach Melba) in honour of the famous singer Nellie Melba when she was staying there in 1893. In 1899 he moved to the Carlton Hotel, where he was to build up a fabulous reputation for haute cuisine during the next 23 years: on one occasion Emperor William II is reported to have said to Escoffier, "I am the emperor of Germany but you are the emperor of chefs." In recognition of his services to the prestige of French cooking abroad, he



Escoffier

H. Roger-Viollet

was awarded the Legion of Honour in 1920 and made officer of the order in 1928.

Besides the renown of his name, said to be greater even than that of Marie-Antoine Carême, Escoffier left several books, the best known of which are *Le Carnet d'Epicure* (1911), *Le Guide Culinaire* with Philéas Gilbert and Emile Fetu (1903), *Le Livre de Menus* (1912), and *Ma Cuisine* (1934).

Escola Velha (Portuguese: Old School), Spanish dramatists in the early 16th century who were influenced by the Portuguese dramatist Gil Vicente and were later referred to as the Escola Velha. Although in form Vicente was a medieval dramatist, his skill in comedy and character portrayal and the varied subject matter of his plays made him a forerunner of the modern drama. The best known of the playwrights stimulated by Vicente's innovations were Alfonso Álvares and Baltasar Dias, who wrote popular religious plays; António Ribeiro Chiado and his brother Jerónimo Ribeiro, writers of satirical farces; and António Prestes and Simão Machado, who evinced a knowledge of folklore and the peasant life.

Escondido, city, San Diego County, southern California, U.S. Once part of the Rancho Rincón del Diablo, it was laid out in 1885 and named Escondido (Spanish: "hidden") because of its secluded valley site. It became a processing–shipping point for fruits (especially avocados and grapes), wines, cereals, and dairy produce. After World War II there was light industrial development. Immediately southeast, a state historical monument marks the site of the Battle of San Pasqual (1846), fought between the Californian forces of Gen. Andrés Pico and the U.S. Army troops under Brig. Gen. Stephen W. Kearny. The Palomar Mountain Observatory is 20 mi (32 km) northeast in the Cleveland National Forest. Inc. 1888. Pop. (1980) 62,480.

Escorial, El (Spanish village and monastery): *see* El Escorial.

Escravos River, distributary of the Niger River in the western Niger Delta, southern Nigeria. Its 35-mi (56-km) westerly course traverses zones of mangrove swamps and coastal sand ridges before entering the Bight of Benin of the Gulf of Guinea. There are no ports on the river; but the Escravos is linked by a maze of interconnected waterways to the Forcados, Warri, Benin, and Ethiope rivers; by 1960, although the natural passageway over the Escravos Bar at the ocean exit was only 12 ft (4 m) deep, the river had already supplanted the Forcados as the main approach to the Delta ports: Warri, Burutu, Sapele, Koko, and Forcados. Since the completion in 1964 of the Escravos Bar Project, the Escravos has provided the only route for oceangoing vessels to those ports. There is also a petroleum shipping station serving a submarine oil field 11.5 mi offshore from the mouth.

escritoire (furniture): *see* secretary.

Escrivá de Balaguer y Albás, Monsignor Josemaría (b. Jan. 9, 1902, Barbastro, Spain—d. June 26, 1975, Rome), Spanish prelate of the Roman Catholic Church, founder in 1928 of Opus Dei (*q.v.*), a Catholic organization of laymen and priests claiming to strive to live Christian lives in their chosen professions. By the time of Escrivá's death in 1975, its members numbered some 60,000 in 80 countries; and its critics charged it with wielding undue economic and political power, especially in Franco Spain.

The son of an Aragonese businessman, Escrivá studied law at the University of Saragossa and attended the archdiocesan seminary there, becoming ordained on March 28, 1927. Except for a period during the Civil War when he hid out and then was a refugee from the anticlerical Republicans, he did pastoral work in Madrid until 1946, when he moved permanently to Rome. The following year he was promoted to the rank of monsignor, and from 1947 to 1950 he secured formal Vatican approval of Opus Dei.

From Rome, Escrivá oversaw the gradual establishment of vocational, trade, and agricultural centres, numerous high schools and schools of business administration, and the founding of the University of Navarre, which many considered the finest university in Spain. Though Opus Dei made a point of imposing no political ideology on any of its members, Opus Deistas were named to high government positions in Spain when Franco sought out highly trained technicians to implement a program of economic development begun in 1956.

escrow, in Anglo-American law, written instrument, such as a land deed, constituting evidence of obligations between two or more parties, that is given to a third party with instructions that he deliver the instrument only upon the happening of a certain condition. In commercial usage, this condition is most frequently the performance of an act, such as payment of the purchase price, by the party who is to receive the written instrument. Escrow is also commonly used in family transactions, in which, upon the happening of the condition, such as the death of a family member, certain written instruments will be delivered by the third party (escrowee) to another family member. The term is occasionally used to refer to the state or condition of a deed that is held conditionally by a third party, although escrow properly refers only to the written instrument itself.

Escudero, Vicente (b. Oct. 27, 1892, Valladolid, Spain—d. Dec. 4, 1980, Barcelona), Gypsy dancer widely respected for his mastery of flamenco dance and for his adherence throughout his public career to an authentic style rarely distorted or commercialized.

Escudero

By courtesy of the Dance Collection, the New York Public Library at Lincoln Center

Known as a youth for his dancing in the cafés of Spain, Escudero performed in Paris in 1920 with his longtime partner Carmita Garcia at the Olympia Theatre. From 1922 to 1932 he toured widely in Europe, dancing with Pavola in 1931, and in 1932 he first danced in the U.S. He appeared as Carmelo in La Argentina's production of the ballet *El amor brujo* (Madrid, Teatro Español, 1934). In 1954 he returned to Paris, and he toured the U.S. later that year, in 1959, and in 1961. He then retired from dancing, although he continued lecturing on flamenco.

Escuintla, department, southwestern Guatemala, bounded on the south by the Pacific Ocean. Its area of 1,693 sq mi (4,384 sq km) includes Pacific lowlands and southern slopes of the highlands. Sugarcane, bananas, coffee, cotton, corn (maize), tropical fruits, and rubber are the principal crops, and large areas of Escuintla are devoted to the pasturing of beef cattle. The department is well served by highways and railroads, the former centring upon Escuintla (*q.v.*), the departmental capital, the latter leading to San José, the second largest port of Guatemala, on the Pacific. Pop. (1982 est.) 496,522.

Escuintla, capital, Escuintla department, southwestern Guatemala, near the Río Guacalate on the southern flanks of the central highlands, 1,109 ft (338 m) above sea level. It is located 28 mi (45 km) southwest of Guatemala City. Escuintla, one of Guatemala's largest cities, was a prominent political and trading centre for indigo during the 17th and 18th centuries. From the rich agricultural hinterland now come sugarcane, cotton, and coffee, as well as citronella, coconuts, pineapples, and mangoes. In the city are cotton ginning and meat-packing plants; sugar refineries are in the vicinity. Escuintla is also a popular winter resort noted for its mineral baths. It lies on the Pacific Coast Highway and is served by a railroad and a nearby airport. Pop. (1981 prelim.) mun., 73,688.

escutcheon, in furniture design, an armorial shield sometimes applied to the centre of pediments on pieces of fine furniture and, also, the metal plate that surrounds a keyhole or the pivoting metal plate that sometimes covers the keyhole. The keyhole escutcheon has been used on furniture since the Middle Ages, the designs matching the other metal mounts, such as hinges, and varying according to the fashions of the day. Early escutcheons were of wrought iron and might be quite plain, simply serving to prevent wear. From the 17th century, brass, which could be worked in finer designs, was used on fine furniture. For the most lavish designs, ormolu was used, especially in 18th-century France.

Esdraelon, Plain of, also called VALLEY OF JEZREEL, Hebrew 'EMEQ YIZRE'EL, or HA-'EMEQ, "the valley," lowland, northern Israel, dividing the hilly areas of Galilee in the north and Samaria (in Israeli-occupied Jordan) in the south. Esdraelon is the Greek derivation of the Hebrew Yizre'el, meaning "God will sow," or "May God make fruitful," an allusion to the fertility of the area.

The plain, roughly triangular in shape, is oriented northwest–southeast with the apex at the northwest. The hills of Lower Galilee are to the northeast, the opening to the low Bet She'an Valley is at the southeast, and the Samarian hills and Carmel ridge are at the south and west. The length of the plain, from its apex to the Hare (mountains of) Gilboa' and the Bet She'an Valley, is about 25 mi (40 km). The plain is a result of massive dislocation and block faulting, with subsequent subsidence; remnants of former mountains are Mt. Carmel and the isolated summit of Mt. Tabor. *See* Carmel, Mount; Tabor, Mount.

Historically, the plain is an integral part of the ancient Via Maris, the lowland passage between Egypt and the Fertile Crescent (a semicircle of relatively fertile land extending northward around the Syrian Desert and down the Tigris and Euphrates rivers to the Persian Gulf); as such, it was an avenue of commerce and a scene of conflict from remotest antiquity. At the northwest is the site of ancient Megiddo (*q.v.*), founded in the 4th millennium BC and the scene of battles from 1500 BC to AD 1918. The Bible (Joshua 17:16) tells of the Canaanite hold on the area; later, Gideon's armies defeated the Midianites and Amalekites there (Judges 6 and 7). On the slopes of Hare Gilboa' overlooking the plain, Saul and Jonathan were slain (I Samuel 31; II Sam. 1).

Owing to poor natural drainage and neglect, the plain was a sparsely inhabited swampland for many centuries. The sultans declared it Turkish crownland after their conquest of Palestine (1517), but by the beginning of the

20th century large areas had passed to Arab absentee landlords. The first Jewish settlement on the plain was Merḥavya (1911). In 1920 the British lifted the land restrictions and large tracts were bought by Jews for reclamation and settlement. Palestine's first smallholder's cooperative (moshav), Nahalal, and first large kibbutz, 'En Ḥarod, were both founded there in 1921. Since then the swamps have been drained, and dozens of settlements, combining intensive agriculture with light industry, have been set up. The city of 'Afula (*q.v.*) is the principal urban centre.

Esdras, First Book of, also called GREEK EZRA, abbreviation I ESDRAS, apocryphal work that was included in the canon of the Septuagint (the Greek version of the Hebrew Bible) but is not part of any modern biblical canon; it is called Greek Ezra by modern scholars to distinguish it from the Old Testament Book of Ezra written in Hebrew. Originally written in Aramaic or Hebrew, I Esdras has survived only in Greek and in a Latin translation made from the Greek.

The work is textually more closely related to the Old Testament than other books of the Apocrypha, for it traces portions of Israel's history from 621 BC to 444 BC by summarizing II Chronicles 35:1–36:23, the whole of the canonical Book of Ezra, and Nehemiah 7:73–8:12. The only new material is the "Tale of the Three Guardsmen," a Persian folk story that was slightly altered to fit a Jewish context.

The method used in compiling I Esdras is uncertain, especially because of numerous historical inconsistencies and errors; in several instances it also alters biblical texts. The work was composed sometime in the 2nd century BC, probably by an Egyptian Jew.

Given the historical confusion of I Esdras, many scholars feel that its compiler was more interested in inculcating certain moral and religious ideas than in chronicling Jewish history. In this respect the most important part of the work is the "Tale of the Three Guardsmen," which asserts the supremacy of the Hebraic God, who is identified with truth. Also emphasized are the observance of the Mosaic Law, the cult of the Temple of Jerusalem, and laws forbidding the marriage of Jews with non-Jews.

The first identifiable quotations from I Esdras are in *The Antiquities of the Jews* of the 1st-century-AD Jewish historian Josephus, who used it in preference to the canonical Ezra–Nehemiah. The "Tale of the Three Guardsmen" was popular among early Christians, some of whom used its statement about truth to prove that this work prophesied the coming of Christ.

Esdras, Second Book of, also called FOURTH BOOK OF EZRA, or EZRA APOCALYPSE, abbreviation II ESDRAS, apocryphal work printed in the Vulgate and many later Roman Catholic bibles as an appendix to the New Testament. The central portion of the work (chapters 3–14), consisting of seven visions revealed to the seer Salathiel-Ezra, was written in Aramaic by an unknown Jew around AD 100. In the mid-2nd century AD, a Christian author added an introductory portion (chapters 1–2) to the Greek edition of the book, and a century later another Christian writer appended chapters 15–16 to the same edition. It is possible that the whole Greek edition (from which all subsequent translations were derived, the Aramaic version having been lost) was edited by a Christian author, because there are passages in the central Jewish section that reflect Christian doctrines on original sin and Christology.

II Esdras is concerned primarily with the future age that will succeed the present world order. The occasion for its composition was the fall of Jerusalem to the Romans in AD 70, which had a drastic effect on the nationalistic aspirations of the Jews and on their view of Judaism.

The central theme of the work is the justification of the ways of God to man. The author, deeply concerned over the future of Jews deprived of the Temple of Jerusalem, challenges God to explain why the righteous suffer at the hands of sinners. The answers are similar to those in the Book of Job: the actions of God are inscrutable, human understanding is finite and limited, and God will always love his chosen people in spite of appearances to the contrary.

There is a marked dualistic motif in this work contrasting the present, evil-ridden world to a future, heavenly age when the righteous few who survive the final judgment will live in an immortal state.

Esdras and Nehemias, books of: *see* Ezra and Nehemiah, books of.

Esen Taiji (d. 1455, Mongolia), Mongol chief who succeeded in temporarily reviving Mongol power in Central Asia by descending on China and capturing the Emperor.

In 1439 Esen became the chief of the Oyrat Mongols, living in the remote mountainous region in western Mongolia near Lake Baikal, from which had come some of Genghis Khan's most ferocious warriors. Esen began to follow in Genghis' footsteps, subjugating other Mongol tribes and extending his authority eastward until he came to rule the territory between the Great Wall of China and the Korean border.

In 1449 Esen stopped paying the tribute that the Chinese exacted from the Mongol tribes and mobilized his forces along the Chinese border. The Chinese government was then under the domination of the eunuch Wang Chen, who persuaded the Chen-t'ung emperor to take command of an army against Esen. Esen quickly surrounded the poorly led Chinese forces and captured the Emperor. After hesitating for a few months, he advanced into China proper and laid siege to Peking. The Chinese had meanwhile enthroned another emperor and prepared a cannon defense of the capital. Esen soon abandoned his siege and in 1450 released the captured emperor. Three years later he signed a peace treaty with the Chinese and resumed his tribute payments. Esen's son inherited his conquests, but Oyrat power soon declined.

Esenin, Sergey Aleksandrovich: *see* Yesenin, Sergey Aleksandrovich.

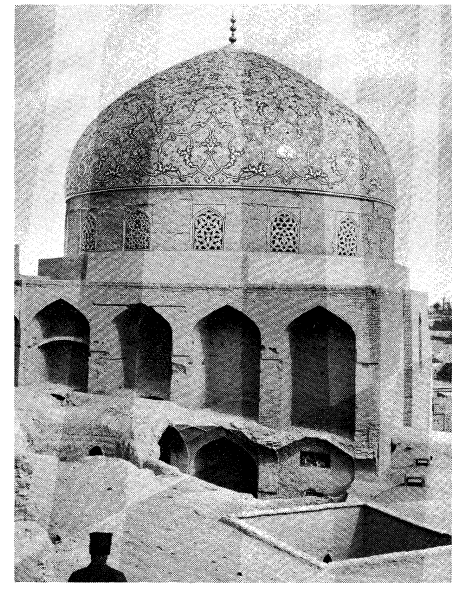
Eset (Egyptian goddess): *see* Isis.

Eṣfahān, also spelled ISFAHAN, major city of the Seljuq Turks (11th–12th century) and of the Ṣafavid dynasty of Iran (16th–18th century), now a major city in west central Iran. It lies on the Zāyandeh River, about 210 miles (340 km) south of Tehrān.

Little is known of Eṣfahān before Sāsānian times (*c.* AD 224–*c.* 651). In the 4th century a colony of Jews was said to have been established in the suburb of Yahūdīyeh. When the Arabs captured Eṣfahān in 642, they made it the capital of al-Jibāl province. Toghril Beg, the Turkish conqueror and founder of the Seljuq dynasty, made Eṣfahān the capital of his domains in the mid-11th century; under his grandson Malik-Shāh I (reigned 1073–92), the city grew in size and splendour. After the fall of the Seljuq dynasty (*c.* 1200), Eṣfahān temporarily declined.

The city's golden age began in 1598 when Shāh 'Abbās I the Great (reigned 1588–1629) made it his capital and rebuilt it into one of the largest and most beautiful cities of the 17th century. In the centre of the city he created the immense Meydān-i Shāh (Royal Square) as well as the noted Masjid-i Shāh (Royal Mosque), which was not finished until after his death, and the Masjid-i Sheykh Loṭfollāh (Loṭfollāh Mosque). In 1722 the Ghilzay Afghans took the city after a long siege.

For many years the greater part of the city was a heap of rubble, and its population dwindled to a fraction of what it had once been. Recovery began during the reign of Reza Shah Pahlavi (1925–41). An industrial quarter was built, and many of the historic buildings were



Dome of the Loṭfollāh Mosque, Eṣfahān, Iran
Laurence Lockhart

restored. Eṣfahān, a major textile centre, is well known for its handicrafts and traditional manufactures of tiles, rugs, and cotton fabrics. More modern industries include steelmaking and petroleum refining. The city is the home of Eṣfahān University (established 1936). Pop. (1985 est.) 1,121,200.

Eṣfahān, Great Mosque of, Persian MASJED-E JĀME' ("Universal Mosque"), a complex of buildings in Eṣfahān, Iran, that centres on the 11th-century domed sanctuary and includes a second smaller domed chamber, built in 1088, known for its beauty of proportion and design. The central sanctuary was built under the direction of Niẓām al-Mulk, vizier to the Seljuq ruler Malik-Shāh, probably between 1070 and 1075. It stands at the south end of the courtyard. Its large brick dome is supported by 12 heavy piers.

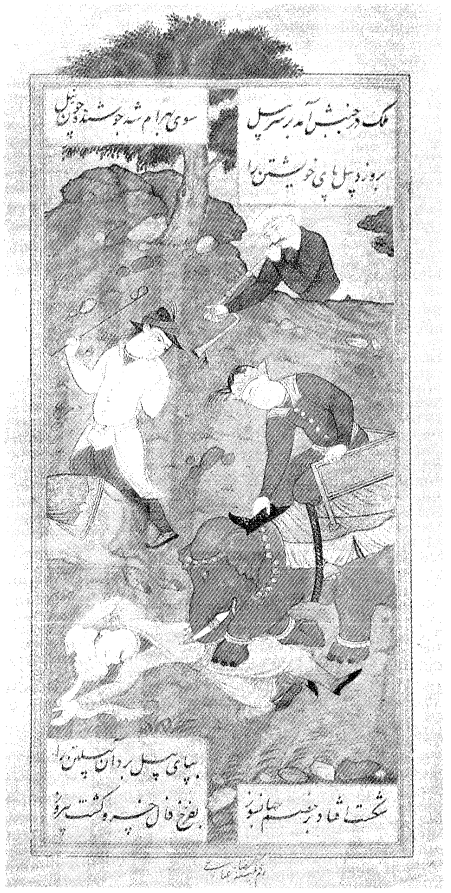
The smaller dome stands at the north end of the courtyard. This single-shelled dome is a structural masterpiece that has survived centuries without damage. The room—made of small, gray, baked bricks—encloses an area approximately 30 feet (9.1 m) square and 60 feet (18.2 m) high. The dome rests on a series of arches, with 16 at the top and one broad arch framed between two narrow ones in each wall at room level. The mosque complex, framed by four huge *eyvān*s, or vaulted niches, includes structures built at various periods from the 11th century to the 18th—among them, private chapels, a school, a library, and a treasury.

Eṣfahān school, last great school of Persian miniature painting, at its height in the early 17th century under the patronage of the Ṣafavid ruler Shāh 'Abbās I (d. 1629). The Eṣfahān school's leading master was Rezā 'Abbāsī, who was greatly influenced by the Kazvin school of portraiture, particularly the work of Ṣādiqī Beg (fl. late 16th century).

Rezā 'Abbāsī preferred naturalistic subjects and portraiture to the illustrative themes that had dominated Persian miniature painting for 200 years. His painting "Two Lovers" (Metropolitan Museum of Art, New York City) is among the most accomplished works of the Eṣfahān school. Although there is an element

of stylization, the exquisiteness and delicacy of the hands, faces, and costumes infuse the painting with an impressionistic quality. The curved, swaying figures are highly effeminate, in the tradition of the late Ṣafavid court. Rezā ʿAbbāsī was also a master of line drawing, a form of art not popular in the Islāmic world before the end of the 16th century.

Painters of the Eṣfahān school imitated Rezā ʿAbbāsī's style, and, although they never equaled the master, they produced much delightful work through the beginning of the 18th century. Among Rezā ʿAbbāsī's best pupils were his son Moḥammad Shafiʿ and Moʿīn Moṣavver.



"Khosrow Makes His Elephant Trample the Enemy," Eṣfahān school miniature by Rezā ʿAbbāsī, 1680, from *Khosrow o-Shirīn* by Neẓāmī (Victoria and Albert Museum, London, fol. 88)

By courtesy of the Victoria and Albert Museum, London

The Eṣfahān school lost its freshness after the master's death, and miniature painting in Iran declined in the absence of an artist of his calibre.

Eshbaal (king of Israel): *see* Ishbosheth.

Eshkol, Levi, original name LEVI SHKOLNIK (b. Oct. 25, 1895, Oratov, near Kiev—d. Feb. 26, 1969, Jerusalem), prime minister of Israel from 1963 until his death.

A Zionist pioneer who went to Palestine in 1914 when it was under Turkish rule, Eshkol helped found Deganya Bet, one of the first kibbutzim in Palestine. Later he became interested in the Zionist Labour Party and was one of the founders of Histadrut (General Federation of Labour). After Israel became an independent nation in 1948, he held several important government posts, including that of minister of finance (1952–63). In 1963, when David Ben-Gurion announced his retirement as prime minister, Eshkol succeeded him. Two years later Ben-Gurion again sought the leadership, but Eshkol easily won the election. In the summer of 1967 he met the crisis of the Six-Day War.

During his period of leadership he unified the three major labour parties into the Israel Labour Party that, with the left-wing Mapam, became the first faction to hold a majority in the Knesset (parliament).

Eshnunna, modern TALL AL-ASMAR, ancient city located in the Diyālā River Valley in east central Iraq. The excavations carried out by the Oriental Institute of the University of

Statuettes from Tall al-Asmar, Early Dynastic II (*c.* 2750–*c.* 2600 BC); in the Oriental Institute, the University of Chicago

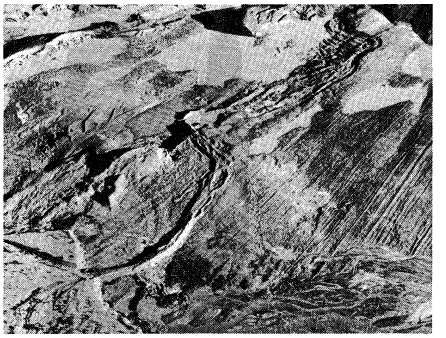
By courtesy of the Oriental Institute, the University of Chicago

Chicago revealed that the site was occupied sometime before 3000 BC. The city expanded throughout the Early Dynastic Period, and during the 3rd dynasty of Ur the city was the seat of an *ensi* (governor). After the collapse of Ur, Eshnunna became independent but was later conquered by Hammurabi, king of Babylonia. During the next century the city fell seriously into decline and may have been abandoned.

The "Laws of Eshnunna" are inscribed on two broken tablets found in Tall Abū Harmal, a mound near Baghdad. The two tablets are not duplicates but separate copies of an older source. The laws are believed to be about two generations older than the Code of Hammurabi; the differences between the two help illuminate the development of ancient law.

Eskdale (Scotland): *see* Annandale and Eskdale.

esker, also spelled ESKAR, or ESCHAR, a long, narrow, winding ridge composed of stratified sand and gravel deposited by a subglacial meltwater stream. Eskers may range from 16 to 160 feet (5 to 50 m) in height, from 160 to 1,600 feet (500 m) in width, and from 300 feet (90 m) to tens of miles in length. They may occur unbroken or as detached segments. The sediment is sorted according to grain size, and cross laminations that show only one flow direction commonly occur. Thus eskers



Esker near Fort Ripley, Minn.

By courtesy of the Minnesota Geological Survey

are considered to be channel deposits (left by streams that flowed through tunnels in and below the ice) that were let down onto the ground surface as the glacier retreated. Esker formation presumably takes place after a glacier stagnates, because movement of the ice would likely spread the material and produce ground moraine. Notable areas of eskers are found in Maine, U.S., Canada, Ireland, and Sweden; because of ease of access, esker deposits often are quarried for their sand and gravel for construction purposes.

Eski Dzhumaya (Bulgaria): *see* Tŭrgovishte.

Eskil (b. *c.* 1100, Denmark—d. September 1182, Clairvaux, Fr.), archbishop who restored the unity of the Danish church and championed its independence.

A nephew of Asser, the first archbishop of Lund (now in Sweden) and thereby primate of Scandinavia, Eskil became bishop of Roskilde in 1134 and archbishop of Lund in 1138. During the 1150s he was forced to accept the division of Sweden and Norway into separate ecclesiastical provinces, but he retained primacy over Uppsala (in Sweden).

Eskil's advocacy of radical reform of the church and of its independence from secular authority brought him into conflict with the Danish king Valdemar I, whom he had helped attain power (1157). In 1170, after a reconciliation, Eskil canonized the King's father and anointed Valdemar's son Canute IV as joint king, initiating the hereditary rule of the Valdemar dynasty. After naming Absalon, the bishop of Roskilde and Valdemar's chief adviser, his successor (1177), Eskil was soon forced into exile in France when his relatives plotted to overthrow the king.

Along with Absalon, Eskil introduced the first ecclesiastical laws to Denmark and was a great founder of monasteries. French monks who entered the country under his influence made important contributions to agriculture, architecture, and science.

Eskilstuna, town, *län* (county) of Södermanland, southeastern Sweden, on Eskilstunaån (river), west of Stockholm. Although it was a trade centre as early as the 12th century, it did not receive its charter until 1659. In the 17th and 18th centuries its iron and steel industry grew rapidly, soon rivaling that of Sheffield, Eng. Eskilstuna is still one of the chief centres of the Swedish metal industry, with cutlery and precision instruments of particular importance. Pop. (1985 est.) mun., 88,664.

Eskimo, also called INUIT, a people who, with the closely related Aleut, constitute the chief element in the native population of the Arctic and sub-Arctic regions of Canada, Greenland, Alaska, and Siberia.

A brief treatment of the Eskimo follows. For full treatment, *see* MACROPAEDIA: Arctic, The.

The Eskimo's own name for themselves is Inuit ("People"). The name Eskimo is apparently derived from a Cree Indian word meaning "eaters of raw meat." The Eskimo are a Mongoloid people (*see* Mongoloid geographical race) distinguishable from the American Indians by their more Mongoloid features, the smallness of their hands and feet, and by a few less obvious traits. Another anomaly is the appreciable percentage in them of the B blood type (ABO system), which seems to be totally absent from the American Indians. Since this is a very stable hereditary trait, it is believed that at least a part of the Eskimo population is of different origin from the Indians and that they are not, as scholars earlier thought, merely an Indian people who developed separately in the far north. Their languages (*see* Eskimo-Aleut languages) support this theory. The oldest known Eskimo culture is that from a site on Umnak Island in the Aleutians, for which an age of 3,018 (plus or minus 230) years was recorded.

Eskimo-Aleut languages, family of languages spoken in Greenland, Canada, Alaska, and eastern Siberia by the Eskimo and Aleut peoples. Aleut is a single language with three

surviving dialects; Eskimo consists of two branches: Yuk, or Yupik, spoken in Siberia and southwestern Alaska, and Inuk, or Inupik, spoken in northern Alaska, Canada, and Greenland. Each branch is composed of several dialects.

A brief treatment of the Eskimo-Aleut languages follows. For full treatment, *see* MACROPAEDIA: Languages of the World.

Eskimo and Aleut are related but quite distinct languages; they have no known outside relatives. Aleut, now greatly reduced in number of speakers, is the smallest branch of the family. It was formerly a neighbouring language to Eskimo on the Alaska Peninsula. It is now spoken in the Aleutian Islands and in the Pribilof Islands in the Bering Sea, settled by Aleuts in the 1820s. On the Soviet Commander Islands, settled in 1826, there are a few Aleut speakers.

Eskimo and Aleut have relatively simple sound systems. Yupik has four distinct vowels, while Inupik and Aleut have only three. Of the consonants, Eskimo has from 13 to 21 depending on the dialect.

Eskimo is a highly inflected language and has a great number of suffixes but practically no prefixes or compounds. In Aleut the word forms are simpler, but the syntactic constructions are more complicated. Suffixes are often accompanied by changes in the stem.

Nouns are inflected for number—singular, dual, and plural—and for possessor. The subject of an intransitive verb and the object of a transitive verb are both in the absolute case, whereas the subject of a transitive verb occurs in the subordinate case. Verbal modes include indicative, interrogative, imperative, optative, participles, and other forms corresponding to subordinate clauses in English. Other modal relations and tenses are specified by derivational suffixes and in Aleut also by auxiliary verbs.

A remarkable feature of the vocabulary is the great number of demonstratives, about 30 in western Eskimo and in Aleut. The possibility of derivation in Eskimo-Aleut is virtually unlimited, and the number of word stems is comparatively small. There are fewer than 2,000 in well-known West Greenlandic.

Eskimo dog, breed of sled and hunting dog found near the Arctic Circle. It is believed

Eskimo dog team

Harry Groom from Rapho/Photo Researchers—EB Inc.

by some authorities to be representative of a pure breed 25,000 to 50,000 years old and by others to be descended from wolves. The Eskimo dog is powerfully built and big-boned. Its long, waterproof outer coat, variable in colour, covers a thick, wooly undercoat. The Eskimo dog stands about 20 to 25 inches (51 to 64 cm) high and usually weighs between 65 and 85 pounds (30 and 39 kg).

Eskişehir, city, west-central Turkey. It lies along the Porsuk River, a tributary of the Sakarya River, at a point about 125 miles (200 km) west of Ankara. Lying near the site of the ancient Phrygian city of Dorylaeum, the present city probably began in Byzantine times as settlements around hot springs. The scene of a crusader victory over the Seljuq Turks in 1097, it came under Ottoman control near the end of the 13th century. The city expanded with the coming of the railway in the late 19th century and the immigration of Turks from the European provinces of the Ottoman Empire in the early 20th century. Despite its name (Turkish: "Old City"), most of the city was rebuilt after its destruction in the Turkish War of Independence (1919–22).

Eskişehir is divided into a commercial and industrial section, situated on low ground, and a residential quarter that occupies higher ground. One of the largest industrial centres in Turkey, it produces sugar, textiles, bricks, cement, chemicals, processed meerschaum, and railway and agricultural equipment. It also has aircraft workshops and is a centre for cotton research. It is a rail junction on the Istanbul–Ankara and Istanbul–Baghdad lines. Eskişehir is the seat of a teacher-training school and of the Eskişehir Academy of Economics and Commercial Sciences (1958). Pop. (1985) 366,765.

Esmāʿīl I (shah of Iran): *see* Ismāʿīl I.

Esmāʿīl I ebn Aḥmad (Sāmānid ruler): *see* Ismāʿīl I ibn Aḥmad.

Esmarch, (Johannes) Friedrich (August) von (b. Jan. 9, 1823, Tönning, Schleswig-Holstein [Germany]—d. Feb. 23, 1908, Kiel, Ger.), German surgeon who is best known for his contributions to military surgery, including his introduction of the use of the first-aid bandage on the battlefield.

Esmarch studied medicine at Kiel and Göttingen. He graduated in 1848 and in the same year was called up as army surgeon in the war with Denmark, during which he was taken prisoner by the Danes. After the war he returned to Kiel, where he became professor of surgery (1857). He saw further military service with the Prussian army against Denmark (1864), Austria (1866), and France (1870), when he held the rank of surgeon general. Esmarch wrote a handbook of military surgical technique and instituted training in first aid for civilian and military personnel. His manuals on first aid were the best in their field and were widely used. A patent of nobility was conferred upon him in 1887 by the German emperor.

Esmeraldas, city, major seaport of northwestern Ecuador. It lies on the Pacific coast at the mouth of the Esmeraldas River. The city is the chief trading centre for the region's agricultural and lumbering resources but is only slightly developed industrially. It is the terminus of the 313-mile (504-kilometre) Trans-Ecuadorian Pipeline from the oil fields in northeastern Ecuador. An oil refinery was completed in 1977, and new oil port facilities at Esmeraldas were opened in 1979. Important exports are bananas and timber. Tourism has been stimulated by nearby seaside resort facilities, an equable climate, and a good all-weather highway to Quito. A technical university was established in Esmeraldas in 1970. Pop. (1989 est.) 130,944.

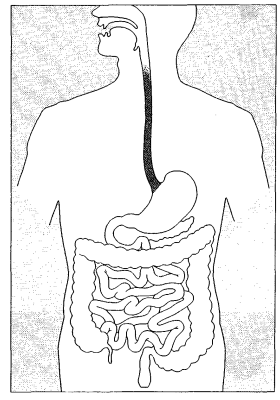
Esnambuc, Pierre Bélain, sieur d' (French trader-explorer): *see* Bélain, Pierre.

Esnault-Pelterie, Robert (-Albert-Charles) (b. Nov. 8, 1881, Paris, Fr.—d. 1957, Nice), French aviation pioneer who made important contributions to the beginnings of heavier-than-air flight in Europe.

After studying engineering at the Sorbonne, Esnault-Pelterie took up gliding, building a duplicate of the Wright brothers' glider of 1902, without, however, fully understanding their steering technique. His lack of comprehension led him to condemn the principle but also to invent ailerons (movable wing parts). In 1907 he built a powered aircraft noteworthy as one of the first monoplanes and also for its innovative 7-cylinder radial engine; his longest flight in it covered 600 m (2,600 feet). He also invented a new type of fuel pump. He became interested in space exploration and produced theoretical studies of high-altitude rocket flight, for which he coined the word astronautics, and helped establish an annual award (the Pel-Hirsch Prize) for work in the field.

esophagus, also spelled OESOPHAGUS, relatively straight tube through which food passes from the pharynx to the stomach. The esophagus can contract or expand to allow for the passage of food. Anatomically it lies behind the trachea and heart and in front of the spinal column; it passes through the muscular chest diaphragm before entering the stomach. Both ends of the esophagus are closed off by muscular constrictions known as sphincters; at the anterior, or upper, end is the upper esophageal sphincter, and at the distal, or lower, end is the lower esophageal sphincter.

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



Esophagus

The upper esophageal sphincter is composed of circular muscle tissue and remains closed most of the time. Food entering the pharynx relaxes this sphincter and passes through it into the esophagus; the sphincter immediately closes to prevent food from backing up. Contractions of the muscles in the esophageal wall (*see* peristalsis) move the food down the esophageal tube. The food is pushed ahead of the peristaltic wave until it reaches the lower esophageal sphincter, which opens, allowing food to pass into the stomach, and then closes to prevent the stomach's gastric juices from entering the esophagus.

Some animals, such as dogs and certain ruminants (cud-chewing animals), can bring the contents of their stomach back through the esophagus by reverse peristaltic movements. It is doubtful that humans have this ability. A bird's esophagus depends mainly on gravity for liquid and food propulsion; the bird must elevate its head to start the food's descent. The esophagus is a short, ill-defined area of alimentary tract of some fish and is elongated in land vertebrates.

Disorders of the esophagus include ulceration and bleeding; heartburn, from gastric juices in the esophagus; achalasia, an inability to swallow or to pass food from the esophagus to the stomach, caused by destruction of the nerve endings in the walls of the esophagus; scleroderma, a collagen disease involving the esophagus; and spasms of the esophageal muscles. For information on esophageal speech, *see* pseudolaryngeal speech.

Esox, fish genus that includes the popular game fishes known as pike, pickerel, and muskellunge (*qq.v.*).

ESP: *see* extrasensory perception.

Espaillat, province, northern Dominican Republic, bounded on the northwest by the Atlantic Ocean and occupying parts of the northern coastal plain and the central section of La Vega Real region. Created in 1885 from La Vega province, the territory of 386 sq mi (1,000 sq km) is crossed by the low Cordillera (mountains) Septentrional. It is an important agricultural producer and one of the most densely populated regions of the Dominican Republic. It is one of the nation's leading coffee-growing provinces; cacao, bananas, tobacco, and corn (maize) are also significant. Espaillat is traversed by secondary highways; Moca is the provincial capital. Pop. (1981) 164,017.

espalier, tree or other plant trained to grow flat against a support (such as a trellis or wall). The term also denotes the trellis or other support on which such trees or plants are trained, as well as the method or technique itself. Espalier was developed in Europe to encourage fruit tree production in an incompatible climate, and the technique originally employed a wall to provide necessary heat as well as support.

Decorative or space-saving espaliers use metal, wire, or wooden frames to create ornamental shapes for shrubbery or to train tree-growth on trellises, on stone, brick, or glass walls, or on fences. One method requires tip-pruning after desired growth is reached, with auxiliary branches tied to a horizontal frame slightly above ground level. Evergreens such as loquat, fire thorn, sweet bay magnolia, and upright yew, as well as dwarf apple and pear trees, make excellent espaliers.

España: *see* Spain.

Español, Pedro: *see* Berruguete, Pedro.

Española (island, West Indies): *see* Hispaniola.

Española Island, also called HOOD ISLAND, southernmost of the major Galápagos Islands, in the eastern Pacific Ocean, about 600 mi (965 km) west of Ecuador. Large seal and albatross colonies live on the island, which has an area of 18 sq mi (47 sq km), but there are no human settlements.

Espartero, Baldomero, PRÍNCIPE (prince) DE VERGARA, also called (from 1839) DUQUE (duke) DE LA VICTORIA, or (from 1837) CONDE (count) DE LUCHANA, byname THE PEACEMAKER OF SPAIN, Spanish EL PACIFICADOR DE ESPAÑA (b. Oct. 27, 1793, Granátula, Spain—d. Jan. 8, 1879, Logroño), Spanish general and statesman, victor in the First Carlist War, and regent.

The son of working class parents, Espartero entered the army at age 15 and fought with Spanish forces in the French Revolutionary and Napoleonic wars and in the rebellious Americas. On the death of Ferdinand VII he showed himself a strong supporter of the queen regent María Cristina and enthusiastically joined the forces opposed to Don Carlos (Carlos María Isidro de Borbón). He was made commander in chief and, for his victory at the Battle of Luchana (December 1836), was created conde de Luchana. Later he opened up the negotiations that led to the Convention of Vergara (1839) and ended the civil war. This success earned Espartero the popular sobriquet *el Pacificador de España* and the title duque de la Victoria. He had begun to dabble in politics in 1836; on his return to Madrid (1840) he became head of the government and selected a cabinet of ministers who agreed with his progressive ideas. María Cristina preferred to resign the regency (October 1840) rather than accept his program of reforms. Espartero was then himself appointed regent by the Cortes (May 1841).

Espartero's regency revealed his faulty understanding of politics. The progressive party was not united, and when Agustín Argüelles was appointed tutor to Isabella II by the Cortes, María Cristina's protests from Paris gained the support of the moderates. Generals Concha and Diego de Léon attempted to seize Isabella in September 1841, and the severity with which Espartero crushed their rebellion made his government unpopular. A republican revolt in 1842 was put down with equal harshness. In 1843 Generals Ramón Narváez and Francisco Serrano rose against Espartero and obliged him to flee to England, where he lived until 1849, when he returned to Spain and lived in retirement at Logroño.

Espartero made his reappearance in politics in 1854 to share control of the government with Gen. Leopoldo O'Donnell during the so-called *bienio progresista.* He finally retired in 1856 and did not even intervene when Isabella was dethroned (1868). Subsequently (1875) he was awarded the title príncipe de Vergara, together with the style of royal highness, by King Amadeus.

esparto, also called ESPARTO GRASS, SPANISH GRASS, HALFA, or ALFA, either of two gray-green needlegrasses (*Stipa tenacissima* and *Lygeum spartum*) that are indigenous to southern Spain and northern Africa; the term also denotes the fibre produced by esparto.

L. spartum, which has stiff, rushlike leaves, grows in rocky soil on the high plains. *S. tenacissima* is especially abundant in the sterile and rugged parts of Murcia and Valencia, and in Algeria, for it flourishes in sandy, ferruginous soils, in dry, sunny situations on the seacoast. It attains a height of three or four feet. The stems are cylindrical and grow in clusters of from two to ten feet in circumference; when young they serve as forage, but after a few years they acquire great toughness. Esparto fibre has great strength and flexibility, and the grass has for centuries been used for making ropes, sandals, baskets, mats and other durable articles. Esparto leaves are also used in the manufacture of paper.

Esperance, town and Indian Ocean port, southern Western Australia, on the northwest shore of Esperance Bay, a shallow inlet of the Great Australian Bight. First settled in 1866, it was named after *l'Esperance,* a ship that was part of the French admiral Bruni d'Entrecasteaux's coastal exploratory expedition of 1792. After 1893 it grew as a minor port serving the gold rushes to inland Murchison, Coolgardie, and Dundas. Today the town, with air, rail, and road connections to Perth (370 mi [600 km] northwest), is the service centre for the 3,000,000-ac (1,200,000-ha) coastal Esperance Plains. Much of this region has been developed by a U.S. syndicate and individual settlers since 1949; the plains yield wool, beef, fodder, and cereals. Much of this produce is shipped through the port at Esperance. The town manufactures superphosphates and has long been a year-round resort for Kalgoorlie (215 mi north). Pop. (1981) 6,375.

Esperanto, artificial language constructed in 1887 by L.L. Zamenhof, a Polish oculist, and intended for use as an international second language. Zamenhof's *Fundamento de Esperanto,* published in 1905, lays down the basic principles of the language's structure and formation.

Esperanto is relatively simple for Europeans to learn because its words are derived from roots commonly found in the European languages, particularly in the Romance languages. Orthography is phonetic, all words being spelled as pronounced. Grammar is simple and regular; there are characteristic word endings for nouns, adjectives, and verbs. Nouns have no gender and are marked by the ending *-o;* the plural is indicated by *-oj* (pronounced *-oy*), and the objective (accusative) case by *-on,* plural *ojn: amiko* "friend," *amikoj* "friends," *amikon* "friend (accusative)," *amikojn* "friends (accusative)." There is only one definite article, *la* (*e.g., la amiko* "the friend"), and no indefinite article. Adjectives end in *-a* (*e.g., bona amiko* "good friend") and take plural and objective endings to agree with nouns (*e.g., la bonaj amikoj estas tie* "the good friends are there," *mi havas bonajn amikojn* "I have good friends"). Verbs are all regular and have only one form for each tense or mood; they are not inflected for person or number (*mi havas, vi havas, ŝi havas, ili havas* "I have, you have, she has, they have"). There is an extensive set of suffixes that can be added to word roots to allow various shades of meaning or newly derived forms; compound words are also used.

Esperanto is probably the most successful of the artificial international languages. The number of Esperanto speakers is estimated at more than 100,000. The Universala Esperanto-Asocio (founded 1908) has members in 83 countries, and there are 50 national Esperanto associations and 22 international professional associations that use Esperanto. There is an annual World Esperanto Congress, and more than 100 periodicals are published in the language. More than 30,000 books have been published in Esperanto.

Esperanza, La, capital, Intibucá department, southwestern Honduras, at an elevation of 4,951 ft (1,509 m) above sea level in the Sierra de Opalaca. It was founded in 1848 adjacent to the Indian settlement of Intibucá and was elevated to city status and department capital in 1883. Some of the surrounding forests have been cleared for growing peaches, quinces, figs, and other fruits. Industrial activity in the capital is largely limited to fruit processing, the production of peach liquor, and lumber production, though the Indians produce fine woven blankets and wool cloth. La Esperanza is linked by highway to neighbouring highland urban centres and also has an airfield. Pop. (1983 est.) 3,592.

Espinel, Vicente (Martínez) (baptized Dec. 28, 1550, Ronda, Málaga, Spain—d. Feb. 4, 1624, Madrid), Spanish writer and musician remembered chiefly for his picaresque novel *La vida del Escudero Marcos de Obregón* (1618; "Life of Squire Marcos of Obregón"), upon which the French novelist Alain-René Lesage based parts of his *Histoire de Gil Blas de Santillane* (1715–35; *The History of Gil Blas of Santillane*).

After his expulsion from the University of Salamanca in 1572, Espinel entered the army and led a roguish life very much like that of his character Marcos, visiting Italy, Flanders, and the Netherlands. He returned to Spain in 1584 and was ordained to the priesthood in 1587. He is thought to have added the fifth string to the Spanish guitar.

Espinhaço Mountains, Portuguese SERRA DO ESPINHAÇO, mountain range of Minas Gerais and Bahia states, eastern Brazil. Their summit stands between 3,600 and 6,500 ft (1,100 and 2,000 m) and forms the divide between the tributaries of the Rio São Francisco and the streams that descend directly to the Atlantic on the east. Since the early 18th century the Espinhaço Mountains have been mined for gold, diamonds, and semiprecious stones, but they are now economically important chiefly for their vast store of high-grade iron ore and manganese. The mountains are the world's chief source of quartz crystals.

Espinosa, Pedro de (b. 1578, Antequera, Spain—d. Oct. 21, 1650, Sanlúcar de Barrameda), Spanish poet and editor of the anthology *Flores de poetas ilustres de España* (1605; "Flowers from the Illustrious Poets of Spain"), in which most of the important poets of Spain's Siglo de Oro (Golden Age; *c.* 1500–

1650) were published. The anthology choices of authors and poems reflect the continuing judgment of later times.

Espinosa's own poetry clearly showed the Baroque influences of highly ornamental language and subtlety bordering on the esoteric. His long poem *Fábula del Genil* is considered one of the better poems in the Baroque mode, enlivening as it does conventional themes such as love of nature and classical mythology.

espionage, process of obtaining military, political, commercial, or other secret information by means of spies, secret agents, or illegal monitoring devices. Espionage is sometimes distinguished from the broader category of intelligence gathering by its aggressive nature and its illegality. *See* intelligence.

espionage, industrial: *see* industrial espionage.

Espírito Santo, *estado* (state) on the east coast of Brazil. It is bounded on the north by the state of Bahia, on the east by the Atlantic Ocean, on the south by the state of Rio de Janeiro, and on the north and west by the state of Minas Gerais. It has a total area of 17,605 sq mi (45,597 sq km), including the uninhabited offshore islands of Trindade and Martin Vaz. Vitória, the port and capital city, stands on an island in the Baía do Espírito Santo (Bay of Espírito Santo), the only bay on the coast.

Espírito Santo formed part of one of the captaincies given by the Portuguese crown to the explorer Vasco Fernandes Coutinho, who, on May 23, 1535, first landed on the future site of Vitória. In 1799 Espírito Santo became an independent captaincy, in 1824 a province of the Brazilian Empire, and in 1889 a state of the newly formed federal republic.

The relief is characterized by the low mountain ranges of the Serra dos Aimorés on the western border and by isolated groups of hills on the eastern coastal plains. The most important rivers—the Doce, São Mateus, and Itapemirim—flow eastward across the state to the ocean; navigation on these rivers is hampered by their irregular rate of flow, as well as by falls, rapids, and sandbars.

The state is today sparsely forested, as most of the forests that formerly supplied Brazil with a substantial proportion of its exports of rosewood and other cabinet woods have now been destroyed.

With the exception of the sandy plains and swamps of the coastal strip, the soil is generally fertile. Repeated plantings of the same crops have, however, exhausted some soils, and many fields have been converted to pasture land. The climate of the coastal zone and the valleys is hot and humid. In the highlands the temperature is lower, and the climate more comfortable. Rainfall, which averages about 50 in. (1,270 mm) a year, is heavier from October to March.

The population is predominantly white, but blacks, mulattoes, and caboclos (of mixed European and Indian ancestry) are also found in high proportions. The population is unevenly distributed. The largest and most populous cities and towns are Vitória, Itaquari, Cachoeiro de Itapemirim, Colatina, and Vila Velha. The overwhelming majority of the population are Roman Catholic, although Protestants of all denominations and Spiritualists are also represented. Portuguese is the mother tongue of almost the entire population.

Campaigns against infectious diseases have been successfully pursued. Yellow fever and smallpox have been eliminated, and malaria has been virtually eradicated. The inroads of tuberculosis have also been greatly reduced. Between 1950 and the late 20th century the death rate dropped sharply.

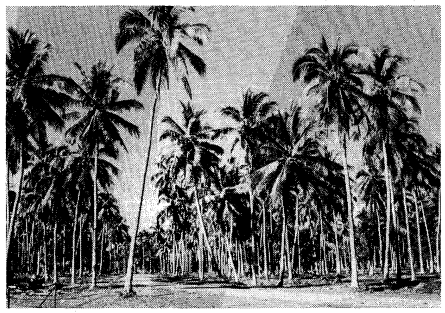
Primary education is administered by the state but is largely subsidized by the federal government. In the late 20th century the state embarked on an extensive school-building program, as well as on a vigorous literacy campaign. Secondary schools are distributed throughout the state; there are two medical schools in Vitória.

Agriculture remains the leading economic activity; coffee, cacao, sugarcane, rice, and corn (maize) are the principal products. Cattle raising is important, with beef cattle generally being raised in the north and dairy cattle in the south. Poultry farming is becoming increasingly important, as is industry, especially food processing. Espírito Santo has two railways—one connecting Vitória with Rio de Janeiro to the southwest and one that moves iron ore from the mines of Minas Gerais for export through the port of Tubarão near Vitória. The state is crisscrossed by an extensive road network, and Vitória airport is capable of handling small jet aircraft.

There are several radio stations and television stations in the state; Vitória has many cultural institutions. Local festivals usually are of a religious nature, and local folklore is deeply rooted in Portuguese and African traditions. Pop. (1985 est.) 2,287,000.

Espírito Santo (city, Brazil): *see* Vila Velha.

Espiritu Santo, also called SANTO, formerly MARINA, largest (1,420 sq mi [3,677 sq km]) and westernmost island of Vanuatu, in the



Coconut plantation near Luganville, Espiritu Santo Island, Vanuatu

Shostal—EB Inc.

southwestern Pacific Ocean. Volcanic in origin, it has a mountain range running along its west coast; Mt. Tabwémasana rises to 6,165 ft (1,879 m). It is heavily wooded and has broad, fertile, well-watered valleys. The island was sighted in 1606 by the Portuguese navigator Pedro Fernández de Quirós, who built a short-lived settlement at the head of St. Philip and St. James Bay.

Hog Harbour, on the northeast coast, is the site of the former British district administration. The former French headquarters is on the south coast at Segond, near which lies Luganville (Santo), second largest town of Vanuatu, with a deepwater port and an international airport. Luganville was an important U.S. Army base during World War II. Exports include copra, coffee, cacao, canned meat, and tuna. Pop. (1979 prelim.) 15,404.

Espoo, Swedish ESBO, town, Uudenmaan *lääni* (Uusimaa province), southern Finland, just west of Helsinki, in a region of broad, flat valleys covered with low clay hills. It is located in an area that has been inhabited since 3500 BC. Granite quarrying is a local industry. The town has railway connections to Helsinki and the remainder of Finland. Notable buildings include a church dating from 1458 and the castle-like studio of the artist Akseli Gallen-Kallela, constructed in 1911–13 and now the Tarvaspää Museum. Espoo is also the location of the Helsinki University of Technology (1908). Pop. (1984 est.) mun., 149,057.

Esposito, Phil, byname of PHILIP ANTHONY ESPOSITO (b. Feb. 20, 1942, Sault Ste. Marie, Ont., Can.), Canadian-born U.S. professional ice hockey centre (1963–81) in the National Hockey League (NHL), who was a leading scorer in his day.

Esposito played hockey from his youth onward, and after a season (1962–63) on a Chicago Black Hawk farm team played as a regular on the parent team from the next season, becoming a regular in the 1964–65 season. He was traded in 1967 to the Boston Bruins and in 1975 to the New York Rangers, retiring in 1981. He was the first hockey player to score more than 100 points (goals plus assists) in a season (1968–69). In the 1968–69 season he scored a record-setting 49 goals and 77 assists (126 points) and increased the record in the 1970–71 season to 152 points, a record tht stood until the 1981–82 season, when it was broken by the Edmonton Oilers' Wayne Gretzky. Esposito's 1,282 games played was second only to Gordie Howe's total. He won the NHL Art Ross Trophy as top scorer of the league five times (1969, 1971–74). After retiring as a player, he was an announcer and did television commentary for Ranger games. His brother Tony was a goalie for the Chicago Black Hawks.

Espoz y Mina, Francisco (b. June 17, 1781, Idocin, Spain—d. Dec. 13, 1836, Barcelona), outstanding guerrilla leader during the Peninsular War, or Spanish War of Independence (1808–14), against the French; he later embraced the Liberal cause and played a role in various uprisings and in the First Carlist War (1833–39).

Espoz y Mina farmed a small family inheritance until 1808, when he joined the struggle against the French invaders. A skilled organizer and strategist, by 1810 he had become the leader of the guerrillas of Navarre, a northern province. In 1813–14 he served with distinction under the Duke of Wellington, the British commander.

After the absolutist Bourbon king Ferdinand VII was restored in 1814, Espoz y Mina led an unsuccessful Liberal coup at Pamplona and fled to France. After the successful revolution against Ferdinand in 1820, he returned and in 1823 led the Liberal army in Catalonia against the French, who had intervened to restore Ferdinand. Defeated, he escaped to England but returned again in 1830 for another abortive uprising. In 1834 after Ferdinand's death, Espoz y Mina took the field with mixed success in engagements with the Carlists, supporters of Ferdinand's brother Don Carlos.

Espronceda y Delgado, José de (b. March 25, 1808, Almendralejo, Spain—d. May 23, 1842, Madrid), Romantic poet and revolutionary, often called the Spanish Lord Byron.

He fled Spain in 1826 for revolutionary activities and in London began a tempestuous affair with Teresa Mancha (the subject of *Canto a Teresa*) which dominated the next 10 years of his life. He participated in the July Revolution of France (1830) and was later allowed to return to Spain, where he was a founder-member of the Republican Party and was imprisoned several times for revolutionary activities. His historical novel *Sancho Saldaña* (1834), influenced by Sir Walter Scott, was written in prison in Badajoz. *El estudiante de Salamanca* (1839; "The Student of Salamanca"), a milestone of Iberian Romanticism, is a variant of the Don Juan legend that carries to extremes the antisocial and antireligious attitudes of its protagonist. Espronceda was most admired for his lyric poetry, and his *Poesías* (1840; "Poems") shows the influence of both Lord Byron and Scott. The unfinished poem *El diablo mundo* ("The Devilish World") contains ideological reflections and is considered one of his best works. Espronceda served as secretary of the diplomatic legation to The Hague (1840) and deputy to the Cortes from Almeria (1842). He also wrote several plays—

Blanca de Borbón (1870), *Ni el tío ni el sobrino* (1834; "Neither the Uncle nor the Nephew"), and *Amor venga sus agravios* (1838; "Love Avenges Its Affronts").

Espy, James Pollard (b. May 9, 1785, Pennsylvania, U.S.—d. Jan. 24, 1860, Cincinnati, Ohio), U.S. meteorologist who apparently gave the first essentially correct explanation of the thermodynamics of cloud formation and growth. He was also one of the first to use the telegraph for collecting meteorological observations. Espy served as a meteorologist with the U.S. War Department and the U.S. Navy until 1852, when he continued his work at the Smithsonian Institution, Washington, D.C. He presented his theory of clouds and his more general (and incorrect) theory of storms before scientific audiences in the U.S. and Europe and in his *Philosophy of Storms* (1841).

Esquimalt, district municipality and western suburb of metropolitan Victoria, southwestern British Columbia, Canada, at the southeastern end of Vancouver Island, on Juan de Fuca Strait. Its harbour was visited (1790) by Manuel Quimper of the Spanish Navy, who called it Puerto de Cordova to honour the Mexican viceroy. The community originated during the Crimean War (1853–56) as a naval base for a combined British–French fleet, which attacked the Russian northern Pacific port of Petropavlovsk on the Kamchatka Peninsula (Siberia). The British-owned installations were transferred to the Royal Canadian Navy in 1910. Esquimalt is the site of one of the world's largest dry docks and is now the headquarters of the Canadian Maritime Forces Pacific. Its Indian name means "place of gradually shoaling waters." Inc. 1912. Pop. (1981) 15,870.

Esquipulas, town, southeastern Chiquimula department, southeastern Guatemala, in the central highlands near the borders of Honduras and El Salvador at an altitude of 3,018 ft (920 m). The town itself is not large; it derives its great importance from its magnificent colonial church, now Central America's greatest pilgrimage centre, built in 1737 by the Archbishop of Guatemala to house the spectacular Black Christ. The figure, commissioned by Spanish conquistadors and first placed in a local church in 1595, was carved out of dark wood in 1594. It is now dressed in white satin and adorned with jewels. Major religious processions occur on January 15 and during Holy Week. Esquipulas is 80 mi (130 km) east of Guatemala City and is accessible by highway and by air. Pop. (1981 prelim.) mun., 18,838.

esquire (Old French *esquier;* Latin *scutarius*), originally, a knight's shield bearer, who would probably himself in due course be dubbed a knight. In England in the later Middle Ages, the term esquire (*armiger*) was used to denote holders of knights' estates who had not taken up their knighthood, and from this practice it became usual to entitle the principal landowner in a parish "the squire." The title esquire, properly held only by the eldest sons of younger sons of peers, by the eldest sons of baronets and knights, and by certain officials (including justices of the peace, mayors, sheriffs, and senior service officers), is by courtesy extended in Britain to all professional men and is used, abbreviated as Esq., as a form of address appended to surnames in place of the title Dr. or Mr.

Esquire, U.S. monthly magazine, founded in 1933 by Arnold Gingrich, that began production as an oversized magazine for men, featuring drawings of scantily clad young women and winning its right to do so in court. Later it abandoned its titillating role. In 1943 the U.S. postmaster general attempted to withdraw *Esquire*'s second-class mailing privileges (an economy generally essential to a magazine's survival) because he did not believe the magazine made a "special contribution to the public welfare." Gingrich and his associates protested all the way to the U.S. Supreme Court. They won the case.

Esquire was a pioneer in the use of unconventional topics and feature stories. As it began to publish the work of Thomas Wolfe, Ernest Hemingway, William Faulkner, John Steinbeck, Truman Capote, and Norman Mailer, the magazine's all-male image and its once racy air gradually receded. It provided an outlet for new writers of fiction and nonfiction. Its topical features, satiric humour, and excellent book, film, and record reviews filled a void between literary and opinion periodicals in the U.S. Although the magazine continued to emphasize clothing and advertising directed to men, *Esquire* evolved into a general-audience publication.

Esquirol, Jean-Étienne-Dominique (b. Feb. 3, 1772, Toulouse, Fr.—d. Dec. 12, 1840, Paris), early French psychiatrist who was the first to combine precise clinical descriptions with the statistical analysis of mental illnesses.

A student of Philippe Pinel, Esquirol succeeded his distinguished teacher as physician in chief at the Salpêtrière Hospital in Paris in 1811, further developing Pinel's diagnostic techniques and continuing his efforts to achieve more humane treatment of the mentally ill. Esquirol provided the first accurate description of mental retardation as an entity separate from insanity, and also coined the term hallucination. His *Des maladies mentales, considérées sous les rapports médical, hygiénique, et médico-légal* (1838) has been called the first modern treatise on clinical psychiatry, and remained a basic text for 50 years. Esquirol anticipated modern views in his suggestion that some mental illnesses may be caused by emotional disturbances rather than by organic brain damage.

ESR: *see* electron paramagnetic resonance.

Eşref DYNASTY, also spelled ASHRAF, Turkmen dynasty (*c.* 1290–*c.* 1326) that ruled in Beyşehir, west of Konya in central Anatolia.

The dynasty traced its origins to a Turkmen tribe that was settled by the Seljuqs of Anatolia on the western frontier. The family's founder, Eşref oğlu Sayfeddin Süleyman I, was a Seljuq *amīr* who played an important role in Seljuq dynastic struggles during the reign of the Seljuq sultan Mas'ūd II (ruled 1283–98). Süleyman was appointed regent to the sons of the deposed Seljuq sultan, Ghiyāth ad-Dīn Kay-Khusraw, by Mas'ūd's opponents in 1285, but he submitted to Mas'ūd when the Sultan consolidated his power. Later Süleyman I assisted Mas'ūd against the latter's brother Siyāwush.

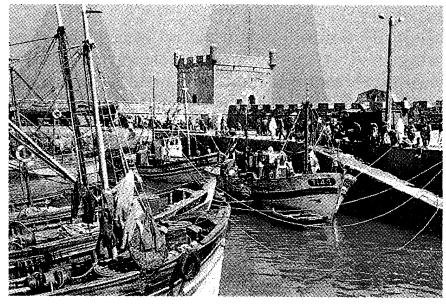
Süleyman's son Mehmed captured Akşehir and Bolvadin and in 1314 accepted Il-Khanid (western Mongol) suzerainty. He was succeeded by his son Süleyman II, whose reign coincided with an attempt by Demirtaş, the Il-Khanid governor of Anatolia, to assert his authority over the independent Turkmen rulers in Anatolia. In *c.* 1326 Demirtaş marched to Beyşehir and killed Süleyman II, putting an end to the Eşref principality. Later its territories were divided between the Karaman and Hamid principalities.

esrog (Jewish ceremonial object): *see* etrog.

Essad Paşa (Toptani) (b. *c.* 1864, Tiranë, Alb.—d. June 13, 1920, Paris), political leader who played a prominent but often disruptive role in Albania's affairs during the early years of the 20th century.

The scion of a rich Albanian family, he joined the Young Turk movement in 1908 and became deputy for Albania in the new Turkish parliament. The most powerful of the central native lords, he was given command of the Turkish forces at Shkodër (Scutari) during the First Balkan War, but traitorously delivered the town to the Montenegrins (1913). Appointed minister of interior and of war in the first sovereign government of Albania under Prince William of Wied, he intrigued against the government with an eye to becoming ruler himself. Though Essad was forced to leave the country when his plans were discovered (May 1914), his unsettling influence precipitated the eventual fall of Prince William in September. During World War I Essad won the recognition of French authorities at Salonika as head of an Albanian government-in-exile. He was assassinated in Paris by Avni Rustem, an Albanian student.

Essaouira, formerly MOGADOR, Atlantic port city, provincial capital, and province, Tensift region, western Morocco, midway between Safi and Agadir. Occupied by Phoenicians and Carthaginians, the site was mentioned in the chronicles of the Carthaginian explorer Hanno (5th century BC). Medieval charts show it as Mogador, a corruption of a Berber word for "safe anchorage." It stands on a peninsula 10–20 ft (3–7 m) above sea level and at times with heavy tides is almost an island. Its harbour is



Quayside scene at Essaouira, Morocco
Syndication International Ltd., London

sheltered by offshore islets and a rocky headland, but the channel is narrow and dangerous. Founded by Sultan Sīdī Muḥammad ibn 'Abdullāh in 1765 as a rival port to Agadir, it was planned by a French captive, Théodore Cornut, and fortified in the style of the military engineer Sébastien Vauban. A colony of Moroccan Jews was installed to extend commerce. On the land side stretch miles of sand dunes studded with broom, and beyond are argan forests unique to Morocco. A temperate climate and fine beaches have made it a bathing resort. Essaouira is known for its artisan industries, notably inlaid cabinetwork. It is connected by road with Safi, Marrakech, and Agadir.

Essaouira province has an area of 2,446 sq mi (6,335 sq km). It is bounded by the provinces of Safi to the north, Marrakech to the east, Agadir to the south, and by the Atlantic Ocean to the west. Cereals (mainly barley), olives, citrus fruits, and livestock are raised; there are oil fields in the province. Pop. (1971) mun., 30,061; (1981 est.) province, 489,400.

Essarhaddon (Assyrian king): *see* Esarhaddon.

essay, a literary composition of moderate length, dealing in an easy, cursory way with a single subject, usually representing the writer's personal experience and outlook. The form was invented in the late 16th century by the French writer Michel de Montaigne, who chose the name *essai* to emphasize that his compositions were attempts or endeavours, feeling their way toward the expression of his personal thoughts and experiences. The reflective Montaigne wrote about himself with startling frankness, capturing his fancies about the intimate things of life with superb skill

and setting them down in a vivid and arresting way. His *Essais*, published in their final form in 1588, are still considered among the finest of their kind.

Francis Bacon was the first great English essayist, although his *Essayes* (1597; enlarged editions in 1612 and 1625) are utterly different from those of Montaigne. The topics were grave and weighty—"Of Ambition," "Of Truth," "Of Great Place," and the like—and the style is lofty and often austere. Abraham Cowley (1618–67) was the first English writer of distinction to follow Montaigne's example, echoing the Frenchman's personal touch in such essays as "Of Myself." In the 18th century the English essay enjoyed a great vogue, taking shape in the hands of such masters as Addison and Steele, Samuel Johnson, and Oliver Goldsmith.

Among the greatest of the English essayists was Charles Lamb (1775–1834), whose "Essays of Elia," which began to appear in 1820, are universally recognized as landmarks of the genre. Lamb's essays combine humour, fantasy, and sentiment with a gift for perceptive observation of life, all expressed in a highly personal style. Another outstanding essay writer was Thomas De Quincey (1785–1859), whose works include such highly polished and imaginative pieces as "On Murder as One of the Fine Arts" and "On the English Mail Coach." In the latter half of the 19th century, the essays of Robert Louis Stevenson are of the same class as those of Montaigne and Lamb, and he approached far more closely than his contemporaries to their level of excellence.

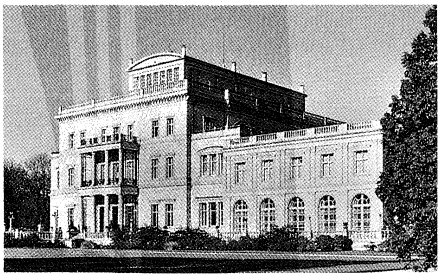
In the United States the essay had been written with genius by Thoreau in *Walden;* and Emerson's *Essays*, though not in the tradition of Montaigne and Lamb, were rich in lofty thought and utterance.

Although invented by a great French writer, the essay was very late in making itself at home in France. The admirable *Causeries du lundi* of Saint-Beuve (1804–69) are literary essays in the fullness of the term and have been the forerunners of much brillant essay writing in France. Other French essayists of special distinction are Théophile Gautier and Anatole France. All these were writers of literary essays, and it is in the analysis of manifestations of intellectual energy that the essay has been best illustrated in France.

During the 20th century the essay has been reborn as a playful kind of literature, and such humorists as James Thurber and Dorothy Parker excelled in the art.

Esseg (Yugoslavia): *see* Osijek.

Essen, city, North Rhine-Westphalia *Land* (state), western Germany, between the Rhine-Herne Canal and the Ruhr River. It was



Villa Hügel, former home of the Krupp family in Essen, Ger.

Archiv fur Kunst und Geschichte, Berlin

originally the seat of an aristocratic convent (founded 852), still represented by the cathedral (the seat of a Roman Catholic bishop), completed in the 15th century. In the suburb of Werden, the abbey church was founded in 796 as part of a monastery. The convent and the abbey exercised local sovereignty as imperial states until their dissolution in 1802, when Essen passed to Prussia.

The development of ironworks, steelworks, and coal mines during the 19th century stimulated rapid growth from a small town (about 3,000 inhabitants in 1802) to the largest industrial city in the Ruhr coalfield. It was occupied by the French (1923–25) and suffered heavy destruction in World War II as a centre of German war industry. The city has since been rebuilt with large, modern administrative and office buildings and housing, concert halls, an economic research institute, and the Museum Folkwang featuring 19th- and 20th-century art. The Ruhr is dammed there to form the Baldeney Lake, near which is the Villa Hügel, originally the home of the Krupps (the noted German industrialists) and since 1953 used for meetings and cultural events.

The industrial hub of the Ruhr, Essen is also a retail trade centre and a rail junction. Apart from coal and steel, it has diversified heavy, medium, and light industries, including construction, chemical and glassworks, and factories for textiles and precision instruments. The coal mines and most of the city's industry are concentrated to the north toward the canal, while the southern part of Essen presents a landscape of woods and parks. Pop. (1989 est.) 620,594.

Essen, Louis (b. Sept. 6, 1908, Nottingham, Nottinghamshire, Eng.), English inventor of the Essen quartz ring clock widely used as a time standard in observatories, and builder of the atomic clock (cesium standard).

In 1929 Essen began work on frequency and time standards at England's National Physical Laboratory, Teddington, Middlesex, making studies of tuning forks and quartz oscillators; his investigations culminated in the quartz ring clock (1938). During World War II he invented a number of radio-wave measuring devices that led him in 1950 to measure the speed of light as 299,792.5 ± 1 km/sec. Later work resulted by 1958 in construction of the cesium atomic beam standard, accurate to 1 part in 10^{11}, and its adoption by Britain the following year as the national standard. Essen was elected a fellow of the Royal Society in 1960.

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

Essene, member of a religious sect or brotherhood that flourished in Palestine from about the 2nd century BC to the end of the 1st century AD. The New Testament does not mention them and accounts given by Josephus, Philo of Alexandria, and Pliny the Elder sometimes differ in significant details, perhaps indicating a diversity that existed among the Essenes themselves.

The Essenes clustered in monastic communities that, generally at least, excluded women. Property was held in common and all details of daily life were regulated by officials. The Essenes were never numerous; Pliny fixed their number at some 4,000 in his day.

Like the Pharisees, the Essenes meticulously observed the Law of Moses, the sabbath, and ritual purity. They also professed belief in immortality and divine punishment for sin. But, unlike the Pharisees, the Essenes denied the resurrection of the body and refused to immerse themselves in public life. With few exceptions, they shunned Temple worship and were content to live ascetic lives of manual labour in seclusion. The sabbath was reserved for day-long prayer and meditation on the Torah (first five books of the Bible). Oaths were frowned upon, but once taken they could not be rescinded.

After a year's probation, proselytes received their Essenian emblems but could not participate in common meals for two more years. Those who qualified for membership were called upon to swear piety to God, justice toward men, hatred of falsehood, love of truth, and faithful observance of all other tenets of the Essene sect. Thereafter new converts were allowed to take their noon and evening meals in silence with the others.

Following the discovery of the Dead Sea Scrolls (late 1940s and 1950s) in the vicinity of Khirbat Qumrān, most scholars have agreed that the Qumrān (*q.v.*) community was Essenian.

Consult the INDEX *first*

essential oil, highly volatile substance isolated by a physical process from an odoriferous plant of a single botanical species. The oil bears the name of the plant from which it is derived; for example, rose oil or peppermint oil. Such oils were called essential because they were thought to represent the very essence of odour and flavour.

Distillation is the most common method for isolation of essential oils, but other processes—including enfleurage (extraction by using fat), maceration, solvent extraction, and mechanical pressing—are used for certain products. Younger plants produce more oil than older ones, but old plants are richer in more resinous and darker oils because of the continuing evaporation of the lighter fractions of the oil.

Out of the vast number of plant species, essential oils have been well characterized and identified from only a few thousand plants. The oils are stored as microdroplets in glands of plants. After diffusing through the walls of the glands, the droplets spread over the surface of the plant before evaporating and filling the air with perfume. The most odoriferous plants are found in the tropics, where solar energy is greatest.

The function of the essential oil in a plant is not well understood. Odours of flowers probably aid in natural selection by acting as attractants for certain insects. Leaf oils, wood oils, and root oils may serve to protect against plant parasites or depredations by animals. Oleoresinous exudations that appear when the trunk of a tree is injured prevent loss of sap and act as a protective seal against parasites and disease organisms. Few essential oils are involved in plant metabolism, and some investigators maintain that many of these materials are simply waste products of plant biosynthesis.

Commercially, essential oils are used in three primary ways: as odorants they are used in cosmetics, perfumes, soaps, detergents, and miscellaneous industrial products ranging from animal feeds to insecticides to paints; as flavours they are present in bakery goods, candies, confections, meat, pickles, soft drinks, and many other food products; and as pharmaceuticals they appear in dental products and a wide, but diminishing, group of medicines.

The first records of essential oils come from ancient India, Persia, and Egypt; and both Greece and Rome conducted extensive trade in odoriferous oils and ointments with the countries of the Orient. Most probably these products were extracts prepared by placing flowers, roots, and leaves in fatty oils. In most ancient cultures, odorous plants or their resinous products were used directly. Only with the coming of the golden age of Arab culture was a technique developed for the distillation of essential oils. The Arabs were the first to distill ethyl alcohol from fermented sugar, thus providing a new solvent for the extraction of essential oils in place of the fatty oils that had probably been used for several millennia.

The knowledge of distillation spread to Europe during the Middle Ages, and isolation of

essential oils by distillation was described during the 11th to 13th centuries. These distilled products became a specialty of the medieval pharmacies, and by about the year 1500 the following products had been introduced: oils of cedarwood, calamus, costus, rose, rosemary, spike, incense, turpentine, sage, cinnamon, benzoin, and myrrh. The alchemical theories of the noted Swiss physician and alchemist Paracelsus (Theophrastus Bombastus von Hohenheim, 1493–1541) played a role in stimulating physicians and pharmacists to seek essential oils by distillation of a range of aromatic leaves, woods, and roots.

Starting from the time of Marco Polo, the much-prized spices of India, China, and the Indies served as the impetus for trade with the Orient. Quite naturally, such spices as cardamom, sage, cinnamon, and nutmeg were subjected to the pharmacists' stills. By the middle of the 18th century about 100 essential oils had been introduced, although there was little understanding about the nature of the products. As chemical knowledge expanded in the late 1800s and early 1900s, many well-known chemists took part in the chemical characterization of essential oils. Improvement in knowledge of essential oils led to a sharp expansion in production, and use of the volatile oils in medicine became quite subordinate to uses in food-stuffs, beverages, and perfumes.

In the United States, oils of turpentine and peppermint were produced before 1800; within the next several decades oils of four indigenous American plants became important commercially; namely, sassafras, wormwood, wintergreen, and sweet birch. Since 1800 many essential oils have been prepared, but only a few have attained commercial significance.

Methods of production. The first step in the isolation of essential oils is crushing or grinding the plant material to reduce the particle size and to rupture some of the cell walls of oil-bearing glands. Steam distillation is by far the most common and important method of production, and extraction with cold fat (enfleurage) or hot fat (maceration) is chiefly of historical importance.

Three different methods of steam distillation are practiced. In the oldest and simplest method a vessel containing water and the chopped or crushed plant material is heated by a direct flame, and the water vapour and volatile oil are recovered by a watercooled condenser. This original method is being replaced by a process in which the plant material is suspended on a grid above the water level, and steam from a second vessel is introduced under the grid. The volatiles are condensed and the oil is separated. In the third process, the vessel containing the plant material on a grid is heated to prevent condensation of steam, so that dry distillation is attained.

In southern France essential oils were extracted with cold fat long before the introduction of extraction with volatile solvents. This process is applied to flowers that do not yield an appreciable quantity of oil by steam distillation or whose odour is changed by contact with boiling water and steam. In this process, flowers are spread over a highly purified mixture of tallow and lard and are left for a period varying from 24 hours to 72 hours. During this time most of the flower oil is absorbed by the fat. The petals are then removed (defleurage), and the process is repeated until the fat is saturated with oil. The final product is called pomade (*e.g.*, pomade de jasmine).

In most cases, it is possible to shorten the long enfleurage process by extracting the essential oils using molten fat for one to two hours at a temperature ranging from 45° to 80° C (113° to 176° F). The fat is filtered after each immersion, and after 10 to 20 extraction cycles the pomade is sold as such, or it may be extracted with alcohol to yield the oil residue.

Since both enfleurage and maceration are rather expensive processes, some essential-oil specialists have shifted almost completely to using volatile solvents for the recovery of essential oils from plant materials that could not be processed by steam distillation. Petroleum naphthas, benzene, and alcohol are the primary solvents.

A procedure called expression is applied only to citrus oils. The outer coloured peel is squeezed in presses, and the oil is decanted or centrifuged to separate water and cell debris. The method is used for oil of sweet and bitter orange, lemon, lime, mandarin, tangerine, bergamot, and grapefruit. Much oil is produced as a by-product of the concentrated-citrus-juice industry.

Chemical composition. Terpenes, organic compounds consisting of multiples of isoprene units (containing five carbon atoms), are by far the most dominant constituents of essential oils. Individual oils, however, may contain appreciable quantities of straight chain, aromatic, or heterocyclic compounds. Thus allyl sulfides are characteristics of oil of garlic, traces of indole and anthranilic acid esters are found in orange oil, straight chain alcohols and aldehydes are recognized in oil of violets, and phenols and other aromatic compounds are common to many oils.

Terpenes are built up from units of the simple five-carbon molecule isoprene. Both hydrocarbons and oxygenated compounds such as alcohols, aldehydes, ketones, acids, esters, oxides, lactones, acetals, and phenols are responsible for the characteristic odours and flavours.

In some oils one or only a few components predominate: thus oil of wintergreen contains about 98 percent of methyl salicylate; orange

Some important essential oils

essential oil	source
Abies sibirica (Siberian fir)	U.S.S.R.
almond, bitter	U.S., Morocco, Spain, France, Algeria
angelica root	Belgium, France, The Netherlands, Germany
anise and star anise	U.S.S.R., eastern Europe, China, Vietnam
bay	West Indies
bergamot	Sicily and the Italian Peninsula, France, Switzerland
bois de rose	Brazil, Peru
camphor	China, Japan, Taiwan
cananga	Java
caraway	The Netherlands, U.S.S.R.
cardamom	Sri Lanka, India, Central America
cedarleaf (thuja)	northeastern U.S.
cedarwood	U.S., Africa, India
celery seed	India, France, U.S.
chenopodium (American wormseed)	U.S.
cinnamon (and cassia)	China, Burma, Sri Lanka
bark oil	China, Burma, Sri Lanka
leaf oil	China, Burma, Sri Lanka
citronella	Sri Lanka, Java, China, Guatemala
clove	
bud	Zanzibar, Madagascar
leaf	Zanzibar, Madagascar
copaiba	South America
coriander	eastern Europe, U.S.S.R.
dillweed	central Europe, U.S.
eucalyptus	Australia, Spain, South America
fennel	central Europe, U.S.S.R., Italy, France
geranium	Réunion, Morocco, U.S.S.R., Madagascar
ginger	Jamaica, India, West Africa
grapefruit	U.S.
jasmine	France, Italy, Morocco
juniper berry	central Europe
lavandin	France
lavender	France, U.S.S.R., U.K.
spike	Spain, France
lemon	U.S., Italy, Brazil, Israel, Greece
lemongrass	Southeast Asia, Central America, West Africa
lime	Mexico, Haiti, West Indies
mandarin	Italy, Spain, Cyprus
Florida tangerine	Florida
neroli	France, Italy, Spain, Lebanon, Egypt
nutmeg	Indonesia, West Indies
Ocotea cymbarum	Brazil, Colombia, Paraguay
orange	U.S., Italy, West Indies
bitter	West Indies, Italy, Brazil, Spain
origanum	Spain, Morocco
palmarosa	India, Java
patchouli	Indonesia, Malaysia, Philippines
pennyroyal	Spain, Morocco
peppermint	U.S., U.K., India, U.S.S.R., Japan
pine	U.S.
rose	
Bulgarian	
Turkish	
French	
Moroccan	
rosemary	Spain, Italy, eastern Europe, U.S.S.R.
sage	
clary	U.S.S.R., France, Hungary
Dalmatian	Yugoslavia
sandalwood	India
spearmint	U.S., Germany, U.K., China
spruce	U.S., Canada
turpentine	U.S., Sweden, Greece, U.S.S.R.
vetiver	Réunion, Java, Brazil, Haiti
wintergreen	U.S.
wormwood	France, U.S.
ylang-ylang	Madagascar, Réunion, Philippines

oil, about 90 percent of *d*-limonene; bois de rose, 90 percent of linalool; and cassia, up to 95 percent of cinnamaldehyde. In most oils there is a mixture of anywhere from a few dozen to several hundred individual compounds. Trace components are very important, since they give the oil a characteristic and natural odour.

Essential oils are generally expensive, with prices ranging from several U.S. dollars per kilogram on the low side to several thousand dollars per kilogram. The high price of the natural oils coupled with their limited availability has encouraged a search for substitutes. Great progress has been made in the synthesis of individual components such as geraniol, citral, linalyl acetate, and the like. These synthetics have been combined with natural oils to extend supplies, and they have also been blended together in an attempt to duplicate the oils themselves. Such reconstituted oils usually lack certain of the odour notes of the natural products, because of absence of trace ingredients, often unidentified, that may be present in the natural oils. They also tend to have a more "chemical" odour, because of trace impurities in the synthetics that are different from the components of natural oils.

Essentuki (Russian S.F.S.R.): *see* Yessentuki.

Essequibo River, river in east central Guyana, the largest river between the Amazon and the Orinoco. It rises in the Acarai Mountains on the Brazilian border and flows northward for approximately 630 miles (1,010 km) through savannas and forests to the Atlantic Ocean. It reaches the Atlantic Ocean 13 miles (21 km) west-northwest of Georgetown, the national capital. Its estuary, 20 miles (32 km) wide, is obstructed by islands and silt. With its chief tributaries, the Rupununi, Mazaruni, and Cuyuni, its system drains more than half of Guyana.

The Essequibo is navigable by small ocean vessels to Bartica, 50 miles (80 km) inland, and by boats for long reaches between rapids. Its name is that of the old Dutch colony of Essequibo, settled from 1616 and one of the entities that joined together in 1831 to form British Guiana, now Guyana.

Essex, one of the kingdoms of Anglo-Saxon England; *i.e.,* that of the East Saxons. An area of early settlement, it probably originally included the territory of the modern county of Middlesex; London was its chief town. Essex sometimes had joint kings, and from 664 they were subject to the rulers of the midland kingdom of Mercia. From 825 Essex was controlled by Wessex, first as a subkingdom ruled by sons of the Wessex kings and then from 860 without separate existence. By the treaty made between King Alfred the Great and the Danish king Guthrum in 878, the latter acquired Essex, but it was won back by the Wessex dynasty early in the 10th century and was thereafter ruled by ealdormen, in origin royal household officials. Essex had been slow to accept Christianity wholeheartedly; an important missionary there was the Northumbrian Cedd (died 664), whose church at Bradwell-on-Sea still survives.

Essex, county of eastern England, extending along the North Sea coastline between the Thames and Stour estuaries. The ancient county stretched westward as far as Middlesex beyond the River Lea, a tributary of the Thames, but since 1965 Greater London has incorporated its southwestern corner. The county is divided into the administrative districts of Basildon, Braintree, Brentwood, Castle Point, Chelmsford, Colchester, Epping Forest, Harlow, Maldon, Rochford, Southend-on-Sea, Tendring, Thurrock, and Uttlesford. It has an area of 1,418 square miles (3,672 square km).

Essex is low-lying, with a flat coast that has many tidal inlets and islands. The hardwood forest cover on its predominantly clay soils resisted efforts at effective agricultural colonization until the Iron Age, and even today some tracts of land that have never been converted to farmland survive as woodland, notably in Epping Forest.

In Roman times Colchester became one of the few *coloniae* (municipalities) in Britain, and there are other Romano-British sites at Chelmsford, Great Chesterford, and Rivenhall. The 5th-century Saxon invaders were followed by the Danes, who won the battle of Maldon in 991. In the absence of local stone, timber was the chief domestic building material, and many examples of medieval timber-framed houses, often plastered and colour-washed, survive. From the 16th century brick was used for mansions, such as Audley End. Two Norman castles—Castle Hedingham and Colchester—survive.

With modern communications the impact of London upon the Essex countryside has intensified. The railways created Harwich as a passenger port for North Sea ferries and brought Londoners to the sandy coast at Southend and Tendring for holidaymaking, retirement, and even commuting. More recently the sheltered waters of the tidal inlets, by which the first agricultural colonists arrived across the North Sea, have been enlivened by the sailing craft of affluent urbanites. Commuters have also swelled the populations of the more accessible inland towns and villages on electrified railways, and modern light industries have attached themselves to historic market towns and given birth to new towns such as Basildon and Harlow that have been created to receive overspill population from London. The port of London has increasingly shifted eastward from London's original Dockland in the East End to deep water on the lower Thameside at Tilbury; giant petroleum installations have been established farther east on the Thames marshes at Shellhaven, Coryton, and Canvey Island. A nuclear power station has also been built at Bradwell-on-Sea; but, after much controversy, plans to develop another major airport for London at Foulness Island on the Essex coast were abandoned.

Despite its proximity to London, much of Essex preserves a rural aspect, and the county is highly farmed, producing rich crops of cereals and supporting prosperous livestock enterprises. Especially where lighter soils cap the clay, there are extensive market gardens and plant nurseries.

Chelmsford, centrally situated, has long been the county headquarters and is also the seat of a modern ecclesiastical diocese. The University of Essex (1961) is at Colchester. Pop. (1985 est.) 1,504,700.

Essex, town (township), Chittenden County, northwestern Vermont, U.S., on the Winooski River, just east of Burlington. Chartered in 1763 and settled in 1783, it consists of the villages of Essex Junction and Essex Center. The junction is a busy industrial (and residential) site, where the Central Vermont Railroad and four highways converge; its railway depot serves as the depot for Burlington. Essex Center is a small, mostly residential settlement. The Champlain Valley Exposition Grounds are nearby, as is the site of Fort Ethan Allen, used as a military reservation during the Spanish-American War and both World Wars but now occupied by private businesses and organizations. Pop. (1982 est.) 14,823.

Essex, EARLS OF, titled English nobility of several creations, notably in the families Mandeville, Devereux, and Capel, grouped below chronologically and indicated by the symbol •.

• **Essex, Geoffrey de Mandeville, 1st earl of** (d. Sept. 16, 1144, Mildenhall, Suffolk, Eng.), the worst of a number of cruel and lawless barons during the reign of King Stephen of England.

Geoffrey was a great landowner in Essex and elsewhere and hereditary constable of the Tower of London. He came to prominence in 1140 when Stephen, who could not dispense with his support against Matilda, a rival claimant for the throne, made him hereditary earl of Essex, by the earliest charter granting an English earldom extant or even known.

When Stephen was captured by Matilda's supporters (February 1141), Geoffrey deserted to her and was granted virtually viceregal powers in Essex. Before the rout of Matilda's force at Winchester (September 1141), Stephen's queen brought Geoffrey back to the royalist side by more concessions, possibly including the viceregal powers in London, Middlesex, and Hertfordshire, which were formally granted to him by Stephen in December 1141.

Arrested at St. Albans for treason against Stephen in 1143, he gave up his offices and castles in return for his freedom and went off to plunder the fenland around Ely, using Ramsey Abbey, which he fortified, as headquarters. It was here that his atrocities became a byword. Stephen besieged him in vain, but in August 1144 Geoffrey was mortally wounded by a chance shot while laying siege to Burwell, and he died the following month.

• **Essex, Thomas Cromwell, earl of:** *see* Cromwell, Thomas.

• **Essex, William Parr, earl of:** *see* Northampton, William Parr, marquess of.

• **Essex, Walter Devereux, 1st earl of,** VISCOUNT HEREFORD, LORD FERRERS, LORD BOURCHIER (b. Sept. 16, 1541, Carmarthen, Carmarthenshire, Wales—d. Sept. 22, 1576, Dublin), English soldier who led an unsuccessful colonizing expedition to the Irish province of Ulster from 1573 to 1575. The atrocities he committed there contributed to the bitterness the Irish felt toward the English.

He was the eldest son of Sir Richard Devereux and the grandson of Walter Devereux, Viscount Hereford, to whose title he succeeded in 1558. Sometime between 1560 and 1565 he married Lettice, daughter of Sir Francis Knollys. He served as "high marshal in the field" in the suppression of an insurrection in northern England in 1569, and in 1572 he was made earl of Essex. In the spring of 1573 he offered to subdue and colonize, at his own expense, a portion of Ulster that had not accepted English overlordship. The region was dominated by the rebellious O'Neills, led by Sir Brian MacPhelim and Turlough Luineach

Walter Devereux, 1st earl of Essex, engraving by Simon Van de Pass, 1620

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

O'Neill, and they were supported by the Scots-Irish under Sorley Boy MacDonnell.

Essex arrived in Ireland by autumn 1573. He was soon engaged in intrigues to divide his enemies, and he had difficulty obtaining the continued cooperation of Queen Elizabeth I and her lord deputy of Ireland, Sir William Fitzwilliam. His military operations took the form of raids characterized by brutal massacres of the populace. He treacherously captured Brian MacPhelim at a conference in Belfast in October 1574 and had MacPhelim and his wife and half brother, all of whom were his guests, executed at Dublin.

On advice from Robert Dudley, earl of Leicester, Elizabeth commanded Essex to "break off his enterprise" in 1575; before leaving Ireland, however, he defeated Turlough Luineach O'Neill, and he massacred several hundred of Sorley Boy's following, chiefly women and children, discovered hiding in the caves at Rathlin.

To compensate Essex for his losses in Ireland, Elizabeth bestowed on him a barony in Monaghan and the office of earl marshal of Ireland. He died of dysentery shortly after returning to Ireland from England in September 1576. There were suspicions that he had been poisoned by Leicester, who later married his widow, but these suspicions were not confirmed by the postmortem examination.

• **Essex, Robert Devereux, 2nd earl of,** VISCOUNT HEREFORD, LORD FERRERS, LORD BOURCHIER (b. Nov. 10, 1567, Netherwood, Herefordshire, Eng.—d. Feb. 25, 1601, London), English soldier and courtier famous for his relationship with Queen Elizabeth I

Robert Devereux, 2nd earl of Essex, detail of a painting after Marcus Gheeraerts the Younger, late 16th century; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

(reigned 1558–1603). While still a young man, Essex succeeded his stepfather, Robert Dudley, earl of Leicester (died 1588), as the aging queen's favourite; for years she put up with his rashness and impudence, but their relationship finally ended in tragedy.

Devereux was a cousin of Elizabeth on his mother's side, and when he was nine, he succeeded to the title held by his father, Walter Devereux, 1st earl of Essex. Young Essex first attained prominence by fighting bravely against the Spanish in the Netherlands in 1586. The following year Elizabeth made him master of the horse. Even at this early date he consistently provoked the Queen's anger while managing to remain in her favour. Contrary to her wishes, he took part in the English operation against Lisbon in 1589 and secretly married Frances Walsingham, widow of the poet Sir Philip Sidney, in 1590. In 1591–92 he commanded the English force in France, which helped King Henry IV, then still a Protestant, in his campaign against the French Roman Catholics.

For the next four years Essex remained in England, becoming an expert on foreign affairs in an unsuccessful attempt to challenge the long-established ascendancy in this field of the Cecil family. He was made privy councillor in 1593 and in 1594 uncovered an alleged plot against the Queen's life by her physician, Roderigo Lopez.

When the revival of offensive operations against Spain in 1596 opened new opportunity for military adventure, Essex became one of the commanders of the force that seized and sacked Cádiz on June 22. This spectacular but indecisive action put him at the height of his fortunes and made him a leading advocate of a more vigorous strategy against Spain. A force that he commanded in 1597, however, failed to intercept the Spanish treasure ships at the Azores. Next year the possibility of peace with Spain sharpened his rivalry with the Cecils, while the growing seriousness of a major rebellion in Ireland led to bitter differences between Essex and Elizabeth over appointments and strategy.

By this time Elizabeth was growing alarmed by Essex' importunate ambition, finding him to be "a nature not to be ruled." During one of their disputes, Essex turned his back upon the queen, who promptly slapped his face. Nevertheless, in 1599 she sent him to Ireland as lord lieutenant. After an unsuccessful campaign against the rebels he concluded an unfavourable truce and, suddenly deserting his post, returned to England to vindicate himself privately to the Queen. She responded by depriving him of his offices (June 1600). Politically ruined and financially destitute but confined only to house arrest, he and 200 to 300 followers tried, on Feb. 8, 1601, to raise the populace of London in revolt. The poorly planned attempt failed, and Essex surrendered. He was executed at the Tower of London after being found guilty of treason. Francis Bacon, the scientist-philosopher for whose advancement in the government Essex had continually pressed, was one of the prosecutors at Essex's trial. Biographies include Robert Lacey, *Robert, Earl of Essex* (1970), and G.B. Harrison, *Life and Death of Robert Devereux, Earl of Essex* (1937).

• **Essex, Robert Devereux, 3rd earl of,** VISCOUNT HEREFORD LORD FERRERS, LORD BOURCHIER (b. January 1591, London—d. Sept. 14, 1646, London), English nobleman who commanded, with notable lack of success, the Parliamentary army against Charles I's forces in the first three years of the English Civil Wars.

Because his father, Robert Devereux, 2nd earl of Essex, had been executed for treason (1601), Devereux had to obtain special permission from Parliament to succeed (1604) to his family titles and estates. In 1606 King James I arranged Essex' marriage to Frances Howard, countess of Suffolk. But the countess soon fell in love with the King's Scottish favourite, Robert Carr, and in 1613 James had a divorce commission annul her marriage

Robert Devereux, 3rd earl of Essex, detail of an engraving by George Glover, 1646

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

so that she could marry Carr, who was also created earl of Somerset. Not surprisingly, the episode embittered Essex against the King.

Essex' military career began in 1620 with five successive campaigns in the Rhine valley in the Thirty Years' War, and in 1625 he was vice admiral in the unsuccessful expedition sent by James's son and successor, Charles I, against the Spanish port of Cádiz. Although Charles appointed him second in command of the bloodless Bishops' War against Scotland in 1639, Essex refused to stand by the King when his chief ministers were deposed by the Long Parliament (beginning November 1640).

In July 1642, Essex was appointed to command the Parliamentary army. He fought courageously against the royalists at the bloody but indecisive Battle of Edgehill in October 1642, and he advanced on London in 1643. But his 6,000-man army was besieged at Lostwithiel, Cornwall, in August 1644, and all surrendered except Essex, who escaped by sea. He resigned his command in April 1645, just before Parliament passed the Self-Denying Ordinance excluding its members from military command. He continued, however, to sit in Parliament and concerned himself with veterans affairs. He died without a surviving son and heir; the earldom of Essex became extinct in his line, though the viscountcy of Hereford went to a cousin. A recent biography is Vernon Shaw, *Essex the Rebel* (1970).

• **Essex, Arthur Capel, 1st earl of,** VISCOUNT MALDEN, BARON CAPEL OF HADHAM (b. 1631/32—d. July 13, 1683, London), English statesman, a member of the "Triumvirate" that dominated policy at the time of the Popish Plot (1678).

The son of Arthur Capel, 1st Baron Capel, who was executed by the Parliamentarians in

Arthur Capel, 1st earl of Essex, detail from a diptych by Sir Peter Lely; in the Staatliche Graphische Sammlung, Munich

By courtesy of Staatliche Graphische Sammlung, Munich

1649, he was, after the Restoration of Charles II, created Viscount Malden and earl of Essex (April 1661). Although his antagonism to court life, to Roman Catholicism, and to extension of the royal prerogative alienated Charles II, he was nevertheless appointed to a succession of offices. As lord lieutenant of Ireland (1672–77), Essex purged the country's financial administration, repelled attempts to exploit the Irish land market, and generally endeavoured to improve the condition of Roman Catholics. As a lord of the treasury (March–November 1679), he worked with the earls of Halifax and Sunderland, at first supporting Halifax' scheme to impose statutory limitations should the Roman Catholic duke of York (afterward James II) become king.

His political attitude became more and more intolerant of the Roman Catholic flavour of the court, and, as member of the Privy Council, he joined Anthony Ashley Cooper, 1st earl of Shaftesbury, in voting (November 1680) for the exclusion of James from the succession. A fervent Protestant, he may have taken part in the Rye House Plot (June 1683) to assassinate

the allegedly pro-Catholic Charles II and his brother James, and he was certainly among the supporters of Charles's illegitimate Protestant son, James Scott, duke of Monmouth. He was arrested and imprisoned in the Tower of London, where he was found with his throat cut. The violence with which the wound had been inflicted made it uncertain whether or not his death was a suicide. If suicide, his motive may have been to prevent an attainder and preserve his titles and estates for his family. He had one surviving son, Algernon (1670–1710), 2nd earl of Essex.

Essex Decision, decision rendered by the British High Court of Admiralty in 1804 and confirmed the following year, which contributed to the bad feeling between the United States and Great Britain that eventually led to the War of 1812. Britain and France were at war, and the American merchant vessel *Essex* had been captured by the British while transporting goods from the French West Indies to France. Because U.S. merchant vessels were forbidden by the British to carry cargo directly between the French colonies and France, American ships evaded this prohibition by interrupting the voyage with a stop at an American port. The court, citing a precedent of 1756, disallowed the legality of this practice and ruled that such a stop did not constitute an interruption of the voyage. The British were thus given broader legal sanction for action against neutral ships trading with France.

Essex Junto, in early U.S. history, a group of Federalist political leaders in Massachusetts. John Hancock coined the name for his Essex County opponents at the state constitutional convention of 1778. The Junto (faction) later supported the policies of the Federalist Alexander Hamilton and opposed those of Thomas Jefferson.

Like Hamilton, the Junto leaders supported neutrality, wanted friendship with Britain, and opposed Revolutionary France. In 1803–04, during Jefferson's first administration, they tried unsuccessfully to form a separate confederation based in New England. They were against Jefferson's anti-British Embargo Act and eventually brought about its repeal (1809). Lack of sympathy with the War of 1812 led the Junto to participate in the secessionist Hartford Convention of 1814. After the war they lost their importance. Timothy Pickering was the group's most conspicuous leader.

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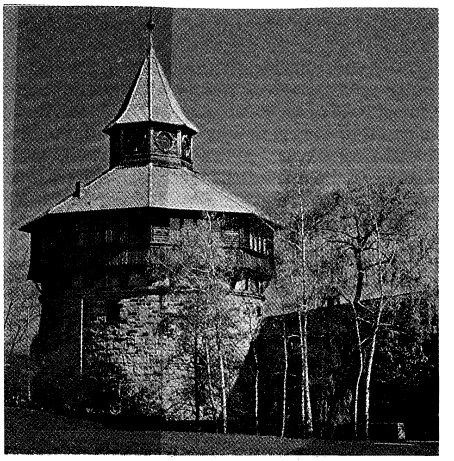
essexite, dark gray to black, fine-grained, intrusive igneous rock that occurs in Essex County, Mass.; at Mt. Royal, near Montreal; near Oslo, Nor.; at Roztoky, Czech.; and at Carclout, Scot. It contains plagioclase as the dominant feldspar, as well as orthoclase feldspar, augite, biotite, hornblende, olivine, and nepheline. As the proportion of nepheline increases, essexite grades into theralite.

Essling, André Masséna, prince d': *see* Masséna, André.

Esslingen, in full ESSLINGEN AM NECKAR, city, Baden-Württemberg *Land* (state), southwestern Germany, on the Neckar River, just southeast of Stuttgart. Mentioned in 777 as Cella and in 866 as Hetsilinga, it was chartered *c.* 1219. It was a free imperial city from 1360 to 1802, when it passed to Württemberg, the rulers of which had often threatened it. On a commanding height above the city stands the old citadel. There are three town halls: the old Rathaus (*c.* 1430); the new Rathaus, formerly a palace; and the Baroque Rathaus (1746) of the imperial city, now a district



Dickerturm (round tower), Esslingen, Ger.
De Wys Inc.

court. The building of the Church of Our Lady (Frauenkirche; 1321–1516) marked the beginning of the special Swabian Gothic style (Hallenkirche). St. Paul's (1233–68) is the oldest existing Dominican church in Germany.

The centre of a fertile wine-producing and fruit-growing district, the town has machine, electrical, textile, and leather works. Pop. (1989 est.) 90,537.

essonite (mineral): *see* hessonite.

Essonne, *département,* Île-de-France region, northern France; it includes some of the southern outer suburbs of Paris. The *département,* occupying a square-shaped area of 696 square miles (1,803 square km), was created in 1964 from the southern part of the former Seine-et-Oise *département,* established in 1790 in the former province of Île-de-France (*q.v.*).

Chiefly consisting of a plateau of agricultural and forest land cut by deep valleys, the *département* is watered by the Essonne, the Orge, and their tributaries, which flow into the Seine from the west. The Seine crosses the northeast corner, passing through Corbeil. It is heavily industrialized on the left bank as it approaches the Paris area. At the northern departmental boundary the Seine is joined from the east by the Yèrre, which flows through pleasant suburbs near the forest of Sénart. The northeast part of the *département,* in which Orly Airport terminal is located, is also crossed by the Autoroute du Sud, the motorway from Paris to the Mediterranean. The *département* also contains two other airfields—Toussus-le-Noble, near Versailles, and Brétigny. The southwest embraces part of the Beauce plain, the main granary of France. In the southeast the region of Milly-la-Forêt, adjoining the Forêt (forest) de Fontainebleau, is a popular area for weekend tourists.

The administrative centre of the *département* is at Évry, close to Corbeil; there are two other *arrondissements,* Étampes and Palaiseau. Essonne is in the educational division of Versailles. Pop. (1985 est.) 1,017,000.

Est, Thomas: *see* East, Thomas.

established church, a church recognized by law as the official church of a state or nation and supported by civil authority. Though not strictly created by a legal contract, the religious establishment is more like a contractual entity than like anything else and, therefore, ordinarily cannot be varied or repudiated by one party to it. The church is not free to make changes in such things as doctrine, order, or worship without the consent of the state. In accepting such obligations, the church usually, though not always, receives financial support and other special privileges.

Among numerous examples of established churches or state religions are the following: Anglicanism in England, Lutheranism in the Scandinavian countries, Roman Catholicism in Italy and Spain, Judaism in Israel, Islām in Saudi Arabia and Egypt, Buddhism in Thailand and Sikkim, and Shintō in Japan before World War II. In pluralistic societies and under modern forms of government, religious establishment has tended, on the whole, to diminish in importance.

Estado de S. Paulo, O (Portuguese: "The State of São Paulo"), influential newspaper published daily except Monday in Brazil's largest city, widely respected for its thorough coverage of national and international news, its publication of the texts of speeches of important government officials, and other matter usually found in a country's newspaper of record. *O Estado* is sometimes called "The New York Times of Latin America" because of its grave editorial demeanour.

Since shortly after its founding in 1875, *O Estado* has been owned by the Mesquita family. On occasion its independence has brought on government censorship and harassment of reporters, and its editor went into exile during the Vargas regime, which ended in 1945. Once boycotted by the German-speaking community in Brazil because of its support of the Allies, *O Estado* is generally friendly to the United States and encourages the cultivation of European arts and culture. Its editorial outlook is normally pro-industry, and because of its immense prestige, *O Estado de S. Paulo* exerts an unusually profound influence on national and local politics.

Estado Novo (Portuguese: "New State"), the dictatorship (1937–45) of President Getúlio Vargas of Brazil, initiated by a new constitution issued in November 1937. Vargas himself wrote it with the assistance of his minister of justice, Francisco Campos.

In the election campaign of 1937 Vargas warned of a threatened Communist coup d'état and declared a 90-day state of emergency, issuing the Estado Novo. The Fascist Integralistas applauded this dictum, but they were outwitted by Vargas when he suddenly used his dictatorial powers to announce that he would succeed himself without election and proceeded to dissolve the Congress. He further declared that the constitution contained in his pronouncement would not be effective while the emergency lasted and would then be brought to a plebiscite, after which the people could elect a new congress.

The plebiscite, however, was never conducted, and Vargas ruled for the next seven years by decree, pending a congressional election. Vargas and his appointees more or less dominated all aspects of national life; but the dictatorship, suggestive of contemporary Fascist states, was somewhat alleviated by its inefficiency. Widespread disaffection with Vargas finally forced him out of power, in spite of a campaign by his supporters, the Queremistas, to have him reelected in 1945, after he had bowed to pressure to permit elections.

Estaing, Charles-Hector, comte d' (count of), in full JEAN-BAPTISTE-CHARLES-HENRI-HECTOR, COMTE D'ESTAING, MARQUIS DE SAILLANS (b. Nov. 24, 1729, Ruvel, Auvergne, Fr.—d. April 28, 1794, Paris), commander of the first French fleet sent in support of the American colonists during the U.S. War of Independence.

D'Estaing served in India during the Seven Years' War and was governor of the Antilles (1763–66). He was appointed vice admiral in 1767 and in 1778 attempted to surprise the English squadrons in North America and enable the colonists to resume the offensive. His blockade of Admiral Howe in New York Bay proved unsuccessful (July 1778), and in August storms prevented him from engaging the

British fleet near Newport, R.I. In November he sailed for the Antilles, where, despite several opportunities, he failed to eliminate a much smaller British squadron. He was seriously wounded in an unsuccessful attack on Savannah, Ga. (September–October 1779), and returned to France with his squadron. D'Estaing was an energetic commander, but his lack of naval experience caused him to be diffident before smaller British forces. His caution and hesitancy greatly disappointed the colonists during a crucial phase of the war.

In France, d'Estaing was an enlightened reformer; he was elected to the Assembly of Notables in 1787. He was commander of the National Guard at Versailles at the outbreak of the Revolution (1789) and was guillotined in Paris during the Terror.

estampie, Provençal ESTAMPIDA, courtly dance of the 12th–14th century. Mentioned in trouvère poetry, it was probably danced with sliding steps by couples to the music of vielles (medieval viols); its afterdance was the saltarello. In musical form the estampie derives from the sequence, a medieval genre of Latin hymn. Like the sequence it has a series of repeated melodic phrases (*aa, bb, cc, . . .*); phrase endings in the repetitions are often varied.

Estampies are among the earliest surviving examples of written instrumental music. The famous troubadour song "Kalenda maya" (by Raimbaut de Vaqueyras, died 1207) is a poem set to an existing estampie. Whether the estampie was identical with, or merely related to, the *stantipes*, a dance mentioned in the 13th century, is debated by scholars.

estancia, in the Río de la Plata region of Argentina and Uruguay, an extensive rural estate largely devoted to cattle ranching and to some extent to the raising of feed grain.

From the late 18th century *estancieros* (owners of estancias) began to acquire tracts of land in the pampas (grasslands) of Argentina, which by the late 19th century had been almost entirely fenced in to form these estates. By 1900 about 300 families owned most of the Argentine pampas, each with an estancia measured in hundreds of thousands of acres. A similar situation obtained in Uruguay.

Like the *fazendeiro* in Brazil and the *hacendado* in Mexico, the *estanciero* exercised wide lawmaking and judicial powers over his tenant farmers and servants. These powers, reminiscent of those exercised by the feudal nobles of medieval Europe, were often abused by the *estancieros* themselves or by overseers, who were left in charge while the landlords lived in luxury in South American or European cities.

The extensive political power of the *estancieros* in Argentina was somewhat lessened during the regime of the dictator Juan Perón (ruled 1946–55), who based his power on the support of the lower middle and working classes.

estate tax, levy on the capital value of property changing hands at the death of the owner, fixed mainly by reference to its total value. Estate tax is generally applied only to estates evaluated above a statutory amount and is applied at graduated rates. Estate tax is usually easier to administer than inheritance tax (*q.v.*) levied on beneficiaries because only the value of the entire estate need be ascertained.

The estate tax was first instituted in Great Britain in 1889 as part of a broad death tax program, and in 1949 it became the only death tax levied there. It was first imposed in the U.S. in 1916, to help finance mobilization for World War I.

Various means have been used to avoid or reduce the estate tax, including gifts, generation-skipping trusts, and the creation of limited interests in the estate. These avoidances have given rise to gift taxes and other death taxes. In Great Britain trusts are treated as if the property were owned by the income beneficiaries.

Critics of the estate tax have claimed that it often forces the sale of small family-owned farms and businesses because the tax is based on the value of the estate but there may not be enough cash available to pay it. General tax reform legislation passed by the U.S. Congress in 1976 contained provisions designed to mitigate this effect of the tax laws.

Estates-General, also called STATES GENERAL, French ÉTATS-GÉNÉRAUX, in France of the pre-Revolutionary monarchy, the representative assembly of the three "estates," or orders of the realm: the clergy and nobility—which were privileged minorities—and a Third Estate, which represented the majority of the people.

The origins of the Estates-General are to be found in traditions of counsel and aid and the development of corporate representation in the 13th century. The first national assembly of representatives of the three estates met in April 1302 to aid Philip IV the Fair against Pope Boniface VIII. There were several comparable meetings, to obtain political or financial support, in the first half of the 14th century. But it became clear during the Hundred Years' War, if not before, that the Estates-General were too unwieldy (and too unyielding) to become an institutional organ of consent. The attempt of such assemblies to take administrative initiative in the 1350s failed not only because of the assassination of the bourgeois reformist Étienne Marcel but also because of provincial dissatisfaction. Although general Estates were occasionally summoned during the next century, their constitutional functions were, in many areas, assumed by provincial Estates, which were easier to attend, easier to manage, and better in keeping with regional custom.

By the end of the 15th century the Estates-General could be said to have acquired its main characteristics, but it was not, nor would it ever become, an institution. Because the kings had already levied a permanent direct tax throughout France (the taille), they were able to get along without the Estates-General in normal times after 1500. Francis I, who reigned from 1515 to 1547, never summoned the Estates-General, which thereafter met only in times of crisis, such as during the Wars of Religion in the late 16th century.

The Estates-General of 1614, held during the minority of Louis XIII, revealed one of the body's major weaknesses—the inability of the three orders to agree because of conflicting interests. The Third Estate refused to consent to the abolition of the sale of offices unless the nobles surrendered some of their privileges, and the meeting ended without action.

The next and last meeting of the Estates-General was at the beginning of the French Revolution (1789), in the face of a financial crisis, widespread agitation, and the weakening power of the king. The deputies of the Third Estate, fearing that they would be overruled by the two privileged orders in any attempt at reform, led in the formation of the revolutionary National Assembly (June 17), signalling the end of representation based on the traditional social classes.

Estaunié, Edouard (b. Feb. 4, 1862, Dijon, Fr.—d. April 1, 1942, Paris), French writer, known for his novels of character. He was by profession an engineer and ended his career as inspector general of telegraphs. He was elected (1923) to the Académie Française.

A theme recurrent in the 12 novels of Estaunié is expressed by the title of one of them, *La Vie Secrète* (1908; "The Secret Life"): each man's outward life masks another, ill-understood, different, and usually much more important life which may break through the mask unexpectedly to take temporary control of him. The novels gain distinction from their profound and detailed psychological analysis. The more important of them are *L'Empreinte* (1895), *Les Choses voient* (1912), *L'Ascension de Monsieur Baslèvre* (1920), and *L'Appel de la route* (1922).

Este, town and episcopal see of Padova province, in the Veneto region of northern Italy at the southern foot of the Colli (hills) Euganei southwest of Padua. Known in antiquity as Ateste (*q.v.*), it was for long the principal seat of the Veneti (*q.v.*), before being absorbed by Rome *c.* 200 BC. Originally on the Adige River, it was completely abandoned after the river (now 9 mi [14 km] to the south) changed course in the 6th century. Although it never regained its early importance, it was known in the Middle Ages as the place of origin (961) and the seat (1056–1288) of the House of Este. After 1288 it passed through numerous hands before becoming Venetian in 1405. Notable landmarks are the ruins of the old castle (founded *c.* 1056, rebuilt 1339), the cathedral (1690–1720), and the Museo Nazionale Atestino (National Museum of Atestine Artifacts). It is now primarily an agricultural centre with some manufacturing. Pop. (1981 prelim.) mun., 18,052.

Este, HOUSE OF, princely family of Lombard origin that played a great part in the history of medieval and Renaissance Italy. It first came to the front in the wars between the Guelfs and Ghibellines during the 13th century. As leaders of the Guelfs, Estensi princes received at different times Ferrara, Modena, Reggio, and other fiefs and territories. Members of the family ruled in Ferrara from the 13th through 16th century and in Modena and Reggio from the later Middle Ages to the end of the 18th century.

Origins. The Estensi were a branch of the great 10th-century dynasty of the Obertenghi, which held power and wealth in Lunigiana, Genoa, and Milan and which also gave rise to the feudal houses of the Malaspina, the Pallavicini, and the margraves of Massa and Parodi. Subsequently, after various vicissitudes, the members of the Obertenghi dynasty removed to the lands of the Venetians, where they had estates at Este, Monselice, Rovigo, and Friuli. The Estensi took their name from the township and castle of Este, 17 miles (27 kilometres) southwest of Padua, and the true founder of the family was the margrave Alberto Azzo II (died 1097). From his son Welf IV, duke of Bavaria, there began a related branch that gave origin to the dukes of Bavaria, Brunswick, and Lüneburg, as well as the electors of Hanover. Another son, Ugo, tried without success to establish in France, while a third son, Folco I (died *c.* 1136), became second in line in the House of Este. Neither he nor his successor, Obizzo I (died 1193), however, achieved any great distinction, beyond the offices and titles that fell naturally to the upper feudal families; but it was during the lifetime of Obizzo I that the Estensi first acquired political importance in Ferrara, through the marriage of his son (Azzo V, who predeceased him) to the heiress of one of the two great and rival families of Ferrara. Obizzo was succeeded by his grandson, Azzo VI, who acquired considerable authority in the city, though his premature death in 1212 left the family temporarily weakened. Not until 1240 did a descendant, Azzo VII, return to power in the city, in alliance with the Guelf league formed by Pope Gregory IX. This marked the true beginning of Este rule in Ferrara.

Lords of Ferrara. In 1264 Azzo's heir, Obizzo II (1264–93), was created perpetual lord by the people of Ferrara under the pressure of Guelf strength. The Pope, lawful lord of the Ferrarese territory, at first did not oppose this action but afterward began to

contest the Estensi government. Obizzo II's power was growing, however, and he had himself chosen lord of Modena in 1288 and of Reggio in 1289. In the 14th century the house of Este went through difficult, stormy periods, not only because of its controversies with the papacy but also because of domestic dissensions, sometimes very hazardous. The house succeeded, nevertheless, in strengthening its position, and, under Nicolò II (reigned 1361–88), called the Lame, there was built the famous Este Castle, the work of the architect Bartolino da Novara, which became a symbol of the power of the city of Ferrara and a sure defense against external dangers. To the brother and successor of Nicolò II, Alberto V (reigned 1388–93), is due the erection of the University of Ferrara, destined for lasting fame; it was obtained by Pope Boniface IX as a concession in 1391.

The reign of Nicolò III (1393–1441), son of Alberto, marked the strengthening of Estensi domination in Ferrara and the introduction of Estensi influence generally in Italian politics. After having defeated an attempt by the Paduans to achieve hegemony in Ferrara, the Estensi duke became intermediary in the political and military contests in the Italian states and extended his dominions. Personally, Nicolò was known for his sensuality; a Ferrarese saying runs, "On both sides of the River Po they all are Nicolò's sons." He had his son Ugo and his young second wife, Parisina Malatesta, beheaded because they were found guilty of adultery together. But he devoted himself to the exterior manifestations of a religious faith—going on a pilgrimage to the Holy Sepulchre and to Vienna's Saint Anthony and playing host to the ecumenical council in 1438 that represented a fruitless attempt to bring together again the Western and Eastern churches. (This council was afterward transferred to Florence.) He even seems to have come close to obtaining the succession of an Estensi heir to the Milanese states, but he died suddenly, perhaps poisoned, on Dec. 26, 1441.

Whereas Nicolò III raised the Estensi state to a high position in Italian politics in spite of its territorial and financial limits, his bastard son and chosen successor, Leonello (reigned 1441–50), gave Ferrara considerable distinction in the fields of art and culture. Leonello had been educated by the humanist Guarino Veronese, called to Ferrara by his father, and the period of his reign was one in which Ferrara represented a lively centre of culture and humanism, filled with painters (Pisanello, Jacopo Bellini, Rogier van der Weyden, Andrea Mantegna), architects (Leon Battista Alberti), and scholars (centring on Guarino Veronese).

Dukes of Ferrara, Modena, and Reggio. Leonello's brother and successor, Borso (reigned 1450–71), notwithstanding some military failures, not only maintained his state and increased its aesthetic and cultural prestige but also received from the Holy Roman emperor Frederick III the title of Duke of Modena and Reggio (1452) and from Pope Paul II the title of Duke of Ferrara (1471).

Ercole I. The long rule of Leonello's and Borso's half-brother Ercole I (1471–1505) marked one of the most important periods for the history of the house of Este and of Ferrara. He succeeded in obtaining considerable political support with his marriage to Leonora, the daughter of the king of Naples. These were troubled times, however. Ercole had to defeat the attempt of a nephew, Nicolò, son of Leonello, to usurp the throne; and then he had to face the hostile coalition of Venice and Pope Sixtus IV, which brought war nearly to the walls of the city of Ferrara (1482–84). The subsequent Peace of Bagnolo, however, though not entirely satisfactory, did free Ferrara from immediate dangers.

Ercole's crucial problem became one of consolidating his own political position by means of marriages that would bind him to the principal Italian powers: of his three daughters, Lucrezia was married to Annibale Bentivoglio (of Bologna), Isabella to Francesco Gonzaga (of Mantua), and Beatrice to Ludovico Sforza (of Milan). Ercole's eldest son, Alfonso, was married first to Anna Sforza (of Milan) and then to the famous Lucrezia Borgia, the daughter of Pope Alexander VI. In spite of these difficult affairs of state, Ercole was able to continue his dynasty's patronage of the arts, taking the poet Matteo Boiardo as his minister, extending his favour to the poet Ludovico Ariosto, espousing the theatre and musical arts, and enlarging and beautifying Ferrara to such an extent as to make it one of the first cities of Europe.

Alfonso I. Ercole's son Alfonso I (reigned 1505–34), rough and rude when he was young, proved wise and sure of himself once he had taken the reins of government. First he foiled a plot of a stepbrother, Giulio, and another brother, Ferrante, against him and sentenced them to perpetual imprisonment. Then his attention was completely attracted by the war against Venice (1509), in which his skill in mechanics and artillery design was proved. He was victorious in the naval battle of Polesella and won back the Polesine of Rovigo (which had been lost by Ercole I). At the same time, however, papal ambitions of territorial expansion became threatening. By consistent adherence to the French interest in Italy, Alfonso came into collision with Pope Julius II and was deprived of Modena (1510) and Reggio (1512) and was excommunicated. The Medici popes, Leo X and Clement VII, were both determined on the destruction of the Estensi, but the first-mentioned pope was frustrated by death, the second by political weakness, and Alfonso was able to recover Reggio in 1523 and Modena in 1527. He died in 1534. His succession was assured not only by his legitimate children but also by the issue of his lover Laura Eustochia Dianti, from whom derived the future dukes of Modena and Reggio.

Ercole II and Alfonso II. During the reign of Alfonso's son and successor Ercole II (1534–59), the military events proved less interesting (though the wars of 1557–58 were difficult) than the personal ones. Ercole married Renée, daughter of King Louis XII of France, and in Ferrara she came to embrace the Lutheran religion, becoming its ardent defender and establishing at her court a meeting place for the most famous heretics and liberal thinkers of the day. Ercole, who was the pope's vicar in Ferrara, tried restraining her, even to the point of temporary imprisonment, but to no avail. Next to rule was his first-born, Alfonso II (reigned 1559–97), the fifth and last duke of Ferrara. He also tried, vainly, to be elected king of Poland and to organize a crusade against the Turks. More important for the dynasty, however; was the fact that, though Alfonso II had three marriages, he had no children, and Pope Pius V in 1567 expressly forbade having illegitimate children rule in ecclesiastical lands. Alfonso was so disappointed and discouraged that he let the conditions of his state decay. At his death he bequeathed the duchy to his cousin Cesare, but Pope Clement VII refused to recognize the settlement, declaring Cesare illegitimate; in 1598 direct papal rule was established in Ferrara. The main branch of the Este family had come to an end.

Decline of power. Cesare kept Modena and Reggio, but with him the Estensi ceased to play so important a part in Italian politics, and the court was culturally inferior to its brilliant predecessors. Among the several Modenese dukes who followed in the 17th century, Francesco I (reigned 1629–58), who came to the throne during the stormy period of the Thirty Years' War, was perhaps the most important. His people were able to survive the famous plague of 1630. In the wars he was first allied to Spain, then to France, whose alliance he thought would best sustain his claims to Ferrara. Later on, he attempted reconciliation with Spain, but ironically it was on the field of battle, fighting the Spaniards, that he died of malaria. He was a man with enormous aspirations, and, though inclined toward treachery in politics, he gave art his patronage, favouring men of letters and collecting works of art (there is an extraordinary portrait of him by Diego Velázquez and a beautiful bust by Gian Lorenzo Bernini).

Among his successors, the one most deserving to be remembered is Rinaldo I (1694–1737), whose marriage to Charlotte Felicitas of Brunswick-Lüneburg reunited the long-separated branches of the house of Este. Throughout his reign he engaged in imperial politics. His son Francesco III (1737–80), known as a libertine, received the governorship of Lombardy from Empress Maria Theresa of Austria. Ercole III (1780–96), gentle and affable, abandoned Modena in 1796 when the Revolutionary French army invaded it.

After the Napoleonic Wars, Duke Francesco IV (1814–46), son of Maria Beatrice d'Este (the only surviving daughter of Ercole III) and of Archduke Ferdinand of Habsburg-Lorraine, son of Maria Theresa, came back to Modena. He founded the Austro-Este line in Modena, which, however, ended with his son Francesco V (1846–59) when Modena revolted in order to join Sardinia-Piedmont and then Italy.

Childless, Francesco V selected as his universal heir Francis Ferdinand, heir to the Austrian throne, who was murdered at Sarajevo in 1914. Today, the rightful holder of the surname and heraldic bearings of the Estensi is considered to be Archduke Robert, the second-born of Charles I of Austria and Zita of Bourbon-Parma. In 1953 he married the princess Margherita of Savoy-Aosta.

(L.Ch.)

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Este, Marie Beatrice d': *see* Mary of Modena.

Este, Thomas: *see* East, Thomas.

Esteban Echeverría, *partido* (county) at the southern limits of Greater Buenos Aires, Argentina, in Buenos Aires *provincia.* Created in 1913 from portions of the *partidos* of Lomas de Zamora and San Vicente, Esteban Echeverría agricultural (and, more recently, low-income suburban) zone with an area of 146 square miles (377 square km), characterized by green villas that support dairy farms and orchards of fruit trees. Ezeiza, the major international airport of Buenos Aires, is located there. The *cabecera* (county seat) is Monte Grande. Pop. (1980) 188,923.

Estébanez Calderón, Serafín, Estébanez also spelled ESTÉVANES, byname EL SOLITARIO (b. Dec. 27, 1799, Málaga, Spain—d. Feb. 5, 1867, Madrid), one of the best-known costumbristas, Spanish writers who depicted in short articles the typical customs of the people. He moved to Madrid in 1830, where he published newspaper articles under the pseudonym El Solitario and pursued a career that combined Arabic studies, poetry, and the collecting of manuscripts. He was also influential in the government.

Estelí, city, northwestern Nicaragua. It lies along the Estelí River in the central highlands, at an elevation of 2,674 feet (815 m). A Spanish settlement founded near prehis-

toric carved-stone figures, it was a scene of heavy fighting between Sandinista guerrillas and government troops in 1978–79 that left much of the centre of the city in ruins. Estelí is an agricultural and commercial centre, with sawmilling, tanning, and the manufacturing of hats. It lies on the Pan-American Highway north of Managua, the national capital. The surrounding area, despite its rugged relief, is important for the production of livestock, cotton, tobacco, sesame, cheese, and various fruits and vegetables. Pop. (1985 est.) 30,635.

Estenssoro, Víctor Paz: *see* Paz Estenssoro, Víctor.

ester, any of a class of organic compounds that react with water to produce alcohols and organic or inorganic acids. Esters derived from carboxylic acids are the most common.

Carboxylic acid esters, formula RCOOR′ (R and R′ are any organic combining groups), are commonly prepared by reaction of carboxylic acids and alcohols in the presence of hydrochloric acid or sulfuric acid, a process called esterification. In the reaction the hydroxyl group (OH) of the carboxylic acid is replaced by the alkoxy group (R′O) of the alcohol. The reverse of the reaction is an example of hydrolysis (*q.v.*). Esters may also be obtained by reaction of acid halides or acid anhydrides with alcohols or by reaction of salts of carboxylic acids with alkyl halides. One ester may be converted to another ester by reaction (transesterified) with an alcohol, a carboxylic acid, or a third ester in the presence of a catalyst.

The hydrolysis of esters in the presence of alkalies, a reaction called saponification, is utilized in the preparation of soaps from fats and oils and is also used for the quantitative estimation of esters.

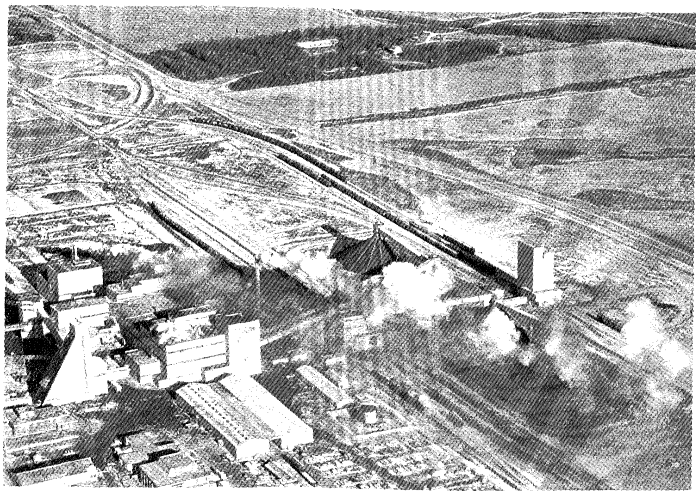
Carboxylic acid esters of low molecular weight are colourless, volatile liquids with pleasant odours, slightly soluble in water. Many are responsible for the fragrance and flavour of flowers and fruits; for example, isopentyl acetate is present in bananas, methyl salicylate in wintergreen, and ethyl butyrate in pineapples. These and other volatile esters with characteristic odours are used in the preparation of synthetic flavours, perfumes, and cosmetics. Certain volatile esters are used as solvents for lacquers, paints, and varnishes; for this purpose, large quantities of ethyl acetate and butyl acetate are commercially produced. Waxes secreted by animals and plants are esters formed from long-chain carboxylic acids and long-chain alcohols. Fats and oils are esters of long-chain carboxylic acids and glycerol.

Liquid esters of low volatility serve as softening agents for resins and plastics. Esters also include many industrially important polymers. Polymethyl methacrylate is a glass substitute sold under the names Lucite and Plexiglas; polyethylene terephthalate is used as a film (Mylar) and as textile fibres sold as Terylene, Fortrel, and Dacron.

Esters are also formed from alcohols and such inorganic acids as sulfuric, phosphoric, and nitric acids. Nitrate esters (*e.g.,* glyceryl trinitrate, or nitroglycerin) are explosive. Phosphate esters are biologically important (nucleic acids belong to this group) and are used widely in industry as solvents, plasticizers, flame retardants, gasoline and oil additives, and insecticides.

Esters of sulfuric and sulfurous acids are used in the manufacture of dyes and pharmaceuticals. Dimethyl sulfate, the best-known ester of sulfuric acid, is a dangerous poison.

Esterhazy, town, southeastern Saskatchewan, Canada. It lies in the Qu'Appelle River valley, 132 miles (212 km) east of Regina. It



Potash mine at Esterhazy, Sask.
George Hunter—Shostal/EB Inc.

is named after Count Paul Otto d'Esterházy (1830–1912), a French-Hungarian nobleman who promoted settlement in the area. Esterhazy is a marketing town for a mixed-farming (especially wheat) and stock-raising region and has flour-milling and dairying industries. Since 1962, however, it has been noted for its potash production; two shaft mines, among the largest on the continent, operate north and east of town. Inc. village, 1903; town, 1952. Pop. (1986) 3,083.

Esterházy FAMILY, also spelled ESZTERHÁZY, aristocratic Magyar family that produced numerous Hungarian diplomats, army officers, and patrons of the arts.

By the 18th century the Esterházys had become the largest landowners in Hungary, and they came to possess a private fortune even larger than that of the Habsburg emperors whose supporters they were. The various members of the family continued to hold important governmental, ecclesiastical, diplomatic, and military posts in Hungary well into the 20th century.

Ferenc Zerházy (1563–94), deputy lord lieutenant of the county of Pozsony (now Bratislava, Czech.), was the first family member of historical importance. He took the name Esterházy upon becoming baron of Galántha, an estate the family acquired in 1421. With his sons the family was divided into the lines of Fraknó, Csesznek, and Zólyom.

Miklós (1582–1645) founded the Fraknó line, which became the most prominent of the three. He opposed the Protestant champions Gábor Bethlen and György Rákóczi I while upholding the idea of freeing Hungary from Turkish dominance through a consolidation of Habsburg dynastic power. He was honoured by the Holy Roman emperors Matthias and Ferdinand II, and at the Diet of Sopron (1625) he was appointed palatine (imperial governor) of Hungary.

Miklos' third son, Pál (1635–1713), founded the princely branch of the Fraknó line. Distinguishing himself in wars against the Turks, he was made commander in chief of southern Hungary in 1667 and participated in the deliverance of Vienna in 1683, two years after his election as palatine. For his devotion to the Habsburgs, he was created prince of the empire in 1687. A devotee of the arts and sciences, Pál also wrote several religious works.

Prince Pál Antal (1711–62) was a grandson of the first prince and became a field marshal. Prince Miklós József (d. 1790), brother of Pál Antal, was also an outstanding soldier and a patron of the arts. He rebuilt Esterháza, the family castle, in such magnificent Renaissance style that it came to be known as the Hungarian Versailles, and he employed Joseph Haydn as conductor of his orchestra for 30 years.

Prince Miklós (1765–1833), the grandson of Miklós József, is best remembered for his great collection of paintings and engravings in Vienna and for his actions against the French during the Napoleonic Wars. He raised a regiment at his own expense to fight the French in Austria, and, despite Napoleon's overtures to him in 1809 suggesting the Magyars elect Miklós as king, he refused the honour and continued to defend Habsburg interests. His son Prince Pál Antal (1786–1866) served as a diplomat in London and Paris. During the Napoleonic Wars he was secretary of the Austrian embassy in London and later (1807) in Paris under Metternich. After the peace settlement (1815), he became ambassador to England. He represented Austria at the coronation of Charles X of France and at the London conference (1830–38). He served as minister of foreign affairs in Hungary's first responsible Cabinet in 1848, but he resigned that post after finding no satisfactory way to reconcile court and nation and spent his final years in obscurity.

The counts of the Fraknó line belonged to the junior branch of the Fraknó Esterházys, which was split into three lines by the sons of Ferenc Esterházy (1641–83), brother of the first prince, Pál. Count Antal (1676–1722), the first son of Ferenc, distinguished himself in wars both against and in league with Ferenc Rákóczi II, an anti-Habsburg Magyar noble and national hero. Antal accompanied Rákóczi in 1710 to Poland and later to France and to Turkey, where he died in exile.

Count Miklós Bálint (1740–1806), whose father, József Bálint, was Count Antal's son, had entered the service of France. Miklós Bálint became a favourite of Marie Antoinette and also stood in favour with the Count d'Anjou (later Charles X of France). During the French Revolution Miklós Bálint helped many royalists emigrate.

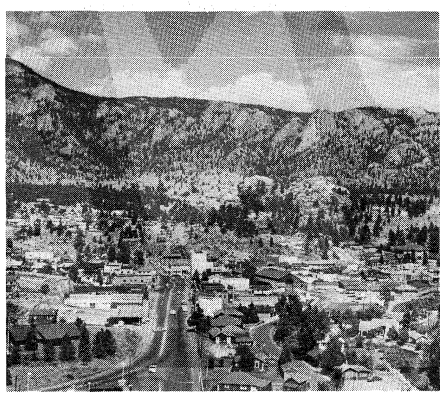
Esterhazy, (Marie-Charles-) Ferdinand Walsin (b. 1847, Austria—d. May 21, 1923, Harpenden, Hertfordshire, Eng.), French army officer who was a major figure in the Dreyfus case.

Esterhazy had posed as a count and served in the Austrian army during the 1866 war with Prussia. He then served in the French Foreign Legion before being commissioned in the regular French army (1892).

Having fallen deeply into debt, Esterhazy apparently sold French military secrets to Germany. When Alfred Dreyfus was convicted (1894) of betraying military information to Germany, Esterhazy came under the suspicion of Lieutenant Colonel Georges Picquart, head of the French army's "statistical section" (the cover name for the army's counterintelligence unit), who recognized Esterhazy's handwrit-

ing on the treasonable document attributed to Dreyfus. Esterhazy was brought before a court-martial in 1897 and acquitted by his fellow officers, but the movement for revision of Dreyfus' conviction continued to gain supporters (including many French intellectuals). Esterhazy, in panic, fled to Belgium and then to London. Esterhazy's own accounts of his activity included one that he had indeed been a spy for Germany. In England, he worked as a translator and writer under the pseudonym "Comte de Voilemont" and may have worked as a traveling salesman.

Estes Park, town, Larimer county, northern Colorado, U.S. It is situated in the Front Range of the Rocky Mountains, at an elevation of 7,522 feet (2,293 m), on Big Thompson River. It is the eastern entrance and headquarters of Rocky Mountain National Park, and Roosevelt National Forest adjoins the town on the north, east, and south. Named for Joel Estes, the first settler (1859), the town is a touring centre and year-round resort and engineering headquarters for the Colorado-Big Thompson water-diversion power-irrigation project. Trail Ridge Road, the highest continuous highway



View of Estes Park, Colo.
J. Beckner—Shostal/EB Inc.

in the United States, goes from Estes Park across the Continental Divide to Grand Lake. An aerial tramway ascends Mount Prospect, providing passengers with a superb view of the Divide. Nearby is the Hidden Valley Ski Area. Inc. 1917. Pop. (1986 est.) 3,280.

Estevan, city, southeastern Saskatchewan, Canada. It lies along the Souris River at the latter's junction with Long Creek, just north of the North Dakota (U.S.) border, 125 miles (201 km) southeast of Regina. It was settled in 1892 with the arrival of the Canadian Pacific Railway, and its name is said to be an acronym of George *Ste*phen and William *van* Horne, railroad developers. Estevan is mainly an agricultural service centre, with abundant supplies of lignite coal, clay, oil, and natural gas that have given the city a twofold orientation—mixed-farming and strip-mining. The city is a port of entry from the United States, an administrative headquarters for the oil industry, and a manufacturer of coal briquettes, clay, brick, tile, flour, and dairy products. Extensive tree nurseries line the riverbanks. Boundary Dam, just south of the city, impounds Long Creek for irrigation and flood control. Inc. village, 1899; town, 1906; city, 1957. Pop. (1986) 10,161.

Esther, Book of, an Old Testament book that belongs to the third section of the Judaic biblical canon, known as the Ketuvim, or "Writings." Esther appears between Judith and Job in the Roman Catholic canon and includes six chapters that are considered apocryphal in the Jewish and Protestant traditions. Esther appears between Nehemiah and Job in the Protestant canon. In the Jewish Bible, Esther follows Ecclesiastes and Lamentations and is read on the festival of Purim, which commemorates the rescue of the Jews from Haman's plottings. The Book of Esther is one of the Megillot, five scrolls read on stated Jewish religious holidays.

The book purports to explain how the feast of Purim came to be celebrated by the Jews, but its fanciful explanation belongs to the realm of historical legend rather than fact. Esther, the beautiful Jewish wife of the Persian king Ahasuerus (Xerxes I), and her cousin Mordecai persuade the king to retract an order for the general annihilation of Jews throughout the empire. The feast of Purim was purportedly established to celebrate the day, decided by lot (*pur*), on which the Jews were to be destroyed, but on which they instead destroyed their enemies, who were led by Haman, the king's vizier and favourite. This explanation of the origin of the feast of Purim is surely legendary, but there is nothing close to a consensus as to what historical event provided the basis for the story. The book may have been composed as late as the first half of the 2nd century BC, though the origin of the Purim festival could go back to the late Persian period.

The secular character of the book (the divine name is never mentioned) and its strong nationalistic overtones made its admission into the biblical canon very questionable for both Jews and Christians. Apparently in response to the conspicuous absence of any reference to God in the Book of Esther, the redactors (editors) of its Greek translation in the Septuagint interspersed many additional verses throughout the text that demonstrate Esther's and Mordecai's religious devotion. These so-called Additions to the Book of Esther do not appear in the Hebrew Bible, are treated as canonical in Roman Catholic Bibles, and are placed in the Apocrypha in Protestant versions.

Estherville, city, seat (1859) of Emmet county, northern Iowa, U.S. It lies along the West Fork of the Des Moines River, 92 miles (148 km) northwest of Fort Dodge. It was settled in 1857 shortly after a massacre of whites by Sioux at nearby Spirit Lake and was named for Esther Ridley, wife of one of the planners. Fort Defiance (1862), built as a protection against marauding Sioux, is preserved in a state park 1 mile (1.6 km) southwest. Three large fragments of a meteorite that exploded over the area on May 10, 1879, are displayed in museums in Vienna, London, and the University of Minnesota. The city is a trade and shipping centre with an agriculture-based economy and is the gateway from the east to the Iowa Great Lakes (*q.v.*) resort area. It is the seat of Iowa Lakes Community College (1924). Inc. town, 1881; city, 1894. Pop. (1986 est.) 6,420.

esthetic, esthetics, etc.: *see under* aesthetic, aesthetics, etc.

Estienne, Henri II, Estienne also spelled ÉTIENNE, Latin STEPHANUS (b. 1528, Paris, Fr.—d. 1598, Lyon), scholar-printer, grandson of Henri Estienne, founder of the family printing firm in Paris, and son of Robert I Estienne, who left Paris to establish a printing firm in Geneva.

Educated in classical literature, Estienne traveled as a young man in Italy, England, and Flanders, studying ancient manuscripts and visiting scholars before joining his father in Geneva. There he began by publishing the results of his own researches in the first printed editions of several ancient Greek texts. In 1559 he succeeded to ownership of the press at Geneva.

In 1566 Estienne published a Latin edition of Herodotus, with an apologia accompanied by a French version. This "Apologie pour Hérodote," perhaps Estienne's most famous work, caused Estienne trouble in Geneva. Ostensibly designed to show how the strange stories in Herodotus are paralleled by equally strange ones in modern times, it is bitterly satirical of his own age; and some passages were most objectionable to Genevan churchmen. Arrested and tried, Estienne was obliged to cancel the offending pages. Even so, the book went through 12 editions in 16 years.

In classical scholarship Estienne's output continued to be voluminous: his Greek and Latin text of Plutarch, 13 vol. (1572), is an example. His greatest work was his Greek dictionary, *Thesaurus graecae linguae,* 5 vol. (1572), a masterpiece and a monument of lexicography of which new editions appeared as late as the 19th century.

In 1578 Estienne published a defense of pure French against Italianizing innovations; again Genevan authorities were displeased. Thereafter he spent a year in France, where he was very well received by King Henry III, and his new book in praise of the French language was printed in Paris in 1579.

Estienne returned to Geneva in 1580, but after 1583 he spent much time away from his home, wandering from city to city in search of a congenial patron. The later publications of his press thus suffered to some extent from neglect. He died on a visit to France.

Estienne, Robert I, Estienne also spelled ÉTIENNE, Latin STEPHANUS (b. 1503, Paris, Fr.—d. Sept. 7, 1559, Geneva, Switz.), scholar-printer, second son of Henri Estienne who founded the family printing firm about 1502 in Paris.

Robert became head of the firm in 1526, and it was he who adopted the device of the olive tree for his title pages. In 1527–28 he published his first complete Bible in Latin, and in 1531 he completed his great *Dictionarium seu linguae latinae thesaurus,* a Latin dictionary that marks an epoch in the history of lexicography, not only for Latin but also for all other languages. Francis I of France made him king's printer for Hebrew and Latin works in 1539; in 1540 he became de facto king's printer also for Greek. He was commissioned in 1541 to supply the king's library with books printed in the Greek type of Claude Garamond. He prepared the first printed editions of many works by ancient Greek and Roman authors. Among his Latin editions, his Virgil of 1532 is noteworthy. He also published grammars and other educational texts.

The hostility of theologians at the Sorbonne forced Estienne to leave Paris for Geneva in 1551. His younger brother Charles (d. *c.* 1564), better known as a writer, succeeded to control of the family press at Paris. Works printed by Robert Estienne in Geneva include a Greek New Testament (1551), in which the present division of the text into verses occurs for the first time.

Title page to the *Biblia,* showing olive-tree motif adopted as family emblem, 1532
By courtesy of the trustees of the British Library; photograph, J.R. Freeman & Co. Ltd.

estimation, in statistics, any of numerous procedures used to calculate the value of some property of a population from observations of a sample drawn from the population. A point estimate, for example, is the single number most likely to express the value of the property. An interval estimate defines a range within which the value of the property can be expected (with a specified degree of confidence) to fall. Bayesian estimation is designed to facilitate revision of estimates on the basis of further information. In sequential estimation the experimenter evaluates the precision of the estimate during the sampling process, which is terminated as soon as the desired degree of precision has been achieved.

Estonia, officially ESTONIAN SOVIET SOCIALIST REPUBLIC, Russian ESTONIYA, or ESTONSKAYA SOVETSKAYA SOTSIALISTCHESKAYA RESPUBLIKA, Estonian EESTI, or EESTI NÕUKOGUDE SOTSIALISTIK VABARIIK, historic region and one of the union republics of the Soviet Union.

A brief treatment of Estonia follows. For full treatment, *see* MACROPAEDIA: Union of Soviet Socialist Republics.

Estonia consists of a mainland area and some 800 islands. Its capital is Tallinn. Estonia, which had been independent since 1918, was taken over by the Soviet Union in 1940. It is bounded on the north by the Gulf of Finland, on the east by the Russian S.F.S.R., on the south by Latvia, and on the west by the Baltic Sea.

Geography. The Estonian landscape bears extensive traces of glacial activity; the south is covered with morainal hills, and the central part abounds in elongated glacial hills with flat tops. The latter are usually arrayed in the direction of glacial movement. There are numerous lakes and forests, and many rivers, most draining northward into the Gulf of Finland, others flowing eastward into Lake Peipus (shared with Russia), and a few emptying westward into the Gulf of Riga. The Estonian climate is generally favourable to agriculture, with February low temperatures averaging 23° F (−5° C) and July highs 63° F (17° C) and an annual precipitation of about 26 inches (650 mm).

About 60 species of mammal live in Estonia, among them elk, roe deer, red deer, wild pig, and, in the northeastern forests, bear and lynx. There are also fox, badger, otter, rabbit and hare, mink, nutria (coypu), and various seals.

The most important mineral is oil shale; Estonia accounts for most of the output of the Soviet Union, and many of its industrial workers are employed in its production and processing. Reserves and production of peat are also substantial, and there are large deposits of high-quality phosphorites, limestone, dolomites, marl, and clay.

Estonia's economy is basically industrial, but agriculture is also important. The republic's shale-processing industry produces most of the Soviet Union's synthetic gas and is important for the production of thermal electric power for its own industry and for the other Baltic states and the whole northwestern Soviet Union. A chemical industry relying on shale processing produces benzine, adhesives, tanning agents, resins, formaldehyde, and detergents. The republic also produces building materials.

Woodworking is a traditional and important industry. Excessive exploitation of its forest resources threatened the industry. Reforestation policies have begun to restore the forests, but the woodworking industry still must import some of its raw timber. Forest products include paper, pulp, plywood, matches, and furniture. Estonia is noted for its textiles, especially cotton cloth; it also produces wool, silk, and linen, knitted and woven garments, and shoes.

Cattle and pigs and forage crops dominate agriculture. The land is difficult to farm because of the large glacial stones that have to be removed from the fields and because of the need for drainage in most of the natural pastures. Fodder crops for animal husbandry account for much of total crop production. Estonia's agriculture was collectivized at the end of World War II, and 120,000 private small farms were converted to some 450 collectives and state farms.

Estonians, who belong to the Baltic-Finnish group of Finno-Ugric people, constitute about two-thirds of the population. Russians account for a quarter, and there are Ukrainian, Finnish, and Belorussian minorities.

The highest organ of state power is the Supreme Soviet, whose members had been selected by the Communist Party of Estonia. In 1989, however, the party was purged of most of its old-line antinationalists and lost its "leading role." An unofficial Congress of Estonia competed for national power.

Education is free and compulsory for 11 years. There is an extensive system of social-welfare support for the ill and disabled. Nationalist stirrings in Estonian literature began in the 19th century, but from 1940 to the late 1980s they were partially undermined by Soviet communist repression.

Tallinn has an opera house, a ballet theatre, a puppet theatre, and several legitimate theatres. Parnu, Viljandi, and Rakvere also have professional theatres. Tallinn is famous for its song festivals featuring thousands of singers.

History. Estonians are first mentioned by Tacitus, a Roman historian, in his *Germania* (1st century AD). They were invaded by Vikings in the 9th century and later by Danes, Swedes, and Russians but in general were able to withstand the assaults until the 13th century. In 1346 the Danish crown, in possession of northern Estonia and the islands, sold its sovereignty to the Teutonic Order (an organization of German crusaders), then in possession of Livonia (southern Estonia and Latvia), and German conquest was complete. In the mid-16th century, on the dissolving to the Teutonic Order, Estonia was once more divided, with northern Estonia capitulating to Sweden, and Poland gaining Livonia. By the Truce of Altmark (1629), Poland surrendered most of Livonia to Sweden. Early in the 18th century, Peter I the Great of Russia defeated Charles XII of Sweden and seized Livonia, dividing it into the provinces of Estonia, Livonia, and Kurlandia. During the next century, reforms of property ownership were undertaken and serfdom was abolished. With the accession of Alexander III (1881), however, Estonia began to undergo rigid Russification. Estonia gained and lost independence several times during the tumultuous opening decades of the 20th century. It was incorporated into the U.S.S.R. in 1940. Germany briefly held the region during World War II, but the Soviet regime was restored in 1944, and Estonia became a union republic. In 1990 the Estonian Supreme Soviet made initial moves toward independence. Area 17,400 square miles (45,100 square km). Pop. (1989) 1,573,000.

Estonian language, Estonian EESTI KEEL, member of the Finno-Ugric branch of the Uralic language family, spoken in Estonia, U.S.S.R., and in scattered pockets in surrounding regions. The language occurs in two major dialectal forms, northern and southern; the northern, or Tallinn, dialect is the basis of the Estonian literary language. The first notable written materials on Estonian stem from the early 16th century AD (the Kullamaa prayers of the 1520s).

Belonging to the Baltic-Finnic branch of the Finno-Ugric languages, Estonian is most closely related to Finnish, Votic, Livonian, Ingrian, Karelian, and Veps. In structure the language is best known for its unusual contrast of three degrees of consonant and vowel length—*e.g., koli* "junk" (with short *o*), *kooli* "of school" (with long *o*), and *kooli* "to school" (pronounced with an extra long *o* although spelled the same as the preceding form). It also has the characteristic Baltic-Finnic consonant gradation, in which consonants alternate in certain contexts, but it has lost the feature of vowel harmony. As in the Uralic languages in general, its primary method of marking grammatical categories is by suffixes added to the stem. Estonian has borrowed many vocabulary items from German. *See also* Finno-Ugric languages.

Consult the INDEX *first*

Estonian literature, body of writings in the Estonian language. The consecutive domination of Estonia from the 13th century to 1917 by Germany, Sweden, and Russia resulted in few early literary works in the vernacular. Writings in Estonian became significant only in the 19th century. Moreover, many writers went into exile in World War II, which led to a considerable output of postwar exile literature.

Early written Estonian is strongly Germanic, and the first known book is a translation of the Lutheran catechism (1535). The New Testament was translated into south Estonian in 1686 (north Estonian, 1715); in his translation of the Bible (1739), Anton Thor Helle united the two dialects on a north Estonian basis.

The strongest genre of Estonian literature is lyric poetry, owing to the influence of the folk poetry that flowered from the 14th century to the 17th. Though it includes variants of Finnish epic themes, it is more lyrical than Finnish folk poetry. About a billion pages of folk poems are preserved in the national archives at Tartu; some are published in *Vana kannel,* 3 vol. (1875–1938), and *Setukeste laulud,* 3 vol. (1904–07; "Songs of the Setus," the peoples of southeastern Estonia). As in Finnish folk poetry the staple metre is the trochaic four-foot line; and assonance, alliteration, repetition, and parallelism predominate.

Written literature began in the so-called Estophile period (*c.* 1750–1840) with moral tales and manuals written by Balto-German enthusiasts for the native language and culture. The philological journal *Beiträge zur Genauern Kenntniss der ehstnischen Sprache* ("Contributions to a Better Understanding of the Estonian Language") contained examples of folk poetry and essays, including work by the first native Estonian poet, Kristjan Jaak Peterson. More significant for literature was an epic, *Kalevipoeg* (1857–61; translated in part in *The Hero of Estonia*), part authentic tradition and part a creation of F.R. Kreutzwald, for this inspired the Romantic nationalistic movement soon to emerge. Popular patriotic Romantics were the poets Lydia Koidula and Anna Haava, and the first novelist was Juhan Sommer, whose book *Luige Laus* appeared in 1843. The first Estonian historical novel was Eduard Bornhöhe's *Tasuja* (1880; "The Avenger"). Jakob Pärn's *Oma tuba, oma luba* ("Own House, Own Master") approached the realistic style fully developed in the later work of Juhan Liiv.

The realism epitomized in Liiv's writings held sway from 1890 to 1906. It was superseded by the Neoromantic Young Estonia group, whose leader, a poet, Gustav Suits, devised the slogan "More European culture! Be Estonians but remain Europeans!" For Suits and his followers this meant greater attention to form. With the Russian Revolution

of 1917 emerged the Siuru group (named after a bird in Finno-Ugrian mythology). These Neoromantic poets reacted against Suits's emphasis on formalism. Their emotional intensity was well-illustrated by Henrik Visnapuu, who, with Marie Under, developed the lyrical potential of Estonian to the full. By the 1930s a renewal of realism brought poetry closer to life, but the only outstanding poetry of this revival was descriptions of modern urban life in the work of Juhan Sütiste (Schütz). The Arbujad group (which also took its name from a word with origins in mythology) of the mid-1930s, on the other hand, stressed intellectual and aesthetic aspects of literature. Leading poets were Betti Alver, whose skillful use of symbolic imagery was shown in *Tolm ja tuli* (1936; "Dust and Fire"); Heiti Talvik, who in *Kohtupäev* (1937; "Doomsday") predicted the coming holocaust; Uku Masing, a religious mystical poet; and Bernard Kangro, later the leading lyrical poet in exile.

After World War II more than half of Estonia's writers went into exile, and their poetry reflected either pessimism, like Kangro, or longing for Estonia, as in Visnapuu's exile poetry. Gradually a new generation of ironic poets emerged, best-exemplified by Kalju Lepik, experimental author of *Kollased nõmmed* (1965; "Yellow Heaths"); a skeptical poet, Arno Vihalemm, whose work was spiced with self-irony; and the author of the epic *Peetri kiriku kellad* ("The Bells of St. Peter's"), Ivar Grünthal. In Estonia little poetry appeared under Stalin's Socialist Realism, but new poets, adopting Western styles, appeared in the 1960s. Among these were Jaan Kross, Ellen Niit, Ain Kaalep, and Mats Traat.

Prose writing was equally influenced by movements current in Europe. The realism of the beginning of the century was exemplified in the social criticism of Liiv's *Kümme lugu* (1893; "Ten Tales") and in Ernst Peterson's criticism of social injustice, *Boils* (1899–1901). An outstanding realist novelist was Eduard Vilde, who wrote a historical trilogy attacking the Balto-Germanic feudal system and in *Mäeküla piimamees* (1916; "The Dairyman of Mäeküla") again treated the relationship between landowner and serf. Friedebert Tuglas, who introduced Impressionism and Symbolism, belonged to Young Estonia, while August Gailit was a leading Siuru prose writer. Among the Neoromantics who became realists were Anton Tammsaare, who wrote an ethico-psychological chronicle, *Tõde ja õigus* (1926–33; "Truth and Right"), and Albert Kivikas, whose *Nimed marmortahvlil* (1936; "Names on the Marble Tablet") was about the war of liberation.

Novelists in exile found inspiration in the very fact of their exile. Two principal themes were wartime experiences and the problem of adapting to new environments. Among writers in exile were Gailit, Mälk, Kivikas, Ristikivi, Pedro Krusten, Karl Rumor, Juhan Jaik, Evald Mänd, and Valev Uibopuu. New writers included a critic, essayist, and dramatist, Arvo Mägi, and the novelists Ilmar Talve, Ilmar Jaks, Helga Nõu, and Elin Toona. Of these, the last three showed an increasing internationalism in their work. In Estonia postwar fiction decayed in the way poetry did. The deadening effect of Socialist Realism gradually gave way to greater subtlety, and younger novelists, such as Arvo Valton, Enn Vetemaa, and Mati Unt, were able to examine some of the problems of Communism and begin stylistic experimentation.

Dramatic works were few, but two early playwrights stood out: August Kittsberg, author of both comedies and serious plays, and Hugo Raudsepp, whose realistic and symbolical plays were social satires. (V.U.)

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Estoril, fashionable resort, Lisboa *distrito* ("district"), Portugal. It is located on the Cascais Bay (the Portuguese Riviera) of the Atlantic Ocean, 15.5 miles (25 km) west of Lisbon. Tourism is the economic mainstay of the town, which is both a summer and winter resort. Its chief feature is the magnificent avenue of palm trees leading from the seafront to the Casino Internacional. The nearby Estoril Hill (358 feet [109 m]) is noted for its trees, especially pines, eucalyptus, and palms. Pop. (1981) town, 3,776; (1981 prelim.) town with adjacent *freguesia* (parish), 23,940.

Estournelles de Constant, Paul-H(enri)-B(enjamin) d', original name PAUL-HENRI-BENJAMIN BALLUAT, BARON DE CONSTANT DE RÉBECQUE D'ESTOURNELLES (b. Nov. 22, 1852, La Flèche, Fr.—d. May 15, 1924, Paris), French diplomat and parliamentarian who devoted most of his life to the cause of international cooperation and in 1909 was cowinner (with Auguste-Marie-François Beernaert) of the Nobel Prize for Peace.

In the French diplomatic service he reached the rank of minister plenipotentiary. Later he entered politics and was elected deputy for the Sarthe *département* in 1895 and reelected in 1898 and 1902. From 1904 he sat in the Senate and was reelected in 1909 and 1920. He took an active part in the interparliamentary international conferences that began in 1889 and was a member of the French delegation to the Hague peace conference of 1899, which led to the formation of the Permanent Court of Arbitration at The Hague. When that court seemed likely to be ignored by governments, he persuaded President Theodore Roosevelt to submit to it a minor dispute between the United States and Mexico in September 1902. This example was then followed by other governments.

In 1905 he set up in Paris the Association for International Conciliation, with branches in a number of other countries. He was active in securing the summoning of the second Hague conference in 1907. His contribution to internationalism arose in large part from his work as propagandist and organizer. Among his publications are *La Politique française en Tunisie* (1891); *La Conciliation internationale* (1906); *Le Rapprochement franco-allemand* (1909); *Pour l'aviation*, 2nd ed. (1909); *Les États-Unis d'Amérique* (1913; *America and Her Problems*); and *Pour la Société des Nations* (1921).

Estrada Cabrera, Manuel (b. Nov. 21, 1857, Quezaltenango, Guatemala—d. Sept. 24, 1924, Guatemala City), jurist and politician who became dictator and ruled Guatemala for the first two decades of the 20th century through a standing army, secret police, and systematic oppression.

After a church-directed education, he practiced law for a time in Guatemala City and was appointed a judge on the Supreme Court. He then entered politics, was elected to the Congress, and served successively as minister of public instruction, of justice, and of the interior. When President José María Reina Barrios was assassinated in 1898, Estrada Cabrera was appointed provisional president and then elected president. He served his first term respecting the constitution but then had it changed in order to ensure his repeated "reelections."

Estrada Cabrera's strong rule gave Guatemala internal peace and some economic improvement. He attracted investment in the nation by the United Fruit Company, built a few schools, increased agricultural production, and improved sanitation. At the same time, he plundered the treasury, kept the Indians in a state of peonage, and extinguished the few political liberties the Guatemalans had won in previous years. Finally, an armed revolt in 1920 led to his downfall. Stripped of his plundered fortune, he died ignominiously in jail.

Estrada Palma, Tomás (b. July 9, 1835, near Bayamo, Cuba—d. Nov. 14, 1908, Oriente province), first president of Cuba, whose administration was noted for its sound fiscal policies and progress in education.

As a general in the revolutionary army, Estrada Palma served during the Ten Years' War (1868–78) against Spain and became president of the provisional government in 1875. He was captured by the Spanish in 1877. Upon his release he moved to Orange County, New York, to become principal of the Central Valley School for Boys. From that base he led the Cuban junta in New York City and later, on the death of José Martí, became the actual head of the revolution.

After the Spanish–American War (1898) the United States turned the island over to the Cubans (1902), and Estrada Palma became president. He had aligned himself with no party, nor had he campaigned for the position, returning to Cuba only after the election. In the 1905 election Estrada Palma was forced by the need for the cooperation of Congress to align himself with a political party—the Conservatives (later known as the Moderates). The opposition Liberals accused the Conservatives of using fraudulent means to win the election, and the revolution of 1906 followed. Estrada Palma resigned in September, and the United States intervened, taking temporary control.

Estrades, Godefroi (-Louis), comte d' (count of) (b. 1607, Agen, Fr.—d. Feb. 26, 1686, Paris), marshal of France and one of Louis XIV's ablest diplomats.

Estrades served with distinction in the Low Countries during the Thirty Years' War, conducted a famous defense of Dunkirk (1651–52), and took part in later campaigns in Catalonia (1655), Italy (1657), and Holland (1672). He was mayor *perpétuel* of Bordeaux (to which the title of count was attached) from 1653 to 1674 and was made chevalier de l'Ordre du Saint Esprit in 1661 and marshal of France in 1675. Having been ambassador extraordinary to Holland (1646) and a participant in the conferences at Münster, he went as ambassador to London in 1661; the attempt of the Spanish ambassador there to have precedence over him led to a great triumph for France; and in 1662 he negotiated the purchase from England of Dunkirk, of which he became governor. He was again ambassador to Holland from 1663 to 1668 and also represented the French in the negotiations at Breda in 1667 and at Nijmegen from 1675 to 1678.

estragon (herb): *see* tarragon.

Estrangela, also spelled ESTRANGELO, an early form of Syriac writing that was in almost exclusive use until about AD 500. *See* Syriac alphabet.

Estrées, Gabrielle d', DUCHESSE (duchess) DE BEAUFORT, DUCHESSE D'ÉTAMPES (b. 1573—d. April 10, 1599, Paris), mistress of King Henry IV of France and, with him, founder of the Vendôme branch of the House of Bourbon.

The daughter of the Marquis de Coeuvres, Gabrielle met Roger de Saint-Lary, later Duke de Bellegarde, at the court of Henry III and became his mistress. Saint-Lary in turn introduced her to Henry IV, who fell in love with her; it was probably during Henry's siege of Chartres (1591) that she became his mistress. Henry arranged a purely formal marriage for her with Nicolas d'Amerval (June 1592; annulled 1594), but this formality did not prevent him from publicly acknowledging her as his mistress in December 1592. Indeed, Henry was often accused of compromising his victories in order to visit her. She had his entire confidence and influenced him in his

decision to become a Roman Catholic in the expectation that the pope would then annul his marriage to Queen Margaret.

Surrounded by a rapacious entourage, Gabrielle showed herself neither disinterested nor faithful. She bore the king three children, who were legitimized: César, Duke de Vendôme; Catherine-Henriette, Duchess d'Elbeuf; and Alexandre, Chevalier de Vendôme, later grand prior of France. In 1595, when César was legitimized, Gabrielle was made Marquise de Monceaux; later she was made Duchess de Beaufort (1597) and Duchess d'Étampes (1598). By this time Henry was master of all France. He seriously considered marrying her, despite the opposition of the Holy See and the Duke de Sully, whose protector she had been. Henry considered her to be his wife, and she looked on herself as queen of France, but she died suddenly, before any definite steps toward marriage were taken.

Estrela Mountains, Portuguese SERRA DA ESTRELA, highest mountains of Portugal, situated between the basins of the Tagus and Mondego rivers. The western continuation of the Cordillera Central (Spain), the range runs about 40 miles (65 km) from northeast to southwest and is between 10 and 15 miles (16 and 24 km) wide. The highest point is the Malhão da Estrela (6,532 feet [1,991 m]). With an annual rainfall of more than 90 inches (2,300 mm) above 4,000 feet (about 1,200 m), the range is one of Portugal's chief pastoral districts, the seasonal herding of sheep and goats still being practiced there. Wildlife includes wild goat, deer, fox, and wild boar. Tin, titanium, and tungsten are mined in the mountains. Winter sports, including skiing, account for a small tourist trade.

Estrelleta, La (province, Dominican Republic): *see* Elias Piña.

Estremadura, historical province of central Portugal. The landforms of Estremadura are geologically younger than other parts of the Iberian Peninsula, containing sandstone, limestone, and volcanic rock instead of granite and schist. The peninsulas of Lisbon and Setúbal are divided by the lower Tagus River valley. Land use north of the Tagus is diverse. Vineyards, olive groves, and cereal plots are found on the hilly slopes, and the Cartaxo and Torres areas are known for their wines. South of the Tagus the landscape is less-tamed; much is still unproductive or in extensive estates of cork oak forest. Along the Tagus valley corn (maize), grapes, rice, and wheat are cultivated, and some of Portugal's finest horses and fighting bulls, both used in the Portuguese bullfights, are raised there. The Quinta da Terra (Pinheiro de Loures) is a provincial bullfighting museum.

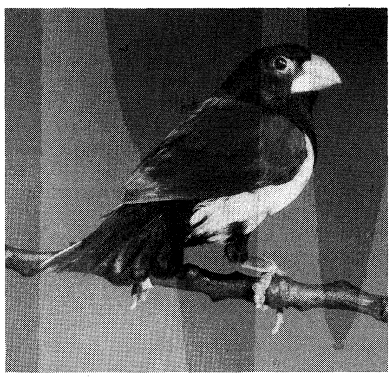
Known as the Portuguese Riviera, the coastal region west of the city of Lisbon has important resort centres, including Estoril, Cascais, and Sintra. Apart from Lisbon, other chief towns include Setúbal, the main sardine port, with canneries; Bareiro and Almada, suburbs of Lisbon; and the fishing towns of Peniche and Nazaré.

Estremadura (Spain): *see* Extremadura.

Estremoz, city and *concelho* (township), Évora *distrito* ("district"), eastern Portugal. An ancient, gated city, it is overlooked by a 13th-century castle, in which St. Isabella of Portugal, widow of King Dinis, died in 1336. Estremoz was an important base for the Portuguese army in its successful battles against the Spanish during the 17th century. It is renowned for its distinctive pottery. Local produce includes wine and olive oil; there are cork-processing and wool-milling industries, and white marble is quarried in the neighbourhood. Pop. (1981) city, 7,869; *concelho*, 18,480.

Estrildidae, songbird family, order Passeriformes, consisting of about 107 species of small finchlike birds of the Old World, many of which are favourite cage birds.

Members range in size from 7.5 to 15 cm (3 to 6 inches) long. They have short, stout bills and short legs and display a wide variety of colours and patterns. These gregarious ground feeders search for seeds, berries, and insects. Waxbills are poor singers, their songs being interspersed with chirps, buzzes, and chatters; but their bright colours, liveliness, and adaptability recommend them to bird fanciers. The members include mannikins and munias (*Lonchura*), cordon bleus and grenadiers (*Uraeginthus*), fire finches (*Lagonosticta*), waxbills (*Estrilda*), parrot finches (*Erythrura*), and negro finches (*Nigrita*).



Black-headed munia, or chestnut mannikin (*Lonchura malacca*), a member of the Estrildidae family
Eric and David Hosking

The waxbills are sometimes listed as a subfamily (Estrildinae) in the weaverfinch family (Ploceidae). The Estrildidae family belongs to the songbird suborder (Passeres).

estrogen, any of a group of hormones that primarily influence the female reproductive tract in its development, maturation, and function. There are three major hormones—estradiol, estrone, and estriol—among the estrogens, estradiol being the predominant one. The major sources of estrogens are the ovaries and the placenta (the temporary organ that serves to nourish the fetus and remove its wastes); additional small amounts are secreted by the adrenal glands and by the male testes. It is believed that the egg follicle (the saclike structure that holds the immature egg) and interstitial cells (certain cells in the framework of connective tissue) in the ovary are the actual production sites of estrogens in the female. Estrogen levels in the bloodstream seem to be highest during the egg-releasing period (ovulation) and after menstruation, when tissue called the corpus luteum replaces the empty egg follicle.

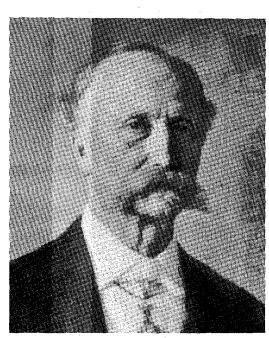
Estrogens affect the ovaries, vagina, fallopian tubes, uterus, and mammary glands. In the ovaries, estrogens help to stimulate the growth of the egg follicle; they also stimulate the pituitary gland in the brain to release hormones that assist in follicular development. Once the egg is released, it travels through the fallopian tubes on its way to the uterus; in the fallopian tubes estrogens are responsible for developing a thick muscular wall and for the contractions that transport the egg and sperm cells. The young female uterus, if deprived of estrogens, does not develop into its adult form; the adult uterus that does not receive estrogens begins to show tissue degeneration. Estrogens essentially build and maintain the endometrium—a mucous membrane that lines the uterus; they increase the endometrium's size and weight, cell number, cell types, blood flow, protein content, and enzyme activity. Estrogens also stimulate the muscles in the uterus to develop and contract; contractions are important in helping the wall to slough off dead tissue during menstruation and during the delivery of a child and of the placenta. The cervix, the tip of the uterus, which projects into the vagina, secretes mucus that enhances sperm transport; estrogens are thought to regulate the flow and thickness of the mucous secretions. The growth of the vagina to its adult size, the thickening of the vaginal wall, and the increase in the vaginal acidity that reduces bacterial infections are also correlated to estrogen activities. In the breasts the actions of estrogens are complexly interrelated with those of other hormones, and their total significance is not easily defined; they are, however, responsible for growth of the breasts during adolescence, pigmentation of the nipples, and the eventual cessation of the flow of milk.

Estrogens also influence the structural differences between the male and female bodies. Usually the female bones are smaller and shorter, the pelvis is broader, and the shoulders are narrower. The female body is more curved and contoured because of fatty tissue that covers the muscles, breasts, buttocks, hips, and thighs. The body hair is finer and less-pronounced, and the scalp hair is usually more permanent. The voice box is smaller and the vocal cords shorter, giving a higher-pitched voice in females than in males. In addition, estrogens suppress the activity of sebaceous (oil-producing) glands and thereby reduce the likelihood of acne in the female. In experimental animals, loss of estrogens diminishes the mating desires and other sexual behaviour patterns.

In the male, traces of estrogens are present in the blood and urine; estrogens seem to be most evident in the male during puberty and old age. Their function in the male and their interplay with the male hormones are not completely known.

Estrup, Jacob Brønnum Scavenius (b. April 16, 1825, Sorø, Den.—d. Dec. 24, 1913, Copenhagen), statesman and Conservative prime minister of Denmark from 1875 to 1894.

In 1864 Estrup entered the Landsting (upper chamber) as a member of the National Landowners' Party. As minister of the interior from 1865, he made major improvements in the railways and in Esbjerg harbour. He influenced the writing of the new constitution of July 1866, which gave landowners extensive power in the Landsting. Estrup then became the leader of a powerful group in the Landsting. In 1875, backed by the majority and by the king, Christian IX, he became prime minister and formed a government. The right demanded large appropriations for defense, but the Folketing (lower chamber) rejected Estrup's motion on fortifications. His government was able to maintain itself in power by letting the king declare a provisional budget. The Liberals considered the measures uncon-



Estrup, detail from an oil painting by August Gerndorff, 1895
By courtesy of the Nationalhistoriske Museum paa Frederiksborg, Denmark

stitutional; Estrup counteracted public unrest with police action and a stricter penal code.

Faced with a strong Conservative Party, the Liberal Party broke into factions. Thereafter the Conservatives, under Estrup's leadership, controlled the government for nearly two decades. He carried through some social reforms with the help of the moderate Liberals, whose majority also supported the Financial Act of April 1894; this act contained grants for temporary military installations but repealed Estrup's earlier police and press measures. After Estrup resigned in 1894, he remained a prominent critic of the Liberal governments.

estrus, also spelled OESTRUS, the period in the sexual cycle of female mammals, except the higher primates, during which they are in heat—*i.e.,* ready to accept a male and to mate. One or more periods of estrus may occur during the breeding season of a species. Prior to ovulation the endometrium (uterine lining) thickens, in preparation for holding the fertilized ova. As the proliferation of uterine tissue reaches its peak, receptivity is highest—this is the estrous period. Some animals (*e.g.,* dogs) are monestrous, having only one heat during a breeding season. Others (*e.g.,* ground squirrels) are polyestrous: if not impregnated, they will come into heat repeatedly during the breeding season. Males can recognize a female in heat by smell; certain substances (pheromones) are secreted only at this portion of her cycle. The female's genital area may be swollen during estrus, and she may show by a variety of behavioral signals that she is ready to mate.

estuary, partly enclosed coastal body of water in which river water is mixed with seawater. In a general sense, the estuarine environment is defined by salinity boundaries rather than by geographic boundaries. Many coastal features that are designated by other names are in fact estuaries. For example, various coastal embayments, such as Chesapeake Bay and Galveston Bay, also are estuaries because fresh and salt water undergo considerable mixing. Moreover, most of the world's fjord systems are estuaries, as are large semienclosed tidal-flat regions and coastal marshes (*e.g.,* the Waddenzee area of The Netherlands).

A brief treatment of estuaries follows. For full treatment, *see* MACROPAEDIA: Rivers.

Estuaries have long been important to humankind as harbour sites and centres of commerce. Some of the oldest continuous civilizations have flourished in such estuarine environments as the lower region of the Tigris and Euphrates rivers, the Po River delta region of Italy, the Nile delta, the Ganges delta, and the lower Huang Ho valley. As civilizations developed, it was logical that the seaports were founded at the seawardmost point of the major river systems. Such cities as London (Thames River), New York City (Hudson River), Montreal (St. Lawrence River), Hamburg (Elbe River), and Bordeaux (Gironde Estuary) have developed on estuaries and have become important centres of commerce.

The geologic processes that form an estuary are extremely complex and varied, but it is clear that the existence of an estuary is largely dependent on the position of sea level relative to the freshwater discharge. If sea level were lowered, the estuarine zone would migrate seaward at the interface of the marine water and the edge of the newly exposed land area. Such migration has occurred in the past as a consequence of the Earth's several glaciations. For each glaciation, the primary source of moisture has been the oceans. Whenever sea level fell, the estuarine environment at the continental margin was forced to migrate in a seaward direction.

About 18,000 years ago the Wisconsin Glacial Stage attained its maximum, and glacial melting began. The seas rose, forcing the estuarine environment to migrate back up the continental shelf. During the period of lowered sea level, some rivers had become entrenched in the continental shelf and deepened their valleys, which were soon flooded by the rising marine waters, forming a typical drowned river estuary. In areas such as Norway and parts of the coast of British Columbia, valley glaciers had deepened river valleys. These narrow drowned glacial valleys became the modern fjord estuaries as sea level rose.

The geomorphology (*i.e.,* form) of an estuarine basin is usually developed by one of three agents: (1) fluvial or glacial erosion, (2) fluvial and marine deposition, or (3) tectonic activity. The last of these involves the downfaulting of a coastal area or the broad local subsidence of a stretch of coastline, as in the case of San Francisco Bay.

Esus (Celtic: "Lord," or "Master"), powerful Celtic deity, one of three mentioned by the Roman poet Lucan in the 1st century AD; the other two were Taranis ("Thunderer") and Teutates ("God of the People"). Esus' victims, according to later commentators, were sacrificed by being ritually stabbed and hung from trees. A relief from the Cathedral of Notre-Dame in Paris portrays him as a bended woodman cutting a branch from a willow tree. This and a related relief from Trier, Ger., associate him with the sacred bull and his accompanying cranes or egrets.

Eszék (Yugoslavia): *see* Osijek.

Esztergom, German GRAN, Latin STRIGONIUM, Slovak OSTRIHOM, town, Komárom *megye* (county), northwestern Hungary. It is a river port on the Danube (which at that point forms the Czechoslovak frontier), 25 miles (40 km) northwest of Budapest. The various forms of its name all refer to its importance as a grain market. It is at the western end of the valley cut by the Danube between the Pilis and Börzsöny hills, dividing the Little Alföld (Little Hungarian Plain) from the Great Alföld (Great Hungarian Plain). Esztergom was the capital and royal residence of the early Árpád kings and successive Hungarian kings until the mid-13th century. Stephen I was born in the town and crowned there in 1000. The archbishopric, one of the oldest in Hungary and dating from 1189, moved to Trnava during the Turkish occupation (1543–1683), to return in 1820. The fortress, last restored in the 18th century, is still largely intact atop Várhegy (Castle Hill). The great cathedral (built 1822–60), modeled on St. Peter's in Rome, overlooks the Danube and is the largest church in Hungary, the outside height of the cupola being 348 feet (106 m). It is on the site of St. Stephen's original cathedral (1010). The treasury of the cathedral has a rich collection of medieval goldsmiths' work and a textile collection. The former primate's palace, the Christian Museum, has a rich painting collection. The Castle Museum has relics of the royal palace (10th–12th century, major period of construction). The town has many fine Baroque houses. Since World War II, industrial development in machine tools, bricks and pottery, viticulture, and man-made fibres has taken place. Pop. (1987 est.) 33,000.

Christian Museum with the dome-topped great cathedral and fortress of St. Stephen in the background, Esztergom, Hung.

ZEFA/EB Inc.

Eszterháza (Hungary): *see* Fertőd.

Eszterházy FAMILY: *see* Esterházy family.

eta (Japanese minority): *see* burakumin.

ETA, abbreviation of EUZKADI TA AZKATASUNA (Basque: "Basque Homeland and Liberty"), Basque separatist organization in Spain that adopted violent methods in its campaign for an independent Basque state.

ETA grew out of the Basque Nationalist Party (Partido Nacionalista Vasco; PNV), which had been founded in 1894 and which managed to survive, though illegally, under Francisco Franco's fascist regime by maintaining its headquarters in exile in Paris and keeping quietly out of sight in Spain. In 1959 some youthful members, angered at the party's persistent rejection of armed struggle, broke away and founded ETA. Within the next few years the new organization developed groupings associated increasingly with Marxist positions, setting revolutionary socialism as their end. In 1966 at the ETA's fifth conference, the organization divided ideologically into two wings—the "nationalists," or ETA-V, who adhered to the traditional goal of Basque autonomy, and the "ideologists," or ETA-VI, who favoured a Marxist-Leninist brand of Basque independence and the use of public sabotage and, later (from 1968), assassination to achieve it. The Franco regime's retaliation and repression in the Basque provinces were severe, the police using arbitrary arrest, beatings, and torture. By 1969–70 the principal leaders had been rounded up by the police and subjected to military trials in the city of Burgos.

Factionalism continued to plague ETA in the 1970s and '80s under generally new leaders, with two and sometimes three or more internal factions pursuing alternately violence and political action. After Franco's death in 1975, Spain's democratic governments moved to establish regional autonomy for the Basque provinces and to offer pardons to ETA members renouncing terrorism, but in the decade after Franco the number of ETA killings by bombing and assassination multiplied 10-fold over what had existed under Franco's iron-handed repression.

In the early years, ETA maintained links with various foreign liberation groups, such as the Irish Republican Army, the Red Brigades of Italy, and Palestinian groups; and ETA members received training in South Yemen, Algeria, and Libya. In later years, however, the strongest surviving faction, ETA Militar, or ETA-M, tended to forsake most international connections. ETA became increasingly self-sustaining, relying financially on robberies, kidnappings, and "revolutionary taxes" extorted from businessmen and organizationally on a network of cells overseen by a directorate of 8 to 10 men and women. ETA also found electoral allies in the political parties Herri Batasuna (HB; "United People") and Euzkadiko Ezkerra (EE; "Basque Left").

Eta Carinae, also called KEYHOLE NEBULA, peculiar red star and nebula (catalog number NGC 3372) in the southern constellation Carina. The English astronomer Sir Edmond Halley noted it in 1677 as a star of about fourth magnitude. In 1838 Sir John Herschel observed it as a first-magnitude star. By 1843 it had reached its greatest recorded brightness, approximately −1 magnitude, or as bright as the brightest stars. Unlike the common types of exploding stars called novae and super-

novae, it remained bright for several years. From about 1857 it faded steadily, disappearing to the unaided eye only about 1870. Since then it has varied irregularly about the seventh magnitude. The nebula around the star is an expanding shell of bright gas resembling a halo. It is thought that the star's consumption of its nuclear fuel may be accelerating and that Eta Carinae may be a supernova at some future time.

Etah, town, administrative headquarters of Etah district, Uttar Pradesh state, northern India, northeast of Āgra. A marketplace for agricultural products, it has three colleges affiliated with Āgra University.

Etah district, 1,715 sq mi (4,449 sq km) in area, is a section of alluvial plain on the Ganges River's southern bank. Irrigated by both the Upper and Lower Ganges canals, it contains a fertile area between the river's present channel and its ancient bed to the southwest. Wheat, cotton, and sugarcane are grown. Kāsganj, north of Etah, is also an agricultural market and is a centre of cotton and sugar processing. Soron, farther north, is a Hindu pilgrimage centre. Pop. (1981) town, 53,784; district, 1,858,692.

Étampes, city, Essonne *département,* Paris region, northern France, on the Juine River, about 28 mi (45 km) south of Paris. The city in ancient times was a stronghold and it preserves several architectural remnants of those times, including a 12th-century donjon, the tower of Guinette, its churches (Saint-Basile, Notre-Dame du Fort, Saint-Gil, and Saint-Martin), a town hall, and private houses. Étampes is a busy commercial centre set in a fertile countryside and its industries are diversified, including metallurgy, food processing, and other manufactures. Pop. (1982) 18,552.

Étampes, Anne de Pisseleu, duchesse d' (duchess of) (b. 1508—d. *c.* 1580), mistress of King Francis I of France and the major supporter of the party of the Duc d'Orléans in opposition to that of the Dauphin.

The daughter of a nobleman of Picardy, she came to court before 1522 as maid of honour to Louise of Savoy, duchess of Angoulême and mother of Francis I. She first met Francis on his return from Spain in 1526 and soon became his mistress. In 1533 he married her to Jean de Brosses, governor of Brittany, whom he created duc d'Étampes. Known for her wit and intellect as well as for her beauty, the Duchess d'Étampes was also ambitious. In competition with her rival, Diane de Poitiers, mistress to the Dauphin (the future Henry II), she supported the party of the Duc d'Orléans. Upset by the Dauphin's progress against Emperor Charles V, she tried to convince Francis to detain Charles, then visiting France, until a settlement was reached. Charles tried to win over the Duchess, a circumstance that lent credence to the charge made against her in 1544 that she had betrayed plans to Charles before his attack on France. With the death of Francis in 1547 and the accession of Henry II, the Duchess d'Étampes was dismissed from court. She died in obscurity.

Étampes, Gabrielle d'Estrées, duchesse d' (duchess of): *see* Estrées, Gabrielle d'.

Etana Epic, ancient Mesopotamian tale concerned with the question of dynastic succession. In the beginning, according to the epic, there was no king on the earth; the gods thus set out to find one and apparently chose Etana, who proved to be an able ruler until he discovered that his wife, though pregnant, was unable to give birth, and thus he had no heir to the throne. The one known remedy was the birth plant, which Etana was required to bring down personally from heaven. Etana, therefore, prayed to the god Shamash, who heard his request and directed him to a mountain where a maimed eagle, languishing in a pit (into which it had been thrown as punishment for breaking a sacred pact), would help him obtain the special plant. Etana rescued the eagle, and as a reward it carried him high up into the sky.

The result of Etana's quest is uncertain because of the incomplete state of the texts. According to one fragment, Etana reached heaven and prostrated himself before the gods. There the text breaks off. According to another fragment, however, Etana either became dizzy or lost his nerve before reaching heaven and crashed to the ground. If, as many scholars believe, Etana was successful, the myth may have been used to support early dynastic claims.

Etana of the myth is probably the Etana who ruled Kish in southern Mesopotamia sometime in the first half of the 3rd millennium BC, although there is no historical evidence laying claim to the exploits recorded in the epic.

Étaples, Jacques Lefèvre d': *see* Lefèvre d'Étaples, Jacques.

État Indépendant du Congo: *see* Congo Free State.

État Luxembourg, Musées de l' (French: Luxembourg State Museum), national museum of Luxembourg in Marché-aux-Poissons, housed in a late Gothic and Renaissance mansion and containing collections of Gallo-Roman art, coins, medieval sculpture, armour, and contemporary art as well as sections devoted to natural history. The Gallo-Roman objects include finds from Titelberg, Dalheim, and Kehlen. Upstairs there is an exhibit entitled "The Fortress of Luxembourg" with models. In addition there are sections devoted to geology, mineralogy, and astronomy, including a planetarium.

Etāwah, town, administrative headquarters of Etāwah district, Uttar Pradesh state, northern India, on the Yamuna River, southeast of Āgra. The town is crossed by numerous ravines, one of which separates the old city (south) from the new city (north); bridges and embankments connect the two. Etāwah contains a 16th-century mosque, the Jāmiʿ Masjid, built on high ground from the ruins of old Hindu buildings. There is also a ruined 15th-century fort, surrounded by Hindu temples. The town has important cotton- and silk-weaving industries, contains oilseed mills, and is a distribution centre for ghee (clarified butter).

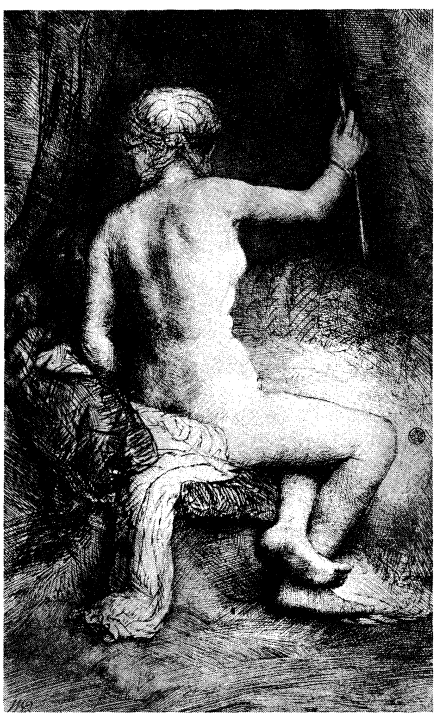
Etāwah district, 1,671 sq mi (4,327 sq km) in area, comprises a stretch of alluvial plain drained by the Yamuna and its tributaries and irrigated by a branch of the Ganges Canal system. Crops include wheat, corn (maize), barley, and millet. The southwest has many large ravines, and soil erosion is a problem along the rivers. Reclamation and forestation projects have helped to reclaim some of the land. Pop. (1981) town, 212,174; district, 1,742,651.

Etchareottine (people): *see* Slave.

etched glass, type of glassware whose decorative design has been cut into the surface by the corrosive action of an acid. An etched-glass surface may be either rough and frosted or satiny smooth and translucent, depending largely on the composition of the glass and the amount of time the glass is exposed to the acid. Design transfer is accomplished by several methods. In one common practice, the glass is coated with a layer of beeswax or paraffin on which patterns or pictures are traced with metal needles. The glass is then dipped in hydrofluoric acid, which etches the design through the grooves made by the needles in the protective coating. Engraving and enamelling are often used in conjunction with the etching process to enhance the decorative design.

etching, a method of making prints from a metal plate, usually copper, into which the design has been corroded by acid. The copperplate is first coated with an acid-resistant substance, called the etching ground, through which the design is drawn with a sharp tool. The ground is usually a compound of beeswax, bitumen, and resin. The plate is then exposed to nitric acid or dutch mordant, which eats away those areas of the plate unprotected by the ground, forming a pattern of recessed lines. These lines hold the ink and, when the plate is applied to moist paper, the design transfers to the paper, making a finished print.

The practice of making prints from etched metal plates grew out of the custom of etching designs on armour and was adopted by



"The Woman with the Arrow," etching by Rembrandt, 1661

By courtesy of the National Gallery of Art, Washington, D.C., Rosenwald Collection

printmakers as an easy way of engraving, a process of making prints from metal plates incised with a tool called a burin. The first dated etching was made in 1513 by the Swiss artist Urs Graf, who printed from iron plates. The prolific German graphic artist Albrecht Dürer made only five etchings. In his "Cannon" (1518), he tried to imitate the formal, premeditated quality of engravings, revealing that etching's spontaneity and flowing line were as yet not valued in northern Europe. The 16th-century Italian artist Parmigianino, however, made etchings with easy, graceful strokes that show his full understanding of the technique. In France, the printmaker Jacques Callot used etching as an aid to engraving in his series "Grandes Misères de la Guerre" (1633). He not only incised the metal when drawing through the ground, he also reinforced the lines with an engraver's burin after the plate had been exposed to acid.

The first and perhaps greatest master of pure etching was Rembrandt (1606–69). He abandoned all links with engraving and produced over 300 etchings with unsurpassed virtuosity, using the freedom inherent in the medium to render light, air, and space. The 18th-century Venetian artists Giovanni Battista Tiepolo and Canaletto also used etching to capture atmospheric effects, and the Roman etcher

and archaeologist Giambattista Piranesi used etching to serve his fantasy in his series "Carceri" (*c.* 1745), a group of interior views of foreboding imaginary prisons. More horrific was the series "Los desastres de la guerra" (1810–14), by the Spanish artist Francisco de Goya. Unlike most of his other prints, Goya's "Desastres" were done mainly in etching with little aquatint.

During the late 18th and early 19th centuries, soft-ground etching, or *vernis mou,* became current. This technique involves drawing with a pencil on a sheet of paper placed on a copperplate coated with an extremely soft, sticky ground. The ground adheres to the paper wherever the pencil passes, leaving the metal exposed in broad, soft lines. The plate is exposed to acid and, when printed, yields results similar to pencil or chalk drawings. It was primarily a reproductive technique but was used by the 18th-century English artists Thomas Gainsborough, John Sell Cotman, and Thomas Girtin for original designs, mainly landscapes.

Etching continued to be used by most artists throughout the 19th century, and in the 20th century the technique was adopted with new enthusiasm by several prominent artists. Primary among them is Pablo Picasso, who first made etching a vehicle for his Cubist ideas and subsequently exploited the technique's purity of line in his "classical" period. Henri Matisse, Marc Chagall, Georges Rouault, Joan Miró, and Stanley Hayter also did much important work in this medium.

etesian wind, remarkably steady southbound drift of the lower atmosphere over the eastern Mediterranean and adjacent lands in summer. From about mid-May to mid-September, it generally dominates the Adriatic, Ionian, and Aegean seas and the adjacent countries.

The name (from Greek *etos,* "year") is suggestive of the wind's regular recurrence. The wind is of such significance to human activities that the ancient Greeks announced its expected beginning in the marketplaces. An extreme example of its constancy is at Cairo, where July winds blow from the northwest, north, or northeast 98 percent of the time.

The etesian wind, which reaches maximum intensity in the early afternoon and may cease during the night, is part of the general inflow of air toward an intense low-pressure area usually centred over northwestern India in summer. The wind is not of the class generally termed monsoon winds because it is practically rainless, is not accompanied by high relative humidity, and is not replaced in winter by a drift from the opposite direction.

Similar wind regimes and climates, called etesian climates and characterized by dry summers and rainy winters, are present in California, Chile, South Africa, and southwestern Australia.

ethanal (chemistry): *see* acetaldehyde.

ethane, a colourless, odourless, gaseous hydrocarbon (compound of hydrogen and carbon), belonging to the paraffin series; its chemical formula is C_2H_6. Ethane is structurally the simplest hydrocarbon that contains a single carbon–carbon bond. The second most important constituent of natural gas, it also occurs dissolved in petroleum oils and as a by-product of oil refinery operations and of the carbonization of coal.

The industrial importance of ethane is based upon the ease with which it may be converted to ethylene (C_2H_4) and hydrogen by pyrolysis, or cracking, when passed through hot tubes. Like propane and, to a lesser extent, butane, ethane is a major raw material for the huge ethylene petrochemical industry, which produces such important products as polyethylene plastic, ethylene glycol, and ethyl alcohol.

More than 90 percent of the ethane produced in the 1960s was burned as fuel without separation from natural gas. Ethane gas can be liquefied under pressure or at reduced temperatures and thus be separated from natural gas. Unlike propane, liquid ethane is not in common use as an industrial or domestic fuel.

ethanol: *see* ethyl alcohol.

ethanolamine, the first of three organic compounds that can be derived from ammonia by successively replacing the hydrogen atoms with hydroxyethyl radicals ($-CH_2CH_2OH$), the others being diethanolamine and triethanolamine. The three are widely used in industry, principally as absorbents for acidic components (*e.g.,* carbon dioxide) of natural gas and of petroleum-refinery gas streams. As salts (soaps) with fatty acids, they are used as emulsifiers in numerous household and industrial products. Triethanolamine is a corrosion inhibitor for automobile antifreeze solutions and airplane-engine coolants. The ethanolamines are commercially prepared by the reaction of ammonia and ethylene oxide.

Ethelbald (personal name): *see under* Aethelbald.

Ethelbert (personal name): *see under* Aethelberht.

Ethelfleda (queen of Mercia): *see* Aethelflaed.

Ethelfrith (Anglo-Saxon king): *see* Aethelfrith.

Etheling (Old English title): *see* Aetheling.

Ethelred (personal name): *see under* Aethelred, except as below.

Ethelred II, also spelled AETHELRED, byname ETHELRED THE UNREADY, or AETHELRED UNRAED (b. 968?—d. April 23, 1016, London), king of the English from 978 to 1013 and from 1014 to 1016. He was an ineffectual ruler who failed to prevent the Danes from overrunning England. The epithet "unready" is derived from *unraed,* meaning "evil counsel."

Ethelred II, coin, 10th century; in the British Museum
Peter Clayton

The son of King Edgar (ruled 959–975), Ethelred ascended the throne upon the assassination of his half brother King Edward the Martyr in March 978. Widespread suspicion that Ethelred may have had a part in the murder created much of the distrust and disloyalty that undermined his authority. Hence, there was no unified defense when the Danish invasions resumed in 980.

Nearly all of the country was ravaged, and Ethelred's efforts to buy peace only made the invaders more rapacious. When they did begin to settle down in towns, Ethelred provoked further invasions by launching a massacre of Danish settlers (Nov. 13, 1002). By the end of 1013 the Danish king Sweyn I had been accepted as king in England, and Ethelred had fled to Normandy.

After Sweyn died in February 1014, Ethelred's council of advisers invited him to return to the throne on condition that he agree to satisfy their grievances. At the time of Ethelred's death in 1016, Sweyn's son Canute was ravaging England. Ethelred was succeeded by his son Edmund II Ironside (ruled 1016); one of his other sons ruled England as Edward the Confessor from 1042 to 1066.

Ethelred OF RIEVAULX, SAINT: *see* Aelred of Rievaulx, Saint.

Ethelstan: *see* Athelstan; Guthrum.

Ethelwerd (English chronicler): *see* Aethelweard.

Ethelwulf (Anglo-Saxon king): *see* Aethelwulf.

ether, also spelled AETHER, also called LUMINIFEROUS ETHER, in physics, a theoretical, universal substance believed during the 19th century to act as the medium for transmission of electromagnetic waves (*e.g.,* light and X-rays) much as sound waves are transmitted by elastic media such as air. The ether was assumed to be weightless, transparent, frictionless, undetectable chemically or physically, and literally permeating all matter and space. The theory met with increasing difficulties as the nature of light and the structure of matter became better understood; it was seriously weakened (1881) by the Michelson-Morley experiment (*q.v.*), which was designed specifically to detect the motion of the Earth through the ether and which showed that there was no such effect.

With the formulation of the special theory of relativity by Einstein in 1905 and its acceptance by scientists generally, the ether hypothesis was abandoned as being unnecessary in terms of Einstein's assumption that the speed of light, or any electromagnetic wave, is a universal constant.

ether, any of a class of organic compounds characterized by an oxygen atom attached to two carbon atoms that are part of a hydrocarbon. Ethers are similar to alcohols but are generally less dense, less soluble in water, and have lower boiling points. They are relatively inert.

A brief treatment of ethers follows. For full treatment, *see* MACROPAEDIA: Chemical Compounds.

At room temperature, ethers are pleasant smelling, colourless liquids. In nature, ethers are found as part of substances such as sugar, starch, and cellulose. Ethers may be manufactured by dehydrating alcohols, but catalytic hydration (addition of water) of olefins (forms of hydrocarbons) is the major method of production.

While often regarded as derivatives of alcohol, ethers exhibit properties that are more likely to resemble those of their parent hydrocarbons. They form salts called oxonium compounds when they are reacted with strong inorganic acids and Lewis acids (compounds capable of accepting electron pairs). When strong acids break one of the carbon–oxygen linkages, alcohols are formed. Other organic derivatives are produced if both linkages are broken. Heat decomposes ethers into olefins. In the presence of oxygen, ethers slowly oxidize to unstable peroxides; this reaction can result in an explosion.

Ethers will form azeotropes (constant-distillation mixtures) with a large number of organic compounds. As a result, they are used extensively for extraction and separation of organic chemicals. Ethers are also employed as solvents for fats, oils, waxes, perfumes, resins, dyes, gums, and hydrocarbons. Vapours of certain ethers are used as insecticides, miticides, and fumigants for soil. Ethers are also very important in medicine and pharmacology, especially for use as anesthetics. Codeine,

for example, is the methyl ether of morphine. Ethyl ether is best known as an anesthetic. A highly volatile liquid, it is also used as a solvent, an extractant, and a reaction medium. Methyl ether is used as a spray propellant and refrigerant. The ethers of ethylene glycol are used as solvents and plasticizers.

Etherege, Sir George (b. *c.* 1635, Maidenhead, Berkshire, Eng.?—d. *c.* May 10, 1692), creator of the English Restoration comedy of manners.

Etherege probably accompanied his father to France in the 1640s. About 1653 his grandfather apprenticed him to an attorney in Beaconsfield, Buckinghamshire.

Etherege's first comedy, *The Comical Revenge; or, Love in a Tub*, was premiered at Lincoln's Inn Fields Theatre in 1664. An immediate success, it was novel in its exploitation of contemporary manners, especially in the intrigue of the stylish Sir Frederick Frollick. It still followed earlier tradition, with its romantic plot, in heroic couplets and blank verse, and farcical subplot. Its success gave Etherege an entrée into the world of fashion, where he became the boon companion of the literary rakes Sir Charles Sedley, the Earl of Rochester, and the Earl of Dorset.

She wou'd if she cou'd, Etherege's second comedy (1668), failed because of poor acting. It was the first comedy of manners to attain unity of tone by shedding the incongruous romantic verse element.

From 1668 to 1671 Etherege was in Turkey as secretary to the English ambassador, Sir Daniel Harvey. After his return he wrote the prologue for the opening in 1671 of the new Dorset Garden Theatre. There his last and wittiest comedy, *The Man of Mode, or, Sir Fopling Flutter*, was produced with acclaim in 1676. He was knighted in 1680.

Etherege was appointed envoy to the Diet in Ratisbon in 1685. His two Letterbooks from there include personal, as well as official, correspondence. Although irresponsible, Etherege showed qualities of loyalty, and he followed his king, James II, to Paris after that monarch was deposed in the "Glorious Revolution" of 1688.

Known to his friends as easy and gentle, Etherege had a relish for life and a shrewd knowledge of men. His style of comedy was successfully cultivated by his successors and persisted to modern times. His own plays, however, failed to hold the stage after the mid-18th century. His love lyrics are among the most charming of their day.

Etheria, Pilgrimage of: *see* Peregrinatio Etheriae.

Etherington, Marie Susan: *see* Tempest, Dame Marie.

etherophone: *see* theremin.

Ethical Culture, a movement based upon the conviction that moral tenets need not be grounded in religious or philosophical dogma. Ethical culture has sought to promote social welfare through community effort. The movement originated in New York City under the leadership of Felix Adler in 1876. Adler contended that Judaism and Christianity were mistaken in making ethics dependent on religious dogma. Adler started with the basic principle of the 18th-century German philosopher Immanuel Kant that every human being is an end in himself and is worthwhile on his own account. He had three basic goals for the Society for Ethical Culture, which he founded: (1) sexual purity, (2) devoting surplus income to the improvement of the working classes, and (3) continued intellectual development. The movement spread to England, France, Germany, Austria, Switzerland, Japan, and India. Adler promoted the movement as a religion that included Sunday services, solemnization of marriages, and funerals. Other leaders in the movement were W.M. Salter, Stanton Coit, and Walter L. Sheldon.

Ethical Policy, in Indonesian history, a program introduced by the Dutch in the East Indies at the turn of the 20th century aimed at promoting the welfare of the indigenous Indonesians (Javanese). Toward the end of the 19th century, leaders of the ethical movement argued that The Netherlands had acquired huge revenues from Indonesians by means of compulsory labour under the Cultuur-Stelsel, or Culture System (*q.v.*), and that the time had come for the Dutch to pay "the debt of honour" to the Indonesian people by promoting reforms in education and agriculture and by decentralizing the Indies administration, providing more autonomy for Indonesian officials. This policy led to the development of a Dutch school system in the Indies and a further penetration of the Western economic system in the rural areas. Rapid social change took place in the Indies. Social dislocation eventually manifested itself in the form of unrest, which caused the Dutch authorities to reconsider the Ethical Policy program. The Governor General in about 1925 began to discontinue the policy, but its total abolition took place only after the 1926–27 Indonesian Communist Uprisings.

ethical relativism, the view that what is right or wrong and good or bad is not absolute but variable and relative, depending on the person, circumstances, or social situation. The view is as ancient as Protagoras, a leading Greek Sophist of the 5th century BC, and as modern as the scientific approaches of sociology and anthropology.

Many people's understanding of this view is often vague and confused. It is not simply the belief, for example, that what is right depends on the circumstances, because everyone, including the absolutists, agrees that circumstances can make a difference; it is acknowledged that whether it is right for a man to enter a certain house depends upon whether he is the owner, a guest, a police officer with a warrant, or a burglar. Nor is it the belief that what someone thinks is right is relative to his social conditioning, for again anyone can agree that there are causal influences behind what people think is right. Ethical relativism is, rather, the view that what is really right depends solely upon what the individual or the society thinks is right. Because what one thinks will vary with time and place, what is right will also vary accordingly. Ethical relativism is, therefore, a view about the truth status of moral principles, according to which changing and even conflicting moral principles are equally true, so that there is no objective way of justifying any principle as valid for all people and all societies.

The sociological argument for relativism proceeds from the diversity of different cultures. Ruth Benedict, an American anthropologist, suggested, for example, in *Patterns of Culture* (1934) that the differing and even conflicting moral beliefs and behaviour of the North American Indian Kwakiutl, Pueblo, and Dobu cultures provided standards that were sufficient within each culture for its members to evaluate correctly their own individual actions. Thus, relativism does not deprive one of all moral guidance. However, some anthropologists, such as Clyde Kluckhohn and Ralph Linton, have pointed up certain "ethical universals," or cross-cultural similarities, in moral beliefs and practices—such as prohibitions against murder, incest, untruth, and unfair dealing—that are more impressive than the particularities of moral disagreement, which can be interpreted as arising within the more basic framework that the universals provide. Some critics point out, further, that a relativist has no grounds by which to evaluate the social criticism arising within a free or open society, that his view appears in fact to undercut the very idea of social reform.

A second argument for relativism is that of the skeptic who holds that moral utterances are not cognitive statements, verifiable as true or false, but are, instead, emotional expressions of approval or disapproval or are merely prescriptions for action. In this view, variations and conflicts between moral utterances are relative to the varying conditions that occasion such feelings, attitudes, or prescriptions, and there is nothing more to be said. Critics of the skeptical view may observe that classifying moral utterances as emotive expressions does not in itself disqualify them from functioning simultaneously as beliefs with cognitive content. Or again, they may observe that, even if moral utterances are not cognitive, it does not follow that they are related, as the relativist suggests, only to the changeable elements in their background; they may also be related in a special way to needs and wants that are common and essential to human nature and society everywhere and in every age. If so, the criticism continues, these needs can provide good reasons for the justification of some moral utterances over others. The relativist will then have to reply either that human nature has no such common, enduring needs or that, if it does, they cannot be discovered and employed to ground man's moral discourse.

ethics: *see under* descriptive word (*e.g.*, comparative ethics; normative ethics; teleological ethics), except as below.

ethics, also called MORAL PHILOSOPHY, the discipline concerned with what is morally good and bad, right and wrong. The term is also applied to any system or theory of moral values or principles.

A brief treatment of ethics follows. For full treatment, *see* MACROPAEDIA: Ethics.

The subject of ethics essentially comprises issues fundamental to practical decision-making, and so the discipline, though long considered a branch of philosophy, is closely linked with many other fields of inquiry, including anthropology, economics, politics, and sociology. Ethics, nonetheless, remains distinct from such areas of study in that it is occupied not so much with factual knowledge as it is with values—namely, human conduct as it ought to be, rather than as it actually is.

Ethics is generally divided into three major subdisciplines. These are (1) metaethics, (2) normative ethics, and (3) applied ethics.

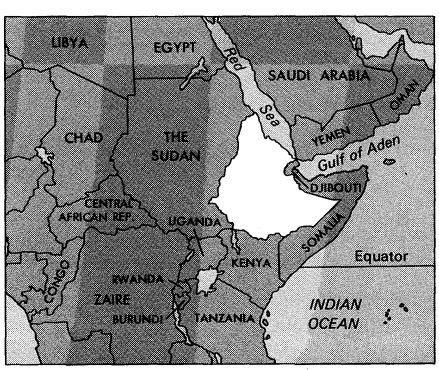
Metaethics centres on questions relating to the nature of moral concepts and judgments. Philosophers in metaethics have taken markedly different positions on this matter. Some have held that moral concepts describe natural or supernatural (*i.e.*, metaphysical) entities in the world. Others, while agreeing that moral concepts are descriptive of such entities, have maintained that the entities are entirely unique in kind. Still others assert that the primary function of moral concepts is to express attitudes or emotions or to prescribe or prohibit. Corresponding views about the logical status of moral judgments have been held by these various philosophers: either the judgments are capable of being true or false and of constituting a kind of knowledge, or they are incapable of such and function rather to express attitudes or to convey condemnation and praise. There also has been much disagreement over whether moral judgments are objective or subjective, absolute or relative.

Normative ethics is primarily concerned with establishing standards or norms for conduct and is commonly associated with general theories about how one ought to live. One of the central questions of modern normative ethics has to do with whether human actions are to be judged right or wrong solely accord-

ing to their consequences. Traditionally, theories that judge actions by their consequences have been known as teleological, though the term consequentialist has largely supplanted it. Another class of theories in normative ethics, designated as deontological, judges actions by their conformance to some formal rule or principle (*e.g.*, the ethical system of the German philosopher Immanuel Kant).

Perhaps the most striking development in the study of ethics during the second half of the 20th century has been the growing interest among philosophers in applied ethics—*i.e.*, the application of normative theories to practical moral problems. Such moral issues as racial and sexual equality, human rights, and justice have become prominent, as have questions about the value of human life raised by controversies over abortion and euthanasia. Related to the latter are the ethical implications of various developments in medicine and the biological sciences, as, for example, in vitro fertilization, sperm banks, and gene manipulation. This field of applied ethics, known as bioethics, frequently requires the cooperative efforts of philosophers, physicians, scientists, lawyers, and theologians.

Ethiopia, officially PEOPLE'S DEMOCRATIC REPUBLIC OF ETHIOPIA, Amharic YEĒTĪY-OP'IYA HEZBAWI DIMOKRASĪYAWĪ RĒPUBLĒK, country of eastern Africa, situated on the Horn of Africa, and covering an area of 472,400 square miles (1,223,500 square km). The capital is Addis Ababa. It is about 700 miles (1,130 km) in length, northwest to southeast, and 640 miles (1,030 km) in width, northeast to southwest. Ethiopia is bordered on the east by Djibouti and Somalia, on the south by Kenya, and on the west by The Sudan. It has 628 miles (1,010 km) of coastline along the



Ethiopia

Red Sea, on the northeast, and about 150 Red Sea islands belong to Ethiopia. The population in 1990 was estimated to be 50,341,000, one of the largest in Africa.

A brief treatment of Ethiopia follows. For full treatment, *see* MACROPAEDIA: Eastern Africa.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. Ethiopia can be divided into three major relief regions: the Western Highlands, the Eastern Highlands, and the relatively low-lying Rift Valley and Western Lowlands. The Western Highlands lie at elevations between 8,000 and 12,000 feet (2,400 and 3,700 m). The northern end of this region is in northern Eritrea, where erosion has cut down to the basement rock. South of Eritrea in the Simen Mountains, the highest peak in Ethiopia, Mount Dashen, rises to 15,157 feet (4,620 m). The tablelands of this region are surrounded by deep gorges and canyons. The Shewan Plateau in west-central Ethiopia is the widest area (from west to east) in the Western Highlands, with a general elevation of more than 7,000 feet (2,100 m).

The Eastern Highlands, separated from the Western Highlands by the Rift Valley, have a largely basaltic cover, and the highest area is a mountain chain that runs along the Rift Valley escarpment, sloping steeply on its eastern side. High peaks include Mount Filfo, which rises to more than 14,000 feet (4,270 m). The Bale Massif, which is mostly above 9,000 feet (2,740 m), lies between the upper courses of the Genale and Wabe Shebele rivers. In the southeastern part of Ethiopia is the arid Harerge Plain and Ogaden region, and the Sidamo-Borena Plain occupies the southernmost Eastern Highlands.

The Rift Valley region, dotted by a series of lakes at an elevation of about 5,000 feet (1,500 m), extends the length of central Ethiopia from south to north and is bounded by the Eastern and Western Highlands. To the north the Rift Valley widens into the Awash River basin. Active volcanoes are located on the Denakil Plain farther to the north. A desert depression north of the Denakil Plain runs parallel to the Red Sea and contains salt lakes and the Kobar Sink, a depression that dips below sea level. The Western Lowlands extend in a thin crescent along Ethiopia's western border with The Sudan from Eritrea in the north to the northern shores of Lake Rudolf in the south.

The climate is temperate in the highlands and hot in the lowlands. The average daily temperature ranges from a minimum of 60° F (16° C) to a maximum of 84° F (29° C). Rainfall for most of Ethiopia is brought by southwesterly winds, which bring rainfall from July to September. Northeasterly winds blowing from the dry Arabian Peninsula account for the intensity of the dry season in the northern parts of the country. The amount of annual rainfall varies from almost 100 inches (2,500 mm) in the southwest to about 2 inches (50 mm) in the northeast along the Red Sea.

The wet and cool highlands are mostly grassland or farmland, with occasional clumps of trees. At higher elevations the subtropical forests are dominated by the yellowwood, an evergreen tree with a pulpy fruit. Acacia predominates in the lowlands; in the southern part of the Rift Valley there is rich savanna grassland with many trees. Among the rare animals of Ethiopia are the Abyssinian, or walia, ibex (a type of mountain goat), the mountain nyala (a kind of antelope), and the gelada monkey. Jackals, wild dogs, bat-eared foxes, lions, elephants, leopards, buffalo, zebras, giraffes, and black rhinoceroses also inhabit the region. Closed forest occupies only about 3 percent of the total area. Some 12 percent of Ethiopia's area is considered arable, while about 40 percent of the land is used for grazing.

The people. Ethiopia has seen so much racial intermixing of caucasoid, negroid, and aboriginal Cushitic peoples that the resulting population is best identified in linguistic, religious, and cultural terms. Within that framework, the largest single ethnic group, the Amhara, are culturally and politically dominant; they constitute almost two-fifths of the total population and live in the northern and central parts of the country. The Oromo account for more than one-third of the population and live in the eastern and southern parts. Other ethnic groups include the Tigre, Afar, Somali, Saho, and Agew peoples. The official language is Amharic, but many other Cushitic and Nilotic languages are also in use. More than one-half of the population are Christian, mostly Ethiopian Orthodox, and almost one-third are Muslim.

A majority of the population is rural. The urban population forms only about one-tenth of the total. Ethiopia's lowland areas are generally more sparsely populated than the highlands. The two major cities are Addis Ababa in the centre of the Shewan Plateau and Asmera, the capital of Eritrea, in the far north. There are some 5,000,000 nomads and seminomads.

Almost one-half of Ethiopia's populace is less than 15 years of age. Both birth and death rates are high, and infant mortality is among the highest in the world. During the military conflicts of the mid-1970s and 1980s, and because of recurrent drought and famine (1982–84), an estimated 1,500,000 refugees fled to neighbouring countries.

The economy. Ethiopia is one of the world's poorest countries and has a centrally planned, developing economy largely based on agriculture. The rise to power of a Marxist government in 1974 was followed by sweeping land reforms and nationalizations during the middle and late 1970s, but rebellion, war, and drought continued to disrupt the economy. The gross national product (GNP) is growing much more slowly than the population, and the GNP per capita is one of the lowest in the world.

Agriculture accounts for approximately one-half of the GNP and employs four-fifths of the work force. Production is mainly for subsistence, yields are generally low, and much of the country's produce is transported by pack animals. Cereals such as corn (maize), barley, wheat, millet, teff (a cereal grass), and sorghum are the main food crops. Sugarcane is also a major crop. Animal husbandry provides an estimated one-fourth of the agricultural portion of the GNP. Government initiatives to boost agriculture include the distribution of fertilizers to farmers on credit and the gradual replacement of peasant farms with larger state farms and cooperatives. Commercial fishing is almost entirely restricted to the Red Sea coastal waters. Coffee is the main export crop, accounting for approximately two-thirds of the total exports.

Industry accounts for about one-tenth of the GNP and employs less than 10 percent of the work force. The manufacturing sector is dominated by the textile industry and food processing (including sugar processing), followed by beer and mineral-water production, shoes and leather goods, and tobacco. Almost all industry is nationalized. More than 80 percent of Ethiopia's electricity is generated by hydroelectric power plants.

Services account for about one-third of the GNP and employ about one-eighth of the work force. The government has improved the network of national parks, wildlife sanctuaries, and hotels in an attempt to revive the tourist industry.

The number of military personnel has increased substantially in recent years, largely because of continuing conflict with Eritrean secessionist groups, and debts to the Soviet Union and Cuba for military assistance are considerable. Levies on foreign trade provide about half of the country's total tax revenue.

Ethiopia's substantial balance-of-trade deficit can be largely attributed to its internal disorders, which have lowered production of exports, severely disrupted the distribution of imports, and prompted huge increases in the importation of military equipment. Exports largely consist of coffee, hides and skins, pulses (legumes), and oilseeds; imports include food and live animals, industrial supplies, motor vehicles, petroleum and petroleum products, and machinery. Chief trading partners are Germany, the Soviet Union, the United States, Italy, and The Netherlands.

A highway links Addis Ababa with Nairobi, Kenya, and a railway runs from Addis Ababa to the port of Djibouti, in the Republic of Djibouti, on the Gulf of Aden. The country has four international airports, and its main seaports are Aseb and Mitsiwa on the Red Sea.

Government and social conditions. Ethiopia was governed from 1974 to 1987 by a collective military dictatorship known as the Provisional Military Administrative Council

(PMAC), popularly called Dergue (Amharic term for "committee"). The PMAC was composed of military officers, and its chairman was the head of state. The (Communist) Worker's Party of Ethiopia (WPE) was established in 1984; it was to serve as the "guiding force" of the state and was virtually identical to the PMAC, which was dissolved with the adoption of a constitution in 1987. This document provided for an 835-member Shengo (national assembly), with five years as the term of office. The Shengo elects the president and the 24-member Council of State, which oversees matters of state when the Shengo is not in session. At the apex of the judicial system are the Supreme Court and the High Court, and there are regional and subregional courts. Ethiopia has one of the largest armed forces on the African continent, numbering more than 300,000 troops.

Medical and health care is provided through hospitals and clinics, and rural areas are served by teams of medical personnel trained in the Public Health College and Training Centre. Modern health services, however, reach only a small part of the population, and the bulk of the country's inhabitants must still rely on traditional methods of treatment. Ethiopia's main health problems are contagious and tropical diseases. Life expectancy at birth is little more than 40 years.

Ethiopia has a four-tiered educational system that is composed of elementary and junior and senior secondary schools and institutions of higher education. The main institution of higher education is Addis Ababa University (1961). There are, in addition, several vocational schools and in-service training programs. Mass media are controlled by the government through the Ministry of Information and National Guidance. The few newspapers of national circulation are all published in Addis Ababa. The communications medium that reaches the greatest number of people in Ethiopia is radio. Radio broadcasts are carried in Amharic, English, Somali, Arabic, and several other local languages. The Ethiopian Television Service has daily programing in Amharic and English.

Cultural life. Religion and language have probably been the two most important focal points of the cultural life of Ethiopia, and Christianity has been traditionally predominant. The national literature is Christian in either content or orientation. Only in certain localities does Islām dominate, but it has not been able to bring political unity to its ethnically diverse adherents in Ethiopia. Traditional painting is chiefly of a religious, instructive nature, and many modern artists continue this tradition. The culturally dominant languages have been Semitic languages in general and Ge'ez and Amharic in particular. The National Museum, which contains notable archaeological exhibits, and the National Library are located in Addis Ababa.

History. The northern and central parts of Ethiopia are said to have been occupied in the 2nd millennium BC by the Cushites, a group of Hamito-Semitic-speaking peoples. The Cushites drove out the various tribes speaking Nilotic or Sudanese languages in the southern and western zones of the Ethiopic plateau. These peoples may have been the aboriginal inhabitants of the area, rather than immigrants from the lowlands of the Nile River basin. According to Egyptian hieroglyphic texts, an early civilization (known to the Egyptians as Punt) began in the area during the 2nd millennium BC. The pharaohs sent fleets of ships there to buy precious goods such as spices, incense, and myrrh. The Egyptian text commenting on these depicted activities calls the Ethiopians "Habashat," from which later came the name Abyssinia. From the 6th century BC to the 1st century AD, the Sabaeans of southern Arabia influenced Ethiopian society, economy, religion, and art. During the last centuries BC, Ethiopia also felt the influence of Hellenistic Egypt. In the 2nd century AD the Aksumite kingdom emerged, which was, according to tradition, descended from Menelik I, the legendary son of the Hebrew King Solomon and the Queen of Sheba (Saba'). It flourished economically and culturally under Jewish influence until the 4th century, when, under the ruler Ezana, the region converted to Christianity and continued to prosper until the 9th century. Becoming Monophysite Christian during the early 4th century, it was cut off from the rest of the Christian world in 675 by the Muslim conquests of Egypt and Nubia. In the 11th century the Zagwe dynasty seized power, but the Solomonids of the ancient Aksum tradition were restored in the late 13th century. In the mid-15th century Ethiopia resumed contact with the Christian world when Ethiopian monks attended an ecumenical council in Florence. European Christians believed they had found the legendary kingdom of Prester John, a powerful Christian sovereign created in the minds of Europeans during the Crusades as a potential ally against Islām. In the 16th century Ethiopia was aided by the Portuguese in expelling the Muslim sultan of the Somalis. It was the centre of considerable missionary activity by the Jesuits until their expulsion in 1633.

The Gonder period of Indo-Portuguese influence began at this time and lasted until 1855, during which period Ethiopia experienced a cultural renaissance but maintained a feudal political system. The unification of modern Ethiopia was begun by Tewodros II (1855–68) and continued by Yohannes IV (1872–89); it was completed during the reign of Menelik II (1889–1913). In the early 1930s, upon ascending the throne, Emperor Haile Selassie I began a modernization program. Italy, which had gained a foothold in Eritrea in 1890, invaded Ethiopia in 1935 and occupied most of the country until 1941. After liberation, modernization continued, but Haile Selassie refused to allow equally modern political activity and barely acknowledged the suffering caused to millions of peasants by drought and by absentee landowners. In 1974 the emperor was deposed in a military coup d'état, and in 1975 the monarchy was abolished and socialist Ethiopia proclaimed. The PMAC was established, and by 1977 Lieutenant Colonel Mengistu Haile Mariam emerged as head of state and chairman of the Dergue.

The military government was faced with a civil war in Eritrea and Tigray and conflict over the Ogaden region in the southeast. In 1977 Somalia invaded the Ogaden and was pushed out only with the help of Soviet equipment and Cuban troops. Eritrean secessionists fought unceasingly for independence, and armed groups in Tigray were bent on overthrowing the government. These conflicts exacerbated the region's cyclical drought and accompanying famine conditions, which brought millions to the brink of starvation in the 1970s and '80s. Hundreds of thousands of Ethiopians sought refuge in neighbouring Djibouti, Somalia, and The Sudan.

Ethiopian chant, vocal liturgical music of the Ethiopian Christians in East Africa. A musical notation for Ethiopian chant introduced in the 16th century is called *melekket* and consists of characters from the ancient Ethiopian language, Ge'ez, in which each sign stands for a syllable of text. These characters seem also to serve as a cue for a specific melodic formula, or *serayu.* In performance, a formula is embellished with improvised melodic ornaments. There are also apparently three distinctly different manners of chanting: *ge'ez,* in which most melodies are performed; *araray,* presumably containing "cheerful" melodies and used only infrequently in services; and *ezel,* used in periods of fasting and sorrow. According to Ethiopian tradition, these forms were revealed in the 6th century to a chanter named Yared, who composed the entire body of hymns (since revised) that is found in the six books of chants. The first known manuscripts, however, date to the 14th century. The *debtara,* an unordained member of the clergy, is well versed in the Ethiopian Church rituals, in aspects of the liturgy, and in the scriptures; he is also trained to distinguish the subtleties of moods and manners of performance. Although he is required to copy the whole body of liturgical chants while a student, in the end he memorizes the melodies and, while singing, improvises along the outlines of basic melodic formulas. The exact relationship of Ethiopian musical traditions to other Middle Eastern cultures is unclear.

Ethiopian Church: *see* Ethiopian Orthodox Church.

Ethiopian literature, writings either in classical Ge'ez (Ethiopic) or in Amharic, the modern official language of Ethiopia. The earliest extant literary works in Ge'ez are translations of Christian religious writings from Greek, which may have influenced their style and syntax. From the 7th century to the 13th, a period marked by political disturbances, there was no new literary activity; but, with the restoration of the Solomonid dynasty in Ethiopia in 1270, there began the most productive era of Ge'ez literature, again characterized by translation, not from Greek but from Arabic, though the originals were frequently Coptic, Syriac, or Greek. The subject matter was mostly theological or strongly flavoured by religious considerations. The most interesting work occurring at the beginning of this period was the *Kebra Negast* ("Glory of the Kings"), a combination of mythical history, allegory, and apocalypse, the central theme of which is the visit of the Queen of Sheba to Solomon and the birth of a son, Menelik, who became the legendary founder of the Ethiopian dynasty.

Abba Salama, an Egyptian Copt who became metropolitan of Ethiopia in 1350, was not only responsible for a revision of the text of the Bible but translated or induced others to translate several books popular among the Ethiopian faithful. The rhapsodical *Weddase Mariam* ("Praise of Mary") is appended to the Psalter and thus has almost canonical status. In a slightly later period, about the beginning of the 15th century, various separate lives of saints and martyrs, including St. George (the patron saint of Ethiopia), were written. At this time was undertaken a translation of the Arabic Synaxarium, containing lives of saints—one or more for every day in the year.

The early 15th century saw the translation of several apocalyptic books, which inspired two original compositions. *Fekkare Iyasus* ("Elucidation of Jesus") was written during the reign of Tewodros I (1411–14); "Mystery of Heaven and Earth" was written somewhat later and is noteworthy for a vigorous account of the struggle between Michael and Satan. This book must not be confused with another original work of the same period, the "Book of Mystery" by Giorgis of Sagla, a refutation of heresies. The large hymnals and antiphonaries called *Deggua, Mawase'et,* and *Me'raf* also probably dated from this time, though some of the anthems may be older. Another type of religious poetry first composed during the 15th century was the *malk'e* ("likeness"), consisting generally of about 50 five-line rhyming stanzas, each addressed to a different physical or moral attribute of the saint apostrophized. As a last example of the religious literature of the "golden age" may be mentioned the "Miracles of Mary," translated from Arabic in 1441–42; it was enormously popular and went through several recensions, or critical revisions.

During the Muslim incursion of 1527–43, Ethiopian literary activity ceased and many manuscripts were destroyed; Islāmization was widespread, and, even after the repulsion of the invaders, the country never fully recovered. A Muslim merchant who had been converted to Christianity and, as Enbaqom (Habakkuk), became prior of the monastery of Debre Libanos, wrote *Anqas'a amin* ("Gate of Faith") to justify his conversion and to persuade apostates to recant. Other similar works were produced, and several were written to defend the Monophysite branch of the Christian faith. Meanwhile the arrival of Roman Catholic missionaries constituted a further danger to the Ethiopian Church.

The ancient language of Ge'ez had by now lost its vigour and became a liturgical language in which few people were thoroughly conversant. During the 16th century, Amharic, the principal spoken language, was beginning to be used for literary purposes, and Amharic expressions even appeared in royal chronicles. About 1600, nevertheless, a few substantial works in Ge'ez appeared, including *Hawi,* an enormous theological encyclopaedia translated by Salik of Debre Libanos, a *History* by Johannes Madabbar, bishop of Nikiu, containing an account of the Arab conquest of Egypt, valuable since the Arab original has been lost, and *Fetha Negast* ("Justice of the Kings"), a compilation of canon and civil law. Ge'ez poetry (*qene*) flourished, at Gonder particularly, in the 18th century and has since continued to be practiced at many monasteries. Some poems of Alaqa Taye were printed in Asmera in 1921, and an important anthology compiled by Hiruy Walde Selassie was published at Addis Ababa in 1926.

Ethiopia's Jewish population, known as Falasha, who lived mostly in regions north of Lake Tana, still used Ge'ez as their sacred language. Besides the Old Testament (including the *Book of Jubilees*), the Falasha have a few books peculiar to themselves, notably *Te'ezaza Sanbat* ("Ordinance of the Sabbath"), of uncertain date and perhaps mostly a translation from Arabic of the 14th century. A *Falasha Anthology* was published by Wolf Leslau in 1951.

The earliest known Amharic compositions are songs celebrating the victory of Amda Tseyon (1314–44). From the 16th century onward theological works were produced. A translation of the Bible was made in Cairo early in the 19th century (though probably not by a true Ethiopian, to judge by the quality of the Amharic), and from this version missionary societies composed their editions. Revisions were made by foreigners with an inadequate knowledge of Amharic. A more scholarly version of the New Testament was printed in Addis Ababa in 1955, followed by the Old Testament in 1961. The first official chronicles wholly in Amharic were those of Tewodros II (1855–68). A translation of John Bunyan's *Pilgrim's Progress* made in 1892 pointed the way to a new popular form—the allegorical novel, often partly in verse, with a religious bias, of which the first was *Libb wallad tarik* (1908; "Imaginative Story") by Afeworq Gabre-Eyesus. During the regency of Ras Tafari (1916–20; afterward Emperor Haile Selassie I), Hiruy Walde Selassie (died 1938) became the leading Amharic writer, especially notable for allegorical compositions such as *Wadaje lebbe* ("My Heart as My Friend").

With the restoration of Ethiopian independence after the Italian occupation of 1936–41, a great impetus was given to Amharic literature, with Emperor Haile Selassie encouraging authors to produce many types of books, especially on moral and patriotic themes. Writers of merit during this period were Makonnen Endalkachew (who produced allegorical novels and plays), Kebede Mikael (verse dramas, some history and biography), and Tekle Tsodeq Makuria (histories). (S.G.W.)

Ethiopian Orthodox Church, also called ETHIOPIAN CHURCH, independent Christian patriarchate in Ethiopia holding to Monophysite (*q.v.*) doctrine, that is, that Christ has only one nature. The church recognizes the honorary primacy of the Coptic patriarch of Alexandria. It is headquartered in Addis Ababa.

Ethiopia was Christianized in the 4th century AD by two brothers from Tyre—St. Frumentius, later consecrated the first Ethiopian bishop, and Aedesius; they won the confidence of King Ezana at Aksum (a powerful kingdom in northern Ethiopia) and were allowed to evangelize. Toward the end of the 5th century, nine monks from Syria, probably Monophysites, are said to have brought monasticism to Ethiopia and encouraged the translation of the Scriptures into the Ge'ez language. The Ethiopian Church followed the Coptic Church (in Egypt) when the latter continued to adhere to the Monophysite doctrine after this doctrine had been condemned by the bishops of Rome and Constantinople at the Council of Chalcedon in AD 451.

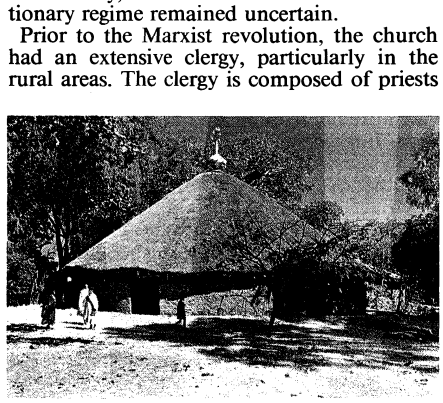
In the 7th century the conquests of the Muslim Arabs cut off the Ethiopian Church from contact with most of its Christian neighbours. The church absorbed various syncretic beliefs in the following centuries, but contact with the outside Christian world was maintained through the Ethiopian monastery in Jerusalem.

Since the 12th century the patriarch of Alexandria had appointed the Ethiopian archbishop, known as the *abuna* (Arabic: "our father"), who was always an Egyptian Coptic monk; this created a rivalry with the native *itshage* (abbot general) of the strong Ethiopian monastic community. Attempts to shake Egyptian Coptic control were made from time to time, but it was not until 1929 that a compromise was effected: an Egyptian monk was again appointed *abuna,* but four Ethiopian bishops were also consecrated as his auxiliaries. A native Ethiopian *abuna,* Basil, was finally appointed in 1950, and in 1959 an autonomous Ethiopian patriarchate was established.

The Amhara and Tigre peoples of the northern and central highlands have historically been the principal adherents of the Ethiopian Orthodox Church, and the church's religious forms and beliefs have been the dominant element in Amhara culture. Under the Amhara-dominated Ethiopian monarchy, the Ethiopian Orthodox Church was declared to be the state church of the country, and it was a bulwark of the regime of Emperor Haile Selassie. Upon the abolition of the monarchy and the institution of socialism in the country beginning in 1975, the Ethiopian Orthodox Church was disestablished, its patriarch was removed, and the church was divested of its extensive landholdings. The church was placed on a footing of equality with Islām and other religions in the country, and its future under the revolutionary regime remained uncertain.

Prior to the Marxist revolution, the church had an extensive clergy, particularly in the rural areas. The clergy is composed of priests and deacons, who conduct the religious services, and *debtera,* who, though not ordained, perform the music and dance associated with church services and also function as astrologers, scribes, wizards, and fortune-tellers, and learn church lore. Ethiopian Orthodox Christianity blends Christian conceptions of God, saints, and angels with non-Christian beliefs in benevolent and malevolent spirits and imps (minor devils). Considerable emphasis is placed on the Old Testament. Circumcision is almost universally practiced; the Saturday Sabbath (in addition to Sunday) is observed by some devout believers; the ark is an essential item in every church; and rigorous fasting is still practiced.

The priesthood of the Ethiopian Church, on the whole, is not learned, though there are theological seminaries in Addis Ababa and Harer. Monasticism is widespread, and individual monasteries often teach special subjects in theology or church music. Each community also has its own church school, which until 1900 was the sole source of Ethiopian education. The liturgy and scriptures are in Ge'ez, though both have been translated into Amharic, the national language. The church has about 18,500,000 adherents in Ethiopia in the late 20th century.



Debre Sunai, 14th century, Gorgora, Eth.
Alain Froissafdey—Atlas Photos

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Ethiopian region, one of the six major land areas of the world defined on the basis of its characteristic animal life. Part of the Megagaean realm, it encompasses Africa south of the Sahara, the southwestern tip of Arabia, and Madagascar. It has the world's largest concentration of antelopes, giraffes, gorillas, and rhinoceroses, as well as a rich variety of other animals. The vegetational division roughly corresponding to this region is the African subkingdom of the Palaeotropical kingdom (which excludes the Cape of Good Hope). Among the notable plants are acacias, grasses, and palms; giant types of euphorbias, heaths, groundsels, and lobelias are conspicuous.

Ethiopianism, religious movement among sub-Saharan Africans that embodied the earliest stirrings toward religious and political freedom in the modern colonial period. The movement was initiated in the 1880s when South African mission workers began forming independent all-African churches, such as the Tembu tribal church (1884) and the Church of Africa (1889). An ex-Wesleyan minister, Mangena Mokone, was the first to use the term when he founded the Ethiopian Church (1892). Among the main causes of the movement were the frustrations felt by Africans who were denied advancement in the hierarchy of the mission churches and racial discontent encouraged by the colour bar. Other contributing factors were the desire for a more African and relevant Christianity, for the restoration of tribal life, and for political and cultural autonomy expressed in the slogan "Africa for the Africans" and also in the word Ethiopianism.

The mystique of the term Ethiopianism derived from its occurrence in the Bible (where Ethiopia is also referred to as Kush or Cush) and was enhanced when the ancient independent Christian kingdom of Ethiopia defeated the Italians at Adowa in 1896. The word therefore represented Africa's dignity and place in the divine dispensation and provided a charter for free African churches and nations of the future.

Parallel developments occurred elsewhere and for similar reasons. In Nigeria the so-called African churches—the Native Baptist Church (1888), the formerly Anglican United Native African Church (1891) and its later divisions,

and the United African Methodist Church (1917) were important. Other Ethiopian-related movements were represented by the Cameroun Native Baptist Church (1887); the Native Baptist Church (1898), in Ghana; in Rhodesia, by a branch (1906) of the American Negro denomination, the African Methodist Episcopal Church and Nemapare's African Methodist Church (1947); and the Kenyan Church of Christ in Africa (1957), formerly Anglican.

Early Ethiopianism included tribalist, nationalist, and Pan-African dimensions, which were encouraged by association with independent U.S. black churches and radical leaders with "back to Africa" ideas and an Ethiopianist ideology. This ideology was explicit in the thought of such pioneers of African cultural, religious, and political independence as E.W. Blyden (1832–1912), and J.E. Casely-Hayford of Ghana (*e.g.,* his *Ethiopia Unbound,* 1911).

Ethiopian movements played some part in the Zulu rebellion of 1906 and especially in the Nyasaland rising of 1915 led by John Chilembwe, founder of the independent Providence Industrial Mission. From about 1920, political activities were channelled into secular political parties and trades unions, and the use of the term Ethiopian then narrowed to one section of African independent religious movements (*see* Zionist church). These Ethiopian-type churches originated by secession (and further sub-secessions) from a mission-connected church, which they resemble in beliefs, polity, and worship and from which they differ in certain cultural and ethnic practices.

By the early 1970s the term Ethiopianism was not in popular use outside southern Africa and, when employed for this form of religious movement elsewhere in Africa, is used by many but not all scholars as a historical or classificatory term.

Ethiopic alphabet, writing system used to write the Ge'ez literary and ecclesiastical language and the Amharic, Tigre, and Tigrinya languages of Ethiopia. Apparently derived from Sabaean, a South Semitic script, the Ethiopic script probably originated in the early 4th century AD; it is unclear whether Ethiopic resulted from a gradual evolution of the Sabaean script or whether it was invented deliberately by some individual who used the Sabaean script as a model. Current opinion is that the letters were derived gradually from Sabaean, while the vocalic (vowel) markings used with the letters were the work of a single individual. Inscriptions from the 4th century occur in the Ge'ez language both in Sabaean and in varieties of the Ethiopic script.

The Ethiopic alphabet consists of 26 letters, all representing consonants, which may be transformed into syllabic symbols by the attachment of the appropriate vocalic markers to the letters. The 26 letters are derived from 24 of the 28 letters in Sabaean, plus added letters to represent the *p* sound, which did not exist in the Sabaean language. The direction of writing, unlike that of Sabaean and the other Semitic languages, is from left to right; this is probably a result of Greek influence. *See also* Semitic alphabets, South.

Ethiopic language: *see* Ge'ez language.

Ethiopic languages, the Semitic languages of Ethiopia, including Ge'ez, the liturgical language of the Ethiopian Church; Amharic, the official language of modern Ethiopia; Tigré; Tigrinya, or Tigrai; Argobba; Hareri; and Gurage. Although some scholars formerly considered Ethiopic to be a separate branch of Semitic, these languages are now generally grouped together with the dialects of the South Arabic language as Southern Peripheral Semitic or South Arabic-Ethiopic. *See also* Ge'ez language; Amharic language.

ethnic group, a social group or category of the population that, in a larger society, is set apart and bound together by common ties of race, language, nationality, or culture.

A brief treatment of ethnic groups follows. For full treatment, *see* MACROPAEDIA: Social Differentiation.

For international data on ethnic groups by country, *see* BRITANNICA WORLD DATA in the current issue of the *Britannica Book of the Year.*

Ethnic diversity is one form of the social complexity found in most contemporary societies. Historically it is the legacy of conquests that brought diverse peoples under the rule of a dominant group; of rulers who in their own interests imported peoples for their labour or their technical and business skills; of industrialization, which intensified the age-old pattern of migration for economic reasons; of political and religious persecutions that drove people from their native lands.

Until quite recently ethnic diversity posed no great problems for empires. Its chief historic significance has been and remains its relationship to the nation-state, whose primary goal is political unity, which tends to be identified with social unity. In theory, the nation-state and ethnic diversity are diametrically opposed, and on many occasions nation-states have attempted to solve the problem of ethnic diversity by the elimination or expulsion of ethnic groups—notable examples being the Nazi policy against the Jews during World War II, the expulsion of the Moors and Jews from 15th-century Spain, or the expulsion of the Arabs and East Indians from several newly independent African countries.

More common solutions have been assimilation or acculturation, whether forced, induced, or voluntary. Forced assimilation was imposed in early modern times by the English conquerors, themselves an amalgam of Saxon and Norman elements, when they suppressed the native language and religion in the Celtic lands of Wales, Scotland, and Ireland. Similar methods were employed by their French contemporaries as they extended their conquests into the *langue d'oc* region of southern Europe. Through considerably less brutal methods, the Chinese ethnic groups in Thailand and Indonesia have been legally induced to adopt the dominant culture through a process called "directed acculturation."

A variant of this process has been the more or less voluntary assimilation achieved in the United States under the rubric of "Americanization." This is largely a result of the unusual opportunities for social and economic mobility in the United States and of the fact that for the European ethnic groups, in contrast to the racial minorities, residence in the United States was a matter of individual or familial choice, not conquest or slavery. But both public policy and public opinion also contributed to American assimilation.

Another way of dealing with ethnic diversity, one that holds more promise for the future, is the development of some form of pluralism, which usually rests on a combination of toleration, interdependence, and separatism. One of the most notable long-term solutions has been that of Switzerland, where the three major ethnic groups are concentrated in separate cantons, each enjoying a large measure of local control within a democratic federation. Another, less stable federal pluralism is found in Canada, where the French Catholic province of Quebec is increasingly assertive about its desire for complete independence and forced acculturation of its own ethnic minorities.

The political function of ethnicity is more important today than ever, as a result of the spread of doctrines of freedom, self-determination, and democracy throughout the world. In 19th-century Europe, these doctrines influenced various movements for the liberation of ethnic minorities from the old European empires and led to the partially successful attempts to establish nation-states along ethnic lines, as in the case of Poland and Italy. After World War II the rising tide of democratic aspirations among the colonial peoples of Asia and Africa led to the breakup of empires established by European conquerors, in areas of enormous ethnic complexity, without regard to ethnic considerations. The result has been a proliferation of national states and the eruption of a host of local conflicts with ethnic-related causes. If this condition of fragmentation and warfare is to be terminated peacefully within the nation-state system, it will have to be done in the form of local autonomy, federalism, or some other political institution not incompatible with self-determination.

Ethnikí Orgánosis Kipriakoú Agónos (Cypriot organization): *see* EOKA.

Ethnikón Apeleftherotikón Métopon-Ethnikós Laikós Apeleftherotikós Stratos (Greek guerrillas): *see* EAM-ELAS.

Ethnikón Arkhaiologikón Mouseíon (Athens): *see* National Archaeological Museum.

ethnobotany, systematic study of the botanical knowledge of a social group and its use of locally available plants in foods, medicines, clothing, or religious rituals. Rudimentary drugs derived from plants used in folk medicines have been found to be beneficial in the treatment of many illnesses, both physical and mental. The ethnobotany of prehistoric cultures is discovered through examination of ancient writings, pictures, pottery, and plant remains in jars or midden heaps (garbage dumps) excavated at archaeological sites. From this information, the agricultural practices and cultural development of a people can be determined. Ethnobotanists often live for periods of time in the society they are studying, to observe all phases of their lives, including mythology, religious practices, and language in order to determine the specific plants used and the methods involved in their preparation. Travellers' journals, the field notes of early botanists, and other writings serve as sources of information about agricultural methods and folk remedies of the past.

ethnography, descriptive study of a particular human society or the process of making such a study. Contemporary ethnography is based almost entirely on fieldwork and requires the complete immersion of the anthropologist in the culture and everyday life of the people who are the subject of his study.

There has been some confusion regarding the terms ethnography and ethnology. The latter, a term more widely used in Europe, encompasses the analytical and comparative study of cultures in general, which in U.S. usage is the academic field known as cultural anthropology (in British usage, social anthropology). Increasingly, however, the distinction between the two is coming to be seen as existing more in theory than in fact. Ethnography, by virtue of its intersubjective nature, is necessarily comparative. Given that the anthropologist in the field necessarily retains certain cultural biases, his observations and descriptions must, to a certain degree, be comparative. Thus the formulating of generalizations about culture and the drawing of comparisons inevitably become components of ethnography.

The description of other ways of life is an activity with roots in ancient times. Herodotus, the Greek traveller and historian of the 5th century BC, wrote of some 50 different peoples he encountered or heard of, remarking on their laws, social customs, religion, and appearance. Beginning with the age of exploration and continuing into the early 20th century, detailed accounts of non-European peoples were

rendered by European traders, missionaries, and, later, colonial administrators. The reliability of such accounts varies considerably, as the Europeans often misunderstood what they saw or had a vested interest in portraying their subjects less than objectively.

Modern anthropologists usually identify the establishment of ethnography as a professional field with the pioneering work of the Polish-born British anthropologist Bronisław Malinowski in the Trobriand Islands of Melanesia (*c.* 1915). Ethnographic fieldwork has since become a sort of rite of passage into the profession of cultural anthropology. Many ethnographers reside in the field for a year or more, learning the local language or dialect and, to the greatest extent possible, participating in everyday life while at the same time maintaining an observer's objective detachment. This method, called participant-observation, while necessary and useful for gaining a thorough understanding of a foreign culture, is in practice quite difficult. Just as the anthropologist brings to the situation certain inherent, if unconscious, cultural biases, so also is he influenced by the subject of his study. While there are cases of ethnographers who felt alienated or even repelled by the culture they entered, many—perhaps most—have come to identify closely with "their people," a factor that affects their objectivity. In addition to the technique of participant-observation, the contemporary ethnographer usually selects and cultivates close relationships with individuals, known as informants, who can provide specific information on ritual, kinship, or other significant aspects of cultural life. In this process also the anthropologist risks the danger of biased viewpoints, as those who most willingly act as informants frequently are individuals who are marginal to the group and who, for ulterior motives (*e.g.,* alienation from the group or a desire to be singled out as special by the foreigner), may provide other than objective explanations of cultural and social phenomena. A final hazard inherent in ethnographic fieldwork is the ever-present possibility of cultural change produced by or resulting from the ethnographer's presence in the group.

Contemporary ethnographies usually adhere to a community, rather than individual, focus and concentrate on the description of current circumstances rather than historical events. Traditionally, commonalities among members of the group have been emphasized, though recent ethnography has begun to reflect an interest in the importance of variation within cultural systems. Ethnographic studies are no longer restricted to small primitive societies but may also focus on such social units as urban ghettos. The tools of the ethnographer have changed radically since Malinowski's time. While detailed notes are still a mainstay of fieldwork, ethnographers have taken full advantage of technological developments such as motion pictures and tape recorders to augment their written accounts.

ethnolinguistics, that part of anthropological linguistics concerned with the study of the interrelation between a language and the cultural behaviour of those who speak it. Several controversial questions are involved in this field: Does language shape culture or vice versa? What influence does language have on perception and thought? How do language patterns relate to cultural patterns? These questions, which had been posed earlier by the German scholars Johann Gottfried von Herder and Wilhelm von Humboldt and their followers in the idealist-romanticist tradition, emerged again in the United States as a result of the discovery of the vastly different structure of American Indian languages, as delineated by the American anthropological linguists Edward Sapir and Benjamin L. Whorf. They noticed, for example, that Eskimo has many words for snow, whereas Aztec employs a single term for the concepts of snow, cold, and ice. The notion that the structure of a language conditions the way in which a speaker of that language thinks is known as the Whorfian hypothesis, and there is much controversy over its validity.

ethnomusicology, scientific study of music in any world culture or subculture in terms of its actual sounds and performance practices, in its relation to the specific culture, and in comparison with other cultures. The field was originally called comparative musicology in the 1880s by scholars concerned with the measurement of pitches, anthropological data, museum archiving, or the study of exotic music.

Jaap Kunst, a Dutch expert in Indonesian music, created the term ethnomusicology in the 1950s, and in 1956 an ethnomusicology society was founded, consisting of musicians and anthropologists interested in world music. In the spirit of the preceding definition, the field has continued to expand so that such topics as Japanese art music, New Guinean tribal music, African court music, English folk songs, jazz, and the social and financial structure of European-American popular music can be found in its studies.

ethology, the study of animal behaviour. Although many naturalists have studied aspects of animal behaviour through the centuries, the modern science of ethology is usually considered to have arisen as a discrete discipline with the work in the 1920s of biologists Nikolaas Tinbergen of The Netherlands and Konrad Lorenz of Austria. Ethology is a combination of laboratory and field science, with strong ties to certain other disciplines—*e.g.,* neuroanatomy, ecology, evolution. The ethologist is interested in the behavioral process rather than in a particular animal group and often studies one type of behaviour (*e.g.,* aggression) in a number of unrelated animals.

ethrog (Jewish ritual plant): *see* etrog.

ethyl acetoacetate, also called ACETOACETIC ESTER ($CH_3COCH_2COOC_2H_5$), an ester widely used as an intermediate in the synthesis of many varieties of organic chemical compounds. Industrially it is employed in the manufacture of synthetic drugs and dyes.

The ester is produced chiefly by self-condensation of ethyl acetate, brought about by sodium metal. It readily forms sodium derivatives that can be alkylated and dialkylated. The resulting esters may be converted to ketones or carboxylic acids. Ethyl acetoacetate readily enters into condensation reactions, and it has been employed in the synthesis of pyridines, quinolines, furans, pyrazoles, pyrroles, and purines.

The pure ester is a colourless, fragrant liquid, boiling with slight decomposition at 180.4° C under a pressure of 760 mm.

ethyl alcohol, also called ETHANOL, GRAIN ALCOHOL, or ALCOHOL, the most important member of a class of organic compounds that are given the general name alcohols; its molecular formula is C_2H_5OH. It is the intoxicating ingredient of many beverages produced by fermentation.

There are three main processes for the manufacture of ethanol: the fermentation of carbohydrates, the hydration of ethylene, and the reduction of acetaldehyde (commonly prepared by the hydration of acetylene). Before 1930 all ethanol was prepared by fermentation process, which still remains the most important method in most countries. In the United States, 70 to 90 percent of the total output of ethanol is now produced by hydration of ethylene, however. The fermentation process involves the transformation of carbohydrates to ethanol by growing yeast cells. The chief raw materials for this process are molasses and corn (maize). The hydration of ethylene is achieved by passing a mixture of ethylene and a large excess of steam.

Ethanol produced either by fermentation or by synthesis is obtained as a dilute aqueous solution and must be concentrated by fractional distillation. Direct distillation can yield at best the constant-boiling-point mixture containing 95.6 percent by weight of ethanol. Dehydration of the constant-boiling-point mixture yields anhydrous, or absolute, alcohol. Because ethyl alcohol for beverage purposes is subject to tax in all countries, ethyl alcohol for industrial purposes must be rendered unfit to drink (denatured) to escape taxation. Typical denaturants that are mixed with ethyl alcohol are methanol, camphor, benzene, and kerosene.

Pure ethanol is a colourless, flammable liquid (boiling point 78.5° C [173.3° F]) with an agreeable ethereal odour and a burning taste. Ethanol is toxic, affecting the central nervous system. Moderate amounts stimulate the mind and relax the muscles, but larger amounts impair coordination and judgment, finally producing coma and death. It is an addictive drug for some persons, leading to the disease alcoholism.

Ethyl alcohol is converted in the body first to acetaldehyde and then to carbon dioxide and water, at the rate of about 0.75 ounce per hour; this quantity corresponds to a dietary intake of about 200 calories.

ethyl chloride, also called CHLOROETHANE, colourless, flammable, mobile liquid of low boiling point, belonging to the family of organic halogen compounds and principally used in the manufacture of tetraethyl lead; it has uses as a solvent, a refrigerant, and an anesthetic and in the production of other organic chemicals. For use in medicine as an anesthetic, it is prepared from hydrogen chloride and ethyl alcohol; its chemical formula is C_2H_5Cl. Although a gas at room temperature, ethyl chloride is stored and sold under pressure in glass bottles fitted with trigger-controlled spray nozzles as a colourless, mobile liquid with a sweet, burning taste and a characteristic odour resembling that of ether.

It has been used as a local anesthetic for small incisions, tooth extractions, and needle punctures by spraying it on the surface of the skin or mucous membrane in a fine stream, with particular care that the end of the spray stream is focused upon the point to be frozen. Its rapid evaporation causes local freezing (−35° C can be obtained).

As a general anesthetic, it is usually given in doses of 3 to 5 cubic cm in a closed inhaler. Short administrations produce an anesthesia similar to that of nitrous oxide, with equally rapid loss of consciousness, quick recovery, and slight aftereffects. It is suitable only for short operations because it does not produce the desired muscular relaxation effected by chloroform for protracted operations. Ethyl chloride has been recommended for anesthesia of short duration because it is less dangerous than, and as satisfactory as, nitrous oxide. Its effect on the circulatory and respiratory systems is slightly stimulating, causing slight acceleration of the pulse rate and deeper and more rapid breathing.

Pure ethyl chloride boils at 12.3°C (54.1°F) and freezes at −138.7°C (−217.7°F); it dissolves freely in alcohol, ether, and other organic solvents but only slightly in water.

Preparation of tetraethyl lead is based on the reaction of ethyl chloride with an alloy of sodium and lead, forming sodium chloride as a by-product. Ethylcellulose, a component of lacquers and plastics, is made from ethyl chloride and cellulose.

ethyl ether, also called DIETHYL ETHER, well-known anesthetic, commonly called sim-

ply ether, an organic compound belonging to a large group of compounds called ethers; its molecular structure consists of two ethyl groups linked through an oxygen atom, as in $C_2H_5OC_2H_5$.

Ethyl ether is a colourless, volatile, highly flammable liquid (boiling point 34.5° C [94.1° F]) with a powerful, characteristic odour and a hot, sweetish taste. It is a widely used solvent for bromine, iodine, most fatty and resinous substances, volatile oils, pure rubber, and certain vegetable alkaloids.

Ethyl ether is manufactured by the distillation of ethyl alcohol with sulfuric acid. Pure ether (absolute ether), required for medical purposes and in the preparation of Grignard reagents, is prepared by washing the crude ether with a saturated aqueous solution of calcium chloride, then treating with sodium.

ethylene, the simplest member of the olefinic hydrocarbon series and one of the most important raw materials of the organic chemical industry; chemical formula, $CH_2=CH_2$. It occurs in both petroleum and natural gas, but the bulk of the industrial material is produced by heating of higher hydrocarbons. Numerous large-scale processes have been developed, using raw materials ranging from ethane to whole crude oil; in the U.S., ethane and ethane–propane mixtures are commonly used.

Ethylene undergoes polymerization (combination of small molecules to form large molecules) to polyethylene, a plastic material having many uses, particularly in packaging films, wire coatings, and squeeze bottles. The polymerization may be carried out at high pressures and temperatures or by the more recently introduced Ziegler process, which uses a catalyst. With sulfuric acid, ethylene forms a mixture of sulfates that can be hydrolyzed to ethyl alcohol; it combines with chlorine or bromine to yield the corresponding ethylene dihalides, useful solvents and gasoline additives. The reaction of ethylene and oxygen gives ethylene oxide, used in the manufacture of antifreeze, detergents, and other derivatives. Ethylene and benzene combine to form ethylbenzene, which is dehydrogenated to styrene for use in the production of plastics and synthetic rubber.

In botany, ethylene is a plant hormone that inhibits growth and promotes leaf fall. In fruit, however, ethylene is regarded as a ripening hormone. Involved in its action in fruit is some other factor that influences ethylene sensitivity of the tissues.

Pure ethylene is a colourless, flammable gas having a sweetish taste and odour; it freezes at −169.4° C (−272.9° F) and boils at −103.9° C (−155.0° F).

ethylene bromide, also called ETHYLENE DIBROMIDE, or 1,2-DIBROMOETHANE, a colourless, sweet-smelling, nonflammable, toxic liquid belonging to the family of organic halogen compounds, principally used in conjunction with lead-containing anti-knock agents as a component of gasoline.

Ethylene bromide is manufactured by the reaction of ethylene with bromine. It is denser than water and very slightly soluble in it but is soluble in many organic liquids. Its use in internal-combustion engines derives from its ability to convert nonvolatile lead compounds into lead bromide, which vaporizes at the high temperatures in the combustion chamber and is swept out in the exhaust gases.

ethylene chloride, also called ETHYLENE DICHLORIDE, or 1,2-DICHLOROETHANE, a colourless, toxic, volatile liquid belonging to the family of organic halogen compounds and having an odour resembling that of chloroform. It was formerly important as a solvent and as a raw material for making ethylene glycol and polysulfide rubbers, but now it is principally used for making vinyl chloride and as a component of tetraethyllead anti-knock formulations for gasoline.

Ethylene chloride is produced by the reaction of ethylene and chlorine; it is denser than water and practically insoluble in it. It is an effective solvent for fats, waxes, greases, and numerous other organic compounds, but its use as a solvent has been largely discontinued in favour of tetrachloroethylene.

Ethylene chloride is converted to vinyl chloride (an important raw material for plastics) by contact with a catalyst at about 500° C (900° F) or by reaction with dilute caustic alkali at about 150° C (300° F). The use of ethylene chloride with tetraethyllead depends upon its ability to prevent the accumulation of lead compounds within the engine by converting them into lead chloride, which is sufficiently volatile to be vaporized and carried away in the exhaust gases.

ethylene glycol, simplest member of the glycol family of organic compounds (*see* glycol).

ethyne (chemistry): *see* acetylene.

Étienne (French personal name): *see under* Stephen.

etiquette, system of rules and conventions that regulate social and professional behaviour. In any social unit there are accepted rules of behaviour upheld and enforced by legal codes; there are also norms of behaviour mandated by custom and enforced by group pressure. An offender faces no formal trial or sentence for breach of etiquette; the penalty lies in the disapproval of other members of the group. Regardless of its level of material culture, any highly stratified society will possess an etiquette in which every person knows the behaviour expected from him toward others and from others toward himself.

The royal court was the natural home of etiquette, because it centred upon a monarch around whom niceties of behaviour spread in expanding circles. The author of Beowulf, writing of Anglo-Saxon society, describes Wealtheow the queen, "mindful of etiquette," carrying the goblet first to the king, then to the courtiers, in a clearly defined order of precedence.

The Middle Ages was a golden period for Western etiquette, since the feudal system was strictly stratified. Jean Froissart in his *Chronicle* speaks of the Black Prince waiting at table upon the captive king John of France, after the Battle of Poitiers.

In Britain standards of conduct were greatly affected by the publication in the 16th century of certain Italian works known as courtesy books. Probably the most influential of these was Baldassare Castiglione's *Il libro del cortegiano* (1528; *The Book of Courtesy,* 1561). Further elaborations by English authorities—*e.g.,* Richard Brathwaite's *The English Gentleman* and *Description of a Good Wife*—arrived in colonial America with passengers of the "Mayflower." These British imports were soon followed by such indigenous products as the manual for parents entitled *School of Good Manners* (attributed to Eleazar Moody, 1715).

The late 18th and early 19th centuries showed another great flowering of etiquette in Britain when exquisites like Beau Nash and Beau Brummell imposed their whims as rules upon polite society; even the Prince Regent would not leave his waistcoat unbuttoned to a greater degree than Brummell prescribed. In the late 19th and early 20th centuries those in the upper strata of society regarded the observance of the most trivial demands of etiquette as at once a diversion and, for the women, an occupation. More and more elaborate rituals were designed to create a sense of exclusiveness for the initiates and to keep the unworthy, ignorant of them, at a distance.

By mid-20th century, however, concern about polite conduct was no longer confined to a social elite. Good manners for ordinary people in everyday situations were set forth in the United States by two prominent and influential arbiters of taste, Emily Post and Amy Vanderbilt. Drawing on her own wide experience in social, political, and diplomatic situations, no less a personage than Eleanor Roosevelt published her own typically practical *Book of Common Sense Etiquette* (1962).

World wars and increasing social equality resulted in a simpler code, appropriate to the faster tempo and less pampered conditions of life in society. Nonetheless, etiquette remains active on royal or ceremonial occasions and in the more formal aspects of professional or communal life. No rule of law or principle of morality decrees that a soup plate should be tilted away from, never toward, the diner, or that (in Great Britain) a surgeon shall be known as "Mr." while a physician is addressed as "Dr.," but etiquette ordains it. Since the framework and content of the communities of which society is formed are constantly changing, the habits of etiquette can and do change with them.

Etna (Mount), Latin AETNA, Sicilian MONGIBELLO, active volcano on the east coast of Sicily. The name comes from the Greek Aitne, from *aithō,* "I burn." Etna is the highest active volcano in Europe, its topmost elevation being more than 10,000 ft (3,200 m). Like other active volcanoes, its height varies: in 1865, for example, the volcanic summit was 170 ft higher than it was in the late 20th century. Etna covers an area of 600 sq mi (1,600 sq km); its base has a circumference of about 93 mi (150 km).

Its geological characteristics indicate that Etna has been active since the end of the Tertiary Period, somewhat more than 2,500,000 years ago. The volcano has had more than one active centre. A number of subsidiary cones have been formed on lateral fissures extending out from the centre and down the sides. The present structure of the mountain is the result of the activity of at least two main eruptive centres.

The Greeks created legends about the volcano, saying that it was the workshop of Hephaestus and the Cyclops or that underneath it the giant Typhon lay, making the Earth tremble when he turned. The ancient poet Hesiod spoke of Etna's eruptions, and the Greeks Pindar and Aeschylus referred to a famous eruption of 475 BC. From 1500 BC to AD 1669 there are records of 71 eruptions, of which 14 occurred before the Christian Era. The most violent historical eruption was in 1669 (March 11–July 15), when about 990,000,000 cu yd (830,000,000 cu m) of lava were thrown out. The eruption took place along a fissure that opened above the town of Nicolosi, widening into a chasm from which lava flowed and solid fragments, sand, and ashes were hurled. The latter formed a double cone more than 150 ft high, named Monti Rossi. The lava flow destroyed a dozen villages on the lower slope and submerged the western part of the town of Catania. Efforts to divert the lava stream away from Catania were made by workers who dug a trench above the village. Historically, this seems to have been the first attempt to divert a lava stream. Between 1669 and 1900, 26 more eruptions were reported. During the 20th century there have been eruptions in 1908, 1910, 1911, 1918, 1923, 1928, 1942, 1947, 1949, 1950, 1955, and 1971. Activity was almost continuous in the decade following 1971, and in 1983 an eruption that lasted four months prompted authorities to explode dynamite in an attempt to divert lava flows.

Among Etna's better known ancient eruptions was that of 396 BC, which kept the Carthaginian army from reaching Catania. An

eruption of 1381 sent a lava flow as far as the sea. The eruption of 1852 took many lives. That of 1928 cut off the railway that runs around the base of the mountain and buried the village of Mascali. That of 1971 threatened several villages with its lava flow and destroyed some orchards and vineyards.

The mountain has three ecological zones, one above the other, each exhibiting its own characteristic vegetation. The lowest zone, sloping gradually upward to perhaps 3,000 feet (915 m), is fertile and rich in vineyards, olive groves, citrus plantations, and orchards. Several densely populated settlements, notably the city of Catania, are found on the lower slopes, but they become less frequent as the height increases. Above, the mountain grows steeper and is covered with forests of chestnut, beech, oak, pine, and birch. At heights of more than 6,500 feet (1,980 m), the mountain is covered with ashes, sand, and fragments of lava and slag; there are a few scattered plants such as *Astragalus aetnensis* (local name: spino santo), which forms typical bushes almost 1 yard (about 0.9 m) high, while some alpine plants manage to survive even near the top. Algae have been found near the steam outlets at 9,800 feet (2,990 m).

Etna has been studied systematically since the middle of the 19th century, and three observatories have been set up on its slopes; they are located at Catania, Casa Etnea, and Cantoniera.

Etō Shimpei (b. March 18, 1834, Hizen province, Japan—d. April 13, 1874, Saga prefecture, Kyushu), statesman who played a leading role in the Meiji Restoration (the 1868 return of power to the emperor and overthrow of the Tokugawa shogunate).

Although Etō was not a native of Chōshū or of Satsuma, the two feudal fiefs that played the leading role in the Meiji Restoration, he was responsible for the support given the imperial forces by troops from his native domain of Saga. After the 1868 coup he became an important member of the new government and was partially responsible for the transfer of the imperial capital from Kyōto to Edo, renamed Tokyo. He then assisted in setting up a new civil administration and public-finance system and initiated the reform of the old judicial apparatus.

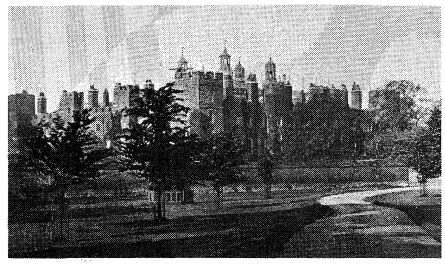
In 1873, however, Etō was a member of a faction within the Cabinet that advocated a military expedition against Korea. When this idea was rejected, Etō resigned from the Cabinet and helped form a political club, the Aikoku Kōtō ("Public Party of Patriots"). Angered by the domination of the government by samurai (hereditary warriors) from Chōshū and Satsuma, the group denounced the arbitrary manner in which official decisions were being made and called for the establishment of a parliamentary system of government.

When the administration ignored these suggestions, Etō returned to Saga, where he organized a revolt, the first serious challenge to the new government. Dissident samurai in other provinces failed to rally to Etō's cause, however, and he was captured and beheaded.

Etobicoke, city that, with the cities of North York, Scarborough, York, and Toronto, and the borough of East York, forms the Municipality of Metropolitan Toronto, southeastern Ontario, Canada. It has an area of 49 square miles (127 square km) and is bordered north by Vaughan Township, east by the cities of Toronto, North York, and York, west by the city of Mississauga, and south by Lake Ontario. It was established on Jan. 1, 1967, through amalgamation of the former Township of Etobicoke (incorporated 1851), the former towns of New Toronto and Mimico, and the former village of Long Branch. The name Etobicoke, an Indian word meaning "place where the alders grow," was originally given to Etobicoke Creek. There are about 1,600 acres (650 hectares) of parks. Industries are diversified and include a large tire and rubber plant. Pop. (1986) 302,973.

Eton, town ("parish"), Windsor and Maidenhead district, county of Berkshire, England, across the River Thames from Windsor. It is renowned for Eton College, the largest of the great public (independent) schools of England. Pop. (1981) 3,559.

Eton College, in Eton, Berkshire, largest public school (independent secondary school) in England and one of the highest in prestige. It was founded by Henry VI in 1440–41 for 70 highly qualified boys who received scholarships from a fund endowed by the king. Simultaneously, Henry founded King's College, Cambridge, to which scholars from Eton were to proceed. The connection is continued by the reservation of 24 scholarships there for Etonians.



Eton College from the playing fields
Popperfoto

Today, as throughout the school's history, Eton names 70 King's Scholars, or Collegers, each year based on the results of a competitive examination open to boys between 12 and 14 years of age. In recent years King's Scholars have been required to pay fees. The King's Scholars are boarded in special quarters in the college.

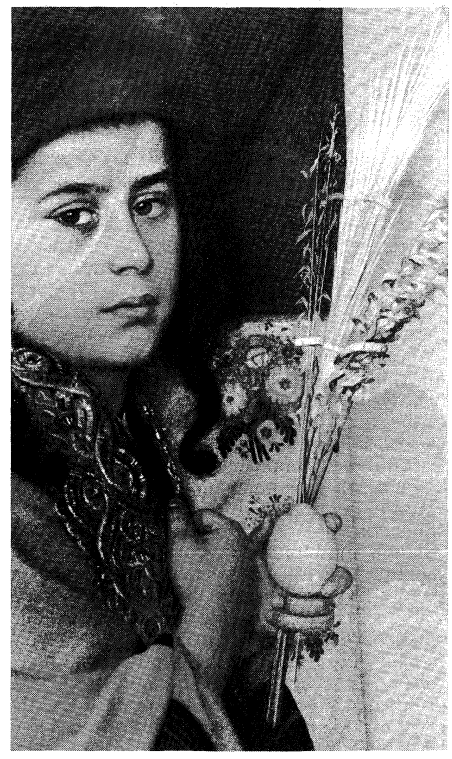
The other students, called Oppidans, now number more than 1,000 and are housed in boardinghouses under the care of house masters. The Oppidans generally come from England's wealthiest and most prestigious families, many of them aristocratic. Boys enter Eton at about age 13 and continue there until they are ready to enter university.

Etosha Pan, extremely flat salt pan, northern Namibia, covering an area of approximately 1,900 square miles (4,800 square km) at an elevation of about 3,400 feet (1,030 m). This enormous expanse of salt, glimmering green in the dry season, is the largest of its kind in Africa. It was first discovered by Europeans when Sir Francis Galton and Charles Andersson sighted it in 1851. There is geological evidence that the Kunene River of Angola formerly flowed southward into the pan, forming a huge lake. Later the river changed its course westward to the Atlantic Ocean, and the lake, deprived of its inflow, shrank in size, the water evaporating to form the salt pan, or salina. There are lone salt springs on the pan that have built up little hillocks of clay and salt used by animals as salt licks. The pan is fed by a number of nearly parallel channels (*oshanas*) extending north into Angola that in the monsoon season from December to March fill parts of Etosha ("Place of Mirages") and surrounding areas with rainwater pools.

The Etosha Pan is the centre of Etosha National Park, which has an area of 8,598 square miles (22,269 square km) and one of the largest accumulations of big-game species in the world, including lions, elephants, rhinoceros, elands, zebras, and springbok. Abundant bird life includes flamingos, vultures, hawks, eagles, ostriches, guinea fowl, and geese. The eastern portion of Etosha National Park has a tree-savanna type of vegetation (abounding in tambouti [a deciduous tree that is locally used for furniture and cabinetwork], wild fig, and date palms); moringa trees are typical of the more arid thorn-shrub savanna of the western part of the park. The German colonial fort of Namutoni (originally built in 1901, destroyed in 1904, and reconstructed between 1905 and 1907), at the eastern end of the pan, resembles a fort of the French Foreign Legion. It has been restored for use as a tourist camp for Etosha National Park. A severe drought and warfare between a guerrilla organization, the South West Africa People's Organization (SWAPO), and South African troops decimated a great deal of the national park's big-game population in the late 1970s and early 1980s.

etrog, also spelled ETHROG, or ESROG (Hebrew: "citron"), plural ETROGIM, ETHROGIM, ESROGIM, ETROGS, ETHROGS, or ESROGS, one of four species of plants used during the Jewish celebration of Sukkoth (Feast of Booths), a festival of gratitude to God for the bounty of the earth that is celebrated in autumn at the end of the harvest festival. For ritual purposes the etrog must be perfect in stem and body. It is generally placed in an ornate receptacle and was at one time widely used as a symbol of Judaism.

The other ritual plants used for Sukkoth are a palm branch, or lulab (*lulav*), myrtle (*hadas*), and willow (*'arava*). The etrog is held in the left hand during the service while the right hand holds the palm branch with myrtle and willow entwined. On the seventh day of Sukkoth the four species are carried seven times around the synagogue. During the singing of specified Psalms (Hallel), the etrog and lulab are waved upward and downward and toward the four points of the compass to indicate the omnipresence of God.



Etrog, lulab, myrtle, and willow held by a child; detail of "Sukkoth," painting by Isidor Kaufmann; in the Jewish Museum, New York
By courtesy of the Jewish Theological Seminary of America, New York; photograph, Art Resource—EB Inc.

Etruscan, member of an ancient people of Etruria, in Italy (between the Tiber and Arno rivers west and south of the Apennines), whose urban civilization reached its height in the 6th

century BC. Many features of Etruscan culture were adopted by the Romans, their successors to power in the peninsula. It is possible that the Etruscan aristocracy of historical times descended from a people who invaded Etruria from Asia Minor before 800 BC and established themselves over the native Iron Age inhabitants of the region. Their origin will not be conclusively proved, however, until scholars are able to translate the Etruscan language.

Whatever their origins, by the middle of the 7th century BC the chief Etruscan towns had been founded. Before they had reached the Arno River in the north and included all Tuscany in their dominion, the Etruscans embarked upon a series of conquests initially probably not coordinated but undertaken by individual cities. The pressing motive for expansion was that by the middle of this century the Greeks not only had obtained a grip on Corsica and expanded their hold on Sicily and southern Italy but also had settled on the Ligurian coast (northwestern Italy) and in southern France. Etruscan expansion to the south and east was confined at the line of the Tiber River by the strong Italic Umbrian people settled beyond it on the south and the Picenes on the east. To the northeast no such united power opposed their expansion, since the Apennine mountains in Aemilia (modern Emilia) and Tuscany were held by scattered Italic tribes. Through these the Etruscans were able, in the middle of the 6th century, to push into the Po Valley. As capital of this northward region they established the old Villanovan centre at Bologna (the Etruscan city of Felsina) and on the banks of the Reno founded Marzabotto. On the Adriatic coast to the east, Ravenna, Rimini (ancient Ariminum), and Spina traded with Istria (ancient Istra) and the Greek Dalmatian colonies. From the Po Valley contacts were made with the central European La Tène cultures. Etruscan conquests in the northeast extended to include what are now the modern cities of Piacenza, Modena, Parma, and Mantua. To the south they were drawn into Latium and Campania from the end of the 7th century, and in the 6th century they had a decisive impact on the history of Rome, where the Etruscan dynasty of the Tarquins is said to have ruled from 616 to 510/509 BC. It is possible that the Roman Tarquins were connected with a family called Tarchu, which is known from inscriptions.

Rome before the Etruscan advent was a small conglomeration of villages. It was under the new masters that, according to tradition, the first public works such as the walls of the Capitoline hill and the Cloaca Maxima were constructed. Considerable evidence of the Etruscan period in Rome's history has come to light in the region of the Capitol. That there were rich tombs in Rome itself cannot be doubted—tombs similar to those in the Latin town of Praeneste (modern Palestrina). Meanwhile, by the beginning of the 6th century the Etruscans had included Fiesole (ancient Faesulae) and Volterra (ancient Volaterrae) in their northern limits and at the same time began to push southward into Campania. Capua became the chief Etruscan foundation in this region and Nola a second; a necropolis has been found in the Salerno region and Etruscan objects in low levels at Herculaneum and Pompeii. The coastal region was still, however, in Greek hands. When the Etruscans attacked the Greek foundation of Cumae in 524 BC, their advance was finally checked by their defeat at the hands of Aristodemus of that city. The rivalry between Greek trade in the western Mediterranean and that carried on between the Etruscans and Carthage had already come to a head at the battle of Alalia in 535 BC, a battle which the Greeks claimed to have won but which so upset them that they determined to abandon Corsica to Etruscan influence.

In the last quarter of the 6th century, when Etruscan power was at its height from the Po to Salerno, small settlements of Etruscans might have been planted beyond these limits. At Spoleto (ancient Spoletium) in the north and Fossombrone in Liguria their power was not, however, to last long; Cumae felt the first of sharp waves of resistance that came from Greeks, Samnites, Romans, and Gauls. About 509 BC the Etruscans were chased from Rome as reflected in the story of the expulsion of Tarquinius Superbus, the intervention of Lars Porsena of Clusium, and the Latin victory over Aruns Porsena's son at Aricia. When Latium was lost, relations between Etruria and its Campanian possessions were broken with disastrous effect. A series of piecemeal feuds between Etruscan cities and Rome led to the incorporation of the former into the Roman sphere—first the nearby town of Veii in 396 BC, after which Capena, Sutri, and Nepet (modern Nepi) fell in turn, thus beginning the end of that first Etruscan attempt at the unification of Italy.

Nevertheless, the Etruscans had established a thriving commercial and agricultural civilization. Characteristic of their artistic achievements are the wall frescoes and realistic terracotta portraits that have been found in their tombs. Their religion stressed the horrors of the afterlife and employed elaborately organized cults and rituals, including the extensive practice of divination.

Etruscan alphabet, writing system of the Etruscans, a non-Indo-European people of Italy, derived from the Greek alphabet (probably the Chalcidian form) as early as the 8th century BC. It is known to modern scholars from over 10,000 inscriptions. Like the alphabets of the Near East and the early forms of the Greek alphabet, the Etruscan script was usually written from right to left but occasionally appears in *boustrophedon* style (*i.e.*, the direction of writing alternates with each line, right-to-left/left-to-right). The alphabet went through many changes in form and composition over the course of time; it achieved its final ("classical") form about 400 BC, with 20 letters—four vowels (*a,e,i,u*) and 16 consonants—a reduction from earlier forms with 26 letters (*c.* 700 BC) and 23 letters (5th century BC). The script continued to be written in its classical form until at least the 1st century AD, although the Etruscan language continued to be spoken for several centuries after that. The Etruscan writing system gave rise to the other Italic alphabets, including the Latin alphabet, which finally replaced it.

Etruscan language, language spoken by the ancient Etruscan people of Etruria (now Tuscany) in Italy, who were early neighbours of the Romans. Etruscan does not seem to be an Indo-European language, although it had apparently been greatly influenced by that language family.

A brief treatment of the Etruscan language follows. For full treatment, *see* MACROPAEDIA: Languages of the World.

The Etruscan language is known mainly from epigraphic records dating from the 7th century BC to the first years of the Christian Era. There are some 10,000 of these inscriptions, mainly brief and repetitious epitaphs or dedicatory formulas. However, there are some exceptions to the general brevity of the inscriptions, found in a variety of places. One example includes a text of 281 lines written on a roll of linen that had been cut into strips and used in Egypt as a wrapping for a mummy. Another example is a bronze model of a liver found at Piacenza and probably representing the Etruscan microcosm in a form used for instruction in divination; it has 45 words on it.

Despite many attempts at decipherment and some claims of success, the Etruscan records still defy translation. For some words, however, the grammatical category has been established, and for fewer still, a meaning has been assigned.

Although nothing at all is certain except that the Etruscans existed in Italy, all evidence favours a non-Italic but certainly Mediterranean origin of the people. Thus it is unlikely that their language is genetically related to one existing in an area remote from the Mediterranean. Proceeding from right to left, Etruscan writing has an alphabet probably derived from one of the Greek alphabets. Its recognizability is important because sound values can then be assigned with some degree of precision to each symbol. A marked tendency to make all vowels in a word similar or identical is characteristic: Greek *Klutaimēstra,* which if transliterated directly into Etruscan would be *cluthemestha,* actually occurs as *cluthumustha* and *clutmsta.* Greek *Alexandros* appears as *elchsntre.* The consonant cluster of *elchsntre,* while extreme, is not untypical of Etruscan spelling; words thus written have led some to suggest that a very economical spelling system may have been used that was far removed from the reality of pronunciation.

In earliest times Etruscan had no word division or punctuation. In about the 6th century BC a system of dots, consisting of four, three, or two dots inscribed vertically, was introduced to mark word boundaries and, in some instances, to indicate syllables and abbreviations.

Among the continuing mysteries of Etruscan are the reasons why they left no written records of their great civilization other than inscriptions and occasional texts and why the Romans, who knew the Etruscans intimately, transmitted little or nothing to posterity about Etruscan literature or language, which must certainly have been spoken, or at least preserved, by some families in Rome long after the period of Etruscan greatness had passed.

Etsch (river, Italy): *see* Adige River.

Etterbeek, municipality, Brabant province, central Belgium. First mentioned in the early 12th century, it is one of the 19 suburban communes that, with Brussels proper, make up Greater Brussels. Primarily industrial, it has chemical, clothing, metalwork, machinery, and furniture manufacturing. There is a large army barracks in the southeast section bordering the new campus of the Free University of Brussels. Pop. (1982) mun., 44,040.

Ettlingen, city, Baden-Württemberg *Land* (state), southwestern Germany, on the Alb River, just south of Karlsruhe. Originally a Roman settlement, it belonged to Weissenburg Abbey in the early Middle Ages, it was chartered in 1192, and it passed to Baden in 1219. It was severely damaged by fire in 1689, and most of its notable buildings date from the 18th century, including the former palace of the margraves (its chapel has frescoes by the brothers C.D. and E.Q. Asam) and the town hall. Of the numerous Roman relics, the best known is the "Neptune" sculpture in the wall of the town hall. Ettlingen has textile and paper industries. Pop. (1989 est.) 37,269.

Ettrick and Lauderdale, district, Borders region, southern Scotland, created by the local government reorganization of 1975 from the former county of Selkirk and parts of the former counties of Berwick, Roxburgh, and Midlothian. The district covers an area of 525 sq mi (1,360 sq km) of the Southern Uplands, drained by the rivers Tweed, Yarrow, and Ettrick Water flowing eastward to the North Sea, and the Lauder flowing southward to join the Tweed near Melrose. The highest land—heavily glaciated undulating plateau country reaching 2,000 ft (600 m)—lies in the west and southwest and is given over to sheep and cattle raising. Farther east the lower altitudes

and fertile glacial deposits in the valleys allow cultivation of barley, oats, and fodder crops.

The area was settled by Picts, Romans, and Anglo-Saxons before being annexed to Scotland in 1020 and later suffered from centuries of border warfare. The Selkirk area, especially, suffered from the Battle of Flodden in 1513, when the Scottish army was annihilated by the English. The market towns of Galashiels, the seat of the district authority, and Selkirk are noted for their traditional, but gradually declining, woollen knitwear and tweed industries, their recent establishment of electronics firms, and their close historic association with the novelist Sir Walter Scott, who once was a sheriff of Selkirk. Pop. (1982 est.) 33,291.

Etty, William (b. March 10, 1787, York, Yorkshire, Eng.—d. Nov. 13, 1849, York), one of the last of the English academic history painters.

In 1807 he was admitted to the Royal Academy schools, and by 1818 he had developed considerable talent as a portraitist. The grand but simply conceived "Combat" (1825; National Gallery of Scotland, Edinburgh) brought him his first great success. During the last decade of his life bad health, economic pressure, and unenlightened patronage forced him to concentrate on minor pieces that sold easily. His nude studies, which date from this period, are still admired.

étude (French: "study"), in music, originally a study or technical exercise, later a complete and musically intelligible composition exploring a particular technical problem in an esthetically satisfying manner. Although a number of didactic pieces date from earlier times, including vocal solfeggi and keyboard works (Domenico Scarlatti's *Esercizi per gravicembalo*), the étude came into its own only in the late 18th and early 19th centuries with collections published by the virtuoso pianist Muzio Clementi (especially his *Gradus ad Parnassum*, 1817), emulated by other pianist-composers, including Johann Baptist Cramer, Henri Bertini, and especially Karl Czerny. With the 27 piano études by Chopin, the étude became a composition of considerable musical interest apart from its merit as a technical study; Claude Debussy's *Douze Études* (1915; *Twelve Études*) is a notable later example.

The violin étude, less cultivated than the piano étude, is represented in a number of collections by Rodolphe Kreutzer, Pierre Baillot, Pierre Rode, Charles-Auguste de Bériot, and others, following the example of Niccolò Paganini, whose 24 *Capricci* for solo violin set the pace for 19th-century virtuosity at large.

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

etymology, the history of a word or word element, including its origins and derivation. Although the etymologizing of proper names appears in the Old Testament and Plato dealt with etymology in his dialogue *Cratylus*, lack of knowledge of other languages and of the historical developments that languages undergo prevented ancient writers from arriving at the proper etymologies of words.

Modern scientific etymological study is based on the methods and findings of historical and comparative linguistics, the basic principles of which were established by linguists during the 19th century. The general principles involved in present-day etymology are:

1. The earliest form of a word, or word element, must be ascertained, as well as all parallel and related forms.
2. Every sound of a given word, or word element, must be compared with the corresponding sound in the form (often called its etymon) from which it is derived.
3. Any deviation in the previously established phonetic correspondences for the language of which the word is a part must be plausibly and rationally explained.
4. Any shift in meaning that has occurred in the historical transmission of the word must also be explained.
5. Words that present non-native sounds, or combinations of sounds, that appear isolated in the language, or that show marked deviation from the usual phonetic correspondences, are probably borrowed rather than inherited, and the language of origin must be determined.

Etzel (Germanic epic character): *see* Atli, Lay of; Kriemhild; Nibelungenlied.

Etzel (Zionist terrorist organization): *see* Irgun Zvai Leumi.

EUB: *see* Evangelical United Brethren Church.

eubacteria, true bacteria, so called because they typify the earlier conception of bacteria as undifferentiated, single-celled organisms with a rigid wall. In earlier classifications the eubacteria constituted a large and diverse order, Eubacteriales, the validity of which is now in question. The current trend is to depart from a complete hierarchy for the classification of bacteria, discarding theoretical schemes in favour of more natural groupings.

The term survives, however, to distinguish the simpler bacteria, such as *Escherichia, Bacillus,* and *Staphylococcus,* from the so-called higher bacteria, such as *Mycobacterium, Streptomyces,* and *Spirillum,* which are larger and morphologically more complex.

Euboea, Modern Greek ÉVVOIA, island, the largest in Greece, after Crete. In the Aegean Sea, it forms with the island of Skyros to the northwest, the *nomós* (department) of Euboea, whose capital is Chalcis (*q.v.*). Recognized geographically as part of the Greek mainland, which it almost touches at Chalcis, it lies along the coasts of the *nomoi* of Attica, Boeotia, Phthiotis, and Magnesia. It is separated from the mainland by the Vórios Evvoïkós Kólpos and Nótios Evvoïkós Kólpos (North Gulf of Euboea and South Gulf of Euboea). It is about 110 mi (180 km) northwest–southeast, from 4 to 30 mi in breadth, and 1,412 sq mi (3,657 sq km) in area. The island is distinctly a prolongation of the Thessaly massif. Its principal ranges are separated by fertile lowlands.

The highest peaks in the north are Xirón Óros (*óros,* mountain; 3,251 ft [991 m]) and Teléthrion Óros (3,182 ft). From Teléthrion the range trends eastward to the coast. In the centre rises Dhírfis Óros (5,715 ft), while in the south Ókhi Óros reaches 4,587 ft. The east coast is rocky and harbourless; in ancient times the main traffic from the north Aegean to Athens used the inshore channels because of the hazards of Ákra (cape) Kafirévs on the southeast coast. Euboea has few streams, though south of Chalcis flows the Potamós (river) Lílas, the fertile plain of which in antiquity was a horse-breeding region bitterly contested by the rival cities of Chalcis and Eretria (Erétria).

The earliest inhabitants were the Abantes, who brought a Bronze Age culture from central Greece. In classical literature the island had a number of names, including Macris, Doliche, Abantis, and Hellopia, the last derived from the Hellopes, who occupied the north. The centre was occupied by the Ionians and the south by the Dryopes. The Ionians excelled at navigating the sea and traded in swords; Ionian Chalcis led the colonizing movement to Italy and Sicily, while Eretria, just south of Chalcis, *c.* 750–700 BC led a large-scale colonization of the Thracian peninsula, later known as Chalcidice. Eretrians were the first to colonize Corfu, but on the arrival of the Corinthians (*c.* 734 BC) they retired to the Albanian coast. The alphabet of Chalcis and the local country tribal name of Graecus were eventually adopted by the Romans and western Europe.

Euboea's prosperity was checked by several decades of war, beginning *c.* 700 BC, between Chalcis and Eretria. When the Euboeans lost their former trade advantages on the mainland, they were forced into an alliance with Boeotia and Sparta against Athens. In 506 Athenians captured Chalcis and settled the Lelantine Plain with their own citizens. In 490 the Persian king Darius I the Great subjugated Carystus (modern Káristos) in the south and destroyed Eretria. During the counteroffensive Euboea joined the Delian League and helped to win a great naval victory over the Persians (480). The island soon fell to Athenian imperialism, against which Euboea revolted in 446 and 411, the latter during the Peloponnesian War. A league of Euboean states formed during the second half of the 4th century BC had a long but interrupted existence. Under Roman domination Chalcis prospered. At the end of the 14th century AD, Venice won complete control of the island, but in 1470 they lost it to the Turks, who held it until it became a part of Greece in 1830.

The mountains of Euboea still have good pasture for sheep and cattle, and the name may be derived from *euboia,* "rich in cattle." Both forests and pastures, however, were devastated badly under the Turks by poor land-use practices. In antiquity the mountains yielded iron and copper, the basis of Chalcis' lucrative metalworking and export trade; now magnesite and nickel are exported. Lignite is mined at Kími and near Alivérion to fuel power stations. Káristos exports the green and white *cipollino* marble, which was much used for building in imperial Rome. The valleys produce grapes, olives, vegetables, fruit, and cereals. There is some industry, and the population is varied: the south, much like Nísos (island) Andros to the southeast, is occupied by Albanians, and a Vlach element lives in the hill country. Pop. (1981) island, 185,626; *nomós,* 188,410.

Euboea, Gulf of, Modern Greek EVVOÏKÓS KÓLPOS, arm of the Aegean Sea, between the island of Euboea (northeast) and the Greek mainland (southwest). Trending northwest–southeast, the gulf is divided by the narrow Porthmós Evrípou (Strait of Euripus), at the town of Chalcis (Khalkís). The northern part, Vórios Evvoïkós Kólpos, is about 50 mi (80 km) long and up to 15 mi wide, and the southern part, Nótios Evvoïkós Kólpos, is about 30 mi long, with a maximum width of 9 mi. The northern gulf's western shore is very irregular; several large inlets indent the base of the Kallídhromon mountain range. The eastern shore is more regular although also highly indented, as is the southern gulf's western margin.

Euboea was probably once connected to the geologically related mainland at its northern tip, and a land bridge certainly once existed across the Euripus, a submerged river valley the present water depth of which, at 20 to 27 ft (6 to 8 m), is navigable only by small vessels. The Euripus has been spanned since 411 BC, when the Chalcidians and Boeotians barred the channel with a dike and tower system. Chalcis has port facilities on both sides of the strait, as well as a shipyard on the mainland side at Avlis.

Eubulides OF MILETUS (b. Miletus, fl. 4th century BC), a member of the Megarian school of philosophy in Athens and renowned as an inventor of logical paradoxes, the most famous of which is "The Liar" ("Does a man who says that he is now lying, speak truly?"). He was a contemporary of Aristotle, whom he attacked, and tradition says that he was a teacher of Demosthenes.

Eubulus (fl. 4th century BC), Athenian statesman noted for his able financial administration.

Eubulus first became prominent in 355 and from then until 346 he was the most influential politician in Athens. As chief commissioner of the Theoric Fund, which provided free seats at public spectacles, he exercised control over Athenian finances, since commissioners of the fund were granted power in other departments of finance. His astute supervision of state expenditure restored the economic position of Athens without increasing the burden of taxation. Under his guidance the efficiency of the fleet was improved and docks and fortifications repaired. Because this financial policy was based on the assumption that Athens should not be involved in major wars, Eubulus maintained a pacific attitude toward Philip II of Macedonia but was bitterly opposed by the anti-Macedonian politician Demosthenes. Eubulus was largely responsible for the overtures to Philip that led to the Peace of Philocrates in 346; with this treaty his political ascendancy ended.

Eucalyptus, large genus of mostly very large trees, of the myrtle family (Myrtaceae), native to Australia, New Zealand, Tasmania, and nearby islands. More than 500 species have been described. In Australia the eucalypti are commonly known as gum trees or stringybark trees. Many species are cultivated widely throughout the temperate regions of the world as shade trees or in forestry plantations. Economically, eucalyptus trees constitute the most valuable group within the order Myrtales.

The leaves are leathery and hang obliquely or vertically. The flower petals cohere to form a cap when the flower expands. The fruit is surrounded by a woody, cup-shaped receptacle and contains numerous minute seeds. Possibly the largest fruits—from 5 to 6 centimetres (2 to 2.5 inches) in diameter—are borne by *E. macrocarpa,* also known as the mottlecah, or silverleaf, eucalyptus.

The eucalypti grow rapidly, and many species attain great height. *E. regnans,* the giant gum tree or mountain ash of Victoria and Tasmania, attains a height of about 90 metres (300 feet) and a circumference of 7.5 m.

The leaf glands of many species, especially *E. salicifolia* and *E. globulus,* contain a volatile, aromatic oil known as eucalyptus oil. Its chief use is medical, and it constitutes an active ingredient in expectorants and inhalants. *E. globulus, E. siderophloia,* and other species yield what is known as Botany Bay kino, an astringent dark-reddish resin, obtained in a semifluid state from incisions made in the tree trunk.

Eucalyptus wood is extensively used in Australia as fuel, and the timber is commonly used in buildings and fencing. Among the many species of timber-yielding eucalypti are *E. salicifolia, E. botryoides, E. diversicolor* (commonly called karri), *E. globulus, E. leucoxylon* (commonly called ironbark), *E. marginata* (commonly called jarrah), *E. obliqua, E. resinifera, E. siderophloia,* and others. The bark of many species is used in papermaking and tanning.

eucaryote, any cell or organism that possesses a clearly defined nucleus, a description that excludes bacteria and blue-green algae. The eucaryotic cell has a nuclear membrane, well-defined chromosomes (bodies containing the hereditary material), mitochondria (cellular energy exchangers), a Golgi apparatus (secretory device), an endoplasmic reticulum (a canal-like communication system within the cell), and lysosomes (digestive apparatus within many cell types). *Compare* procaryote.

Eucharist, also called HOLY COMMUNION, or LORD'S SUPPER, a Christian sacrament commemorating the action of Jesus at his Last Supper with his disciples, when he gave them bread saying, "This is my body," and wine saying, "This is my blood." The story of the institution of the Eucharist by Jesus on the night before his Crucifixion is reported in four books of the New Testament (Matt. 26:26–28; Mark 14:22–24; Luke 22:17–20; and I Cor. 11:23–25). The letters of Paul and the Acts of the Apostles make it clear that early Christianity believed that this institution included a mandate to continue the celebration as an anticipation in this life of the joys of the banquet that was to come in the Kingdom of God.

The Eucharist has formed a central rite of Christian worship. However, although the Eucharist is intended as a symbol of the unity of the church and as a means of fostering that unity, it has been a source of disunity and contention as well. All Christians would agree that it is a memorial action in which, by eating bread and drinking wine (or, for some Protestants, grape juice), the church recalls what Jesus Christ was, said, and did; they would also agree that participation in the Eucharist enhances and deepens the communion of believers not only with Christ but also with one another. The breaking of the bread and the pouring of the wine are recognized by every Christian denomination as the central symbols of the death of Jesus Christ on the Cross. Most Christian traditions teach that Jesus is present in the Eucharist in some special way, though they disagree about the mode, the locus, and the time of that presence. In short, there is more of a consensus among Christians about the meaning of the Eucharist than would appear from the confessional debates over the sacramental presence, the effects of the Eucharist, and the proper auspices under which it may be celebrated.

According to the eucharistic doctrine of Roman Catholicism, the elements of bread and wine are "transubstantiated" into the body and blood of Christ; *i.e.,* their whole substance is converted into the whole substance of the body and blood, although the outward appearances of the elements, their "accidents," remain. Such practices as the adoration and reservation of the Host follow from this doctrine that the whole Christ is really present in his body and blood in the forms of bread and wine. During the 19th and 20th centuries the Roman Catholic Liturgical Movement put new emphasis on the frequency of communion, on the participation of the entire congregation in the priestly service, and on the Real Presence of Christ in the church as the fundamental presupposition for the Real Presence in the Eucharist.

The eucharistic beliefs and practices of Eastern Orthodoxy have much in common with those of Roman Catholicism, differing principally in the area of piety and liturgy rather than doctrine. The major difference includes the use of leavened rather than of unleavened bread. While Roman Catholic theology maintains that the recitation of the words of institution constitutes the Eucharist as a sacrament, Eastern theology has taught that the invocation of the Holy Spirit upon the elements (Greek *epiklēsis*) is part of the essential form of the Eucharist.

Among other Western Christians, those that adhere most closely to the traditions of Catholic eucharistic doctrine and practice are the Anglicans and the Lutherans. Early Anglican theology vigorously opposed Roman Catholic teaching on the sacraments, but, from the beginning of and, especially, since the 19th century, Anglican liturgical practice has retained much of the Catholic tradition. In the 16th century, Lutheranism unequivocally affirmed the Real Presence of the body and blood of Christ "in, with, and under" the bread and wine and emphasized that the reason for the Eucharist is the remission of sins. In their liturgies both Anglicanism and Lutheranism worked within the framework of the mass, adopting certain elements and rejecting others; the liturgical movements in both traditions during the 19th and 20th centuries restored additional elements, even though the theological interpretation of the Lord's Supper continued to display great variety.

In Reformed Christianity, Huldrych Zwingli emphasized the memorial aspect of the Eucharist. John Calvin, however, taught a "real but spiritual presence" of the living Christ, but in the sacramental action rather than in the elements.

In other traditions within Protestantism the sacraments have become "ordinances," not channels of grace but expressions of faith and obedience of the Christian community. Among Baptists the practice of "close communion" has restricted the ordinance to those who are baptized properly; *i.e.,* as adults upon a profession of faith. The Society of Friends (Quakers) dropped the use of the Eucharist altogether in its reaction against formalism.

As a result of these variations in both doctrine and practice, the Eucharist has been a central issue in the discussions and deliberations of the ecumenical movement.

Euchre, card game that in the late 1800s was the most popular family card game in the United States, mainly as the partnership game for four.

The game is played with a 32-card deck, the cards ranking from ace down to 7, except that in the trump suit the jack, called the right bower, is the highest trump and the jack of the other suit of the same colour, called left bower, is the second highest trump. Five cards are dealt each player in a three–two or two–three sequence. The next card is turned face up as trump, which each player can accept or reject (starting with the player to the dealer's left). If any player accepts, the dealer can discard a card from his hand and take the turn-up. If all four reject trump, the turn-up card is placed at the bottom of the pack; then, starting to the left of the dealer, each player in turn can name another suit or pass. If all pass, the hands are thrown in.

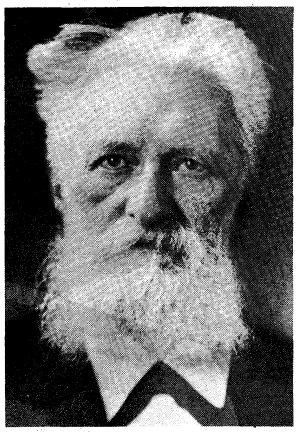
If trumps are made, the player to the dealer's left leads, but the trump maker can announce "I play alone"; his partner then lays his cards face down and the lead comes from maker's left. The usual rules of trick making apply, the highest card of the suit led winning or the highest trump. The object is to win three or more tricks (the point), preferably all five (the march). If the maker's side fails to win, it is euchred. The maker's side scores 1 for the point, 2 for the march, or 4 for the march if won by the lone player.

Cutthroat Euchre is for three players: the maker plays alone against the other two. Two-hand Euchre is the same as the regular game but is played with a 24-card deck, omitting the 7s and 8s. Railroad Euchre allows various local rules, such as using the joker as a 10th and highest trump. Auction Euchre is played with five, six, or seven hands and a three-card widow (four if a joker is used); highest bidder through one round names trumps and selects one or more partners, after seeing the widow, based on the size of his bid.

Eucken, Rudolf Christoph (b. Jan. 5, 1846, Aurich, East Friesland—d. Sept. 14, 1926, Jena, Ger.), German Idealist philosopher, winner of the Nobel Prize for Literature (1908), interpreter of Aristotle, and author of works in ethics and religion.

Eucken studied at the University of Göttingen under the German thinker R.H. Lotze, a teleological Idealist, and at Berlin under F.A. Trendelenburg, a German philosopher whose ethical concerns and historical treatment of

philosophy attracted him. Appointed professor of philosophy at the University of Basel, Switz., in 1871, Eucken left in 1874 to become professor of philosophy at the University of Jena, a position he held until 1920.



Eucken

By courtesy of the Universitatsbibliothek, Jena, E.Ger.

Distrusting abstract intellectualism and systematics, Eucken centred his philosophy upon actual human experience. He maintained that man is the meeting place of nature and spirit and that it is his duty and his privilege to overcome his nonspiritual nature by incessant active striving after the spiritual life. This pursuit, sometimes termed ethical activism, involves all of man's faculties but especially requires efforts of the will and intuition. A strident critic of naturalist philosophy, Eucken held that man's soul differentiated him from the rest of the natural world and that the soul could not be explained only by reference to natural processes. His criticisms are particularly evident in *Individual and Society* (1923) and *Der Sozialismus und seine Lebensgestaltung* (1920; *Socialism: An Analysis,* 1921). The second work attacked Socialism as a system that limits human freedom and denigrates spiritual and cultural aspects of life. Eucken's Nobel Prize diploma referred to the "warmth and strength in presentation with which in his numerous works he has vindicated and developed an idealist philosophy of life." His other works include *Der Sinn und Wert des Lebens* (1908; *The Meaning and Value of Life,* 1909) and *Können wir noch Christen sein?* (1911; *Can We Still Be Christians?,* 1914).

Eucla Basin, artesian depression in Western Australia and South Australia, Australia. Sloping southward to the Great Australian Bight and underlying the enormous limestone waste of the Nullarbor Plain, its area is about 69,500 sq mi (180,000 sq km). Composed of two aquifers, the upper layer of the basin is a sequence of limestones of Tertiary age and the deeper layer is composed of sandstone of Cretaceous age. Surface water percolating down through the limestone of the basin has created subterranean caves and tunnels. Small amounts of groundwater can be tapped through bores. The name Eucla is derived from the Aboriginal words *yer,* meaning "bright"; and *coloya,* meaning "fire."

Euclid, Greek EUCLEIDES (fl. *c.* 300 BC, Alexandria), the most prominent mathematician of Greco-Roman antiquity, best known for his treatise on geometry, the *Elements.*

Life and work. Of Euclid's life it is known only that he taught at and founded a school at Alexandria in the time of Ptolemy I Soter, who reigned from 323 to 285/283 BC. Medieval translators and editors often confused him with the philosopher Eucleides of Megara, a contemporary of Plato about a century before, and therefore called him Megarensis. Writing in the 5th century AD, the Greek philosopher Proclus told the story of Euclid's reply to Ptolemy, who asked whether there was any shorter way in geometry than that of the *Elements*—"There is no royal road to geometry." Another anecdote relates that a student, probably in Alexandria, after learning the very first proposition in geometry, wanted to know what he would get by learning these things, whereupon Euclid called his slave and said, "Give him threepence since he must needs make gain by what he learns."

Sources of the Elements. Euclid compiled his *Elements* from a number of works of earlier men. Among these are Hippocrates of Chios (5th century BC), not to be confused with the physician Hippocrates of Cos (flourished 400 BC). The latest compiler before Euclid was Theudius, whose textbook was used in the Academy and was probably the one used by Aristotle. The older elements were at once superseded by Euclid's and then forgotten. For his subject matter Euclid doubtless drew upon all his predecessors, but it is clear that the whole design of his work was his own. He evidently altered the arrangement of the books, redistributed propositions among them and invented new proofs if the new order made the earlier proofs inapplicable. Thus, while Book X was mainly the work of the Pythagorean Theaetetus (flourished 369 BC), the proofs of several theorems in this book had to be changed in order to adapt them to the new definition of proportion developed by Eudoxus (*q.v.*). According to Proclus, Euclid incorporated into his work many discoveries of Eudoxus and Theaetetus. Most probably Books V and XII are the work of Eudoxus, X and XIII of Theaetetus. Book V expounds the very influential theory of proportion that is applicable to commensurable and incommensurable magnitudes alike (those whose ratios can be expressed as the quotient of two integers and those that cannot). The main theorems of Book XII state that circles are to one another as the squares of their diameters and that spheres are to each other as the cubes of their diameters. These theorems are certainly the work of Eudoxus, who proved them with his "method of exhaustion," by which he continuously subdivided a known magnitude until it approached the properties of an unknown. Book X deals with irrationals of different classes. Apart from some new proofs and additions, the contents of Book X are the work of Theaetetus; so is most of Book XIII, in which are described the five regular solids, earlier identified by the Pythagoreans. Euclid seems to have incorporated a finished treatise of Theaetetus on the regular solids into his *Elements.* Book VII, dealing with the foundations of arithmetic, is a self-consistent treatise, written most probably before 400 BC.

Other books of the *Elements* are not on this high mathematical level. In Book VIII, the second of the three arithmetical books, are found cumbersome enunciations, needless repetitions, and even logical fallacies. Apparently Euclid's exposition excelled only in those parts in which he had excellent sources at his disposal.

Renditions of the Elements. In ancient times, Hero and Pappus of Alexandria and Proclus and Simplicius all wrote commentaries. Theon of Alexandria (4th century AD) brought out a new revision of the work with textual changes and some additions; his version was the basis of all published Greek texts and translations until, early in the 19th century, an important Greek manuscript containing an ante-Theonine text was discovered in the Vatican. Three Arabic translations were made in the middle ages: by al-Ḥajjāj ibn Yūsuf ibn Maṭar, first for the Abbāssid caliph Hārūn ar-Rashīd (ruled 786–809) and again for the caliph al-Ma'Mūn (ruled 813–833); by Ḥunayn ibn Isḥāq (ruled 808–873), in Baghdad, whose translation was revised by Thābit ibn Qurrah (died 901); and by Naṣīr ad-Dīn aṭ-Ṭūsī in the 13th century. Euclid was first made known in the West through Latin translations of these Arabic versions.

The first extant Latin translation of the *Elements* was made about 1120 by Adelard of Bath, who obtained a copy of an Arabic version in Spain, where he travelled while disguised as a Muslim student. Adelard also composed an abridged version and an edition with commentary. Hermann of Carinthia translated Books I–XII from the same Arabic version. Gerard of Cremona (*c.* 1114–87) translated the 15 books of Euclid from the Isḥāq-Thābit version. The first Latin translation to be printed was by Johannes Campanus in the 13th century.

The first direct translation from the Greek without the Arabic intermediary was made by Bartolomeo Zamberti and published in Vienna in Latin in 1505; and the *editio princeps* of the Greek text was published at Basel in 1533 by Simon Grynaeus. But the most important Latin translation of this period was by Federico Commandino in 1572. The first edition of the complete works of Euclid was the Oxford edition of 1703, in Greek and Latin, by David Gregory. All texts are now superseded by *Euclidis Opera Omnia* (8 vol. and a supplement, 1883–1916), edited by J.L. Heiberg and H. Menge. The first English translation of the *Elements* was by Sir Henry Billingsley. The many later editions include Robert Simson's in Latin and English, containing Books I–VI, XI, XII, and the *Data,* in 1756; and the definitive *The Thirteen Books of Euclid's Elements* by T.L. Heath, with introduction and commentary (3 vol., 1908; 2nd ed., 1926).

Other writings. Other extant works of Euclid include two belonging to elementary geometry: the *Data,* containing 94 propositions, which demonstrates that, if certain elements in a figure are given, then other things are given—*i.e.,* can be determined; and a book *On Divisions* (of figures), discovered in both Arabic and Latin versions and restored and edited in 1915, which deals with problems of dividing a given figure by one or more straight lines into parts that are equal or that have given ratios to one another or to other given areas. The *Optics* of Euclid is extant in Greek in two forms, one being Euclid's own treatise, and the other a critical revision by the Greek writer Theon. The *Catoptrica* ("Reflections") is not by Euclid but is, rather, a later compilation from ancient works on the subject. The *Phaenomena,* extant in Greek, is a treatise on the geometry of the sphere for use in astronomy and is similar in content to the work, by Autolycus of Pitane, *Moving Sphere. The Elements of Music* is attributed to Euclid by Proclus and Marinus, the latter being another Greek commentator. Included in this work are two treatises that probably are not by Euclid: the *Sectio canonis* ("Division of the Scale"), which gives the Pythagorean theory of music with some later additions; and the *Introductio harmonica* ("Introduction to Harmony"), written by Cleonides, a student of Aristoxenus, in which an identifiable tone separates notes on the scale.

Four lost works in geometry are described in Greek sources and attributed to Euclid. The purpose of the *Pseudaria* ("Fallacies"), it is said, was to distinguish and to warn beginning students against different types of fallacies to which they might be susceptible in geometrical reasoning. The *Porisms,* in three books, was an advanced work of which Pappus gave a summary account. Although the word means "corollaries," Euclid apparently meant a statement that was intermediate in significance between a problem and a theorem. The *Conics,* made up of four books on conic sections, cor-

responded in content to the first four books of Apollonius' *Conics,* although Apollonius added new theorems to his own treatment. Euclid called the conics by their previous designations, sections of a right-angled cone, an obtuse-angled cone, and an acute-angled cone, respectively; it was Apollonius who first gave them the names parabola, hyperbola, and ellipse, the descriptions of which he derived. Pappus also mentioned the *Surface-loci,* which is made up of two books that probably dealt with loci on surfaces, perhaps also loci which are surfaces, and with conic sections.

A fragment in Latin, *De levi et ponderoso,* which is included in Gregory's edition of Euclid, contains a statement of the principles of Aristotle's dynamics but is not by Euclid.

Assessment. Almost from the time of its writing and lasting almost to the present, the *Elements* has exerted a continuous and major influence on human affairs. It was the primary source of geometric reasoning, theorems, and methods at least until the advent of non-Euclidean geometry in the 19th century. It is sometimes said that, next to the Bible, the *Elements* may be the most translated, published, and studied of all the books produced in the Western world. Euclid may not have been a first-class mathematician. He certainly was, however, a first-class teacher of mathematics, inasmuch as his textbook has remained in use practically unchanged for more than 2,000 years. (B.L.v.d.W.)

MAJOR WORKS. Euclid's extant works are collected in *Euclidis Opera Omnia,* ed. by J.L. Heiberg and H. Menge, 8 vol. and a supplement (1916), containing the *Elements,* Books I–XIII (*The Thirteen Books of Euclid's Elements,* trans. by Sir Thomas Heath, 1952), *Data* (*Euclid's Data, restored to their true and genuine order,* trans. by R. Jack, 1756), *Euclid's Book on Divisions of Figures,* ed. by R.C. Archibald (1915), *The Optics,* and *The Phaenomena.*

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Euclid, city, Cuyahoga County, northeastern Ohio, U.S., on Lake Erie, just northeast of Cleveland. The original township area was settled in 1798 and was named for the famous Greek mathematician by the surveyors who arrived with Moses Cleaveland, an agent of the Connecticut Land Company. It remained largely rural, noted chiefly for grapes, until after 1940, when there was rapid industrial and urban growth. Manufactures now include airplane parts, castings, brass and copper goods, electrical and welding equipment, and road machinery. Inc. town, 1880; village, 1903; city, 1930. Pop. (1980) 59,999.

Euclidean and non-Euclidean geometry, the study of points, lines, angles, surfaces, and solids, on the basis of either the 10 axioms and postulates selected by the Greek mathematician Euclid (*c.* 300 BC) or a modification of Euclid's system (commonly the replacement of the so-called parallel postulate). The importance of Euclidean geometry lies not so much in the actual mathematics that it contains as in the systematic method used by Euclid to present and develop that mathematics. This method, called the axiomatic-deductive method, has served as the model for the development of many other mathematical subject areas for more than 2,000 years.

A brief treatment of Euclidean and non-Euclidean geometry follows. For full treatment, *see* MACROPAEDIA: Geometry: *Euclidean geometry; Non-Euclidean geometry.*

Euclid's *Elements,* a set of 13 books, dealt with various aspects of plane and solid geometrical figures, their measurement, and their relationships to one another. It appears that very little of the mathematics contained in the *Elements* was due to Euclid himself, although some of the results and proofs undoubtedly were.

From the 10 axioms and postulates, Euclid deduced 465 theorems, or propositions. This was the first demonstration of the power of the axiomatic method, in which the truth of the derived theorems follows from the truth of the axioms and postulates. Because the latter were offered as self-evidently true, Euclid's contemporaries felt that the derived theorems constituted accurate descriptions of the world and valid tools for studying it.

Euclid's parallel postulate attracted interest almost as soon as the *Elements* appeared, because it seemed less self-evident than the others. Its most popular equivalent is: Through a given point P not on a line l, there is only one line in the plane of P and l that does not meet l. Attempts to derive the parallel postulate from the others, thereby transforming it into a theorem, involved replacing it with its two alternatives—that there is no such line or that there are more than one—and then showing that contradictions ensue. Unexpectedly, no contradictions resulted from either substitution: the outcome was, instead, two new, non-Euclidean geometries that were found to be just as valid and consistent as Euclidean geometry.

It soon became clear that it is impossible to tell which, if any, of the three geometries is the most accurate as a mathematical representation of the real world. Thus, mathematicians were forced to abandon the cherished concept of a single correct geometry and to replace it with the concept of equally consistent and valid alternative geometries. They were also forced to realize that mathematical systems are not merely natural phenomena waiting to be discovered; instead, mathematicians create such systems by selecting consistent axioms and postulates and studying the theorems that can be derived from them. It is this change of viewpoint that may prove to be the most important and far-reaching part of Euclid's intellectual legacy.

Eucommiales, order of dicotyledonous flowering plants comprising the single species *Eucommia ulmoides* (family Eucommiaceae). It is an elmlike tree of central and eastern China notable as a woody plant of temperate regions with milky latex from which rubber can be produced.

Eucommia is cultivated as an ornamental in mild climates. The bark has medicinal properties and is valued especially by the Chinese. The species is also of interest for its isolated evolutionary position, as reflected in the status it holds as a single-species order. No other plant orders quite encompass the characteristics of this plant, although it has been referred to the witch hazel and nettle orders (Hamamelidales and Urticales) by different authorities.

In addition to latex and deciduous leaves, the order is characterized by the presence of simple, toothed leaves produced alternately along the stems. The flowers are solitary and unisexual and lack petals and sepals. The male flowers have 6 to 10 stamens (pollen-producing structures), and the female flowers have one ovary composed of two carpels, one of which aborts during development. The fruit thus contains only one seed and is a dry, winged structure.

Eucommia ulmoides
Kitty Kohout from Root Resources—EB Inc.

Eucratides (d. *c.* 159 BC), king of Bactria, who reigned from *c.* 170/165 to *c.* 159 BC. Little is known of his reign. According to some scholars, he was a cousin of the Seleucid king Antiochus IV and assumed power in Bactria as the result of an invasion. Others have assumed that he was a Bactrian official who raised a rebellion while King Demetrius was in India.

Upon Demetrius' return from India, he besieged Eucratides and 300 followers for several months, until Eucratides broke the siege and seized the kingdom. Once in control of Bactria, Eucratides went to India to claim possession of Demetrius' territory there. During his absence the Parthians apparently annexed two Bactrian provinces. Returning from India to reconquer them, Eucratides is said to have been murdered by his son.

eucrite, rock that contains 30 to 35 percent calcium-rich plagioclase feldspar (bytownite or anorthite), as well as augite, hypersthene, pigeonite, and olivine. The name was given (1863) by Gustav Rose to stony meteorites of this composition (*see* achondrite), but it has been extended to include similar intrusive igneous rocks (solidified from a liquid state). Occurrences of terrestrial origin are in Scotland, where it is common in the Tertiary ring complexes, and Carlingford, County Louth, Ire.

Eucryphia, genus of evergreen shrubs and trees, constituting the family Eucryphiaceae, with about five species native to Australia and Chile. They are planted in warm regions for their foliage and showy camellia-like cream-white flowers, which appear in late summer and fall.

E. cordifolia, which grows to a height of 12 m (40 feet), and *E. glutinosa,* up to 4.5 m (14.8 feet), have produced the hybrid *E.* ×*nymansensis,* hardier than *E. cordifolia* and tolerant of alkaline soils.

Eucumbene, Lake, one of Australia's largest reservoirs (capacity 3,890,000 acre-feet [4,798,000,000 cubic m], surface area 56 square miles [145 square km]), the major storage facility of the Snowy Mountains Hydroelectric Scheme, in the Eastern Highlands, New South Wales, 55 miles (88 km) southwest of Canberra. Its dam (completed 1958), fed by the Eucumbene, Upper Murrumbidgee,

and Snowy rivers, is 381 feet (116 m) high. The river waters are conveyed to and from the lake by means of pressure tunnels and are regulated to serve the Tumut and Murray electric power stations. The lake has also been developed as a tourist and fishing centre.

eudaemonism, also spelled EUDAIMONISM, or EUDEMONISM, in ethics, a self-realization theory that makes happiness or personal well-being the chief good for man. The Greek word *eudaimonia* means literally "the state of having a good indwelling spirit, a good genius"; and "happiness" is not at all an adequate translation of this word. Happiness, indeed, is usually thought of as a state of mind that results from or accompanies some actions. But Aristotle's answers to the question "What is *eudaimonia?*" (namely, that which is "activity in accordance with virtue"; or that which is "contemplation") show that for him *eudaimonia* was not a state of mind consequent on or accompanying certain activities but is a name for these activities themselves. "What is *eudaimonia?*" is then the same question as "What are the best activities of which man is capable?"

Later moralists, however—for instance, the 18th- and 19th-century British utilitarians Jeremy Bentham and John Stuart Mill—defined happiness as pleasure and the absence of pain. Others, still regarding happiness as a state of mind, have tried to distinguish it from pleasure on the grounds that it is mental, not bodily; enduring, not transitory; and rational, not emotional. But these distinctions are open to question. A temporal dimension was added to eudaemonism in ancient times by Solon, who said, "Call no man happy till he is dead," suggesting that happiness and its opposite pertain, in their broadest sense, to the full course of one's life. Contemporary moralists have tended to avoid the term.

Eudemus OF RHODES, also spelled EUDEMOS, or EUDEMIS (fl. before 300 BC), Greek philosopher who was a pupil of Aristotle and a friend of Theophrastus.

Together with Theophrastus, Eudemus completed Aristotle's philosophy from the point of view of systematization. The fragments of his *Physics* (preserved by Simplicius) and his *Analytics* paraphrase those of Aristotle—and it was Eudemus who edited or revised the *Eudemian Ethics,* which are preserved under Aristotle's name. His history of geometry, arithmetic, and astronomy completed the *Doctrines of the Natural Scientists* of Theophrastus. The fragments have been edited by F. Wehrli, *Eudemos von Rhodos* (1955), being part viii of *Die Schule des Aristoteles: Texte und Kommentar.*

Eudes (French personal name): *see under* Odo, except as below.

Eudes, German ODO (d. Jan. 1, 898), count of Paris and the first king of the West Franks (France) who was not of Merovingian or Carolingian blood.

The son of Robert the Strong, from whom all the Capetian kings of France descended, Eudes successfully defended Paris against the besieging Vikings (or Normans) in 885–886 and gained election as king as a result. Internal opposition meant that his position was never secure, however, and between 893 and 897 he had to fight off the challenge of the future Charles III the Simple, who was supported by Archbishop Fulk of Reims and Count Baldwin II of Flanders. Although Eudes won a victory over the Vikings at Montfaucon in 888, their depredations if anything became worse during his reign.

Eudes DE CHÂTILLON-SUR-MARNE, also called EUDES DE LAGERY, or DE LAGNY (pope): *see* Urban II.

Eudes, Saint John, French SAINT JEAN EUDES (b. Nov. 14, 1601, Ri, near Argentan, Fr.—d. Aug. 19, 1680, Caen; canonized 1925; feast day August 19), founder of the Congregation of Jesus and Mary (Eudist Fathers), an order dedicated to the training of candidates for the priesthood and to the preaching of missions.

Educated by the Jesuits at Caen, John Eudes entered the Bérullian Oratory and in 1625 was ordained priest. A noted orator, he devoted 50 years to the preaching of parish missions. For the education and rehabilitation of delinquent girls and women, he established the Order of Our Lady of Charity (1641). Two years later he founded the Eudist Fathers. His most revered achievement was promoting the devotions to the Sacred Hearts of Jesus and Mary; he established the first feasts in their honour, for which he wrote the mass and office.

Eudocia, original name ATHENAIS (d. Oct. 20, 460, Jerusalem), wife of the Eastern Roman emperor Theodosius II. She was a highly cultured woman who exercised great influence over her husband until her withdrawal from Constantinople.

Athenais, as she was then called, came from Athens, where her father, Leontius, was a pagan philosopher. Before she and Theodosius were married (in June 421), Athenais was baptized a Christian and changed her name to Eudocia. A year later she gave birth to a daughter, Licinia Eudoxia, who married (437) the Western emperor Valentinian III (reigned 425–455). In 438 Eudocia went on a year's pilgrimage to Jerusalem. After a quarrel with Theodosius' influential sister Pulcheria, she returned to Jerusalem in 443 and remained there for the rest of her life, directing the rebuilding of that city's fortifications and the construction of several splendid churches.

Eudocia was sympathetic to Monophysitism—a heresy that maintained that Christ's human nature is absorbed in his divine nature—but she died an orthodox Christian. In addition to religious poetry she wrote a panegyric on the Roman victory over the Persians (422).

Eudocia Macrembolitissa (b. 1021, Constantinople, Byzantine Empire [now Istanbul, Tur.]—d. 1096, Constantinople), Byzantine empress and, in 1067 and 1071, regent, who has been called the wisest woman of her time.

The daughter of John Macrembolites and niece of Michael Cerularius, the patriarch of Constantinople, Eudocia was the wife of the emperor Constantine X Ducas. After his death in May 1067, she became regent for her three sons—Michael, Andronicus, and Constantine—ruling wisely and moderately and personally taking charge of the education of the heir apparent, Michael (the future Michael VII Ducas).

The threat of the Seljuq Turks, however, necessitated a strong military government, and Eudocia was persuaded to marry Romanus Diogenes, a Cappadocian general, who became the emperor Romanus IV Diogenes in 1068. After his disastrous defeat and capture by the Turks at Manzikert, Armenia, in August 1071, Eudocia and Michael ruled jointly. When Romanus, who had been ransomed from the Turks, attempted to reassert his claim to the throne, he was deposed. Eudocia was soon succeeded by Michael and subsequently entered a convent.

Eudoxia (d. Oct. 6, 404), wife of, and a powerful influence over, the Eastern Roman emperor Arcadius (reigned 383–408).

Her father was a Frankish chieftain and one-term Roman consul (385) named Bauto. The marriage (April 27, 395) of Arcadius to Eudoxia was arranged by Arcadius' corrupt minister, the eunuch Eutropius, who had supported the match in order to undercut the position of a political rival. But Eudoxia came to resent being dominated by Eutropius, and in 399 she helped bring about his downfall. The period of Eudoxia's most decisive influence over her ineffectual husband dates from her designation as augusta on Jan. 9, 400.

Although an earnest Christian, she quarreled bitterly with John Chrysostom, patriarch of Constantinople, who attacked her and the frivolity of her court in outspoken terms. In 404 she expelled him from his see and sent him into exile. Shortly afterward Eudoxia died from a miscarriage. But she had borne Arcadius four daughters and a son, who became the emperor Theodosius II (reigned 408–450). One of the daughters, Pulcheria, was regent for Theodosius II for several years.

Eudoxia, Russian in full YEVDOKIYA FYODOROVNA LOPUKHINA (b. Aug. 9 [July 30, Old Style], 1669, Moscow, Russia—d. Sept. 7 [Aug. 27], 1731, Moscow), tsarina and first wife of Peter I the Great of Russia.

In 1689 she was given in marriage to Peter, a bridegroom of only 17. Endowed with beauty but lacking intelligence and ambition, she had little in common with the young tsar, whose chief interest was the mechanics of war.

In 1698 Peter sent her to a monastery. There she took vows (1699) but left after six months and resumed life as a laywoman. Following the trial of her son, Tsarevich Alexis, for treason (1718), she was kept in confinement at a fortress east of St. Petersburg on Lake Ladoga. Upon the accession (1727) of her grandson Peter II, she was released and later installed at the Voznesensky Convent in Moscow and provided with a generous allowance. After the death of Peter II (1730), she made a feeble, unsuccessful attempt to succeed him.

Eudoxus OF CNIDUS (b. *c.* 400, Cnidus, Asia Minor [now in Turkey]—d. *c.* 350 BC, Cnidus), ancient Greek mathematician and astronomer who substantially advanced number theory and gave the first systematic explanation of the motions of the Sun, Moon, and planets. He introduced geometry into the science of astronomy and began the necessary interaction between observation and theory that has characterized its development ever since. His contributions are known through ample Greek sources, including commentaries in Byzantine codices, even though none of his writings has survived.

Life. Eudoxus, son of Aeschines, learned mathematics and medicine at a school that rivaled for a time that of Hippocrates of Cos. Impressed by his ability, a well-to-do physician paid his way to Athens so that he could study at Plato's Academy, which had been established in 387. He also spent 16 months in Egypt during the reign of Nectanebo I (380–363). At Heliopolis, now a Cairo suburb, Eudoxus learned the priestly wisdom, which included astronomy; there he wrote the *Oktaëtēris,* his first major work, concerning a calendar based on an eight-year cycle, perhaps from a study of Venus. Earning his living as a teacher, he then traveled in the region of the Sea of Marmara before returning to Athens, where he became respected throughout Greece as a legislator. The few facts concerning his life are derived largely from the writings of Diogenes Laërtius in the 3rd century AD.

Theory of proportion. It is generally agreed that Euclid drew heavily on Eudoxus in writing the *Elements,* particularly Books V and XII and sections of Books VI, X, and XIII. Eudoxus' two major contributions to mathematics are the theory of proportion, found in Book V, and the method of exhaustion, in Book XII. The philosopher Proclus attributed the first to him, and Archimedes credited him with the second. It is also possible that Euclid's axiomatic method was first developed by Eudoxus.

Around the 5th and 4th centuries BC, the Pythagoreans had observed relationships between certain geometrically measurable quan-

tities, such as that between the hypotenuse and legs of a right triangle (*i.e.*, the square of the hypotenuse is equal to the sum of the squares of the other two sides). But following this development, they also discovered that the lengths of certain geometric figures (*e.g.*, the diagonal of a square with sides equal to one) could be expressed only as an irrational number (*i.e.*, a nonterminating decimal, such as 1.414213 . . . or $\sqrt{2}$). The discovery of irrational numbers about 400 BC meant that Pythagorean geometry, which dealt initially with commensurable quantities only, was inadequate; it had no means for dealing with irrational numbers.

Eudoxus' theory of proportion is treated extensively in Euclid's *Elements,* Book V, in which the definition of equal ratios (No. 5) is the principal source of the modern view of irrational numbers. With this theory, which was a major contribution to number theory, mathematics for the first time could take into account incommensurable quantities (*e.g.*, those whose ratio is not the quotient of two integers, such as the diameter and circumference of a circle), as well as such well-known commensurables as two sides of certain triangles. Thus, following the early Greek solution to the problem of finding areas and volumes bounded by straight lines that were represented by rational numbers, the theory of proportion allowed Eudoxus to deal, by means of rational approximations, with measurements that involved irrational numbers. He demonstrated that irrational numbers could be defined by means of approximations of rational numbers.

Method of exhaustion. More difficult, however, was the problem of calculating areas and volumes bounded by curves. Eudoxus' solution was the method of exhaustion—a modern term, not used by the ancient Greeks. By successfully including in this method not only the irrational but also the concept of the infinitesimally small quantity, he showed how to subdivide continuously a known magnitude (*e.g.*, the length of a straight line) until it closely approached that of an unknown, such as the properties of a curve. According to Archimedes, Eudoxus used this method to prove that the volumes of pyramids and cones are one-third the volumes of prisms and cylinders, respectively, with the same bases and heights—although Democritus probably had already discovered that this was so. Eudoxus also demonstrated that the areas of circles are proportional to the squares of their diameters. His technique was something like, but far more rigorous than, inscribing polygons with increasing numbers of sides within a circle in order to find its area. Because it could be used to compute areas and volumes bounded by curves, the method of exhaustion, which is fully elaborated in Book XII of Euclid's *Elements,* was a forerunner of integral calculus.

Although the geometric method of calculating the distance of the Sun and Moon from the Earth is usually attributed to Aristarchus of Samos (3rd century BC), there is a possibility that it may have been invented by Eudoxus. He also proposed a solution for another problem in astronomy—how to explain mathematically the observed motions of the Sun, Moon, and five planets. In order from the stationary Earth, these seven heavenly bodies were the Moon, Mercury, Venus, the Sun, Mars, Jupiter, and Saturn. Although Eudoxus' own account of his solution by means of concentric spheres (an idea that may have originated with Parmenides of Elea around 500 BC) has not survived, the 19th-century Italian astronomer Giovanni Schiaparelli described its details from an analysis of brief references in Aristotle's *Metaphysics* and from a substantial discussion in the commentary on Aristotle's *De caelo* (Book II), written in the 6th century AD by the Greek philosopher Simplicius.

Astronomy. Because the stars did not appear to have independent motion, the ancients perceived them to revolve around the Earth as a unit, forming a fixed backdrop against which the complicated and irregular motions of the planets were observed and plotted. To explain the motions Eudoxus constructed a model of 27 spheres. On the outer sphere he placed all the fixed stars, to account for their diurnal (daily) east-to-west motion. He devised a set of interconnected spheres for each of the other heavenly bodies—three each for the Sun and Moon and four each for the five planets. Each planet rode on the equator of its inner sphere except for the Moon, which rode on the middle; each sphere had its own appropriate axial inclination and rotational velocity. The outermost sphere accounted for the diurnal east-to-west motion.

The Moon's inner sphere was set at an angle to the ecliptic (the apparent path of the Sun through the constellations) and rotated east to west once each lunar (nodical) month (now known to be 27.2122 days). The middle sphere that carried the Moon moved west to east along the ecliptic to account for the Moon's phases. The Sun's inner sphere, moving west to east, was inclined (erroneously) to the ecliptic to account for the inequality of the seasons, and its middle sphere moved west to east along the ecliptic once each sidereal year (a round trip to the same place in the constellations).

To represent the retrograde motions of the five planets, Eudoxus depended on the combined rotatory motions of the two inner spheres of each. The resulting motion described an elongated figure-eight, which he called a hippopede. One of the few noncircular curves in antiquity, it represented the planet's "wandering" motion in latitude and longitude. As the planet, attached to the innermost sphere, oscillated along Eudoxus' hippopede during retrogressions, the hippopede itself revolved daily on the outermost sphere, while proceeding bodily once each sidereal year around the ecliptic by means of the next inner sphere (from the outside).

By devising combinations of spheres, Eudoxus accounted for the apparently irregular motions of the celestial bodies in the solar system, thus maintaining the Greek vision of circular perfection, the ancient symbol of wholeness. His system was an admirable attempt to "save the phenomena," the vivid Greek expression, in that it closely represented the observed motions of Mercury, Jupiter, Saturn, the Sun, and the Moon. But it was unsatisfactory for Venus and failed completely for Mars; nor could it account for variations in brightness, orbital period, apparent size of the Moon, or synodic period.

After his death in about 350 BC, Eudoxus' fundamental contributions to geometry and number theory led to further, lasting developments in Greek mathematics, as exemplified by the work of Archimedes. Eudoxus introduced into astronomy the view that uniform circular motion would account for the irregular motions of all the celestial bodies—the view that, with the epicyclic refinements of Ptolemy, prevailed until the time of the 17th-century astronomer Johannes Kepler. And his perception of circular regularity persists in modern mathematics in the periodic character of the infinite series. (R.P.A.)

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Eudoxus OF CYZICUS (b. Cyzicus, Phrygia; fl. 2nd century BC), Greek navigator and explorer who made the first known attempt to circumnavigate Africa from western Europe. Following two successful voyages to India from the Red Sea for the king of Egypt, Ptolemy Euergetes II, he went to Gades, present-day Cádiz, Spain, where he outfitted three ships for his planned circumnavigation. On the first attempt he was driven aground south of Morocco. He sailed again down the west coast of Africa but the entire expedition was lost. No further attempt was made to round southern Africa until the late 15th century.

Euemeros (Greek mythographer): *see* Euhemerus.

Eufaula, city, Barbour County, southeastern Alabama, U.S., on the Chattahoochee River (there dammed to form the Walter F. George Reservoir [or Lake Eufaula], 48,600 ac [19,700 ha]), at the Georgia state line. Founded (*c.* 1820) on an Eufaula Indian village site, it became a shipping point for cotton. The arrival (late 1850s) of the Central and Georgia Railroad led to industrial development. Agriculture, light manufacturing, paper milling, and bauxite mining form its economic base. A bridge over the reservoir connects with Georgetown, Ga. Lakepoint Resort State Park is at the reservoir's northern end. Inc. 1857. Pop. (1980) 12,097.

Eufaula, city, seat (1907) of McIntosh County, east central Oklahoma, U.S., near the confluence of the Canadian and North Canadian rivers, southwest of Muskogee. It originated as an Indian settlement and trading post and was named for a Creek town on the Chattahoochee River in Alabama called Yufala, meaning "they split here and went to other places." It developed as a ranching centre after the arrival of the Missouri-Kansas-Texas Railroad in 1872. The Eufaula Boarding School for Indian Girls, successor to the Asbury Mission School (established in 1849 by the Methodist Episcopal Church under contract to the Creek Indian Council), remains active as a government institution. The state's oldest newspaper, the *Indian Journal* (founded [1876] as a tribal organ in Muskogee) is published in Eufaula. The completion of the Eufaula Dam (1964) on the Canadian River, impounding one of the world's largest man-made lakes, covering 102,500 ac (41,500 ha), and the creation of Fountainhead State Park (north) and Arrowhead State Park (south) have made the city the focus of a recreation area. Pop. (1980) 3,159.

Eugene, city, seat (1853) of Lane County, western Oregon, U.S., on the Willamette River, adjoining Springfield to the east. Settled by Eugene Skinner in 1846, it was laid out in 1852, named Eugene City in 1853, and incorporated in 1862. The arrival of the Oregon and California (now Southern Pacific) Railroad in 1870 stimulated growth as an agricultural and lumber centre. The University of Oregon was founded there in 1872, followed by Northwest Christian College in 1895 and Lane Community College (1965). An art museum on the University of Oregon campus specializes in Oriental and Pacific Northwest collections.

A lumber–plywood economy, which also relies on the city's educational institutions, prevails and is augmented by food processing and light manufacturing. Eugene is a tourist centre for the MacKenzie River recreational area and Willamette National Forest, headquartered in the city. Pop. (1980) city, 105,624; metropolitan area (SMSA), 275,226.

Eugene OF SAVOY, French in full FRANÇOIS-EUGÈNE, PRINCE DE SAVOIE-CARIGNAN, German FRANZ EUGEN, PRINZ VON SAVOYEN-CARIGNAN (b. Oct. 18, 1663, Paris—d. April 24, 1736, Vienna), field marshal and statesman of the Carignan line of the House of Savoy, who, in the service of the Austrian Holy Roman emperor, made his name as one of the greatest soldiers of his generation. He fought notably against the Turks in central Europe and the Balkans (1683–88, 1697, 1715–18) and against France in the War of the Grand Alliance (1689–97) and in the War of the Spanish Succession (1701–14). He was the teacher of Frederick the Great and the only one among the seven great strategists of all time whose campaigns Napoleon considered worthy of study by posterity.

Life. Eugene was the youngest son of the Comte de Soissons, of the House of Savoy-Carignan, and of Olympia Mancini, a niece of Cardinal Mazarin. His paternal ancestors were the dukes of Savoy, who later became kings of Sardinia, Sicily, and eventually of all Italy, while on his mother's side the family included not only Roman patricians but also hatters, valets, and humble artisans. A rumour once had it that Eugene was actually the son of Louis XIV, the Sun King, who, although he always denied it, was said to have had an affair as a young man with Olympia Mancini. Louis, in any event, was ashamed of this unprepossessing supposed offspring of his. So severely did he restrain Eugene's ambitions that the latter, after spending some 20 inglorious years in Paris and Versailles, left France altogether and offered his sword to the emperor Leopold I, who was busy fighting the Turks.

In his first battle, at the relief of Vienna from siege by the Turks in 1683, Eugene so distinguished himself that the Emperor gave him a regiment of dragoons to command the following year. Nothing could now retard this young genius on his way to world fame. It was more than just an outstanding strategic ability that made him victorious; it was also a contagious élan, which enabled him time and again to lead his men to triumph on the field of battle. With equal impetuosity he climbed the senior military ranks, becoming an imperial field marshal at the age of 29. He fought seven battles of major historical significance. Through the victories of Zenta, Peterwardein, and Belgrade, he once and for all secured Hungary from the Turks; together with the Duke of Marlborough, his great friend, he won Bavaria and all of Germany at Blenheim; at Turin he gained northern Italy; at Oudenaarde and Malplaquet, the Netherlands. He lost only Spain, and that because of the political ineptitude of the emperor Charles VI.

Eugene's battles were among the bloodiest encounters of that sanguinary period, his marches among the most exhausting, and his decisions in difficult situations among the most daring and successful known in the history of war. And yet there was something still greater and rarer than his generalship in 24 battles: his wisdom in regarding military victory as a mere instrument for achieving political ends. Eugene not only made conquests but also secured them, and in his creative hands the works of peace quickly blossomed forth.

During a span of 39 years he continued to lead the Emperor's armies from the River Save all the way to Lombardy, through the Tirol back again to Bavaria and the Rhine, down once more to Hungary against the Turks, and back up again to Flanders. He was wounded 13 times. Even as he faced a world of foes before him, he had a world of enemies at his back, nourished by the "hereditary curse" of Austria: slothful souls and thoughtless minds, low intrigue, envy, jealousy, foolishness, and dishonesty. He served three emperors: Leopold I, Joseph I, and Charles VI. Toward the end of his life, Eugene observed that, whereas the first had been a father to him and the second a brother, the third (who was perhaps least worthy of so great a servant) had been a master.

Belgrade (1718) was Eugene's most famous victory. In order to take the city, he had deployed his forces in a position that was both daring and dangerous. It was to no avail that others implored him again and again to withdraw the troops in order not to give the Turkish army—which was intent on raising the siege and which surrounded Eugene's forces with a superiority of four to one—the chance to undo them all. Furthermore, Eugene's soldiers were being decimated by disease. But he remained in position and, in a terrible battle that began in a thick fog in the dead of night, annihilated the relief army once the fog lifted at daylight. Capturing innumerable prisoners and the entire Turkish encampment, Eugene took the city shortly afterward.

Works. Worn out by the exertions of an active career, Eugene died in 1736. Posterity has endeavoured to add to his military glory the reputation of scientific, artistic, and literary interests. But, although he is known to have corresponded with the philosopher Gottfried Wilhelm Leibniz, his literary interests cannot have been overwhelming, because not one of the tens of thousands of volumes in his library (most of them preserved in the Nationalbibliothek in Vienna) bears any trace of having been much used, and they give the appearance of having been opened hardly at all in the more than 200 years since Eugene neglected to read them. Regarding his interest in architecture and painting, it may be said that, although he commissioned great artists to build and beautify his palaces, he involved himself in these matters no more than was expected of any great lord of his time. Aside from the enormous, in fact uncanny, talent with which he led the Emperor's armies to victory, Eugene had a weakness for comic ruses. At the siege of Philippsburg, for example, he intended to change the course of the Rhine so that it would flow through the French camp, an idea that caused him to laugh uproariously; at Belgrade, he had the Austrian flotilla, which had lain at anchor above the city, move through various canals so that it suddenly appeared below the city. He also indulged in primitive soldiers' pranks—a failing that made him many enemies among his victims. The only subject that held his attention as much as politics was finances, not only public monies (he was also imperial minister of finance) but also and especially his own—he had arrived in Austria with 25 guilders, and he left an estate of about 25,000,000.

(A.L.-Ho.)

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Eugene I–IV (popes): *see* Eugenius I–IV.

Eugenia, large genus of chiefly tropical, mostly aromatic, evergreen shrubs and trees of the myrtle family (Myrtaceae). The leaves are opposite; the flowers are solitary or in small clusters. The fruit is an edible berry, usually tart, and is commonly made into jam or jelly. Some Asian species, formerly considered part of the genus, may be listed under *Syzygium.*

Syzygium aromaticum (sometimes *E. caryophyllata*), the clove tree, which occurs in the West Indies and Indonesia, produces flowers that are removed as buds, dried, and sometimes processed to yield clove oil. The whole clove and its extract are used in flavouring; the

Surinam cherry (*Eugenia uniflora*)
Walter Dawn

oil is also used medicinally (*see* clove). Many species of *Eugenia* yield high-grade lumber. The bark of *E. cymosa* of Indonesia is the source of a black dye. Other species are widely used in the tropics and subtropics as ornamentals.

eugenics, the study of human improvement by genetic means.

A brief treatment of eugenics follows. For full treatment, *see* MACROPAEDIA: Genetics and Heredity, The Principles of.

Proposals for ameliorating undesirable qualities of the human race date from ancient times. Plato's *Republic* depicts a society in which there is an effort to improve human beings through selective breeding. The first thorough exposition of eugenics, however, was made by the English scientist Francis Galton, a pioneer in the use of statistics. In his first important book, *Hereditary Genius* (1869), Galton proposed that a system of arranged marriages between men of distinction and women of wealth would eventually produce a gifted race. He coined the term eugenics in 1883 and continued to expound its benefits until his death in 1911.

The American Eugenics Society, founded in 1926, supported the proposition that the wealth and social position of the upper classes was justified by a superior genetic endowment. U.S. eugenists also supported restrictions on immigration from nations with "inferior" stock, such as Italy, Greece, and countries of eastern Europe, and argued for the sterilization of insane, retarded, and epileptic citizens in the United States. As a result of their efforts, sterilization laws were passed in more than half of the U.S. states, and isolated instances of involuntary sterilization continued into the 1970s. The assumptions of eugenists came under sharp criticism beginning in the 1930s and were discredited after the German Nazis used eugenics to support the extermination of Jews, blacks, and homosexuals.

Since the 1950s there has been a renewed interest in eugenics. Because certain diseases (*e.g.*, hemophilia and phenylketonuria) are now known to be genetically transmitted, many couples choose to undergo genetic screening, in which they learn the chances that their offspring might be affected by some combination of their hereditary backgrounds. Couples at risk of passing on genetic defects may opt to remain childless or to adopt children. Furthermore, it is now possible to di-

agnose certain genetic defects in the unborn. Many couples choose to terminate a pregnancy that involves a genetically disabled offspring. These developments have reinforced the eugenic aim of identifying and eliminating undesirable genetic material. Counterbalancing this trend, however, has been medical progress that enables victims of many genetic diseases to live fairly normal lives. Genetic surgery, in which harmful genes are altered by direct manipulation, is also being studied; if perfected, it could obviate eugenic arguments for restricting reproduction among those who carry harmful genes. Such conflicting innovations have complicated the controversy surrounding eugenics. Moreover, suggestions for expanding eugenics programs, which range from the creation of sperm banks for the genetically superior to the potential cloning of human beings, have met with vigorous resistance from the public, which often views such programs as unwarranted inteference with nature or as opportunities for abuse by authoritarian regimes.

Eugénie, in full EUGÉNIE, COMTESSE (countess) DE TEBA, original name EUGÉNIA MARÍA DE MONTIJO DE GUZMÁN (b. May 5, 1826, Granada, Spain—d. July 11, 1920, Madrid), wife of Napoleon III and empress of France (1853–70), who came to have an important influence on her husband's foreign policy.

Eugénie, detail of a portrait by Franz Xaver Winterhalter; in the Collection de Mouchy, Paris

Giraudon—Art Resource/EB Inc.

The daughter of a Spanish noble who fought on the French side during Napoleon I's Peninsular War in Spain, Eugénie went to Paris when Louis-Napoléon became president of the Second Republic in December 1848. They were married in January 1853 after he had become the emperor Napoleon III.

On March 16, 1856, Eugénie gave birth to an imperial heir, Napoléon-Eugène-Louis Bonaparte. Concerned about the future of her family line, she began to take an active role in political affairs. On at least three occasions she served as regent (1859, 1865, 1870) in her husband's absence and was certainly more than just a figurehead. A devoted Roman Catholic, she supported Ultramontane causes (favouring a strong papacy) and opposed her husband's Italian policies that resulted in a loss of temporal power for the pope. She is often credited with having a preponderant voice in the decision to create a French-sponsored kingdom of Mexico (1861).

Eugénie, especially sensitive because of her origins, supported French opposition to a Prussian candidate for the vacant Spanish throne, in the controversy that precipitated the Franco-German War of 1870. After the Battle of Sedan (Sept. 1, 1870) she joined her family in exile in England and, after the death of her husband (1873), continued to play a dominant role in Bonapartist political activities. When her son died (1879), she assumed the role of the grande dame in exile.

Eugenikos, Markos (b. *c.* 1392, Constantinople—d. June 23, 1445, Constantinople), Greek Orthodox metropolitan of Ephesus (near modern Selçuk, Tur.) and theologian who led the anti-unionist party in the Eastern Orthodox Church following the Council of Florence, Italy (1439).

After a classical and theological education under tutors antagonistic to Rome, Eugenikos at 26 gave his property to the poor and became a monk on the Greek island of Antigone. Forced to return to Constantinople in 1422 because of Muslim harassment, he stayed at the urban monastery of Mangani, where he gained a reputation for learning and sanctity. Groomed for the Council of Florence by the Byzantine emperor John VIII Palaeologus (1425–48), Eugenikos was made metropolitan of Ephesus *c.* 1436 and represented the patriarchs of Antioch and Alexandria at the council. In Florence he delivered most of the addresses allotted to the Greek Orthodox and became increasingly firm in his repudiation of Western teaching, particularly on the Holy Spirit. He demanded that the Latins remove the *Filioque* ("and from the Son") phrase from the Nicene Creed and accused them of falsifying scriptural and patristic texts in order to buttress their dogma.

Refusing to sign the council's final document of reunion, Eugenikos returned to Constantinople to organize anti-unionist opposition. He was imprisoned for two years after vainly attempting to seek refuge at the monastery on Mt. Athos. Released, he resumed his anti-Western campaign, handing over this responsibility on his deathbed to Georgios Scholarios, the future patriarch Gennadius II.

Among Eugenikos' writings are a confession of faith (creedal summary), interpretations of the Church Fathers, a critique of Latin doctrine on the Trinity, and a refutation of the Western Church's use of unleavened bread in the Communion service. He particularly contested the Western teaching on purgatory. Eugenikos also composed treatises on liturgical subjects, in which he faulted the Western rite, and wrote several tracts on ascetical themes. He was officially proclaimed a saint by the Greek Orthodox Church in 1734.

Eugenius, English EUGENE, name of Roman Catholic popes, grouped below chronologically and indicated by the symbol •

• **Eugenius I,** SAINT (b. Rome—d. June 2, 657, Rome; feast day June 2), pope from 654 to 657. He was elected while his predecessor, Pope St. Martin I, was still alive in exile. Later, in a letter of September 655, Martin acknowledged Eugenius to be the legitimate pope. The Byzantine emperor Constans II Pogonatus urged Eugenius to recognize Patriarch Peter of Constantinople, but Eugenius refused because Peter was a Monothelite—*i.e.,* advocator of a condemned doctrine proposing that Christ had only one will. Eugenius was buried at St. Peter's.

• **Eugenius II** (b. Rome—d. Aug. 27, 827, Rome), pope from 824 to 827. He was a cardinal priest when chosen as successor to St. Paschal I. In 824 Eugenius received the Holy Roman co-emperor Lothair I, who had come to Rome to issue the Constitutio Romana that affirmed imperial sovereignty over Rome, demanded an oath of fealty from Eugenius, and vested papal election in the Roman clergy and nobles, subject to imperial confirmation. Eugenius opposed a revival in the Eastern Church of the Iconoclastic Controversy, a long-standing theological dispute over the worship of icons.

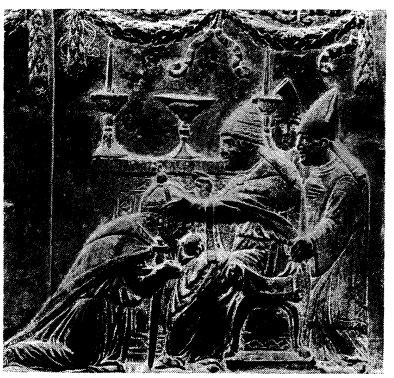
• **Eugenius III,** BLESSED, original name BERNARD OF PISA, Italian BERNARDO DI PISA, or BERNARDO PAGANELLI DI MONTEMAGNO? (b. near Pisa—d. July 8, 1153, Tivoli, near Rome; beatified 1872; feast day July 8), pope from 1145 to 1153.

Possibly a member of the family Paganelli di Montemagno, he was a disciple of St. Bernard of Clairvaux and a Cistercian abbot of the monastery of SS. Vincent and Anastasius when he was elected on February 15. Eugenius, like others of western Europe, was shocked by the fall of Edessa, the capital of the first crusader state, in 1144. With Rome in a state of anarchy, by early 1146 Eugenius was forced into exile by his archenemy, the Italian reformer Arnold of Brescia. While in France (1147) he urged King Louis VII the Young to lead a crusade for the liberation of Edessa, naming Bernard as its preacher. The Second Crusade, most impressive of all in scope, ended in failure.

Eugenius returned to Italy in June 1148 and in July excommunicated Arnold, who denounced Eugenius as "a man of blood" and spread the revolt against him. Away from Rome under its hostile new Senate during much of his reign, Eugenius held many councils. He concluded the Treaty of Constance (1153) with the Holy Roman emperor Frederick I Barbarossa, fixing conditions for his imperial coronation, but the Pope died before Frederick could come to Italy.

• **Eugenius IV,** original name GABRIELE CONDULMER (b. *c.* 1383, Venice—d. Feb. 23, 1447, Rome), pope from 1431 to 1447.

Formerly an Augustinian monk, he was a cardinal when unanimously elected to succeed Martin V. His pontificate was dominated by his struggle with the Council (1431–37) of Basel, which assembled to effect church reform. When Eugenius sought to dissolve the council because of its hostility toward the papacy, its members affirmed superiority over



Eugenius IV crowning the emperor Sigismund, detail from a bronze relief by Filarete; on the doors of St. Peter's, Rome

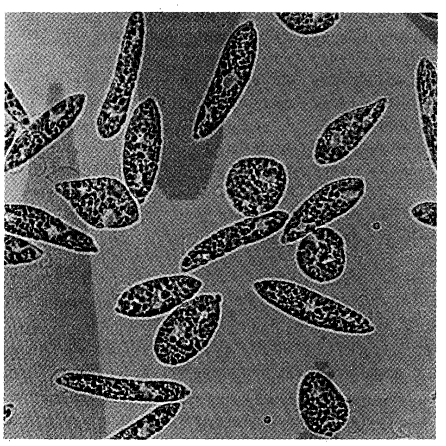
Alinari—Art Resource/EB Inc.

the Pope (1433). The conflict between Eugenius and the council eased as a possibility emerged of reuniting the Roman and Greek churches. The Greeks preferred negotiating with the Pope and wished to meet in Italy. Eugenius thus ordered the council to transfer to Ferrara in 1438. Many of the bishops obeyed, but dissidents stayed on at Basel as a rump council, whose members Eugenius excommunicated. They, in turn, promptly "deposed" him.

Meanwhile, on July 7, 1438, King Charles VII of France issued, against Eugenius' will, the Pragmatic Sanction of Bourges, a pronouncement—prompted by the decrees of the Council of Basel—that established certain liberties for the French Church and advocated restriction of papal power. A plague forced the council at Ferrara to move to Florence, where a union of the Greek and Roman churches

(though short-lived) was concluded on July 6, 1439. Eugenius' success at the Council of Ferrara–Florence enabled him to defy the Basel assembly, thus ending the rump council and restoring papal sovereignty to the church.

Euglena, genus of single-celled organisms with both plant and animal characteristics. It is considered a member of the protozoan order Euglenida or a member of the algal division Euglenophyta. The genus is characterized by an elongated cell (15 to 500 micrometres,



Euglena gracilis (highly magnified)
Walter Dawn

or 0.0006 to 0.02 inch) with one nucleus, pigment-containing chloroplasts (some species are colourless), a contractile vacuole, an eyespot (stigma), and flagella. Certain species (*e.g., E. rubra*) appear red in sunlight because they contain a large amount of pigment. Some species, which lack a rigid cellulose wall, have a flexible pellicle (envelope) that allows changes in shape. Food, absorbed directly through the cell surface or produced by photosynthesis, is stored as a complex carbohydrate (paramylum). Reproduction is asexual, by longitudinal cell division; sexual reproduction is unknown. *Euglena* live in fresh and brackish water rich in organic matter. Some species develop tremendous populations as green or red "blooms" in ponds or lakes. Several species produce resting cysts that can withstand drying. The colourless species are used to study cell growth and metabolism at high temperatures, in the dark, in ultraviolet light, or with certain chemicals.

Euhemerus, also spelled EUEMEROS, or EVEMERUS (fl. 300 BC), Greek mythographer who established the tradition of seeking an actual historical basis for mythical beings and events. It is thought he was born at Messina, though some claim he was born at Chios, Tegea, or Messene in the Peloponnesus. He lived at the court of Cassander, king of Macedonia, from approximately 301 to 297 BC. He is chiefly known by his *Sacred History,* a philosophic romance based upon archaic inscriptions that he claimed to have found during his travels in various parts of Greece.

In this work he systematized for the first time an old Oriental (perhaps Phoenician) method of interpreting the popular myths; he asserted that the gods were originally heroes and conquerors who had earned a claim to the veneration of their subjects. This system spread widely, and the early Christians, especially, used it as a confirmation of their belief that ancient mythology was merely an aggregate of fables of human invention.

The word euhemeristic is applied to such explanations of primitive myths. There is no doubt an element of truth in this approach, for, among the Romans, the gradual deification of ancestors and emperors was a prominent feature of religious development. Among primitive people, it is sometimes possible to trace family and tribal gods back to great chiefs and warriors. But it is not accepted by students of comparative religion as the sole explanation of the origin of gods.

eulachon, also called CANDLEFISH, species of smelt (*q.v.*).

Eulaeus River (Iran): *see* Kārūn River.

Eulalius (d. 423), antipope from December 418 to April 419. He was an archdeacon set up against Pope St. Boniface I by a clerical faction. The rivalry that ensued led to the first interference of the temporal authorities in papal elections. Both the Pope and the Antipope were asked by Emperor Honorius to leave Rome pending a council's decision, but Eulalius (the imperial favourite) imprudently returned to perform the Holy Week services at the Lateran. For this defiance of the Emperor's orders, he was rejected and exiled to the Campania, where he died in obscurity.

Eulenburg, Botho (Wend August), Graf zu (count of) (b. July 31, 1831, near Bartenstein, Prussia—d. Nov. 5, 1912, Berlin), Prussian statesman associated with the Conservative Party in imperial Germany.

As Prussian minister of the interior (1878–81), Eulenburg formulated Bismarck's laws against the Social Democrats and presented them to the imperial Reichstag. In 1892 he became prime minister of Prussia, succeeding the imperial chancellor, Leo, Graf von Caprivi, who from 1890 had held both offices. When Caprivi attempted to liberalize the Prussian franchise, Eulenburg demanded imperial legislation against the Social Democrats and tried to persuade the emperor, William II, to restrict universal suffrage for the imperial Reichstag. The conflict between Eulenburg and Caprivi typified the struggle between Junker Prussia and democratic Germany; the Emperor "resolved" the problem by abruptly dismissing them both in 1894. In 1899 Eulenburg entered the Prussian Herrenhaus (House of Lords).

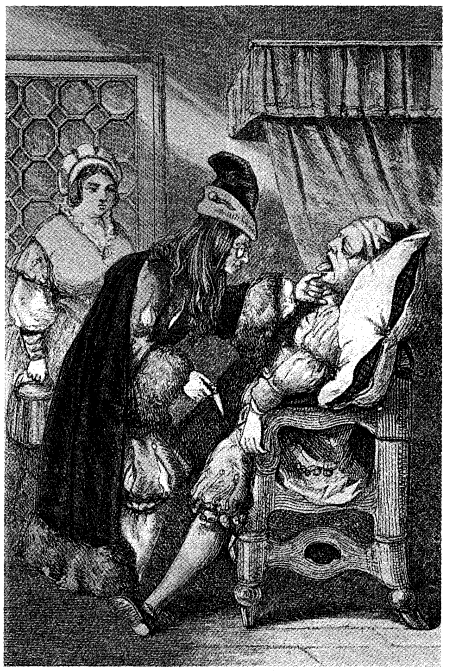
Eulenburg, Philipp, Fürst zu (prince of), in full PHILIPP FRIEDRICH KARL ALEXANDER BOTHO, FÜRST ZU EULENBURG UND HERTEFELD, GRAF (count) VON SANDELS (b. Feb. 12, 1847, Königsberg, Prussia—d. Sept. 17, 1921, Liebenberg, Ger.), diplomat and intimate friend and adviser of the German emperor William II.

After leaving the army, Eulenburg entered the diplomatic service (1877) and served as secretary to the Prussian mission in Munich (1881–88). A close friend of William II since 1886, he became the Emperor's most influential adviser after Bismarck's fall (1890). In 1894 he refused the chancellorship but went as ambassador to Vienna (1894–1902). In 1901 he was created Graf von Sandels. Eulenburg's career ended tragically when the publicist Maximilian Harden printed (1906) in his paper *Die Zukunft* a series of attacks on Eulenburg's private life. He was accused of homosexuality and, although the charges were never proved, the ensuing scandal seriously damaged the monarchy's prestige. Eulenburg's works include *Aus 50 Jahren* (1923; "Reminiscences of 50 Years") and *Mit dem Kaiser als Staatsmann und Freund auf Nordlandreisen,* 2 vol. (1931; "With the Emperor as Statesman and Friend on Travels in Scandinavia").

Philipp, Fürst zu Eulenburg, 1898
By courtesy of the Staatsbibliothek, West Berlin

Eulenkrüg, south German mid-16th-century owl jugs. Few examples of this early faience are known, and they range in date from 1540 to 1561. Originating in Nürnberg, the vessels are shaped as owls, with detachable head (to be used as a cup), molded relief feathers painted in blue, and a coat-of-arms in relief on the breast, gilded and coloured. It has been suggested that *Eulenkrüge* might have been used as prizes in archery contests or that the owl form was a potter's joke, a play on the Rhenish word *Eulner,* or *Ulner* ("potter").

Eulenspiegel, Till, Low German DYLULENSPEGEL, German peasant trickster whose merry pranks were the source of numerous folk and literary tales. The historical Till is said to have been born at Kneitlingen, Brunswick, and to have died in 1350 at Mölln, Schleswig-Holstein, where his gravestone has been pointed out since the 16th century. Anecdotes associated with his name were printed about 1500 in one or more Low German language versions. The earliest extant text is a High German version, *Ein kurtzweilig lesen von Dyl Vlenspiegel* (Antwerp, 1515; "An Amusing Book About Till Eulenspiegel"); the sole surviving copy is in the British Museum, London. The jests and practical jokes, which generally depend on a pun, are broadly farcical, often brutal, sometimes obscene; but they have a serious theme. In the figure of Eulenspiegel, the individual gets back at society; the stupid yet cunning peasant demonstrates his superiority to the narrow, dishonest, condescending townsman, as well as to the clergy and nobility.



Till Eulenspiegel (left foreground) in "How Owlglass Turneth Doctor," an illustration from *The Marvellous Adventures of Master Tyll Owlglass,* by Kenneth R.H. Mackenzie, 1869
By courtesy of the Folklore Society Library, University College, London; photograph, R.B. Fleming

The Low German text, or parts of it, was translated into Dutch and English (*c.* 1520), French (1532), and Latin (1558). A later En-

glish version, *Here beginneth a merye Jest of a man that was called Howleglas,* appeared *c.* 1560. Eulenspiegel has been the subject of musical and literary works, notably Richard Strauss's symphonic poem *Till Eulenspiegels lustige Streiche* (1894; "Till Eulenspiegel's Merry Pranks") and Gerhart Hauptmann's epic poem *Till Eulenspiegel* (1928).

Euler, Leonhard (b. April 15, 1707, Basel, Switz.—d. Sept. 18, 1783, St. Petersburg, Russia), Swiss mathematician and physicist, one of the founders of pure mathematics. He not only made decisive and formative contributions to the subjects of geometry, calculus, mechanics, and number theory but also developed methods for solving problems in observational astronomy and demonstrated useful applications of mathematics in technology and public affairs.

Euler's mathematical ability earned him the esteem of Jean Bernoulli, one of the first mathematicians in Europe at that time, and of his sons Daniel and Nicolas. In 1727 he moved to St. Petersburg, where he became an associate of the St. Petersburg Academy of Sciences and in 1733 succeeded Daniel Bernoulli to the chair of mathematics.

By means of his numerous books and memoirs that he submitted to the academy, Euler carried integral calculus to a higher degree of perfection, developed the theory of trigonometric and logarithmic functions, reduced analytical operations to a greater simplicity, and threw new light on nearly all parts of pure mathematics. Overtaxing himself, Euler in 1735 lost the sight of one eye. Then, invited by Frederick the Great in 1741, he became a member of the Berlin Academy, where for 25 years he produced a steady stream of publications, many of which he contributed to the St. Petersburg Academy, which granted him a pension. In 1748, in his *Introductio in analysin infinitorum,* he developed the concept of function in mathematical analysis, through which variables are related to each other and in which he advanced the use of infinitesimals and infinite quantities. He did for modern analytic geometry and trigonometry what the *Elements* of Euclid had done for ancient geometry, and the resulting tendency to render mathematics and physics in arithmetical terms has continued ever since. He is known for familiar results in elementary geometry; for example, the Euler line through the orthocentre (the intersection of the altitudes in a triangle), the circumcentre (the centre of the circumscribed circle of a triangle), and the barycentre (the "centre of gravity," or centroid) of a triangle. He was responsible for treating trigonometric functions—*i.e.,* the relationship of an angle to two sides of a triangle—as numerical ratios rather than as lengths of geometric lines and for relating them, through the so-called Euler identity ($e^{i\theta} = \cos\theta + i\sin\theta$), with complex numbers (*e.g.,* $3 + 2\sqrt{-1}$). He discovered the imaginary logarithms of negative numbers and showed that each complex number has an infinite number of logarithms.

Euler's textbooks in calculus, *Institutiones calculi differentialis* in 1755 and *Institutiones calculi integralis* in 1768–70, have served as prototypes to the present because they contain formulas of differentiation and numerous methods of indefinite integration, many of which he invented himself, for determining the work done by a force and for solving geometric problems; and he made advances in the theory of linear differential equations, which are useful in solving problems in physics. Thus, he enriched mathematics with substantial new concepts and techniques. He introduced many current notations, such as Σ for the sum; $\int n$ for the sum of divisors of n; the symbol e for the base of natural logarithms; a, b, and c for the sides of a triangle and A, B, and C for the opposite angles; the letter "f" and parentheses for a function; the use of the symbol π for the ratio of circumference to diameter in a circle; and i for $\sqrt{-1}$.

After Frederick the Great became less cordial toward him, Euler in 1766 accepted the invitation of Catherine II to return to Russia. Soon after his arrival at St. Petersburg, a cataract formed in his remaining good eye, and he spent the last years of his life in total blindness. Despite this tragedy, his productivity continued undiminished, sustained by an uncommon memory and a remarkable facility in mental computations. His interests were broad, and his *Lettres à une princesse d'Allemagne* in 1768–72 were an admirably clear exposition of the basic principles of mechanics, optics, acoustics, and physical astronomy. Not a classroom teacher, Euler nevertheless had a more pervasive pedagogical influence than any modern mathematician. He had few disciples, but he helped to establish mathematical education in Russia.

Euler devoted considerable attention to developing a more perfect theory of lunar motion, which was particularly troublesome, since it involved the so-called three-body problem—the interactions of Sun, Moon, and Earth. (The problem is still unsolved.) His partial solution, published in 1753, assisted the British Admiralty in calculating lunar tables, of importance then in attempting to determine longitude at sea. One of the feats of his blind years was to perform all the elaborate calculations in his head for his second theory of lunar motion in 1772. Throughout his life Euler was much absorbed by problems dealing with the theory of numbers, which treats of the properties and relationships of integers, or whole numbers (0, ±1, ±2, etc.); in this, his greatest discovery, in 1783, was the law of quadratic reciprocity, which has become an essential part of modern number theory.

In his effort to replace synthetic methods by analytic ones, Euler was succeeded by J.-L. Lagrange. But, where Euler had delighted in special concrete cases, Lagrange sought for abstract generality; and, while Euler incautiously manipulated divergent series, Lagrange attempted to establish infinite processes upon a sound basis. Thus it is that Euler and Lagrange together are regarded as the greatest mathematicians of the 18th century; but Euler has never been excelled either in productivity or in the skillful and imaginative use of algorithmic devices (*i.e.,* computational procedures) for solving problems.

(C.B.B.)

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Euler(-Chelpin), Ulf (Svante) von (b. Feb. 7, 1905, Stockholm—d. March 9, 1983, Stockholm), Swedish physiologist who, with British biophysicist Sir Bernard Katz and U.S. biochemist Julius Axelrod, received the 1970 Nobel Prize for Physiology or Medicine. All three were honoured for their independent study of the mechanics of nerve impulses.

Euler was the son of 1929 Nobel laureate Hans von Euler-Chelpin. After his graduation from the Karolinska Institutet in Stockholm, Euler served on the faculty of the institute from 1930 to 1971. He joined the Nobel Committee for Physiology and Medicine in 1953 and was president of the Nobel Foundation for 10 years (1965–75).

Euler's outstanding achievement was his identification of noradrenaline, the key neurotransmitter (or impulse carrier) in the sympathetic nervous system. He also found that noradrenaline was stored within nerve fibres themselves. These discoveries laid the foundation for Axelrod's determination of the role of enzymes in nerve activity.

In addition to the Nobel Prize, Euler's honours include the Swedish Order of the North Star and the Stouffer Prize for his work related to hypertension and arteriosclerosis.

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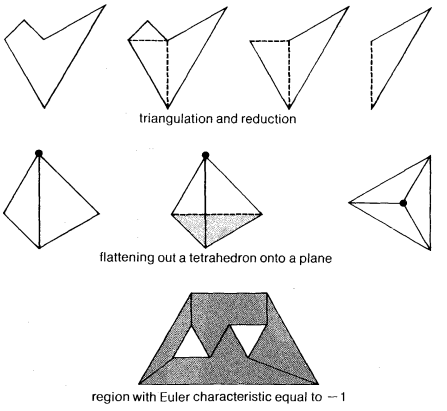
Euler characteristic, in mathematics, a number, C, which is a characterization of the various classes of geometric figures based only on the topological relationship between the numbers of vertices, V, edges, E, and faces, F, of a geometric figure. This number, given by $C = V - E + F$, is the same for all figures the boundaries of which are composed of the same number of connected pieces (*i.e.,* the boundary of a circle or figure eight is of one piece; that of a washer, two). For all simple polygons (*i.e.,* without holes) the Euler characteristic equals one. This can be demonstrated for a general figure by the process of triangulation, in which auxiliary lines are drawn connecting vertices so that the region is subdivided into triangles (*see* Figure, top). The triangles are then removed one at a time from the outside inward until only one remains, the Euler characteristic of which can be easily calculated to equal one. It can be observed that this process of adding and removing lines does not alter the Euler characteristic of the original figure, and so it must also equal one. For any simple polyhedron (in three dimensions), the Euler characteristic is two, as can be seen by removing one face and "stretching" the remaining figure out onto a plane, resulting in a polygon, with a Euler characteristic of one (*see* Figure, middle). Adding the missing face gives a Euler characteristic of two.

For figures with holes, the Euler characteristic will be less by the number of holes present (*see* Figure, bottom), because each hole can be thought of as a "missing" face. In alge-



Examples of Euler characteristic

braic topology, there is a more general formula called the Euler-Poincaré formula, which has terms corresponding to abstract higher-dimensional figures and also terms (called Betti numbers) specifying what the Euler characteristic should be for a particular class of figures, varying according to the number of holes and twists in the figure. The Euler characteristic, named for the 18th century Swiss mathematician Leonhard Euler, was used to show that there are only five regular polyhedra (*i.e.,* with all faces congruent).

Euler-Chelpin, Hans (Karl August Simon) von (b. Feb. 15, 1873, Augsburg, Ger.—d. Nov. 7, 1964, Stockholm), Swedish biochemist who shared the 1929 Nobel Prize for Chemistry with Sir Arthur Harden for work on enzymes in the fermentation of sugar.

After graduating from the University of Berlin (1895), Euler-Chelpin worked with Walther Nernst and in 1897 became assistant to Svante Arrhenius at the Royal Institute of Technology in Stockholm. He joined the faculty at

Euler-Chelpin
Bavaria-Verlag

the University of Stockholm (1900), where he became professor of general and inorganic chemistry (1906) and director of the new biochemical institute (1929).

Euler-Chelpin's work with coenzymes advanced knowledge of the biochemistry of sugar and phosphates. He also helped elucidate the chemical structures of several vitamins.

eulite, silicate mineral belonging to the orthopyroxene (*q.v.*) series.

Eumenes (Greco-Roman mythology): *see* Fury.

Eumenes (b. *c.* 362 BC—d. 316), Greek general who upheld the cause of the Macedonian royal house in the civil war that followed the death of Alexander the Great in 323.

Ancient sources agree that Eumenes was an extremely able general. In the distribution of the empire after Alexander's death, he was assigned Cappadocia in eastern Asia Minor. He gave valuable aid to the regent Perdiccas, Alexander's legitimate successor, in Perdiccas' struggle against the rebel Macedonian generals Antigonus Monophthalmus, Antipater, Craterus, and Ptolemy, each of whom controlled different parts of the empire. After the murder of Perdiccas by his own men, the rebel generals gathered at Triparadisus (321) and condemned Eumenes to death. He escaped but was recognized two years later by the new regent (Polyperchon) as the royal general in Asia. Eumenes collected an army in Cilicia and marched toward the eastern provinces, pursued by Antigonus. Eumenes held Antigonus in check during a long and hard campaign on the Iranian plateau, but he was finally betrayed to the enemy and put to death.

Eumenes I (d. 241 BC), ruler of Pergamum, in Mysia, from 263 to 241 who, in 262, liberated his city from the overlordship of the Seleucids, a dynasty founded in Syria by one of the successors of Alexander the Great. Eumenes succeeded his uncle Philetaerus in 263 and in the following year defeated the army of the Seleucid king Antiochus I near Sardis (the capital of Lydia), thereby establishing an independent city-state.

Eumenes II (d. 160/159 BC), king of Pergamum from 197 until his death. A brilliant statesman, he brought his small kingdom to the peak of its power and did more than any other Attalid monarch to make Pergamum a great centre of Greek culture in the East.

Eumenes was the eldest son and successor of Attalus I Soter (ruled 241–197), and he continued his father's policy of cooperation with Rome. His military skill contributed substantially to the victory of Roman and Pergamene forces over the Seleucid king Antiochus III in the battle of Magnesia, in Lydia (autumn of 190). As his reward Eumenes was given control over the Thracian Chersonese (modern Gallipoli peninsula in European Turkey) and over most of the former Seleucid possessions in Asia Minor. Despite this enlargement of his domain, Eumenes realized that his power rested on Roman might. He therefore cultivated friendship with the Romans, securing their intervention in his struggles against the kings of Bithynia and Pontus, in northern Anatolia.

In 172 Eumenes visited Rome to denounce Perseus, the king of Macedonia, for allegedly plotting aggressions in the East. He then joined the Romans in their struggle against Perseus (Third Macedonian War, 171–168), but when the war dragged on it was rumoured that Eumenes was negotiating secretly with the enemy. Whatever the truth of the report, the mere suspicion of disloyalty was enough to put Eumenes permanently in the shadow of Rome's displeasure.

Eumenes was responsible for the construction of nearly all the main public buildings—together with their splendid sculptures—on the acropolis at Pergamum.

Eumenides (Greek mythology): *see* Fury.

Eumenius (fl. *c.* AD 300), Roman orator and teacher of rhetoric, born in Augustodunum, Gaul (now Autun, Fr.), who was the author of *Oratio pro instaurandis scholis* ("Oration on the Restoration of the Schools"), an interesting document on the education of his time as well as a vigorous panegyric of Emperor Constantius Chlorus. The oration was delivered in 298 to promote the restoration of the university college at Augustodunum, which, like the city, had been damaged in the disturbances and siege of 269. The oration actually amounts to an expression of appreciation to the emperor Constantius Chlorus for his plans for reconstruction, which included appointment of Eumenius as principal of the college. Though Eumenius had been promised double the normal salary for his position, a means of maintaining his status since he had formerly been Constantius' private secretary, he declared that he would donate these emoluments to the reconstruction fund.

From the 16th century onward, other contemporary speeches in the collection of *Panegyrici Latini* have been ascribed to Eumenius—but without evidence or probability. In his remaining oration the frigid affectations of panegyric are enlivened by personal enthusiasm.

Eumolpus, mythical ancestor of the priestly clan of the Eumolpids at Eleusis, a city in ancient Greece, and the site of the Eleusinian Mysteries, the best known of the Greek mystery cults. His name (meaning "good" or "strong singer"; *i.e.,* a priest who could chant his litanies clearly and well) was a personification of the clan's hereditary functions. His legend fluctuated so greatly that three identities for Eumolpus have been assumed:

1. Being a "sweet singer," he was connected with Thrace, the country of Orpheus (*q.v.*). He was the son of the god Poseidon and Chione (Snow Girl), daughter of the north wind, Boreas; after various adventures he became king in Thrace but was killed while helping the Eleusinians in their war against Erectheus of Athens.
2. As one of the originators of the Eleusinian Mysteries, he was an Eleusinian, a son of Earth (Ge), father of Keryx, and the mythical ancestor of the Kerykes (Heralds).
3. Because Orpheus and his followers were closely connected with mysteries of all sorts, Eumolpus was believed to be the son, father, or pupil of Musaeus, a mythical singer closely allied with Orpheus.

Eunan, SAINT: *see* Adamnan, Saint.

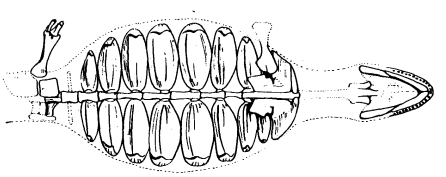
Eunapius (b. *c.* 345, Sardis, Lydia—d. *c.* 420), Greek rhetorician and historiographer whose *Lives of the Philosophers and Sophists* is important as a source of information on contemporary Neoplatonists (edited with Latin translation by J.F. Boissonade, 1849; with English translation by W.C. Wright, *Philostratus and Eunapius,* 1922).

Eunapius was educated under the rhetorician Praeresius and was initiated into the Eleusinian mysteries. Eunapius was an ardent opponent of Christianity. He also wrote a supplement to the *Chronological History* of Publius Herennius Dexippus, continuing the history from AD 270 to 404. Of this work only fragments remain.

Eunomius (b. *c.* 335, Cappadocia, Asia Minor—d. *c.* 394, Dakora, Cappadocia), extreme proponent of Arianism (*q.v.*). With the Arian philosopher and bishop Aëtius, he established the Eunomian sect (*see* Anomoeans), which, although it had an ecclesiastical organization (centred on Constantinople) and several bishops, did not long survive Eunomius.

After serving as secretary to Aëtius in Alexandria, Eunomius accompanied him to Antioch and was ordained deacon there. In 360 or later he was made bishop of Cyzicus in Mysia but soon was deposed because of his teachings. Although his views were initially sustained in a conference at Sirmium in 357, he jeopardized his position by his extremism, particularly in his endorsement of the semi-Arianism (*q.v.*) of Bishop Macedonius of Constantinople. Eunomius' doctrines were attacked by St. Basil and were finally condemned by the Council of Constantinople in 381; he was forced to spend his last years in retirement on his family estate. Most of the extensive writings of Eunomius were burned in 398 at the order of the emperor Arcadius, but enough of his work remains to show the hairsplitting subtlety of his mind.

Eunotosaurus, genus of extinct reptiles found as fossils in Middle Permian deposits of South Africa (the Permian Period began 280,000,000 years ago and lasted 55,000,000 years). It has been suggested that *Eunotosaurus* may be the ancestral form from which the turtles evolved. The structure of *Eunotosaurus* is unusual; the number of vertebrae in the backbone is small, a condition seen in the turtles, and these reptiles had eight pairs of very broad ribs al-



Ventral view of *Eunotosaurus*

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most touching each other, a condition that may foreshadow the development of the turtle carapace, or shell.

eunuch, castrated human male. From remote antiquity on, eunuchs were employed in the Middle East and in China in two main functions: as guards and servants in harems or other women's quarters, and as chamberlains to kings. Eunuchs were considered the most suitable guards for the many wives or concubines a ruler might have in his palace, and the eunuchs' confidential position in the harems of princes frequently enabled them to exercise an important influence over their royal masters, and even to raise themselves to stations of great trust and power. Some rose to become bodyguards, confidential advisers, and even ministers, generals, and admirals. Most eunuchs underwent castration as a condition of their employment, though others were castrated as punishment or after they had been sold by poor parents.

Eunuchs functioned as political advisers to the emperors of China as early as the Chou period (*c.* 1122–221 BC) and continued as such under the Han, T'ang, Ming, and Sung dynasties, persisting almost until the end of the imperial regime. At times palace eunuchs became more powerful than the emperor and effectively ruled China. Eunuchs were used as court advisers and officials in Persia under the Achaemenids (559–330 BC). The Roman emperors Claudius, Nero, Vitellius, and Titus employed eunuchs as such, as did most of the subsequent emperors of the Byzantine Empire. Indeed, many of the patriarchs of Constantinople during Byzantine times were eunuchs. Political eunuchs also flourished in the centres of Muslim power after AD 750, and as a class eunuch advisers only disappeared with the end of the Ottoman Empire in the early 20th century. The Italian practice of castrating boys in order to train them as adult soprano singers (castrati) was ended by Pope Leo XIII (1878).

Eunuchs who were emasculated voluntarily for the avoidance of sexual sin or temptation—the Christian theologian Origen (*c.* AD 185–*c.* 254) being the most celebrated example—have appeared in several Christian periods, basing their action on the text of Matthew 19:12; 5:28–30. The 3rd-century Valesii, a Christian sect of eunuchs, castrated themselves and their guests in the belief that they were thereby serving God.

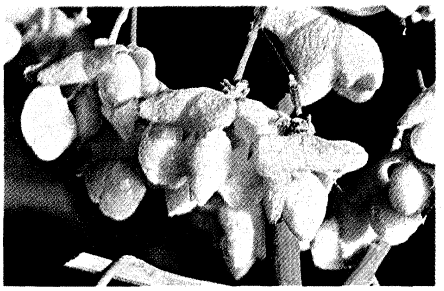
To make the best use of the Britannica, consult the INDEX *first*

Eunus (fl. second half of 2nd century BC), leader of a slave revolt against the Romans in Sicily from 135 to 132.

A Syrian by birth, Eunus was a slave at Enna, Sicily. He organized about 70,000 slaves and took over the city in 135. Calling himself King Antiochus, Eunus soon controlled much of central and eastern Sicily. The first armies sent against the rebels were severely defeated. The consul Lucius Calpurnius Piso managed to reach Enna in 133, however, and his successor, Publius Rupilius, completely suppressed the revolt in the following year. Eunus was captured and died in prison.

Euonymus, genus of about 170 species of shrubs, woody climbers, and small trees, in the staff tree family (Celastraceae), native to temperate Asia, North America, and Europe. It includes many popular landscape ornamental shrubs and ground covers.

Winter creeper euonymus (*E. fortunei,* or *E. radicans*), from East Asia, climbs by aerial rootlets; it has glossy, evergreen leaves and clusters of greenish flowers followed by orange



Wahoo (*Euonymus atropurpurea*)

Clarence Cook from The National Audubon Society Collection/Photo Researchers—EB Inc.

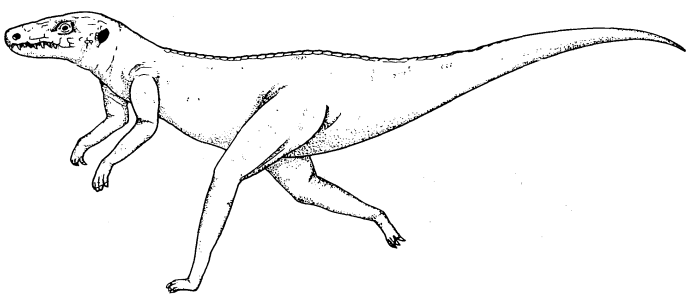
fruits. Its many cultivated varieties include bigleaf, glossy, sarcoxie, baby, longwood, and purpleleaf, widely used in landscaping.

The winged spindle tree, also called burning bush (*q.v.*), is a handsome shrub with corky winged stems. The common spindle tree (*E. europaea*), which grows to 6 m (20 feet), keeps its pink and orange fruits after the leaves fall. In eastern Europe gutta-percha resin is extracted from this plant. The wood is used for pegs and spindles. Several varieties are grown as ornamentals.

Another species called burning bush is *E. atropurpurea,* also known as wahoo, from eastern North America; it is similar to *E. europaea* but has reddish fruits. The strawberry bush (*E. americana*) from the same region is lower and has pinkish fruits.

Euoplocephalus (dinosaur): *see* Ankylosaurus.

Euparkeria, extinct genus of reptiles that may have been ancestral to the major reptilian groups of the Mesozoic era; it is found as a fossil in Early Triassic rocks of South Africa



Euparkeria

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(245 to 240 million years ago). *Euparkeria* was about 1 m (3 feet) long and lightly built. It probably was equally adept at progressing on all four limbs or with the body balanced on the hind legs; the hind limbs were longer and stronger than the forelimbs. Many of the bones were hollow; the very long tail served as a counterbalance when the animal stood upright. The skull was slender and light, with many sharp, well-developed teeth in the margins of the jaws and on the palate as well, a primitive feature.

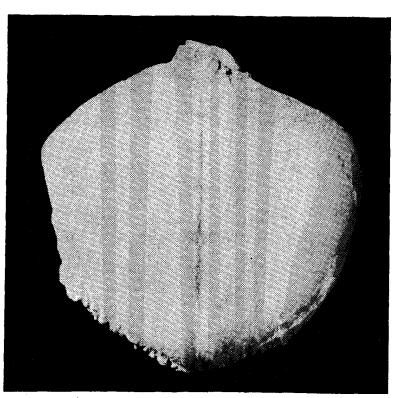
eupatrid (Greek: "of a good father"), member of the nobility of ancient Athens. It is likely that public office before 594 BC was in practice confined to the eupatridae and that they had a political monopoly comparable to that of other Greek aristocracies in the Archaic period. Solon's reforms, by establishing property qualifications for office, limited their power, which disappeared entirely after 580.

Eupen-et-Malmédy, region in Verviers *arrondissement,* Liège *province,* Belgium, comprising the so-called *cantons rédimés* ("redeemed cantons") of Eupen, Malmédy, and Sankt Vith, along the German border. Until 1794 the region was part of the duchy of Limbourg, the ecclesiastical principality of Stavelot-Malmédy, and the duchy of Luxembourg. Under French rule from 1794 to 1814, it belonged to the Ourthe *département* (the present Liège *province*). Most of the region was annexed by Prussia as a result of the Treaty and Congress of Vienna (1815). It included Moresnet, much contested because of its zinc mines, which was divided—one part was given to Prussia, one to The Netherlands, and the third part became a condominium called Neutral Moresnet. After World War I, the Versailles treaty assigned Eupen, the district of Malmédy and Sankt Vith, Prussian Moresnet, and Neutral Moresnet to Belgium. This was ratified by plebiscite (1920), and Germany recognized the new frontier in the Pact of Locarno (1925).

The territories were occupied by Nazi Germany from 1940 until the liberation of Belgium (1944), although some of the heaviest fighting of World War II went on there through January 1945, when the region was a principal locus of the Battle of the Bulge.

Postwar frontier adjustments and land transfers between Belgium and West Germany in 1949 and 1958 (confirmed by an agreement signed in 1956) brought the area of the territories to about 410 square miles (1,060 square km). Most of the inhabitants speak German. Since 1963 Eupen-et-Malmédy has existed as a German-language region composed of two geographic entities. One, around Eupen, comprises the communes of Eupen, Kelmis, Lontzen, and Raeren; the other, around Sankt Vith, consists of Amel, Büllingen, Burg-Reuland, Bütgenbach, and Sankt Vith. The Malmédy region is French-speaking but with facilities for the use of German; it consists of the communes of Malmédy and Waimes. The region is mostly forest and moorland, with areas cultivated for fodder. Eupen produces cloth, electric cables, metal wires, chocolates, and soap. Malmédy (*q.v.*) has a prosperous paper industry and brewery. Sankt Vith is a noted cattle market, and furniture is made there.

Euphemites, extinct genus of gastropods (snails) abundant during the Late Carboniferous epoch (between about 325,000,000 and



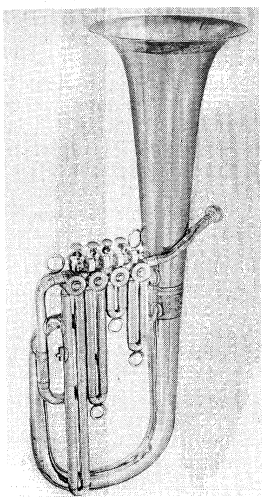
Euphemites

By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

280,000,000 years ago) in the shallow seas that covered the midcontinent region of North America. *Euphemites* was a small, globular snail with a broad and arcuate (bow-shaped) aperture. Ornamentation consists of parallel ridges separated by troughs following the plane of coiling.

euphonia, any of several tropical American birds of the tanager family. *See* tanager.

euphonium, also called BARITONE, German BARYTON, brass wind instrument with valves, pitched in C or B♭ an octave below the trumpet; it is the leading instrument in the tenor–bass range in military bands. It was invented in 1843 by Sommer of Weimar and derived from the valved bugle (flügelhorn) and cornet.



Euphonium, *c.* 1850
By courtesy of Boosey & Hawkes Ltd.

It has a wide conical bore resembling that of the tuba and is held vertically with the bell upward (in the United States the bell is often positioned to face forward on the instrument). It normally carries a fourth valve in addition to the essential three, in order to take the compass continuously down to the fundamental pitches below the bass staff. (Without the fourth valve there would be a gap between the two lowest notes producible.) The total compass rises from the third B♭ below middle C to about the C above it. Its notation is generally in the bass clef at actual pitch in military bands and treble clef a ninth above the actual sound in brass bands. In duplex, or double, euphoniums there is an alternative bell and a tubing that may be switched in by a valve to supply a lighter tone quality.

The euphonium is closely related to the tuba, which it resembles in shape and for which it often serves as a tenor. It also resembles the baritone, with which it is identical in range, although the euphonium's wide bore gives it a different tone quality.

euphony and cacophony, sound patterns used in verse to achieve opposite effects: euphony is pleasing and harmonious; cacophony is harsh and discordant. Euphony is achieved through the use of vowel sounds in words of generally serene imagery. Vowel sounds, more easily pronounced than consonants, are more euphonious; the longer vowels are the most melodious. Liquid consonants and the semivowel sounds (l, m, n, r, y, w) are also considered euphonious. An example may be seen in Tennyson's "The Lotos-Eaters": "The mild-eyed melancholy Lotos-eaters came." Cacophony, the opposite of euphony, is usually produced by combinations of words that require a staccato, explosive delivery. Inadvertent cacophony is a mark of a defective style. Used skillfully for a specific effect, it vitalizes the content of the imagery. A line in Coleridge's "Rime of the Ancient Mariner" illustrates cacophony:

> With throats unslaked, with black lips baked,
> Agape they heard me call.

Euphorbia, large and variable genus of shrubs, trees, and herbaceous plants, in the spurge family (Euphorbiaceae), characterized by a milky sap. The genus is also commonly called spurge (*q.v.*).

Euphorbiaceae, the spurge family of flowering plants, in the order Euphorbiales, comprising about 280 genera. Many members are important food sources; others are useful for their waxes and oils; dangerous for their poisonous fruits, leaves, or sap; or attractive for their colourful bracts (leaflike structures located just below flower clusters) or unusual forms. Although species of the family grow throughout the world, except in cold alpine or arctic regions, most of them are found in temperate and tropical regions. The family consists of annual and perennial herbs and woody shrubs or trees, rarely climbers.

Flowers are of one sex, with male and female flowers usually borne on the same plant. Petals are rarely present. Flowers of *Euphorbia* are in cup-shaped clusters called cyathia, each of which seems to be a single female flower, consisting of a single pistil surrounded by several male flowers, each of which has a single stamen. These clusters of reduced flowers are enclosed by an involucre (whorl) of bracts (modified leaves) that resembles a corolla or whorl of flower petals.

Male flowers of the other genera have one to many stamens, free or joined. Female flowers have three-chambered ovaries that are superior (that is, above and not enclosed by other flower parts). There are as many styles as there are ovary cavities. The fruit is a three-chambered capsule. Leaves are usually simple and are alternate (or rarely opposite or whorled) in arrangement along the stems. The stems of most species contain a milky latex.

Members of the family known for beauty or usefulness include the largest genus, *Euphorbia*, commonly called spurge (*q.v.*), with a wide range of succulent plants from lawn weeds to cactus-like plants; ornamentals such as *Codiaeum,* sandbox tree (*Hura*), copperleaf (*Acalypha*), *Phyllanthus,* redbird cactus (*Pedilanthus*), *Jatropha;* and economically important plants such as castor-oil plant (*Ricinus communis*), croton (*Croton tiglium*), *Omphalea,* cassava (*Manihot esculenta*), rubber (*Hevea*), tung tree (*Aleurites*)—a source of candlenut oil—and tallow tree (*Sapium*). The manchineel tree (*Hippomane mancinella*) bears poisonous fruits, and mercury (*Mercurialis*) is a weed in many areas.

Euphorbiales, diverse order of flowering plants, belonging to the class known as dicotyledon (*q.v.*; characterized by two seed leaves). It is composed of 7 families, about 315 genera, and at least 8,000 species. Members of this order yield rubber, edible roots and fruits, medicinal and poisonous compounds, and ornamental plants. They are most abundant in the tropics, but are widely distributed throughout the world except in arctic and alpine zones.

A brief treatment of Euphorbiales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

The unifying features of Euphorbiales are simple leaves (except in a few species), reduced size of flowers, an ovary that rises above the other flower parts (superior position), and few ovules in each ovary chamber. In both habit and habitat, the order is extremely diverse.

The spurge family (Euphorbiaceae), one of the largest families in the plant kingdom, consists of about 300 genera and about 7,650 species. Its members are distributed worldwide and contribute significantly to the economies of many nations. Cassava, also known as yuca or manioc, is a Brazilian shrub (*Manihot esculenta*) now cultivated in many lowland regions of the tropics for its edible roots. Tapioca is one of its starchy products. Other members of Euphorbiaceae yield products including tallow (*Sapium sebiferm*), latex (Hevea), lumber (Bischofia), tung oil (*Aleurites fordii*), and castor oil (*Ricinus communis*).

Ornamental plants of the Euphorbiaceae, prized for their colour at flowering time, include the poinsettia (*Euphorbia pulcherrima*), originally from tropical Mexico and Central America. It is widely sold during the Christmas season in North America. Its showy bracts are foliage leaves that surround clusters of flowers; only the leaves nearest the flowers turn colour. Species of *Codiaeum,* often known as crotons, are prized for their variegated foliage. *Acalypha wilkesiana,* or Jacob's-coat, produces bronze-green leaves spotted in colours of copper, red, or purple.

The second largest family of the Euphorbiales, the Buxaceae, is largely evergreen and ornamental; its best-known members are the cultivated boxwoods.

Five additional families, with 8 genera and 288 species, are included in the Euphorbiales. Most of them are evergreen shrubs bearing simple leaves. They include the Simmondiaceae, entirely composed of *Simmondsia chinenses,* the fruit of which yields jojoba oil, a substitute for the sperm oil obtained from whales.

The diversity of stem habit and structure in the Euphorbiales is extreme. Heights range from cushion plants a few centimetres (about four inches) to those measuring 100 feet (30 metres). Some are globose, spiny succulents, difficult to distinguish from cacti until flowers appear.

Leaves of this order generally consist of a petiole (leaf stalk) and an undivided (simple) blade. In the majority of species, a small stipule (blade-like units) is present basally, on each side of the petiole. Most leaves of the Euphorbiales are evergreen, with some notable exceptions in the spurge family, species of which lack leaves altogether.

Weedy perennials, such as the leafy spurge, propagate by rhizomes (underground, horizontal stems) that bear many buds. Although many other special cases of fragmentation occur in some species of Euphorbiales, seeds are overwhelmingly the most important method of reproduction in all families.

Flowers in the Euphorbiales may arise singly in the axil of a leaf (upper angle between petiole and stem). In most members, however, several flowers are clustered into various types of inflorescences, from elongate spikes and branched racemes to compact heads. With few exceptions, flowers are either male or female (unisexual); both may be borne on the same plant, depending on the species. In *Euphorbia,* a cluster of flowers simulates a complete flower.

Cross-pollination is the usual method of pollination, though coloured bracts, appendages, and glands of many species also attract a wide variety of pollinating insects. Only a few species are wind-pollinated. After pollination and fertilization, the ovule becomes the seed and the ovary the fruit.

Euphorion (b. *c.* 275 BC?), Greek poet and grammarian, of Chalcis in Euboea, whose poetry was highly regarded in Hellenistic literary circles and later among Catullus' generation of Roman poets in the 1st century BC.

Euphorion studied philosophy at Athens. Soon after 223 BC, Antiochus the Great, king of Syria, gave him the coveted post of royal librarian at Antioch. His works included small-scale epics (*epyllia*) on mythological themes, poetic invectives and epigrams, as

well as scholarly treatises. Surviving fragments reveal him as a plagiarist possessed of a willfully obscure and turgid style.

Euphrates (river, Asia): *see* Tigris–Euphrates River System.

Euphrates Dam, also called ṬABAQAH, or TABQA, DAM, dam on the Euphrates River in north central Syria. The dam, located 30 miles (50 km) upriver from the town of ar-Raqqah, was begun in 1968. Its construction prompted an intense archaeological excavation of the area around the town of Ṭabaqah (*q.v.*). The dam is of earth-fill construction, some 197 feet (60 m) high and 2.8 miles (4.5 km) long. It was completed in 1973, and the reservoir behind the dam, Lake Assad, began filling. The lake at its fullest extent is about 50 miles (80 km) long, averages 5 miles (8 km) in width, and has a capacity of 15,000,000,000 cubic yards (12,000,000,000 cubic m) of water. The accompanying power plant was completed in 1977 and has eight 100-megawatt turbines; provisions were made for a future increase in the number of turbines, for a total of 1,100 megawatts. Electrification subsequently reached to even the remotest villages in al-Jazīrah (the area east of the Euphrates). Several irrigation schemes are associated with the project.

Euphronius (fl. *c.* 520–470 BC), one of the most celebrated Greek painters and potters of his time. He experimented with new ideas, forms, and designs within the context of the Archaic tradition. His signature has been identified on 17 vessels, 5 signed by him as painter and 12 as potter. Generally, Euphronius' earlier works were signed as painter and his later works as potter.

"Heracles and Antaeus," calyx krater by Euphronius, *c.* 510–500 BC; in the Louvre, Paris
Cliche Musees Nationaux, Paris

Among the vases signed by Euphronius as painter is one of Heracles wrestling Antaeus, dated *c.* 510–500 BC and now in the Louvre, Paris; it has been praised for its excellent drawing. A kylix (shallow earthenware cup with stem and handles), now in the Staatliche Antikensammlungen at Munich, is another example of Euphronius' work as painter (*c.* 510–500 BC). A young horseman is painted on the inside of the kylix. Heracles in combat with the triple-bodied Geryon is painted on the outside.

As a potter, Euphronius worked with some of the finest vase painters of his time. The paintings of several, among them Douris, Makron, Hyakynthos, and Onesimos, have been identified on vases signed by Euphronius. Most, however, were painted by the Panaitios Painter. The Pistoxenus Painter was another of the painters of Euphronius' pots. A white-ground cup, now in the Staatliche Museen der Stiftung Preussischer Kulturbesitz, Berlin, signed by Euphronius as potter and Pistoxenus as painter, is the last known signed work by Euphronius. In terms of its style, it could not date earlier than 470 BC.

Eupolis (fl. 2nd half of 5th century BC, Athens), one of the leading Athenian poets of the vigorous and satirical Old Comedy and a rival of Aristophanes.

Eupolis grew up during the Peloponnesian War between Athens and Sparta, and his first play was produced in 429 BC. Of his work 19 titles and more than 460 fragments survive. Objects of his satire included the demagogues Cleon and Hyperbolus and the wealthy Callias and Alcibiades and their fashionable circle. In his last play, *The Demes,* written just after the disastrous Athenian expedition led by Alcibiades to Sicily (412 BC), he addressed himself with patriotic fervour to the problem of how the fortunes of Athens were to be restored. He died young, *c.* 410 BC, probably on active service at the Hellespont.

Eupteleales, order of dicotyledonous flowering plants comprising the family Eupteleaceae, with one genus, *Euptelea,* and two species of trees or large shrubs. The group is characterized by alternately arranged, simple, deciduous, marginally toothed leaves; bisexual flowers with 6 to 18 pistils (female organs) on short stalks and numerous stamens (male, pollen-producing structures) but no sepals or petals; and fruits consisting of a cluster of dry, winged, single-seeded nuts (samaras) with a notch in one side.

The two species, *E. polyandra,* native to Japan, and *E. pleiosperma,* native to southwestern China and Assam, are sometimes grown as ornamentals mainly for their foliage, which is red when young and green at maturity. In the autumn the leaves again turn a bright red or yellow colour.

The order is notable as an evolutionarily primitive group without close living relatives. Its taxonomic position is considered to be nearest the order Trochodendrales.

Euratom: *see* European Atomic Energy Community.

Eure, *département,* Haute-Normandie region, northeastern France, in the eastern part of the historic province of Normandy, occupying 2,332 square miles (6,040 square km). It is bounded in the northeast by the mouth of the Seine River, which flows through its northwesterly section as it leaves the Paris Basin. Nowhere higher than 800 feet (270 m), Eure is broken up by its rivers into well-wooded plateaus. The Eure River flows into the Seine from the southeast after a course of 44 miles (71 km) in the *département.* Évreux (*q.v.*), the capital, is on the Iton, a tributary of the Eure. The climate is mild, with moderate rainfall. Eure is one of the richest agricultural *départements* of France (cattle, horses, cereals, fruit, beetroots, and potatoes) and is noted for the richness of its milk and other dairy products. It has considerable light industry (textiles, building material, leather, chemicals, foodstuffs, and flour) in the valleys. The very active exploitation of quarries in the valley of the Eure has led to the development of almost continuous schemes utilizing the river's course. The most spectacular of the historic sites is the 12th-century ruin of Château Gaillard, built by Richard I the Lion-Heart, dominating the Seine and the town of Les Andelys. The *département* has three *arrondissements*—Évreux, Bernay, and Les Andelys—and is in the educational division of Rouen. Pop. (1985 est.) 480,000.

Eure-et-Loir, *département,* Centre region, northwestern France, created from parts of the historic provinces of Orléanais and Normandy. Most of the *département* is situated in the Paris Basin. More than half of its area of 2,270 square miles (5,880 square km) is occupied by the treeless, grain-supporting (corn [maize] and wheat) plain of Beauce, interspersed with large villages and isolated farms. The northwest comprises the wooded and grassy Thimerais region, the northeast embraces part of the undulating Hurepoix, and the southwest is occupied by the hilly Perche. The *département* derives its name from the Eure River, which flows northward through Chartres (*q.v.*), its capital, and from the Loir, which flows southward through Châteaudun. One of the main granaries of France, it has an essentially rural population. Its climate is mild and dry. Industry (flour milling, tanning, and the manufacture of agricultural machinery) has been little developed.

Historic sites include Chartres, with its world-famous cathedral, begun in the late 12th century and considered one of the finest examples of High Gothic architecture; Dreux, the burial place of the Orléans family; Maintenon, with a fine 14th–16th-century château presented by Louis XIV to Madame de Maintenon; and the beautiful 16th-century château of Diane de Poitiers, mistress of Henry II, in Anet. The *département* has four *arrondissements*—Chartres, Dreux, Châteaudun, and Nogent-le-Rotrou—and is in the educational division of Orléans. Pop. (1985 est.) 375,000.

Eure River, river in northern France, a left-bank tributary of the Seine, with a length of 140 miles (225 km). From its source in the Collines (hills) du Perche, Orne *département,* at an elevation of about 800 feet (240 m), to its confluence with the Seine River above Rouen at Pont de l'Arche, it flows chiefly through agricultural and wooded regions, receiving numerous tributaries, including the Blaise, the Avre, and the Iton. It flows southeast from its source to the area south of Chartres, Eure-et-Loir *département,* and then turns sharply north, passing through the city of Chartres below the cathedral, which is located on high ground on the left bank. Continuing its northern course, the Eure flows through Maintenon, Dreux, and around Anet, veering northwest. After crossing Pacy-sur-Eure, in the Eure *département,* it flows almost parallel to the Seine for more than 20 miles (32 km) before separating into several branches and flowing through the town of Louviers.

Eureka, city, port, seat (1856) of Humboldt County, northern California, U.S., on Humboldt Bay. A major lumber and commercial-fishing centre and headquarters for the Six Rivers National Forest, it was laid out in 1850 and named for the Greek motto (meaning "I have found it") on the state seal. Site of Ft. Humboldt (now a state historic monument) and scene of several Indian uprisings (1853–65), it developed with the exploitation of nearby redwood forests. Tourism and dairying are economic factors. Eureka is the seat of the College of the Redwoods (1965), and Humboldt State University (1913) is at nearby Arcata. Inc. 1856. Pop. (1986 est.) 24,800.

Eureka, byname of EUROPEAN RESEARCH AGENCY, European cooperative organization inaugurated in April 1985 by 18 European nations and formally established with a secretariat in Brussels in 1986. Its purpose is to promote European high-technology industries by linking the efforts of various companies and channeling moneys for their research. The original 18 member nations are the 12 European Communities nations (Belgium, Denmark, France, [then West] Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom) and Austria, Finland, Norway, Sweden, Switzerland, and Turkey. In 1986 Iceland was admitted.

The aim of the organization, first suggested by France and West Germany, is to strengthen European efforts in areas of strategic research—such as advanced electronics,

computers, lasers, transport systems, and environmental control—by encouraging companies in different countries to pool their efforts and develop marketable products. By the organization's charter, a project must include participants of more than one country, offer an identifiable expected benefit, seek a significant technological advance, and secure adequate financial commitment from the companies involved. The individual companies may (and usually do) receive compensatory research grants or subsidies from their national governments. The secretariat in Brussels acts as a clearinghouse for proposals for research projects.

Eureka Stockade (Dec. 3, 1854), the most celebrated rebellion in Australian history. It involved the gold prospectors of Ballarat, Victoria, and was named for the rebels' hastily constructed fortification in the Eureka goldfield.

The rebellion was the culmination of longstanding grievances on the part of the miners, or "diggers," over exorbitant prospecting-license fees, brutal police procedures for collecting those fees, lack of the vote, lack of representation in the Legislative Council, and a prohibition against prospecting on crown lands. While Charles J. La Trobe, the former lieutenant governor of Victoria who had introduced the license fee in 1851, pressed the Legislative Council for reform on these issues, the diggers underwent increased harassment by the police and responded with greater militancy. The murder of a digger named James Scobie in October 1854 and the acquittal of his alleged killers by a government board of inquiry further inflamed the situation. Demonstrations and clashes with the police followed. On November 11 the diggers formed the Ballarat Reform League to petition the authoritarian lieutenant governor Charles Hotham for redress of their grievances. While Hotham's response was promising, the arrival of troop reinforcements on November 28 led to further clashes.

On November 30 many of the diggers organized themselves into military companies and elected Peter Lalor, one of the Reform League's representatives, as their commander in chief. Work then began on the stockade. Troops and police surrounded the 150 diggers who were within the structure on December 3. After refusing to come out, the diggers opened fire on the government forces. The ensuing battle lasted for 15 minutes and ended with the rout of the diggers. Approximately 25 diggers and 5 troopers and police were killed. Lalor escaped and remained in hiding until amnesty was declared. None of the rebels accused of treason was convicted. The Eureka Stockade rising accelerated the enactment of reforms, which followed in 1855.

eurhythmics: *see* eurythmics.

Euric (b. 420—d. 484), king of a great Visigothic realm (usually called the kingdom of Toulouse) in the western part of the Roman Empire that included what is now southwestern France (south of the Loire and west of the Rhône) and most of Spain. He is best known for the code of law that bears his name, the Code of Euric.

Euric ascended the throne after assassinating his brother, King Theodoric II, at the Visigothic capital of Toulouse. He ruled as a federate of the Roman Empire until 475, when he withdrew and became an independent king. He continued to defy Roman authority by extending his boundaries in Gaul and on the Iberian Peninsula for the remainder of his reign. His forces built fortifications at several key locations throughout the empire. Those at the ancient city of Carcassonne in southwestern France are among the finest remains of medieval ramparts in Europe.

The code of law that Euric had Roman jurists compile for his use was memorable in that it acknowledged the rights of his Roman as well as his Gothic subjects. The palimpsest manuscript of the code is preserved in Paris.

Euripides (b. *c.* 484 BC, Athens [Greece]—d. 406, Macedonia), last of classical Athens' three great tragic dramatists, following Aeschylus and Sophocles.

A brief treatment of Euripides follows. For full treatment, *see* MACROPAEDIA: Greek Dramatists, The Classical.

Euripides was the son of Mnesarchus, or Mnesarchides, and Cleito; there is indirect evidence that his family was middle-class. The general impression of Euripides left by tradition is of a figure austere and unconvival. He was accustomed to sit in a cave looking out to sea, a habit considered eccentric by his more sociable contemporaries. He took almost no part in Athens' public affairs. He was passionately interested in ideas, however, and he associated with Anaxagoras and other philosophers of his time. His acquaintance with new ideas brought him restlessness rather than conviction, and his questioning attitude toward the traditional Greek religion is reflected in many of his plays.

Euripides was first chosen to compete in the dramatic festival of Dionysus in 455 BC, and he won his first victory in 441. In all he competed on 22 occasions (four plays at each). In 408 he left Athens to live at the court of Archelaus, king of Macedonia, who was a noted patron of the arts. The fewness of his victories at the Dionysiac festivals, four in his lifetime and one posthumous, suggests some lack of appreciation.

Nineteen of Euripides' plays survive. Among the most notable are *Medea* (431 BC), *Hippolytus* (428), *Electra* (418), *Trojan Women* (415), *Ion* (413), *Iphigenia at Aulis* (406), and *Bacchants* (406). In his plays Euripides took the heroic figures of ancient legend and transformed them into ordinary people who have contemporary attitudes. His highly intellectualized dramas are rich in ethical and social commentary and generally make up in psychological realism what they lack in idealizing grandeur.

Euripus, Modern Greek EURIPOS, EVRÍPOS, or PORTHMÓS EVRÍPOU, narrow strait in the Aegean Sea (an arm of the Mediterranean Sea), between the Greek island of Euboea (Évvoia) and the mainland of central Greece. It is 5 miles (8 km) long and varies from 130 feet (40 m) to 1 mile (1.6 km) in width. It has strong tidal currents (often reaching velocities of 12 knots) that reverse directions seven or more times a day. According to popular tradition, the ancient Greek philosopher Aristotle, in despair at his inability to solve the problem of their cause, drowned here; their cause is not fully understood today. The main port on the strait is Chalcis, or Khalkís (Euboea), an important trading centre since the times of ancient Greece. A 130-foot (40-metre) movable bridge spans the strait at Chalcis, replacing earlier structures that dated back to 411 BC.

euro, also called WALLAROO, one of the largest species of kangaroo (*q.v.*).

euroclydon: *see* gregale.

Eurocommunism, trend among European communist parties toward independence from Soviet Communist Party doctrine during the 1970s and '80s. With Mikhail Gorbachev's encouragement, all communist parties took independent courses in the late 1980s, and by 1990 the term Eurocommunism had become moot.

The term Eurocommunism was coined in the mid-1970s and received wide publicity after the publication of *Eurocomunismo y estado* (1977; "Eurocommunism and the State") by the Spanish Communist leader Santiago Carrillo. A spirit of independence among nonruling communist parties had already appeared, however, shortly before World War II with the growth of Popular Fronts in socialist politics and was afforded dramatic encouragement by the example of Josip Tito's Yugoslavia from 1948 on. The excesses of Joseph Stalin's regime and such Soviet repressions as the crackdown in Hungary in 1956 and the invasion of Czechoslovakia in 1968 alienated many communists in the Western countries and tended to accelerate the movement toward independent policies and autonomy.

The Eurocommunist movement avowedly rejected the subordination of all communist parties to the once-prevalent Soviet doctrine of one monolithic world communist movement. Instead, every party was expected to base its policies on the traditions and needs within its own country. Eurocommunism allegedly supported the establishment of socialism only through legitimate political means and free elections. The need for revolution was implicitly or explicitly abjured, and parliamentary democracy in the Western sense was embraced as essential for true communist government. The Eurocommunist parties advocated pluralistic alliances with other parties that supported similar social and economic programs. In addition, Eurocommunists rejected atheism as an essential ingredient of communism and, with it, the Soviet form of Marxism-Leninism.

The promotion of Eurocommunism seemed to coincide with the stagnation or decline of many European communist parties. First, public opinion in Western Europe had become overwhelmingly anti-Soviet, or anticommunist in Soviet terms. Dissociation from the Soviet brand of communism for this reason may have seemed desirable to Eurocommunists. Second, blue-collar industries, whose workers had formed the bases of most Western communist parties, were declining in favour of service and high-technology industries, whose employees were generally unreceptive to the Marxist idea of class struggle. Eurocommunists may have wished to play down the old Marxist-Leninist agitprop that the Soviet Union, at least pro forma, still seemed to espouse.

In some countries—such as Portugal, Greece, and Cyprus—new industries had not significantly displaced the old worker and peasant conditions rooted in the 19th century, and communist parties still fared moderately well, pulling 15 to 25 percent of the vote. In most other countries, the trend was different. In Belgium, for example, the Belgian Communist Party, once the third largest in the country after World War II, had shrunk to insignificance.

In Spain, after Francisco Franco's death in 1975, the Communist Party of Spain (founded in 1920) reemerged but, within a few years, splintered into several factional parties. Carrillo himself, the patron of Eurocommunism, was forced to leave the mainstream party, even though it remained avowedly "nonaligned." By the early 1980s the Spanish Communists in elections were reduced to less than 5 percent of the popular vote, and the spirit of Eurocommunism had collapsed. Moscow spurned the "nonaligned" Communist Party of Spain and began favouring politically and financially one of the pro-Soviet splinter parties, called, simply, the Communist Party (Partido Comunista), founded by Ignacio Gallego, a former leading member of the old nonaligned party.

In France, the once-powerful French Communist Party, which in the early postwar era was able to command about a third of the French popular vote, experienced a severe decline in later years. Its leader Georges Marchais and his comrades briefly flirted with Eurocommunism in the late 1970s—without

any popular success. The French Communist share of the popular vote had declined to less than an eighth of the national total. On the other hand, the Italian Communist Party remained Italy's second largest party, partly by stressing its independence of Moscow. Its foreign contacts and sympathies seemed to lie more with the European social democrats and labour parties. After the democratic revolutions of 1989, almost all the communist parties of eastern Europe (outside the Soviet Union) became social democratic parties in spirit or name. Eurocommunism, in effect, had become the norm.

Eurodollar, a United States dollar that has been deposited outside of the United States, especially in Europe. Foreign banks holding Eurodollars are obligated to pay in U.S. dollars when the deposits are withdrawn. Dollars form the largest component of all currencies in which such deposits are held and which are generally known as Eurocurrency. The name originated in the early 1960s when eastern European countries wishing to hold dollar deposits outside of the United States deposited them in European banks. Later the market involved many non-European countries.

By accepting a Eurodollar deposit, a bank actually receives a balance with a United States bank. The receiving bank is then able to make dollar loans to customers. Most such loans are used to finance trade, but many central banks also operate in the market.

Europa, in Greek mythology, the daughter either of Phoenix or of Agenor, king of Phoenicia. The beauty of Europa inspired the love of Zeus, who approached her in the form of a white bull and carried her away from Phoenicia to Crete. There she became the mother of

Europa being abducted by Zeus disguised as a bull, detail from an Attic krater, 5th century

By courtesy of the Museo Nazionale Archeologio, Tarquinia, Italy; photograph, Hirmer Fotoarchiv, Munchen

King Minos of Crete, King Rhadamanthus of the Cyclades Islands, and, according to some legends, Prince Sarpedon of Lycia. She later married the king of Crete, who adopted her sons, and she was worshiped under the name of Hellotis in Crete, where the festival Hellotia was held in her honour.

Europa, also called JUPITER II, fourth largest satellite of Jupiter. It was discovered by Galileo in 1610 and was named by the German astronomer Simon Marius shortly thereafter. Europa has a diameter of 3,138 km (1,946 miles), and it orbits Jupiter at a distance of about 670,900 km (415,960 miles). The satellite has a density of 3.03 grams per cubic cm, which indicates that it consists mostly of rock with a fairly small component of ice or water.

Europa was observed at close range in 1979 by the U.S. Voyager 1 and 2 spacecraft. Most of the satellite's surface is smooth, very bright ice. Some regions concentrated near the equator are slightly darker and have a mottled appearance. Europa's impact-crater density is much lower than that of most objects in the solar system. Europa's most striking characteristic is an intricate pattern of dark linear features that crisscross the surface. These measure several tens of kilometres wide and extend in some instances for thousands of kilometres. They seem to have little or no associated surface topography. Their origin is unknown, but their appearance suggests that they may be fractures caused by extensional stresses in Europa's crust. The smoothness of the satellite's surface indicates that its icy crust was relatively warm, soft, and mobile for at least a substantial part of its early history.

Europa Canal: *see* Main-Danube Canal.

Europe, second smallest of the world's continents (after Australia), composed of the westward-projecting peninsulas of Eurasia and occupying an area of about 4,000,000 square miles (10,400,000 square km), which is nearly one-fifteenth of the world's total land area. It is bordered on the north by the Arctic Ocean, on the west by the Atlantic Ocean, and on the south (west to east) by the Mediterranean Sea, the Black Sea, the Kuma and Manych rivers, and the Caspian Sea; the eastern boundary (north to south) runs along the eastern Ural Mountains and the Emba River. Europe's islands and archipelagoes include the Novaya Zemlya, Iceland, the British Isles, Corsica, Sardinia, Sicily, Crete, Malta, and Cyprus. Its major peninsulas include the Scandinavian, Iberian, Italian, Balkan, and Jutland. Indented by numerous bays, fjords, and seas, continental Europe's highly irregular coastline is about 24,000 miles (38,000 km) long. Its population in 1990 was estimated at 785,700,000.

A brief treatment of Europe follows. For full treatment, *see* MACROPAEDIA: Europe; European History and Culture. Other aspects of the subject of Europe are treated in the following MACROPAEDIA articles. For information about distinctive eras and aspects of European history, *see* Byzantine Empire, History of the; Crusades; European Overseas Exploration and Empires, History of; Greek and Roman Civilization, Ancient; Holy Roman Empire, History of the; Prehistoric Peoples and Cultures; Steppe, History of the Eurasian. For information about Europe's peoples and their cultures and institutions, *see* Christianity; Eastern Orthodoxy; European Religions, Ancient; Judaism; Protestantism; and Roman Catholicism; separate articles about Architecture, History of Western; Literature, History of Western; Music, History of Western; Painting, History of Western; Sculpture, History of Western; and Theatre, History of Western; separate articles about Belgian Literature; Celtic Literature; Czechoslovak Literature; Dutch Literature; English Literature; French Literature; German Literature; Greek Literature; Hungarian Literature; Italian Literature; Latin Literature; Polish Literature; Portuguese Literature; Russian Literature; Scandinavian Literature; Spanish Literature; Yiddish Literature; and Yugoslav Literature; and separate articles on Political Philosophy, History of Western; and Legal Systems, Evolution of Modern Western.

Physical and human geography. The greater part of Europe combines low elevations with low relief; about three-fifths of the land is at an elevation of less than 600 feet (180 m) above sea level, more than one-third is between 600 and 3,000 feet (180 and 900 m), and the rest is at elevations of more than 3,000 feet. Europe can be divided into two major parts—western peninsular Europe and eastern continental Europe. And it can be divided into four distinct physiographic regions—southern Europe, the northwestern highlands, the central uplands and plateaus, and the lowlands. The highest elevations and the most rugged relief are found in the Alps (Mont Blanc), the Pyrenees, and the Sierra Nevada, though higher elevations are found at the Europe-Asia frontier of the Caucasus Mountains (Mount Elbrus). The northwest highland region of rugged mountains and high plateaus, their contours softened by prolonged erosion and glaciation, and deep valleys, notably the fjords of Norway, includes much of Iceland, Ireland, Britain, and Scandinavia. The largely wooded and important coal-bearing central upland and plateau region includes the Southern Uplands of Scotland, the Massif Central of France, the Meseta Central of Spain, and the Bohemian Massif. The lowlands include the Russian (or East European) Plain in the east (more than 1,500 miles [2,400 km] wide from north to south), which extends westward into the North European Plain (Poland, northern Germany, southern Scandinavia, Denmark, Belgium, The Netherlands, and northern and western France); southward into the Romanian, Bulgarian, and Hungarian plains; and northward into Finland. The northern lowlands are largely of glacial deposition, whereas northern Scandinavia, Finland, and adjacent parts of the Soviet Union offer landscapes of glacial erosion.

Europe surpasses only Australia and Antarctica in volume of water flow (about 684 cubic miles [2,850 cubic km]) per year. Most of the continent drains into the basin of the Atlantic Ocean and its seas, including the Mediterranean, Black, North, and Baltic. The Volga River, with its principal tributaries the Kama and Oka, is the continent's longest (2,193 miles [3,529 km]) and has the largest drainage basin (525,000 square miles [1,359,750 square km]) and the greatest average annual discharge (more than 282,520 cubic feet per second [8,000 cubic m per second]). Other major rivers are the Danube, Dnepr, Don, Rhine, Vistula (Wisła), Elbe, Rhône, and Oder. Most of the European rivers serve as major transportation routes and are interconnected by networks of canals. Hydroelectricity is important in many regions. Lakes, covering less than 2 percent of Europe's surface, are mostly of glacial origin. Finland is covered by some 55,000 lakes. Lake Ladoga in northern Soviet Europe is the largest (6,826 square miles [17,678 square km]) freshwater lake of the continent. Glaciers, often 1,300 to 2,000 feet (400 to 600 m) thick and in some cases up to 3,300 feet (1,000 m) thick, cover an area of about 44,800 square miles (116,000 square km) in Europe, mostly in the north.

Lying south of the Arctic Circle and north of the tropics, Europe exhibits a wide range of climates. The almost continuous mountain belt trending west-east across the continent impedes the interchange of tropical and polar air masses. Four major regional climate types can be distinguished: the maritime climate of the west with abundant rainfall and mild temperatures both in the winter and summer; the transitional climate of central Europe with 20 to 40 inches (500 to 1,000 mm) of annual rainfall, cold winters, and warm summers; the continental climate of the northeast with 10 to 20 inches (250 to 500 mm) of annual rainfall, long and cold winters, and hot summers; and the Mediterranean climate of southern coastal Europe with moderate rainfall (20 to 40 inches), mild and wet winters, and hot and dry summers. Dry, steppe climate also occurs in two small regions—precipitation is between 10 and 20 inches in southeastern Spain and less than 10 inches in certain areas of the southeastern European Soviet Union.

The continent can be divided into six major vegetation belts (north to south). The narrow strip of the tundra zone is in the extreme northern Soviet Union, Scandinavia, and Iceland; there a thin cover of lichens, mosses, and a variety of grasses support reindeer (caribou),

Arctic fox, and bear. The coniferous taiga, or boreal zone (spruce, fir, pine, willow, and larch), the most extensive forest zone in Europe, is located in the northern Soviet Union (north of the upper Volga River), Scandinavia, and Sweden and is the habitat of elk, reindeer, brown bear, wolf, badger, beaver, and sable. The deciduous mixed-forest zone (oak, maple, pine, beech, birch, elm, and linden), stretching across the continent from the British Isles to the central European Soviet Union, is associated with mink, wildcat, deer, wild boar, and bison. The Mediterranean zone is in southern Europe, where forests of oak, beech, chestnut, spruce, cedar, and scrub (maquis) harbour wild goat and sheep, bear, and wildcat; most of the natural vegetation there has been replaced with wheat and corn (maize) fields, citrus orchards, olive and cork-oak trees, vineyards, and fine pastures. The steppe zone is in the southeastern European Soviet Union, where grasslands have been almost completely replaced by crops such as wheat, corn, and sugar beets; fauna includes many rodents, fox, and varieties of hare. Lastly, the semidesert region around the Caspian Sea supports sheep raising. In the lower Volga-Ural region are large tracts of barren land where only a few salt-tolerant plants survive.

Roughly one-third of Europe is considered arable, a much larger proportion than the world average (excluding Antarctica) of 11 percent. More than half of Europe's total arable land during the mid-1980s was devoted to the production of cereals, principally wheat and barley. One-third of its total land area is forested, much of it interspersed between agricultural and populated areas. Although pastureland accounts for less than one-fifth of Europe's total land, the continent supports substantial herds of both sheep and cattle.

The European countries (excluding the Soviet Union) had, according to late 1980s estimates, the world's leading reserves in only a single metal—mercury (with more than 40 percent of world reserves). They also had 13 percent of the world's total reserves of lead, 20 percent of ilmenite (a major ore of titanium), and 15 percent of zinc. There are substantial reserves of antimony, bauxite (aluminum), cadmium, iron ore, silver, and tungsten. Western Europe is nearly devoid of gold, columbium (niobium), platinum (the only significant amount is in Finland), tellurium, and zirconium and has only 1 percent or less of the global reserves of chromite, cobalt, manganese, molybdenum, tantalum, and vanadium. Europe (excluding the Soviet Union), together with South America, is, nevertheless, the poorest overall in mineral resources of the world's continents. The Soviet Union on the other hand, is the most favourably endowed nation in the world in terms of mineral reserves, including both its European and Asian reserves, in nearly all minerals. Western Europe has substantial reserves of petroleum (about 3 percent of the world's total reserves) and natural gas (about 6 percent of the world's total reserves), most of which is beneath the North Sea. The Soviet Union has more than twice as much petroleum and more than six times as much natural gas. Estimated reserves of coal in the European Soviet Union and in western Europe together account for one-third of global reserves.

The people of Europe constitute about one-seventh of the world's population. Because of its long-standing habitation and the generally low mobility of most of its ethnic groups, Europe has many divisions of language, nationality, political organizations, and standards of living. Western and central Europe, followed by the Ukraine and Hungary, are the most densely populated areas. The highest densities are found in a southerly belt that extends from England across northern France, northern Italy, and central Germany to the Moscow region. Populations are concentrated in highly industrialized urban centres and in areas of intensive mining and commerce.

The United Kingdom is more than 90 percent urban, whereas Romania is only about 48 percent urban, Albania is only 34 percent urban, and Portugal is only 30 percent urban. By the late 1980s Europe had more than 40 cities with a population of more than 1 million each. Huge urban agglomerations such as Greater London and the Ruhr have evolved either by outgrowth from a single central city or by the fusing together of different cities.

Low mortality rates indicative of the advances in modern health care have been attained almost everywhere in Europe. Birth rates in western and northern Europe declined during World War II but recovered afterwards to figures of between 15 and 20 per 1,000. By the early 1990s birth rates in Europe ranged from about 11 per 1,000 in Denmark, Sweden, and Germany to 15 in Poland, 17 in the Soviet Union, and 22 in Albania. For the whole continent, excluding the Soviet Union, the annual rate of natural increase was about 2 per 1,000. The Soviet Union's overall rate of natural increase was almost 7 per 1,000, with higher rates among its Asian populations. Lowered birth rates and increased longevity in most European countries has caused a rising proportion of retired citizens.

Europe has been a major source of emigrants for the settlement and economic development of the Americas, Australia, South Africa, and New Zealand. Since the early 1800s an estimated 60 million persons have emigrated overseas. Emigration was especially heavy between 1846 and 1932 and peaked in 1913, when at least 1.5 million persons emigrated from Europe. Subsequent U.S. entry restrictions, territorial transfers between the great powers, and the attractions of economic opportunity caused emigrants to seek homes in Australia, Canada, South America, and Turkey during the decades since World War I. Although Europe is relatively densely populated, it continues to attract immigrants from other continents in search of employment and a higher standard of living.

The aggregate national income of Europe is growing more rapidly than the population; the average per capita income is among the highest in the world. Per capita income in southern Europe, however, lags behind that in western Europe.

The predominantly market economies of Germany, France, Belgium and Luxembourg, The Netherlands, the United Kingdom, Denmark, and Italy are among the most developed in the world and are integrated with those of Ireland, Greece, Spain, and Portugal in the European Community (EC). Until 1990 the centrally planned economies of the Soviet Union, Poland, East Germany, Czechoslovakia, Hungary, Romania, and Bulgaria were integrated in the Council for Mutual Economic Assistance (Comecon) and were dominated by heavy industries.

Agriculture employs only a little more than one-fifth of the work force in most European countries and is highly mechanized. Small family farms predominate in the EC; the Common Agricultural Policy of the EC encourages regional specialization and protects farmers' incomes by establishing support prices for agricultural commodities. The relatively high prices set by the Common Agricultural Policy have favoured exporters of food over importers such as the United Kingdom. The EC maintains large stockpiles of surplus butter and other agricultural commodities. Collectivized agriculture predominates in the centrally planned economies of Europe.

Agricultural yields along the North Sea are extremely high and are dominated by the raising of cattle for dairy products and beef. The raising of livestock and crops is mixed in the Ukraine, Poland, Romania, Yugoslavia, and some regions of Ireland and Sweden. Agricultural yields in the European Soviet Union, Scandinavia, the Balkans, southern Italy, and the Iberian Peninsula are generally low by European standards but are considerably higher than those in most non-European countries.

Forestry is concentrated in Scandinavia and the Soviet Union; logs are commonly floated downstream to sawmills at the mouths of rivers. Europe's most productive fisheries are concentrated in the North Atlantic Ocean and the adjacent waters of the Norwegian Sea, the North Sea, and the Bay of Biscay. The Soviet Union, Norway, Denmark, and Iceland account for a large part of Europe's total catch of fish.

European mineral industries are based largely on coal (which is mined primarily in the European Soviet Union, Germany, Poland, the United Kingdom, and Czechoslovakia) and iron ore (which is mined primarily in the Soviet Union, France, Sweden, and Spain). Many European coalfields are approaching depletion. The European Coal and Steel Community administers a common market for coal, coke, iron ore, pig iron, and steel within the EC. Large-scale production of petroleum is limited to the offshore North Sea oil fields of the United Kingdom and Norway and scattered oil fields in Romania and the Soviet Union. Most European countries are heavily dependent on imported petroleum. The Netherlands, Romania, and the United Kingdom are the leading producers of natural gas in Europe.

In the late 1980s Europe (excluding the Soviet Union) generated more than one-fourth of the world's total production of electricity. Of the total electricity generated in Europe, more than a quarter was derived from nuclear power. European countries have been active in the development of nuclear power in an effort to reduce costly imports of petroleum. Large-scale production of hydroelectric power is concentrated in Scandinavia, which is deficient in coal. The uniform distribution of electricity over large areas of Europe has broken down the traditional concentration of industries around coalfields.

European manufacturing industries are highly developed and are dependent to a large extent on imported raw materials. The manufacture of petrochemicals, motor vehicles, and electrical goods in the market economies of Europe is dominated by large companies; the largest manufacturing companies in the EC are concentrated in the United Kingdom and Germany. Small-scale industries account for a large percentage of the industrial output of Denmark, Belgium, France, Spain, and Italy. Public corporations control crucial heavy industries in the United Kingdom, France, and Italy. Technologically advanced industries have grown at the expense of heavy industries in the EC and specialize in the assembly of satellites, aircraft, electronic goods, nuclear components, and computers. The centrally planned economies of Europe have favoured the development of heavy, rather than light, industries.

Europe (including the Soviet Union) accounts for approximately one-half of all international trade. Exports represent more than one-fifth of the aggregate GNP of the EC, which is the world's largest trading bloc. There are no internal tariffs within the EC. Trade among members of Comecon was dominated by the Soviet Union, which supplies industries in eastern Europe with fuel and raw materials. Foodstuffs, petroleum, and raw materials dominate European imports; Europe exports a wide range of capital and consumer goods, including machinery, motor vehicles, electronic equipment, chemicals, and textiles.

History. The continent of Europe had a scanty population of Neanderthals, now ex-

tinct, before modern humans appeared approximately 40,000 years ago. Throughout its late prehistoric period, Europe continually received immigrants from Asia. These immigrants spoke Indo-European languages and were Bronze Age in culture and Caucasian in ethnic type. Agriculture and livestock raising first appeared in the Aegean about the end of the 7th millennium BC. By the middle of the 6th millennium, permanent settlements had begun to grow up in the southern Balkans. The middle of the 5th millennium witnessed the expansion of farming over much of central Europe. At the beginning of the 2nd millennium BC, the general disposition of population groups that conditioned the emergence of historical peoples and nations was in evidence.

A number of "barbarian" peoples were established by about 1000 BC, including Celts, Germanic peoples, and Eastern peoples. The earliest Celts are believed to have inhabited an area that constitutes part of present-day France, southern Germany, and adjacent territory. Their elaborate burial mounds give evidence of a rich and diverse culture, which spread as far as Britain and Ireland, central Europe, the Carpathians, and the Balkans.

The origins of the Germanic, or Teutonic, peoples are obscure. It is believed that by the late Bronze Age they inhabited southern Sweden, the Danish peninsula, and northern Germany. They also migrated south and west into areas inhabited by Celtic tribes.

A variety of communities existed in the grasslands that extended from the Black Sea northwestward outside the Carpathian Mountains as far as the Baltic Sea. The nomadic Scythians, who had ranged to the east of the Altai Mountains during the 9th century, were displaced from their traditional area by tribal feuding. They migrated westward, in turn dislodging other tribes and settling in the Caucasus and the region to the north of the Black Sea. They advanced into Syria and Judaea and even as far as Egypt. They were eventually overcome by the Sarmatians, another central Asian tribe. The Slavs may represent the final fusion of all the Indo-European elements on the western edge of the steppes.

The first leap toward civilization in Europe was made by the Greeks. Mycenean civilization, centred in mainland Greece, can be dated from the middle of the 2nd millennium BC, when a branch of the Indo-Europeans intermingled with the populations of the Mediterranean region during the great migrations of nations that started in the area of the lower Danube. Classical Greek civilization is dated from about 900 BC. The Greeks traveled far and wide, founding colonies on the coasts and islands of Asia Minor, on the shores of the Black Sea, in Italy, and in northern Africa. They were in touch with the older advanced cultures of the Middle East and ultimately transmitted many features of these cultures to western Europe. With their own unique achievements, particularly in philosophy, mathematics, and natural science and in the evolution of the city-state, the Greeks laid the foundation for European civilization.

By 146 BC the Greeks were under Roman control. Beginning in Italy, the Romans created a vast empire that, in Europe, covered all the Mediterranean countries, Spain, Gaul, and southern Britain. Rome brought to the conquered parts of Europe the civilization the Greeks had begun, to which it added its own important contributions in the form of state organization, military institutions, and law. Within the framework of the Roman Empire, there began the assimilation of varying types of culture to the Hellenistic-Roman pattern. The empire, operating under the *pax romana* ("Roman peace"), allowed free trade to flourish over a vast, interconnected region. It was under the Roman Empire that the Christian religion penetrated into Europe. During the period of the decline of secular culture, Christianity and the church were the sole forces able to arouse fresh creative strength by assimilating the civilization of the ancient world and transmitting it to the Middle Ages. Christianity and a church with a Roman nature, the most enduring legacy of the ancient world, became one of the most significant features of western European civilization.

Growth in population during the 2nd and 3rd centuries began to force the "barbarian" tribes away from their settlements. The Roman Empire in the west finally collapsed (AD 476) from the repeated incursions of the mostly Germanic peoples of central and eastern Europe. The ensuing Middle Ages (sometimes called the Dark Ages) saw the breakdown of urban civilization in the west and the shift of political power from the Mediterranean to western Europe. The Greek half of the Roman Empire suffered relatively little from the empire's decline and fall. Much of the civilization of antiquity was preserved by the Byzantine Empire. Mediterranean unity finally collapsed with the advent of Islām.

The Carolingian Empire of the 8th and 9th centuries (*c.* 800) was the largest of the medieval Germanic kingdoms, but it was full of diverse peoples who, after the death of Charlemagne and the subsequent decline of the Carolingians, followed their own, ultimately national, patterns. From the 9th to the 10th century, the Vikings carried out raids and incursions throughout the whole of Europe. They penetrated as far as the Caspian Sea, eventually settling in many of the territories they conquered. Of these explorations, the Viking settlement of Iceland is the best-documented. By the mid-11th century, the Viking Age was over, as can be noted in the unsuccessful attempt by Harald III Sigurdsson to recapture England from the Normans.

The Middle Ages were characterized by feudalism, a fragmented political system, and the dominance of the Roman Catholic church. Throughout most of the Middle Ages, the social structure of most European communities was determined by the need for food and for raw materials, and towns that were once thriving centres of commerce and industry began to decline. The waning years of the medieval period witnessed the emergence of nation-states (especially England, France, Portugal, and Spain), the beginnings of the cultural, scientific, and artistic rebirth known as the Renaissance, and the appearance of the Islāmic Ottomans who successfully wrested the Balkans from the rest of Christian Europe.

The 16th century was one of modern Europe's most formative eras. The Reformation destroyed the unity of the Roman Catholic church and set off more than a century of warfare in which political, economic, and religious ambitions were so closely intertwined as to be mutually indistinguishable. Concomitant with this warfare was the growing desire to explore and expand abroad. The 16th century marked the beginning of the English, French, Dutch, Portuguese, and Spanish mercantile empires that would imprint western European culture and institutions on all corners of the globe. Exploration broadened the scope of knowledge, and an influx of Byzantine scholars brought about a revival of interest in ancient Greece and Rome.

Working within the strictures of the medieval worldview, scientists of the 15th and 16th centuries achieved remarkable results. The most important technological advance of the age was the development of printing with movable type. Use of the printing press spread rapidly, and it is doubtful that the Renaissance would have been more than a monkish quarrel or that the Scientific Revolution would have happened at all without it. The spirit of humanism and scholarship grew with the growth of literacy. Working with a model provided by Petrarch, leading humanists emphasized the mastery of language—eloquence as the union of elegance, power, and virtue. Study of the humanities—including rhetoric, grammar, poetry, moral philosophy, and history, and perhaps music and mathematics—became the most important method by which the ideal could be reached.

The age of monarchy that had its roots in the Peace of Westphalia (1648) was to last some 140 years. Many wars were fought in the struggle for supremacy between church and state. Nowhere was the papacy more disappointed than in the Habsburg dominions, where, since the Reformation, the ruling family had vigorously supported Roman Catholicism; yet its sovereigns were sensitive to the slightest hint of papal interference. The peace of 1648 made clear the sovereign independence of the European state. The main supports of the monarchy system were the establishment of nationalized armies and a conscious national policy supporting the idea of a balance of power among nations. During this period the Enlightenment (a movement concerned with the interrelationship between man, God, nature, and reason) gained broad support. It helped to focus attention on the flaws that began to appear in the European political system as early as the 18th century. Britain's American colonies revolted in 1775, and the French toppled their monarchy in 1789. The French Revolution spearheaded the movement toward democracy and equality, yet its immediate results were short-lived. It was followed by Napoleon Bonaparte's tumultuous rampage across Europe and the Congress of Vienna (1815), which strove for a conservative settlement of the various European political questions, based on the idea of balance of power. The Congress' actions brought some measure of peace to Europe, but the movement toward democracy, nationalism, and liberalism was irresistible. The eruption of war in 1914 was, in many ways, the result of the inability of the "old order" to deal with these irresistible movements.

World War I altered the face of Europe dramatically. The creation of a variety of new countries in eastern Europe was an attempt to deal with the nationalities problem, but continuing severe economic troubles gave rise to fascism and impetus to communism, two political systems that severely tested the interwar peace. The Fascist and National Socialist movements that swept across Italy and Germany in the 1920s and '30s brought Europe again to war (1939–45), this time one that engulfed the rest of the world.

After World War II much of eastern Europe fell under Soviet domination, sequestered behind what Winston Churchill called an "Iron Curtain." Western political and economic power shifted, in large measure, to the United States, making one of Europe's most pressing concerns its territorial security against the backdrop of Soviet-U.S. hostility in an age that substituted a nuclear balance of terror for a former balance of power.

Europe, Concert of, in the post-Napoleonic era, the vague consensus among the European monarchies favouring preservation of the territorial and political status quo. The term assumed the responsibility and right of the great powers to intervene and impose their collective will on states threatened by internal rebellion. The powers notably suppressed uprisings in Italy (1820) and Spain (1822) but later condoned Belgium's rebellion and proclamation of independence (1830).

Made obsolete in its original form by the revolutions of 1830 and 1848 and by the subsequent unifications of Italy and Germany, the Concert of Europe survived for most of the 19th century in the consultations among the great powers on territorial questions.

Europe, Council of, organization of representatives of 21 western European states for the purpose of promoting European unity, protecting human rights, and facilitating social and economic progress. The Council was established on May 5, 1949, by 10 founding states (Belgium, Denmark, France, Ireland, Italy, Luxembourg, The Netherlands, Norway, Sweden, and the United Kingdom), which were later joined by 11 others (Austria, Cyprus, West Germany, Greece, Iceland, Liechtenstein, Malta, Portugal, Spain, Switzerland, and Turkey). Headquarters are in Strasbourg, Fr.

In order to undertake and supervise its different activities, the Council established over the years a number of special bodies and expert committees, such as the European Committee on Crime Problems, European Commission of Human Rights, European Court of Human Rights, European Conference of Local Authorities, Council for Cultural Cooperation, European Committee on Legal Cooperation, European Pharmacopeia Commission, and the Council of Europe Resettlement Fund.

European Atomic Energy Community (EURATOM), international organization established in 1958 to form a common market for the development of the peaceful uses of atomic energy. The original members were Belgium, France, West Germany, Italy, Luxembourg, and The Netherlands. Denmark, Ireland, and the United Kingdom joined in 1973, Greece in 1981, and Portugal and Spain in 1986.

A major incentive for the creation of Euratom was to facilitate the establishment of a nuclear-energy industry on a European rather than a national scale. Other aims of the community were to coordinate research in atomic energy, to encourage the construction of nuclear-power installations, to establish safety and health regulations, to encourage the free flow of information and the free movement of personnel, and to establish a common market for trade in nuclear equipment and materials. Euratom's control was not extended to nuclear materials intended for military use.

The treaty establishing the community developed out of the Messina Conference of 1955 and became effective Jan. 1, 1958. The Common Market for Trade in Nuclear Material, which eliminated import and export duties within the community, came into existence in January 1959. From the beginning, Euratom has shared a Court of Justice and a Parliament with the European Economic Community and the European Coal and Steel Community; in July 1967, the executive bodies (the Commission and the Council of Ministers) of all three communities were also merged.

Research has been undertaken at Euratom's own Joint Research Centre, as well as under contract with various research bodies in member countries and under agreements with other countries and international organizations.

European blastomycosis (infection): *see* cryptococcosis.

European Coal and Steel Community (ECSC), administrative agency established by a treaty ratified in 1952, designed to integrate the coal and steel industries of France, West Germany, Italy, Belgium, The Netherlands, and Luxembourg. Denmark, Ireland, and the United Kingdom joined in 1973, Greece in 1981, and Portugal and Spain in 1986. Headquarters are in Brussels.

The first step in the formation of the ECSC was taken in May 1950, when the French foreign minister Robert Schuman proposed the establishment of a common market for coal and steel by those countries willing to delegate their powers over these sectors of the economy to an independent authority. The motive behind the plan (called the Schuman Plan, though it had been drawn up by Jean Monnet, then head of the French planning agency) was the belief that a new economic and political framework was needed if future Franco-German conflict was to be avoided. The first step was to be limited, but the ultimate objective was a United States of Europe. Five other countries—West Germany, Italy, and the three Benelux countries—agreed to negotiate on the basis of this plan.

By 1954 the agency had removed nearly all barriers to trade in coal, coke, steel, pig iron, and scrap iron between its members. Trade in these commodities rose dramatically in the 1950s as a consequence. A set of common rules was established to control cartels and to regulate mergers. The central institution, the High Authority, fixed prices and set production limits or quotas and was authorized to impose fines on business firms that infringed treaty rules.

From the 1960s on, one of the ECSC's main tasks was to supervise its members' reduction of their excess production of coal as that mineral was replaced by petroleum as an industrial fuel. This involved the closing of inefficient or uneconomic coal mines in the member countries. Similarly, in the 1970s the ECSC began to supervise the elimination of its members' excess steelmaking capacity when low-cost steel from Japan and other countries put western European steelmakers at a competitive disadvantage. Under ECSC's aegis, an international group of steelmakers, the European Federation of Iron and Steel Industries (Eurofer), was formed in 1977 to rationalize the industry. By the 1980s, sharp declines in European steel demand and prices compelled the Commission of the European Community to issue compulsory output quotas for all steel companies in the ECSC countries.

European Community (EC), formerly EUROPEAN COMMUNITIES, French COMMUNAUTÉ EUROPÉEN, German EUROPÄISCHE GEMEINSCHAFT, Italian COMUNITÀ EUROPEE, an organization of most of the states of western and southern Europe that works toward and oversees their economic and political integration. The EC was established on July 1, 1967, in the merger of the separate organizations known as the European Economic Community (EEC), the European Coal and Steel Community (ECSC), and the European Atomic Energy Community (*qq.v.*). Previously each of these three communities had its own commission (called the High Authority in the case of ECSC) and its own council. The merger created a single Commission of the European Communities and a single Council of Ministers of the European Communities. Other executive, legislative, and judicial bodies were also collected under the umbrella of the European Communities. The original members of the Communities were Belgium, France, West Germany, Italy, Luxembourg, and The Netherlands. Denmark, Ireland, and the United Kingdom joined in 1973, Greece in 1981, and Portugal and Spain in 1986.

The European Coal and Steel Community (founded 1952) and the European Economic Community and European Atomic Energy Community (both founded 1958) were established in the wake of World War II to promote the lasting reconciliation of France and Germany; to develop a political union of the states of western Europe capable of alleviating their fears of war with each other; and to develop the economies of the member states into one large common market. The liberalized trade policies sponsored by the European Economic Community were conspicuously successful in increasing trade and economic prosperity in western Europe from the 1960s on. Consequently, in 1967 the EEC, the ECSC, and Euratom merged and became known collectively as the European Communities (with the plural being dropped from the name in the 1980s as the economic integration of the nations of western Europe progressed).

The Commission of the European Community—consisting of 14 members, a president, and five vice presidents selected by the member states—is charged principally with formal and practical implementation of the various treaties of the Community and the various rules issued by the Council of Ministers. It also helps prepare acts submitted to the European Parliament and the Council of Ministers. The Commission, as executive, is both initiator and implementer.

The Council of Ministers, whose membership is made up of one representative from each of the member national governments, has the real power of decision in the Community. It determines how the intents of the treaties are to be carried out and how the separate economic policies of the member nations are to be coordinated toward that end.

The European Council, which is composed of the heads of state or government of the member nations, has met regularly since 1974—ordinarily three times a year—for the purpose of policy-making on the highest level.

The European Parliament (*q.v.*) is the legislative branch of the European Community, and the European Court of Justice (*q.v.*) is the judicial branch of the EC.

The Court of Auditors, created in 1977 and consisting of one member from each of the member nations, is responsible for the external audit of the expenditures and revenue of the Communities.

The European Investment Bank, created in 1958, is an independent public institution acting as the European Communities' bank for long-term finance. It makes or guarantees loans for investment projects, mainly in industry, power resources, and infrastructure.

The Economic and Social Committee, a consultative body that was established in 1958, has three groups of representatives—from employers' organizations, trade unions, and "special interests" (professions, consumers, agriculturists, small businesses, etc.). It is intended to advise the Commission and the Council of Ministers on the effect of the Communities' policies and practices on the general economy.

One of the European Community's main goals has been the integration of its members' economies into a single frontierless market that would have a common currency and a common central bank. The measures the EC took in this regard in the late 20th century were obtained by the unanimous consensus of its members. The EC oversaw the establishment of the European Monetary System (EMS) in 1978 to regulate currency exchange rates and aid monetary stability among its members. The EMS, which took effect in 1979, linked the currencies of the EC member countries (excepting those of the United Kingdom, Spain, and Portugal, who declined to participate) so as to avoid large day-to-day fluctuations in currency rates while permitting periodic realignments. In the interest of encouraging the mobility of labour, restrictions on the movement of labour among the EC countries were also effectively removed. In 1987 the EC member states adopted the Single European Act, by which they declared their eventual intention to create a unified market in western Europe that would have no frontiers or national barriers to trade. Measures implementing this declaration began in 1990 with the lifting of exchange controls and the elimination of barriers to Europe-wide banking, insurance, securities, and other financial services. These measures were expected to link the EC countries' capital markets more closely together.

European Court of Justice, also called COURT OF JUSTICE OF THE EUROPEAN COMMUNITY, the judicial branch of the European

Community (EC). The Court of Justice originated in the individual courts of justice established in the 1950s for the European Coal and Steel Community, the European Economic Community, and the European Atomic Energy Community. These courts' function was to ensure the observance of law in those organizations' interpretation and application of their treaties. In 1958 a single, unified European Court of Justice was created to serve all three of the European Communities (now the European Community).

The European Court of Justice reviews the legality of the acts of the Commission and the Council of Ministers of the EC, which are the executive bodies of that organization. The court typically hears cases involving disputes between member states over trade, antitrust, and environmental issues, as well as issues raised by private parties, compensations for damages, and so on. The court has the power to invalidate the laws of EC member nations when those laws conflict with Community law. The European Court of Justice serves as the final arbiter of the growing body of international law that accompanied the economic integration of western Europe in the late 20th century. The court's full bench consists of 13 judges and six advocates-general, appointed by the member governments.

European Defense Community (EDC), an abortive attempt by western European powers, with United States support, to counterbalance the overwhelming conventional military ascendancy of the Soviet Union in Europe by the formation of a supranational European army. The idea was originally mooted at the Hague Conference of 1948. Influenced by the Korean War, René Pleven, a Gaullist until 1946 and twice premier of France, evolved a plan that was later put forward by the French foreign minister Robert Schuman at a meeting of the Council of Europe in 1951. Though the weaker members of the North Atlantic Treaty Organization (NATO) were keen, the Scandinavians were cool toward the idea, and opinion in France and Italy was divided. A treaty was actually concluded in Paris in 1952, but tension between eastern and western Europe lessened, and by 1954 the necessity for the EDC seemed also to diminish. In its place there arose the Western European Unity Treaty (May 6, 1955), setting up the Western European Union.

European Economic Co-operation, Organisation for (OEEC), organization set up by a convention signed in Paris in April 1948 to coordinate efforts to restore Europe's economy under the European Recovery Program (Marshall Plan). Among its many functions, the OEEC helped abolish quantitative trade restrictions between its member countries, allocated scarce resources among them, and devised a system for regular consultation on matters of common economic concern. In 1961 it was superseded by the Organisation for Economic Co-operation and Development, which included non-European members. *See* Economic Co-operation and Development, Organisation for.

European Economic Community (EEC), byname COMMON MARKET, economic association of western European countries that was established by the Treaty of Rome in 1957 to facilitate (1) the removal of barriers to trade among the member nations; (2) the establishment of a single commercial policy toward nonmember countries; (3) the eventual coordination of transportation systems, agricultural policies, and general economic policies; (4) the removal of private and public measures restricting free competition; and (5) the assurance of the mobility of labour, capital, and entrepreneurship. The original members were France, Belgium, Luxembourg, The Netherlands, Italy, and West Germany. The United Kingdom, Denmark, and Ireland joined in 1973, Greece in 1981, and Portugal and Spain in 1986. Greenland, a dependent state of Denmark that had entered the community when under full Danish rule, withdrew from the EEC in 1985.

The plans for a common market had been discussed in 1955 at a meeting in Messina, Sicily; the treaty was finally signed on March 25, 1957, and the community came into operation on Jan. 1, 1958. The four primary structural organs of the EEC were the Commission, the Council of Ministers, the Court of Justice, and the European Parliament; the last two were also to serve the other two branches of the European Communities—the European Coal and Steel Community (ECSC) and the European Atomic Energy Community (Euratom).

In 1965 a treaty was signed to merge the Commission and the Council of Ministers with those of the ECSC and Euratom, forming two bodies in place of six. The actual merging occurred in July 1967, and thus was established the European Community.

From the beginning one of the EEC's main goals was to eliminate the tariffs, customs duties, and quotas that its members imposed on each other's exports. Accordingly, the first 10-percent reduction in EEC internal tariffs was implemented in January 1959, proving so successful in stimulating trade between member states that by July 1968 all internal tariffs had been removed. Trade among the member nations of the EEC quadrupled in value in the period from 1958 to 1968. Meanwhile, the EEC had adopted a common external tariff so that all of its member states imposed uniform duties on goods imported from nations not belonging to the EEC.

A common agricultural policy was established in 1962, consisting of a system of common guaranteed prices (expressed in dollar terms for convenience) that would offer protection against agricultural imports from lower-cost markets outside of the EEC. Because of the high cost of price supports and the resentment of the manufacturing countries, which felt that they were being forced to subsidize inefficient agriculture, the community in 1979 agreed to gradually eliminate the subsidies, replacing them with an intervention price designed to prevent agricultural prices from falling below fixed levels. The economic history of the EEC from the late 1970s on is subsumed in that of the European Community (*q.v.*).

European Free Trade Association (EFTA), group of six countries—Austria, Norway, Sweden, Switzerland (and Liechtenstein), Finland, and Iceland—organized to remove barriers to trade in industrial goods among themselves, but with each nation maintaining its own commercial policy toward countries outside the group. Its aim is not at any type of European political unity. Headquarters are in Geneva.

The member countries of the Organisation for European Economic Co-operation (OEEC) originally proposed an OEEC-wide free-trade area to which countries not wishing to join the European Economic Community (EEC, or Common Market) could belong and in which the EEC would function as one unit. When negotiations for this broke down in November 1958, the "outside" group then composed of Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and the United Kingdom (later known as the Outer Seven) decided to join together in the EFTA to strengthen their future bargaining power in establishing the wider free-trade area. The EFTA is based on the Stockholm Convention signed by the seven nations in November 1959 and became operative in May 1960. Finland became an associate member in July 1961, and Iceland was admitted to full membership in March 1970. In January 1973, however, Britain and Denmark became members of the EEC and left EFTA. Portugal joined the EEC in 1986.

The original convention committed the members to a schedule of tariff reductions and quota liberalizations for industrial goods but also included provisions for escape if the burden imposed on domestic economies proved too great. Provisions were also made for bilateral agreements to liberalize trade in agricultural products. In addition, it established a system for determining the true country of origin of goods in order to prevent non-EFTA goods from being shipped to the EFTA country with the lowest external tariffs and then rerouted to other EFTA countries (thereby avoiding their higher external tariffs). By the end of 1966, import duties on most industrial goods had been abolished. In 1977 EFTA broadened its scope by entering into agreements with the EEC that established industrial free trade between the two organizations' member countries.

A minimal administrative structure was set up by the original convention; meetings at the ministerial level usually occur twice yearly, and meetings at the official level take place every other week. Decisions are implemented by the individual governments themselves; EFTA holds no supranational powers.

European geographic race: *see* Caucasoid geographical race.

European Parliament, legislative assembly of the European Community. The European Parliament, which was inaugurated in 1958 as the Assembly, consisted originally of members selected by the respective national parliaments of the EC member nations. Beginning in 1979, it became a legislature whose members (now totaling more than 500) were apportioned among the member nations and elected by direct universal suffrage.

Although Parliament members sit in political, not national, groups, France, Germany, the United Kingdom, and Italy have the most members. The Parliament meets annually for about 12 one-week "part-sessions," in either Strasbourg or Luxembourg. It is run by a Bureau headed by a president and 12 vice presidents elected from among its members to serve for terms of 30 months. There are 15 specialized standing committees in the Parliament, including ones on political affairs; budgets; agriculture; economic and monetary affairs; energy and research; external economic relations; and social affairs and employment.

Under the treaties, the EC's Council of Ministers is obliged to consult the European Parliament on various legislative matters, and the Parliament is empowered under its own rules to discuss any matter whatsoever, whether related to the general treaties or not. The Parliament's other tasks include scrutinizing the European Community's budgets and exercising democratic control over various executive organs of the Community.

European Plain, one of the world's largest uninterrupted expanses of plain, stretching from the Pyrenees Mountains on the French-Spanish border across northern Europe to the Ural Mountains in the Soviet Union.

A brief treatment of the European Plain follows. For full treatment, *see* MACROPAEDIA: Europe.

In western Europe the plain is about 200 miles (320 km) in width and covers all of western and northern France, Belgium, The Netherlands, northern Germany, southern Scandinavia, and almost all of Poland. Eastward from northern France and Belgium it is commonly called the North European Plain. As it sweeps eastward the European Plain broadens until it reaches its greatest width, extending more than 2,000 miles (3,200 km)

from the Black Sea to the Arctic Ocean, in the Soviet Union; in the east the plain is called the East European Plain.

The western part of the European Plain has a maritime climate, with warm summers and cool winters, favourable to agriculture; deciduous and coniferous forests abound. Farther eastward rain falls mostly in the warmer months, and winters become extremely cold in the zone of continental climate.

The flatness of this enormous lowland is broken by hills, particularly in the west. Sand-dune lands border the North Sea and the Baltic. The Garonne, Loire, and Seine rivers drain the French section of the plain, and the Scheldt and its affluents drain the Plain of Flanders and low plateaus of central Belgium. Deposits from the Rhine River, the main river of west-central Europe, and the Meuse have formed an extensive delta plain in The Netherlands; the part of the North European Plain bordering the North Sea is one of the most highly industrialized and most densely populated areas in the world. The Weser, Elbe, Oder, and Vistula rivers farther east form several broadly parallel systems that flow generally northwestward into the North or Baltic sea. The retreat of the continental glaciers that once covered much of the North European Plain, including large parts of the northwestern U.S.S.R., left heaps of glacial material called moraines in their wake across northern Germany, Poland, and the European sections of the Soviet Union. The Soviet portion of the plain, everywhere below 1,500 feet (450 m) in elevation, is characterized by semi-arid grasslands in the south, hardwood forests and then coniferous forests farther north, and tundra bordering the Arctic Ocean.

European Recovery Program: *see* Marshall Plan.

European Southern Observatory (ESO), astrophysical organization founded in 1962; its activities are financially supported and administered by a consortium of six European nations—Belgium, Denmark, France, West Germany, The Netherlands, and Sweden. The ESO maintains a permanent administrative and technical staff of some 270 people, about half of whom are based at its European headquarters in Garching, near Munich.

In 1965 ESO established the La Silla Observatory in Chile, located about 600 km (372 miles) north of Santiago at an altitude of 2,400 m (7,870 feet) above sea level. Extensive studies of the southern skies are undertaken at the observatory, which has an array of instruments consisting of 10 telescopes with apertures of up to 3.66 m (144 inches). The facilities are used principally by astronomers from the ESO member countries.

European yew: *see* English yew.

europium (Eu), chemical element, rare-earth metal of transition Group IIIb of the periodic table; it is the least dense, the softest, and most volatile member of the lanthanide series. The element was discovered (1896) by Eugène-Anatole Demarçay and named for Europe. One of the least abundant rare earths, it occurs in minute amounts in many rare-earth minerals such as monazite and also in the products of nuclear fission. Europium is usually separated by reducing it to the $^{+2}$ oxidation state and precipitating it with sulfate ions. The primary use of europium has been for research purposes. Because it readily absorbs thermal neutrons, it may prove to be of use in nuclear-reactor control rods. It has been used as a phosphor activator, as a component of certain electronic materials, and as an agent in the manufacture of fluorescent glass. The metal has been prepared by electrolysis of the fused halides and by reduction of its oxide by lanthanum metal followed by distillation of the europium metal. It quickly reacts in air, oxygen, and water. Both of its naturally occurring isotopes are stable: europium-151 (47.82 percent) and europium-153 (52.18 percent).

In its predominant trivalent state, europium behaves as a typical rare earth, forming a series of generally pale pink salts. The Eu^{3+} ion is paramagnetic because of the presence of unpaired electrons. Europium possesses the most easily produced and stablest $^{+2}$ oxidation state of the rare earths. Trivalent europium solutions can be reduced by zinc metal and hydrochloric acid to give Eu^{2+} in solution; the ion is stable in dilute hydrochloric acid if oxygen from the air is excluded. A series of white to pale yellow or green europium(II) salts are known, such as europium(II) sulfate, chloride, hydroxide, and carbonate. The divalent halides may be prepared by hydrogen reduction of the anhydrous trivalent halides.

atomic number	63
atomic weight	151.96
melting point	822° C
boiling point	1,597° C
specific gravity	5.253 (25° C)
valence	2, 3
electronic config.	2-8-18-25-8-2 or $(Xe)4f^{7}5d^{0}6s^{2}$

Europoort, port on the southwestern coast of The Netherlands. It lies opposite the Hoek van Holland, at the entrance of the Nieuwe Waterweg (New Waterway Canal), a distributary of the Rhine, which links it with the Port of Rotterdam. Europoort's construction was begun in 1958; it consists of industrial sites and harbour basins, and it handles chiefly vessels too large to reach Rotterdam, including oil tankers and iron ore bulk carriers.

Europus (ancient Syria): *see* Carchemish.

Eurotas (Greece): *see* Evrótas River.

Eurotunnel, rail tunnel between England and France that runs beneath the English Channel and was scheduled for completion in 1993. The often-considered idea of constructing a tunnel under the English Channel was revived in 1986 by the United Kingdom and France. A rail tunnel was chosen over proposals for a very long suspension bridge, a bridge-and-tunnel link, and a combined rail-and-road link, and the project was privately financed by a consortium of British and French corporations and banks. Digging began on both sides of the Strait of Dover in 1987–88.

When completed, the Eurotunnel will consist of three 50-kilometre- (31-mile-) long tunnels, with two of the tunnels for rail traffic and a central tunnel for services and security. The Eurotunnel will run between Folkestone, Eng., and Calais, Fr., and would allow road traffic to be loaded onto special rail lines that would travel through the tunnel at speeds of as much as 160 kilometres per hour (100 miles per hour); the use of these high-speed trains was expected to cut the surface travel time between Paris and London in half.

Eurydice, in Greek legend, the wife of Orpheus. Her husband's attempt to retrieve Eurydice from Hades forms the basis of one of the most popular Greek legends. *See* Orpheus.

Eurylaimidae (bird family): *see* broadbill.

eurypterid, member of an extinct group of unusual arthropods rarely preserved as fossils. The eurypterids appeared at the beginning of the Ordovician period, about 505 million years ago, and became extinct at the end of the Permian period, about 245 million years ago. Often referred to as giant scorpions, most eurypterids were small animals, although *Pterygotus buffaloenis,* a species from the Silurian period (about 438 to 408 million years ago) in North America, was the largest arthropod ever known; it reached a length of approximately 3 m (10 feet). The bodies of eurypterids consisted of numerous segments; the appendages present in the anterior portion of the animal served as oarlike swimming organs. Some of the eurypterids were active predators and could probably swim rapidly and effectively after prey, whereas others were probably bottom-dwelling scavengers. The eurypterids

Eurypterid (*Eusarcus scorpionis*)
By courtesy of the American Museum of Natural History, New York

inhabited brackish-water environments and generally occurred among a specialized, often impoverished, faunal assemblage.

eurythmics, also spelled EURHYTHMICS, French RYTHMIQUE, harmonious bodily movement as a form of artistic expression; specifically, the Dalcroze system of musical education in which bodily movements are used to represent musical rhythms.

Eurythmics was developed about 1905 by Émile Jaques-Dalcroze, a professor of harmony at the Geneva Conservatory, who was convinced that the conventional system of training professional musicians was radically wrong. Jaques-Dalcroze attempted to improve his students' musical abilities primarily by increasing their awareness of rhythm. His method was based on rhythmic bodily movements, ear training, and vocal or instrumental improvisation. In his system of eurythmic exercises, designed to develop concentration and rapid physical reaction, time is shown by movements of the arms, and time duration—*i.e.,* note values—by movements of the feet and body. A quarter note, for example, is represented by a single step. For advanced students, the system of prescribed movements may be varied somewhat. In a typical exercise, the teacher plays one or two bars, which the student then executes while the next bars are played; thus, the student listens to a new rhythm while executing one already heard, an exercise requiring and at the same time developing concentration.

Jaques-Dalcroze first applied his method to elementary-school children; then, in 1910, he established an institute at Hellerau-Rähnitz (near Dresden), Ger. Headquarters and a central school were later established at Geneva, and the Hellerau school was moved to Laxenburg, near Vienna. Other institutes of eurythmics have been founded in London, Paris, Berlin, Stockholm, and New York City, and the Dalcroze method has been adopted in schools throughout Europe and the Americas.

For Jaques-Dalcroze, the rhythmic movements used in eurythmics were a means of musical education, not an end in themselves or a form of dance. Nonetheless, his system

is considered an important influence on 20th-century theatrical dance, especially central European and American modern dance. To early modern dancers, eurythmics suggested an alternative, nonballetic choreographic technique. Some dancers, such as Ruth St. Denis and Michio Ito, accepted and employed eurythmic principles in their work. Others, such as Mary Wigman and Doris Humphrey, rejected musically influenced choreography and instead developed new forms of pure dance. In ballet, Sergey Diaghilev was among the first to become interested in the Dalcroze system, and Vaslav Nijinsky's revolutionary *The Rite of Spring,* choreographed in 1913 for Diaghilev's company, revealed strong eurythmic influence. Through such pupils of Jaques-Dalcroze as Marie Rambert, Hanya Holm, and the mime Étienne Decroux, eurythmics has also affected contemporary ballet and the dance of the theatre.

Eusden, Laurence (baptized Sept. 6, 1688, Spofforth, Yorkshire, Eng.—d. Sept. 27, 1730, Coningsby, Lincolnshire), British poet who, by flattering the Duke of Newcastle, was made poet laureate in 1718. He became rector of Coningsby and held the laureateship until his death. Alexander Pope satirized him frequently and derisively.

Eusebius, SAINT (b. Greece—d. 309/310, Sicily; feast day August 17, formerly September 26), pope from April 18 to Aug. 17, 309/310. His epitaph, written by Pope St. Damasus I, tells of a violent dispute in Rome about readmitting apostates after the persecution of Christians under the Roman emperor Dioclетian. Eusebius was opposed by a faction that wanted offenders readmitted to the church without penance. The Roman emperor Maxentius exiled both Eusebius and his opponent. Eusebius was sent to Sicily, where he died almost immediately. His body was taken to Rome and interred in the catacomb of Calixtus. Eusebius is venerated as a martyr.

Eusebius HIERONYMUS: *see* Jerome, Saint.

Eusebius OF CAESAREA, also called EUSEBIUS PAMPHILI (fl. 4th century, Caesarea Palestinae, Palestine), bishop, exegete, polemicist, and historian whose account of the first centuries of Christianity, in his *Ecclesiastical History,* is a landmark in Christian historiography.

Eusebius was baptized and ordained at Caesarea, where he was taught by the learned presbyter Pamphilus, to whom he was bound by ties of respect and affection and from whom he derived the name "Eusebius Pamphili" (the son or servant of Pamphilus). Pamphilus came to be persecuted for his beliefs by the Romans and died in martyrdom in 310. Eusebius may himself have been imprisoned by the Roman authorities at Caesarea, and he was taunted many years later with having escaped by performing some act of submission.

The work of the scholars of the Christian school at Caesarea extended into all fields of Christian writing. Eusebius himself wrote voluminously as apologist, chronographer, historian, exegete, and controversialist, but his vast erudition is not matched by clarity of thought or attractiveness of presentation. His fame rests on his *Ecclesiastical History,* which he probably began to write during the Roman persecutions and revised several times between 312 and 324. In this work Eusebius produced what may be called, at best, a fully documented history of the Christian church, and, at worst, collections of passages from his sources. In the *Ecclesiastical History* Eusebius constantly quotes or paraphrases his sources, and he thus preserved portions of earlier works that are no longer extant. He had already compiled his *Chronicle,* which was an outline of world history, and he carried this annalistic method over into his *Ecclesiastical History,* constantly interrupting his narrative of the church's history to insert the accession of Roman emperors and of the bishops of the four great sees (Alexandria, Antioch, Jerusalem, and Rome). He enlarged his work in successive editions to cover events down to 324, the year before the Council of Nicaea. Eusebius, however, was not a great historian. His treatment of heresy, for example, is inadequate, and he knew next to nothing about the Western church. His historical works are really apologetic, showing by facts how the church had vindicated itself against heretics and heathens.

Eusebius became bishop of Caesarea (in Palestine) about 313. When in about 318 the theological views of Arius, a priest of Alexandria, became the subject of controversy because he taught the subordination of the Son to the Father, Eusebius was soon involved. Expelled from Alexandria for heresy, Arius sought and found sympathy at Caesarea, and, in fact, he proclaimed Eusebius as a leading supporter. Eusebius did not wholeheartedly support either Arius or Alexander, bishop of Alexandria from 313 to 328, whose views appeared to tend toward Sabellianism (a heresy that taught that God was manifested in progressive modes). Eusebius wrote to Alexander, claiming that Arius had been misrepresented, and he also urged Arius to return to communion with his bishop. But events were moving fast, and at a strongly anti-Arian synod at Antioch, about January 325, Eusebius and two of his allies, Theodotus of Laodicea and Narcissus of Neronias in Cilicia, were provisionally excommunicated for Arian views. When the Council of Nicaea, called by Constantine, met later in the year, Eusebius had to explain himself and was exonerated with the explicit approval of the emperor Constantine.

In the years following the Council of Nicaea, the emperor was bent on achieving unity within the church, and so the supporters of the Nicene Creed in its extreme form soon found themselves forced into the position of dissidents. Eusebius took part in the expulsion of Eustathius of Antioch (*c.* 337), Athanasius of Alexandria (335), and Marcellus of Ancyra (*c.* 336). Eusebius remained in the emperor's favour, and, after Constantine's death in 337, he wrote his *Life of Constantine,* a panegyric that possesses some historical value, chiefly because of its use of primary sources. Throughout his life Eusebius also wrote apologetic works, commentaries on the Bible, and works explaining the parallels and discrepancies in the Gospels.

Eusebius OF DORYLAEUM (fl. 5th century), bishop of Dorylaeum and famous opponent of the Nestorians. He was one of the formulators of doctrines at the ecumenical Council of Chalcedon (451).

While a layman, Eusebius was the first to challenge publicly (429) the teaching of Patriarch Nestorius of Constantinople, posting throughout Constantinople his famous *Contestatio,* summoning the faithful to rise against Nestorius. His action led to Nestorius' condemnation by the Council of Ephesus (431).

In 448 Eusebius, then bishop of Dorylaeum, charged his friend Eutyches (*q.v.*), an archimandrite at Constantinople, with heresy for holding a doctrine later known as Monophysitism (which asserted that Jesus Christ had but one nature, not two). The charge by Eusebius, the first to oppose Monophysitism, led to Eutyches' deposition by a synod summoned by Bishop Flavian of Constantinople. Eutyches was then excommunicated by Pope St. Leo I the Great but was reinstated by action of the council that met in Ephesus (known as the Robber Synod of Ephesus) in 449; Eusebius was deposed for his role in the matter. He immediately appealed to Leo and was given refuge in Rome. In 451 he was rehabilitated by the Council of Chalcedon, for which he assisted in drafting the classic definitions of the person and natures of Christ and which caused Eutyches' banishment.

Eusebius OF EMESA (b. *c.* 300, Edessa, Macedonia [now in Greece]—d. *c.* 359, Antioch, Syria [now Antakya, Tur.]), bishop of Emesa, one of the chief doctrinal writers on Semi-Arianism (*q.v.*).

A friend of the Roman emperor Constantius II, whom he often accompanied on expeditions against the Persians, Eusebius was appointed (*c.* 339) to the see of Emesa. Because of his unorthodoxy, he was expelled from the city by its inhabitants but was reinstated after taking refuge with Bishop George of Laodicea, a central figure of the 4th-century Arian controversies. Fragments of George's biography of Eusebius are preserved in the writings of the 5th-century church historians Socrates and Sozomen. St. Jerome, who considered Eusebius "a standard-bearer of the Arian faction," describes his work as rhetorically exhibitionistic. Modern research has attributed 29 homilies to him.

Eusebius OF LAODICEA (b. Alexandria, Egypt—d. *c.* 269, Laodicea [now al-Lādhiqīyah], Syria), deacon of Alexandria who became bishop of Laodicea, after risking his life by serving Christian martyrs during the persecutions of the Roman emperors Decius (250) and Valerian (257). He was a former pupil of the illustrious theologian Origen.

When Alexandria was besieged in 262 by troops of Valerian's successor and son, Gallienus, Eusebius and his friend St. Anatolius negotiated the release of persecuted Christians and noncombatants who had been trapped by imperial soldiers and whom Eusebius later tended. In 264 Bishop St. Dionysius of Alexandria sent Eusebius as emissary to a synod at Antioch, whose bishop, Paul, was being tried for heresy. On his return journey, Eusebius, by then revered for his saintliness, was persuaded to become bishop of Laodicea. After his death, he was succeeded by Anatolius.

Eusebius OF NICOMEDIA (b. Syria?—d. *c.* 342), an important 4th-century Eastern church bishop who was one of the key proponents of Arianism (the doctrine that Jesus Christ is not of the same substance as God) and who eventually became the leader of an Arian group called the Eusebians.

Eusebius may have met Arius, the Alexandrian priest and originator of Arianism, in Antioch as a fellow student under the theologian and martyr St. Lucian. Eusebius was, successively, bishop of Berytus and, about 318, bishop of Nicomedia. In August 323 Arius wrote Eusebius for aid when his teachings were being investigated by Bishop Alexander. In support of Arius' cause, Eusebius appealed to other bishops. When Arius was condemned in a synod at Alexandria (September 323), Eusebius sheltered him and sponsored a synod (October 323) at Bithynia, which nullified Arius' excommunication.

Eusebius refused to recognize Christ as being "of the same substance" (*homoousion*) with the Father. Hence, at the first ecumenical Council of Nicaea, in 325, he led the opposition against the Homoousians. When the council finally accepted their clause, Eusebius signed the creed. He refused, however, to sign the anathema condemning the Arians because he doubted "whether Arius really held what the anathema imputed to him." Shortly after the council he renewed his alliance with Arius, and the Roman emperor Constantine I the Great exiled him to Gaul, where he remained until he presented a confession of faith in 328.

Through his friendship with the Emperor's sister, Constantia, he was probably responsible for much of the powerful Arian reaction of the emperor's last years. His unrelenting

harassment of the leaders of the Homoousians helped lead Constantine to depose and exile Bishop St. Athanasius the Great of Alexandria at a synod in Tyre in 335 and to reinstate Arius at a synod in Jerusalem in 335. Eusebius was also favoured by Constantine's son and successor, the pro-Arian Constantius II, and was made bishop of Constantinople in 339. He presided over a synod in Antioch in 341—where a creed omitting the *homoousion* clause was adopted—and he probably died soon afterward.

Eusebius OF SAMOSATA, SAINT (d. *c.* 379, Dolikha, probably in Asia Minor; feast day: Eastern Church, June 22; Western Church, June 21), Christian martyr and famous opponent of Arianism (*q.v.*).

In 361 he became bishop of the ancient Syrian city of Samosata. Eusebius had been entrusted with the official record of the election (360) of Bishop St. Meletius of Antioch, who was supported by the Arian bishops, who were under the mistaken notion that he would prove sympathetic to their cause. When Meletius expounded his orthodoxy, the bishops persuaded the Roman emperor Constantius II, a staunch Arian, to extort the record from Eusebius and destroy it. In 361 Constantius threatened Eusebius with the loss of his right hand because he refused to surrender the record, but the threat was withdrawn when Eusebius offered both hands.

During the persecution of orthodox Christians under the Eastern Roman emperor Valens (also an Arian), Eusebius travelled incognito through Syria and Palestine, restoring orthodox bishops and priests who had been deposed by the Arians. In 374 Valens banished him to Thrace, a region in the Balkan Peninsula, but after the Emperor's death in 378, Eusebius was restored to his see of Samosata. While in Dolikha to consecrate a bishop, he was killed by an Arian woman.

Eusebius OF VERCELLI, SAINT (b. early 4th century, Sardinia—d. Aug. 1, 370/71, Vercelli, Italy; feast day December 16), noted supporter of Bishop St. Athanasius the Great of Alexandria, Egypt, and restorer of the Nicene Creed, the orthodox doctrine adopted by the first Council (325) of Nicaea that declared the relative members of the Trinity as equal.

Eusebius became the first bishop of Vercelli in 345. Living in community with his priests, he was the first Western bishop to unite monastic life with the ministry. As the emissary of Pope St. Liberius at the Council of Milan (355), he refused to sign the condemnation of Athanasius for his attacks against Arianism (*q.v.*). For supporting Athanasius, Eusebius was exiled to the East. Pardoned by the Roman emperor Julian the Apostate, he attended the Synod of Alexandria (362), whose decrees on the Nicene Creed he promulgated, thereby helping to restore orthodoxy and unity throughout the empire. Returning to Italy, he worked with Bishop St. Hilary of Poitiers, Fr., in opposing Arianism.

Three letters written during his exile are extant. The first seven books of *De Trinitate,* long attributed to Athanasius or Bishop Vigilius of Thapsus, are presently accepted as Eusebius' work.

Euskara language: *see* Basque language.

Eustace IV, French EUSTACHE (d. Aug. 17?, 1153, near Bury St. Edmunds, Suffolk, Eng.), count of Boulogne (from 1150) and eldest son of King Stephen of England and his wife Matilda, daughter and heiress of the previous count of Boulogne (Eustace III).

Eustace IV did homage for Normandy (1137) to Louis VII, king of France, whose sister Constance he later married (1140), and he was several times used by the king as an opponent to the claims on the Norman duchy made by the counts of Anjou.

At a council held in London on April 6, 1152, King Stephen induced some English barons to pay homage to his son Eustace as their future king, but Theobald, archbishop of Canterbury, on the command of Pope Eugenius III, refused to crown him. Eustace, whom contemporaries respected only as a soldier, was killed while plundering the abbey of Bury St. Edmunds in Suffolk. His death made possible a settlement of the civil war between Stephen and the empress Matilda. Stephen designated as his heir Matilda's son Henry of Anjou, afterward Henry II of England.

Eustace, SAINT, Latin EUSTACHIUS (d. possibly early 2nd century; Western feast day September 2; Eastern feast day November 2), one of the most famous early Christian martyrs venerated in the Eastern and Western churches, one of the Fourteen Holy Helpers (a group of saints conjointly honoured, especially in medieval Germany), and a patron of hunters.

According to tradition, Eustace was a general named Placidas (Placidus) under the Roman emperor Trajan. During a hunting excursion near Tivoli, Italy, he encountered a stag with a crucifix glowing between its antlers, whereupon a divine voice prophesied that he was to suffer for Christ. That event accounts for his being named patron of hunters. Instantly and miraculously converted to Christianity, he was baptized (taking the name Eustachius) with his wife Theopistis (Theopista) and sons Agapitus (Agapius) and Theopistus.

After their conversion, disasters befell the family: Eustachius lost his property and saw his wife and children carried off by Imperial Romans. Finally restored to his former position, he was also reunited with his family. After refusing to sacrifice to the gods, however, he was seized and, with his family, roasted to death inside a brass bull. The Eustace story became a common narrative pattern in medieval romance.

His cult, probably of Eastern origin, was known in Rome from the 8th century. The 9th-century titular church of Sant' Eustachio in Rome and the Parisian churches of St. Denis and St. Eustache claim possession of his relics. In 1969 the feast day was among those eliminated from the church calendar so that celebration of it is not obligatory in the Universal Church. Eustace is also one of the patron saints of Madrid, and his emblems are either a crucifix, a stag, or an oven.

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eustachian tube, also called AUDITORY TUBE, tube that extends from the middle ear to the pharynx (throat). About 3 to 4 centimetres (1.2–1.6 inches) long in humans and lined with mucous membrane, it is directed downward and inward from the tympanic cavity, or middle ear, to that portion of the pharynx called the nasopharynx, the space above the soft palate and behind and continuous with the nasal passages. The upper end of the eustachian tube is narrow and surrounded by bone. As it nears the pharynx, the tube becomes wider and cartilaginous. The mucous lining is continuous with that of the middle ear. Small cilia (hairlike projections) cover it to aid the drainage of mucous secretions from the middle ear to the pharynx. The main function of the auditory tube is ventilation of the middle ear and maintenance of equalized pressure on both sides of the tympanic (drum) membrane. Closed at most times, the tube opens during swallowing. This permits equalization of the pressure without conscious effort. During an underwater dive or rapid descent in a plane the eustachian tube may remain closed in the face of rapidly increasing surrounding pressure. The pressure on both sides of the eardrum membrane can usually be equalized by holding the nose and blowing, by swallowing, or by wiggling the jaws.

Eustathius (b. *c.* 300—d. 377 or 380), bishop of Sebaste (near present Sabastiyah, Jordan) and metropolitan of Roman Armenia noted for several extreme or heterodox theological positions.

The son of a bishop (perhaps also of Sebaste) named Eulalius, he studied under the heretic Arius at Alexandria; his early exposure to Arianism (*q.v.*) doubtless influenced his rejection, late in life, of the orthodox theory of the Holy Spirit. Much earlier, he was controversial for his advocacy of exaggerated asceticism, according to which marriage and the discharge of family responsibilities were censurable. Despite his condemnation by the Council of Gangra (343) and the divisive effect of his teachings, he was made bishop of Sebaste by 357. Later he visited Rome, signed the Nicene Creed (the orthodox statement of faith), and was received amicably by Pope Liberius (reigned 352–366). After 371 Eustathius upheld Semi-Arianism (*q.v.*). For this reason he quarrelled with his former monastic protégé St. Basil.

Eustathius (Ethiopian saint): *see* Ewostatewos.

Eustathius OF ANTIOCH, SAINT, also called EUSTATHIUS THE GREAT (b. Side, Pamphylia—d. *c.* 337, possibly in Thrace; feast day: Western Church, July 16; Eastern Church, February 21), bishop of Antioch who opposed the followers of the condemned doctrine of Arius (*q.v.*) at the Council of Nicaea.

Eustathius was bishop of Beroea (*c.* 320) and became bishop of Antioch shortly before the Council of Nicaea (325). The intrigues of the pro-Arian Bishop Eusebius of Caesarea led to Eustathius' deposition by a synod at Antioch (327/330) and banishment to Thrace by the Roman emperor Constantine the Great. The resistance of his followers in Antioch created a Eustathian faction (surviving until *c.* 485) that developed into the Meletian Schism, a split in the Eastern Church over the doctrine of the Trinity.

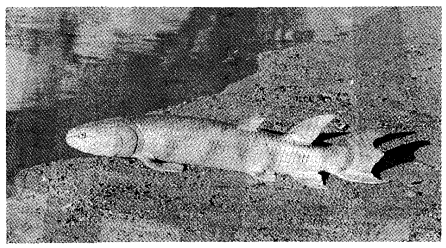
Eustathius OF THESSALONICA (b. early 12th century, Constantinople—d. *c.* 1194, Thessalonica, Greece), metropolitan (archbishop) of Thessalonica (*c.* 1175–94), humanist scholar, author, and Greek Orthodox reformer whose chronicles, oratory, and pedagogy show him to be one of medieval Byzantium's foremost men of learning.

Before his appointment as a deacon of Constantinople's basilica of Hagia Sophia (Holy Wisdom) and teacher of rhetoric in the Patriarchal school, Eustathius was apparently a monk in the cloister of St. Florus in Constantinople. He held the post of master of petitions in the imperial court and wrote on the literary classics of Greek antiquity. Appointed a bishop in 1175, Eustathius had not yet been installed when he was elevated to the post of metropolitan of Thessalonica, a position he held for the remainder of his life.

During the siege and sack of Thessalonica in 1185 by the Normans under William II of Sicily, Eustathius bargained with the invaders for the safety of his people. He recounted these events in his *De Thessalonica urbe a Normannis capta* ("On the Conquest of Thessalonica by the Normans"). Opposing the formalism petrifying the Eastern Church, he criticized clerical complacency in his treatise "On Hypocrisy" and urged the moral and cultural reawakening of monasticism in his famous tract *Inquiry into the Monastic Life.* Noted for his promotion of sound principles of education and for the preservation of books as well as for his moral example, Eustathius

is popularly regarded as a saint by the Greek Orthodox.

Eusthenopteron, genus of extinct fishes preserved as fossils in rocks of Late Devonian age (the Devonian Period began about 395,000,000 years ago and lasted about 50,000,000 years). *Eusthenopteron* was a member of



Eusthenopteron, model by J.S. Collard (H.R. Allen Studios), made under the scientific direction of S.M. Andrews

By courtesy of the Royal Scottish Museum, Edinburgh; photograph, the Natural History Photographic Agency

the group known as the Crossopterygii, or lobe-finned fishes; it was probably near the main line of evolution leading to the first terrestrial vertebrates, the primitive amphibians. It was a slender fish growing to 1.5 to 1.8 metres (5 to 6 feet), and was an active carnivore.

In many of its anatomical characteristics, *Eusthenopteron* foreshadows the early amphibians. The overall pattern of the skull bones is similar to that of early amphibians, but the vertebral column had features intermediate between a fishlike column and that of an amphibian. The paired fins were clearly of the type antecedent to terrestrial vertebrate limbs. *Eusthenopteron* had lungs and could probably make brief excursions out of the streams and ponds in which it lived.

Euston, Henry Fitzroy, earl of: *see* Grafton, Henry Fitzroy, 1st duke of.

Eutaw Springs, Battle of (Sept. 8, 1781), U.S. War of Independence engagement fought near Charleston, S.C., between British troops under Col. Alexander Stewart and American forces commanded by Gen. Nathanael Greene. Greene wished to prevent Stewart from joining Cornwallis in the event of that leader's retreat south from Yorktown. About 2,000 American troops, many ill-clad and barefoot, were slightly outnumbered. In the early fighting the British were more successful; on September 9, however, Stewart withdrew his forces to Charleston, where they remained until the end of the war.

eutectic, the one mixture of a set of substances able to dissolve in one another as liquids that, of all such mixtures, liquefies at the lowest temperature. If an arbitrarily chosen liquid mixture of such substances is cooled, a temperature will be reached at which one component will begin to separate in its solid form and will continue to do so as the temperature is further decreased. As this component separates, the remaining liquid continuously becomes richer in the other component, until, eventually, the composition of the liquid reaches a value at which both substances begin to separate simultaneously as an intimate mixture of solids. This composition is the eutectic composition and the temperature at which it solidifies is the eutectic temperature; if the original liquid had the eutectic composition, no solid would separate until the eutectic temperature was reached; then both solids would separate in the same ratio as that in the liquid, while the composition of the remaining liquid, that of the deposited solid, and the temperature all remained unchanged throughout the solidification.

Euterpe, in Greek religion, one of the nine Muses, patron of tragedy or flute playing. In some accounts she was the mother of Rhesus, the king of Thrace, killed in the Trojan War, whose father was sometimes identified as Strymon, the river god of Thrace.

euthanasia, also called MERCY KILLING, act or practice of painlessly putting to death persons suffering from painful and incurable disease or incapacitating physical disorder. Because there is no specific provision for it in most legal systems, it is accounted either suicide (if performed by the patient himself) or murder (if performed by another). A physician may, however, lawfully decide not to prolong life where there is extreme suffering; and he may administer drugs to relieve pain, even though he knows that this may shorten the patient's life. In the late 20th century, several European countries had special provisions in their criminal codes for lenient sentencing and the consideration of extenuating circumstances in prosecutions for euthanasia.

The opinion that euthanasia is morally permissible goes back to Socrates, Plato, and the Stoics. It is rejected in traditional Christian belief, chiefly because it is thought to come within the prohibition of murder in the Sixth Commandment. The organized movement for legalization commenced in England in 1935, when C. Killick Millard founded the Voluntary Euthanasia Legalisation Society (later called the Euthanasia Society). The society's bill was defeated in the House of Lords in 1936, and so also was a motion on the same subject in the House of Lords in 1950. In the United States, the Euthanasia Society of America was founded in 1938.

The potential of modern medical practice to prolong life through technological means has provoked the question of what must be decided by the physician and the family in cases of extreme physical or emotional suffering, especially if the patient is incapable of choice. Passively doing nothing to prolong life or withdrawing life-support measures has resulted in criminal charges being brought against physicians; on the other hand, the families of comatose and apparently terminal patients have instituted legal action against the medical establishment to make them stop the use of extraordinary life support.

Euthydemus (fl. late 3rd century BC), king of Bactria. At first he was probably a satrap (governor) of the Bactrian king Diodotus II, whom he later killed and whose throne he usurped. In 208 he was attacked by the Seleucid king Antiochus III, and a long war was fought between them. Euthydemus, having failed in his attempt to defend the line of the Arius (Harīrūd) River, fell back to his capital, Bactra (probably Balkh in northern

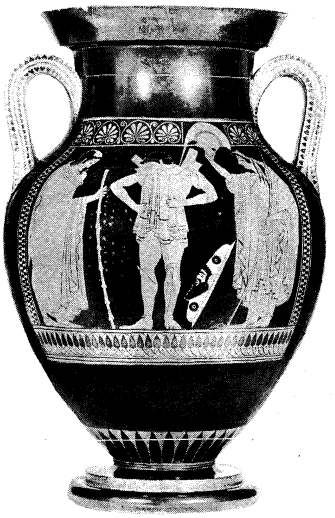
Euthydemus, coin, 3rd century BC

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Afghanistan), where he withstood a two-year siege. Finally a peace was concluded by which Euthydemus kept his kingdom while acknowledging Seleucid overlordship. Later, Euthydemus took territory from Parthia. According to some scholars, he also occupied the eastern provinces of Sogdiana, Arachosia, Drangiana, and Aria.

Euthymides (fl. late 6th and early 5th centuries BC), Athenian red-figure vase painter, a contemporary and perhaps rival of Euphronius. He is admired for his explorations in foreshortening and for his studies in movement, departures from Archaic convention.

Euthymides' signature (as painter) has been found on six vases. An amphora signed by Eu-



"Hector Donning his Breastplate," amphora by Euthymides, *c.* 500 BC; in the Staatliche Antikensammlungen und Glyptothek, Munich

Hirmer Fotoarchiv, Munchen

thymides representing "Revellers" is a study in foreshortening and in three-quarters view. Now in the Antikensammlungen at Munich, it dates from *c.* 510–500 BC.

In addition to his vase painting it is possible that Euthymides made a small clay plaque for the Athenian Acropolis. It was of a "Warrior," painted partly in black-figure, partly in outline.

Euthymides was interested in those aspects of painting that were to concern the masters of the Classical period: foreshortening, movement, form, and space.

Euthymius I (b. *c.* 834, Seleucia, Cilicia, Asia Minor—d. Aug. 5, 917, Constantinople), Orthodox patriarch of Constantinople, monk, and theologian, a principal figure in the Tetragamy (Fourth Marriage) controversy of the Byzantine emperor Leo VI the Wise.

A monk of a monastery on Mt. Olympus, Asia Minor, Euthymius became abbot of St. Theodora in Constantinople and confessor to Leo VI. He used his influence over the Emperor to protect the followers of the late-9th-century patriarch Photius, one of the leading theologians and anti-Roman polemicists of the Greek Church.

When Leo, still seeking a male heir after the death of his third wife, took a mistress, Zoe, Euthymius refused to appear at the imperial court but accepted a monastery built for him near the palace. The Emperor, denied a dispensation by the patriarch Nicholas I the Mystic to marry Zoe after she had borne him a son in 905, appealed the case to the pentarchy ("five patriarchs"), viz., Rome (Pope Sergius III), Constantinople, Jerusalem, Alexandria, and Antioch. This tribunal allowed it on the grounds that it was necessary for the good of the state. Euthymius was named patriarch by Leo in 907, after Nicholas resigned rather than consent to the judgment of the four patriarchs. The new patriarch accepted his office after stipulating that the four patriarchal representatives repeat their decisions on the marriage in his presence and after verifying that Nicholas' resignation was genuine. He degraded Thomas, the priest who had performed the marriage, and refused to

crown Zoe in church or to put her name in the diptychs, the list of those commemorated in the Orthodox liturgy. He also resisted the Emperor's urging that a new law be enacted legitimizing the marriage. Strife raged as the Emperor persecuted the Nicholaites, who had organized as persistent adversaries to the Euthymian party. On the death of Leo in 912, his brother Alexander deposed Euthymius and reinstated Nicholas as patriarch, who in turn condemned and banished Euthymius and his followers. The two were reconciled, however, shortly before Euthymius' death. Euthymius is said to have chosen monastic retirement rather than return as patriarch on an offer of Empress Zoe in 913.

The *Vita S. Euthymii* ("Life of St. Euthymius"), by a contemporary, is a valuable source for Byzantine history. His homilies, or liturgical addresses, on the Virgin Mary and other subjects attest to his reputation in theology and oratory. A Latin–English text of the *Vita S. Euthymii* was edited by P. Karlin-Hayter in 1957.

Euthymius OF TŬRNOVO (b. *c.* 1317—d. *c.* 1402), Orthodox patriarch of Tŭrnovo, near modern Sofia, monastic scholar and linguist whose extensive literary activity spearheaded the late medieval renaissance in Bulgaria and erected the theological and legal bases for the Orthodox churches of Eastern Europe.

Bulgarian by birth, Euthymius joined the monastery of Kilifarevo, near modern Burgas, Bulg., where he became the leading disciple of Theodosius, whom he succeeded as spokesman for Hesychasm, the Byzantine movement of contemplative prayer. Characteristic of this school, Euthymius travelled to various monastic communities at Constantinople and Mt. Athos (northeastern Greece), practicing the ascetic discipline and working in a Greco-Slavic environment as a copyist of manuscripts and a writer. He returned to Bulgaria by 1371 and in 1375 was elected patriarch of Tŭrnovo and primate of the Bulgarian Orthodox Church but was forced into exile after the fall of Tŭrnovo to the Turks in 1393.

During his patriarchate Euthymius wrote much, including the translation and revision of the liturgical and legal codes of the Orthodox church into the formal Old Slavonic language, thus instituting a consistent and structured linguistic program based on specific cultural and theological principles. The Slavonic heritage bequeathed by the 9th-century Greek apostles to the Slavs, Cyril and Methodius, had grown obsolete. The original, single Slavonic tongue had splintered into distinct languages and dialects. Church Slavonic, however, had retained the grammatical and syntactical structure of the old 9th-century form and, by increasing divergence from the various Slavonic idioms, in effect had become a dead language. The biblical and liturgical texts, moreover, had grown ambiguous through a series of coarse revisions and had occasioned the spread of heretical sects, principally the dualistic Bogomils, who held that the visible, material world was created by the devil.

Euthymius' reform followed his conviction that public morality and theological orthodoxy were essentially related to the accuracy and literary qualities of the sacred Scriptures. Thus he revived an international Old Slavonic with its Cyrillic grammar and written form but more intricately interwoven with the Greek rhetorical and emphatic style. Such a linguistic tool furthered his belief in a Slavic destiny as successor to the Byzantine church, culture, and political heritage.

Applying his Hesychast background, Euthymius made this monastic culture the energy source of his theological and literary reform. He emphasized its Byzantine conservatism in ritual and doctrine and prominently portrayed the role of the Holy Spirit in religious experience. Moreover, in Hesychast fashion he used the method of dramatic biographies of the leading Orthodox saints and early fathers as the vehicle for propagating correct doctrine and asceticism by interweaving theological reflections with the narrative. Thus, the Bulgarian monastic centres of Paroria and Kilifarevo and the monk missioners, both native Slav and Greek refugee scholars, carried the Euthymian reform throughout Eastern Europe.

Euthymius THE GREAT, SAINT (b. 377, Melitene, Armenia—d. Jan. 20, 473, Palestinian desert, northeast of Jerusalem; feast day January 20), ascetic and one of the great fathers of Eastern Orthodox monasticism, who established religious communities throughout Palestine.

Orphaned in his youth, Euthymius was educated and later ordained priest by Bishop Otreus of Melitene. He was charged with the spiritual care of the ascetics and monasteries of the city, but in 406 he left for Palestine in search of solitude. Joining the monastery of Pharan, near Jerusalem, he befriended St. Theoctistus, and about 411 they retired to a cave in the wilderness beyond Jerusalem. On being joined by others, they established a cenobitic ("communal") monastery, or laura, that integrated contemplative life with other liturgical and intellectual projects and work done in common.

Entrusting the new foundation to Theoctistus, Euthymius moved on with a small band and set up similar communities, one on the west bank of the Dead Sea, another farther west in the desert of Ziph, and a larger community northeast of Jerusalem, toward Jericho. This last foundation was named after Euthymius, and its church was dedicated by Bishop Juvenal of Jerusalem in 429.

By his moral example Euthymius converted many nomad Saracens to the Orthodox Church and instituted the *parembolai* (Greek: "accompanying ministry") to supply pastoral care in their camps. He was often consulted on theological questions by the Eastern bishops and participated in formulating the decrees of the Council of Ephesus (431) against the Nestorian heresy (an emphasis on the independence of the divine and human natures of Christ). He also contributed to the Council of Chalcedon (451) in refuting the heretical Monophysites, who held that Christ comprised only one nature, a divine essence that subsumed his humanity. Euthymius is credited with disseminating orthodox Christological doctrine throughout Palestinian monasticism, overcoming defamations by his theological adversaries. By his influence the Byzantine empress Eudoxia became convinced that Monophysitism was in error and withdrew support from its chief proponent, Abbot Eutyches of Constantinople.

Euthymius THE HAGIORITE, Georgian EKVTHIME MTHATZMIDELI (Euthymius of the Holy Mountain) (b. *c.* 955, Georgia, Transcaucasia—d. May 13, 1028, Mt. Athos, Greece), monastic leader, scholar, and writer whose propagation of Greek culture and Eastern Orthodox tradition generated the golden age of Georgian education and literature.

The son of a Georgian noble and court official, Euthymius accompanied his father into monastic retirement, first on Mt. Olympus, then on Mt. Athos. At the Georgian monastery of Ivíron on Athos, Euthymius became abbot in 998, in succession to his father. By 1012 he was working exclusively with the translation and revision of biblical and liturgical texts for the use of the Georgian people in their church libraries. Ivíron, with its academy, thus became a centre of Byzantine culture and a school for future leaders of the Georgian church and state. Before the 10th century the Georgian Bible had existed in a variety of disparate versions. Under Euthymius' direction the monks of Ivíron translated the Scriptures from Hebrew, Greek, and Syriac sources into a definitive Georgian text that is still in use. His translation, moreover, of the Greek Byzantine liturgy of St. Basil and St. Chrysostom gradually displaced the former Georgian usage of Jerusalem's liturgy of St. James. In addition to some hagiographical work, Euthymius also produced a Georgian text of most of the 4th-century works of St. Gregory of Nazianzus, usually considered the foremost theologian in the history of Greek Christianity. His work earned him the reputation of a doctor of the church and the sobriquet "the Georgian Chrysostom," a reference to the 4th-century scholar-patriarch of Constantinople.

Eutin, town, Schleswig-Holstein *Land* (state), northeastern Germany, surrounded by lakes. About 30 mi (48 km) north of Lübeck, the town was founded as a border post during the frontier wars between the Germans and the Wends, and it was chartered in 1257. The official seat of the prince-bishops of Lübeck from 1309, it passed to Oldenburg in 1773 and to Schleswig-Holstein in 1937. Notable buildings are the palace (built 1689 on the site of an earlier fortress destroyed by fire), with attractive gardens, and a 13th-century church. The composer Carl Maria von Weber was born in the town (1786), and J.H. Voss, the translator of Homer, lived there (1782–1802).

The gateway to the Holsteinische Schweiz lake region, Eutin is noted for the cultivation of roses and has substantial tourist traffic. Industries include the manufacture of electrical goods, paper, and clothing. Pop. (1989 est.) 16,567.

eutrophication, the gradual increase in the concentration of phosphorus, nitrogen, and other plant nutrients in an aging aquatic ecosystem such as a lake. The productivity or fertility of such an ecosystem increases as the amount of organic material that can be broken down into nutrients increases. This material enters the ecosystem primarily by runoff from land that carries debris and products of the reproduction and death of terrestrial organisms. Blooms, or great concentrations of algae and microscopic organisms, often develop on the surface, preventing the light penetration and oxygen absorption necessary for underwater life.

Cultural eutrophication occurs when man speeds up the aging process by allowing excessive amounts of nutrients in such forms as sewage, detergents, and fertilizers to enter the ecosystem.

Eutropius (d. soon after 399), eunuch who became the most powerful figure in the Eastern Roman Empire under the emperor Arcadius (Eastern ruler 383–408).

By arranging the marriage between Arcadius and Eudoxia, daughter of a Frankish consul, Eutropius sought to thwart his rival Rufinus, chief adviser to Arcadius, who had wished to marry his own daughter to the Emperor. After Rufinus was murdered by the troops of Gainas in 395, Eutropius became the most powerful man in the Eastern Empire. He repelled an invasion of Asia Minor by the Huns in 398 and was nominated consul for 399, the first eunuch to hold that office. In the same year he was overthrown by Gainas (by then master of soldiers) in collusion with Eudoxia and banished to Cyprus; shortly afterward he was beheaded.

The poet Claudian attacked Eutropius, who had gained great notoriety for his corrupt practices, in two extant poems.

Eutyches (b. *c.* 375—d. 454), revered archimandrite, or monastic superior, in the Eastern Church, at Constantinople, who is regarded as the founder of Eutychianism, an extreme form of the Monophysite heresy that empha-

sizes the exclusive prevalence of the divinity in Christ.

Reared in the Christological doctrine of the Alexandrian school under the influence of Patriarch St. Cyril (died 444), Eutyches, in professing one nature in Christ, reflected the Eastern monastic view of Christ and staunchly opposed the rival Antioch school, which espoused the heterodox doctrine of Nestorius, who was named patriarch in Constantinople in 428. The Nestorian doctrine maintained that Christ had two natures: as the son of God, divine; as the son of Mary, human. Thus, it also held that the Virgin was not the mother of God.

Eutyches' opposition to the Nestorians led Bishop Eusebius of Dorylaeum in Asia Minor to proclaim his doctrine heretical (448). Eutyches then was summoned by Flavian, who had become patriarch of Constantinople and who was an opponent of Monophysitism, to a meeting of the standing synod of Constantinople in November 448. There, refusing to discuss Christ's natures, Eutyches declared that his was the faith of the Fathers at the Council of Nicaea (325), which focussed primarily, however, on Christ's divinity and equality in the Trinity, rather than on Christ's nature. Eutyches' repeated affirmation, "two natures before, one after the incarnation," was his own formula and was a specific expression of the Monophysitic doctrine that, in the incarnation, Christ's human nature was deified and subsumed into a single essence. Hence, he concluded that Christ's humanity was distinct from that of other men, which some scholars propose was the real formulation of Monophysitism. Eutyches' position was considered to be theologically unsophisticated, and the synod deposed and excommunicated him.

Flavian then reported Eutyches' heresy to Pope St. Leo I the Great, who on June 13, 449, issued his celebrated *Tome* condemning Eutychianism. Eutyches appealed to Patriarch Dioscorus of Alexandria, who supported his Christological doctrines and persuaded the Eastern Roman emperor Theodosius II to summon a general council to meet at Ephesus the following August. The council, later called the Robber Synod and never recognized by Eastern Orthodox and Western churchmen, reinstated Eutyches and deposed Flavian, Eusebius, and other defenders of the two-nature doctrine.

In 450, Emperor Theodosius II was succeeded by Marcian, who convened the Council of Chalcedon in 451; it banished Eutyches, condemned his heresy, and established a centrist doctrine that came to serve as the touchstone of Christian orthodoxy in East and West. The Council held that Christ had two perfect and indivisible, but distinct, natures: one human and one divine. Thereafter, Eutyches disappeared, but his influence nevertheless grew as Monophysitism spread throughout the East.

The subsequent history of Monophysite doctrine in the Eastern Church is the history of national and independent churches (*e.g.*, the Syrian Jacobites) that, either for reasons of reverence for some religious leader or as a reaction against the dominance of the Byzantine or Roman churches, retained a separate existence.

The text of Eutyches' trial and related correspondence appear in E. Schwartz's monograph *Der Prozess des Eutyches* (1929; "The Trial of Eutyches"). Reference to his trial is in R.V. Sellers' *The Council of Chalcedon* (1953).

Eutychian, a follower of the 4th–5th-century monk Eutyches (*q.v.*), who advocated a type of Monophysitism, a belief that Christ had only one nature (*see* Monophysite). The doctrine of Eutychianism is considered heretical by the Roman Catholic Church.

Eutychian, SAINT, Latin EUTYCHIANUS (b. Tuscany—d. Dec. 7, 283, Rome; feast day December 7), pope from 275 until his death. He succeeded Pope St. Felix I. Fragments of his original Greek epitaph were discovered in the catacombs of Callistus, Rome, but nothing more is known of him.

Eutychides OF SICYON (fl. early 3rd century BC), Greek sculptor, who was a pupil of Lysippus. His most noted work was a statue of "Fortune," which he made for the city of Antioch (founded 300 BC). The goddess, who embodies the idea of the city, was represented seated on a rock, with the Orontes River at her feet. The composition was later repeated on Syrian coins of Tigranes (83 BC) and has been identified in several extant statues.

Euwe, Max, byname of MACHGIELIS EUWE (b. May 20, 1901, Watergrafsmeer, near Amsterdam—d. Nov. 26, 1981, Amsterdam), Dutch chess master who won the world championship (1935) from Alexander Alekhine and lost it to Alekhine in a return match (1937).

Euwe won his first (minor) tournament at the age of 10 but played little thereafter until he had completed his formal education in 1926 at the University of Amsterdam, where he became a professor of mathematics. Known for his vast knowledge of Chess opening theory, numerous books and articles on Chess, and steady rather than spectacular play, he continued in individual competition at the highest level until 1956 and as first board player on The Netherlands team thereafter. In 1959 he became director of The Netherlands Automatic Data Processing Research Centre. From 1961 to 1963 he chaired the Euratom committee studying the feasibility of programming Chess for computers. He was president of the International Federation of Chess from 1970 through 1978.

euxenite, complex oxide mineral, a niobate–titanate that forms hard, brilliant black crystals and masses in granite pegmatites and associated detrital deposits. Titanium replaces niobium–tantalum in the molecular structure to form the similar mineral polycrase; both it and euxenite often contain rare earths. These minerals are widespread in Norway, Madagascar, and Canada and also occur in Sweden, Finland, Greenland, Australia, Brazil, and the U.S. For chemical formula and detailed physical properties, *see* oxide mineral (table).

Euze, Jacques d': *see* John XXII *under* John (papacy).

Euzkadi Ta Azkatasuma (Basque organization): *see* ETA.

Evagoras (d. 374 BC), king of Salamis, in Cyprus, *c.* 410–374 BC, whose policy was one of friendship with Athens and the promotion of Hellenism in Cyprus; he eventually fell under Persian domination.

Most of what is known of him is found in the panegyric "Evagoras" by Isocrates, where he is described, with extravagant praise, as a model ruler whose aim was to promote the welfare of his state by cultivation of Greek refinement and civilization. Evagoras' services to Athens were recognized by the gift of Athenian citizenship. For a time he also maintained friendly relations with Achaemenian Persia, securing Persian support for Athens in the early years of the Corinthian War (395–387) against Sparta. He participated, along with the Persian fleet, in the naval victory over Sparta off Cnidus (394), but from 391 Evagoras and the Persians were virtually at war. Aided by the Athenians and the Egyptians, Evagoras extended his rule over the greater part of Cyprus and to several cities of Anatolia. When Athens withdrew its support after the peace of Antalcides (386), Evagoras' troops fought without allies until they were crushed at Citium (Larnaca, Cyprus) in 381. He fled to Salamis, where he managed to conclude a peace that allowed him to remain nominally king of Salamis, though in reality he was a vassal of the Achaemenian king. He was assassinated by a eunuch.

Evagrius PONTICUS (b. 346, Ibora, Pontus —d. 399, Cellia, Nitrian Desert, Egypt), Christian mystic and writer whose development of a theology of contemplative prayer and asceticism laid the groundwork for a tradition of spiritual life in both Eastern and Western churches.

Evagrius was a noted preacher and theological consultant in Constantinople when a personal spiritual crisis prompted him to leave for Jerusalem to become a monk. He soon withdrew into the Egyptian desert, where he spent the rest of his life evolving his mystical theology in theory and practice while he supported himself by copying manuscripts.

Historical research since 1920 has suggested that Evagrius produced the first major philosophical–theological exposition of monastic mysticism by developing the Neoplatonic biblical theology of the 3rd-century Christian teacher Origen. Evagrius' *Gnostic Centuries* emphasized that the essential function of spiritual beings is to experience union with God, the transcendent One, expressed as pure light. Because of an original, alienating fault, the intellectual world, notably man, can find reconciliation only by an ascetical, self-mortifying process whereby the spirit regains its rule over matter and realizes its capacity to experience the divine simplicity. Evagrius' other written works, only fragments of which are extant in the original Greek, survive mainly in Syriac and Latin translations. They include the *Monachikos* ("The Monastic Life"), a treatise, "On the Eight Principal Vices," and several biblical commentaries.

His spiritual doctrine affected Christianity in the Greek tradition through the 6th-century Neoplatonic philosopher-mystic Pseudo-Dionysius the Areopagite, the 7th-century mystical theologian Maximus the Confessor, and the 14th-century Byzantine monastic centre at Mt. Athos in northeastern Greece. In the Latin culture, he inspired the 5th-century monastic writer John Cassian. Western Christianity, however, has long suspected Evagrius of heresy. His teachings were denounced by the second general Council of Constantinople in 553 as permeated with Origenist errors, viz., subordinationist views on the Trinity, and the doctrine of the preexistence of souls. Nevertheless, he is considered the great doctor of mystical theology among the Syrians and other Eastern Christians, and his philosophy is sometimes seen as the Christian analogue of Zen Buddhism.

Evander, in classical mythology, a migrant from Pallantium in Arcadia (central part of the Peloponnesus) who settled in Italy and founded a town named Pallantion, after his native place. The site of the town, at Rome, became known as the Palatine Hill, after his daughter Pallantia. Evander was the son of the goddess Carmentis (or Carmenta) and the god Hermes. Traditionally he instituted the Lupercalia (*q.v.*) and introduced some of the blessings of civilization, including writing. He hospitably received the heroes Hercules and Aeneas.

Evangelical Alliance, later called WORLD'S EVANGELICAL ALLIANCE, association of churches, Christian societies, and individual Christians of different denominations. It was organized in London in 1846 at an international conference of religious leaders after preliminary meetings had been held in Great Britain by Anglican and other British churchmen in reaction against the Oxford Movement in the Church of England, which emphasized the Catholic heritage of that church. It was decided to form an international association,

and 800 delegates from 50 denominations in Europe and America attended the 1846 founding convention. Subsequently, international conventions were held every few years. Branches were formed in several countries, although the Alliance was always most active in Great Britain. The American branch, organized in 1867, was superseded in 1908 by the Federal Council of Churches, which it had helped establish.

The doctrine of the Alliance is contained in the nine articles adopted in London in 1846: the divine inspiration, authority, and sufficiency of the Scriptures; the right and duty of private judgment in the interpretation of them; the unity of the Godhead and the Trinity of Persons; the utter depravity of human nature; the incarnation of the Son of God and his atonement for the sins of all men; the justification of sinners by faith alone; the work of the Holy Spirit as sanctifier; the immortality of the soul, the resurrection of the body, and the final judgment by Jesus Christ; and the divine institution of the Christian ministry. The founding convention also established the universal week of prayer, observed the first full week of January.

In the 19th century the Alliance was actively concerned with the furtherance of Christian liberty and religious toleration. It was successful in lessening the persecution of individual Christians in many parts of the world.

The influence of the Alliance declined in the 20th century, but it has continued its activities in Great Britain and has played an active part in various nationwide evangelistic campaigns. In association with kindred societies, the Alliance seeks to emphasize the reformed character of the Church of England. It publishes the monthly magazine *Crusade.*

In 1958 the Alliance helped organize the Evangelical Missionary Alliance, "to provide a medium of fellowship and effective cooperation in the interest of evangelical missionary work and service overseas." The more than 70 member missions (denominational, interdenominational, and undenominational) enjoy complete autonomy but subscribe to a common doctrinal basis.

Headquarters of the Evangelical Alliance are in London. It is closely associated with similar alliances in many different countries through the World Evangelical Fellowship, founded in 1951.

Evangelical and Reformed Church, Protestant church in the U.S., organized in 1934 by uniting the Reformed Church in the United States and the Evangelical Synod of North America. The church brought together churches of Reformed and Lutheran background. It accepted the Heidelberg Catechism (Reformed), Luther's Catechism, and the Augsburg Confession (Lutheran) as its doctrinal standards, but when these differed, the Bible was the final rule of faith. In 1957 the Evangelical and Reformed Church merged with the General Council of Congregational Christian Churches to form the United Church of Christ. Membership at that time was about 800,000. The merger was unusual because of the presbyterian form of government of the Evangelical and Reformed Church and the congregational form of the larger body.

The Reformed Church in the United States developed from congregations founded in the 18th century by settlers in Pennsylvania who came from western Germany and Switzerland. For several years these congregations were supervised by the Reformed Church of the Netherlands, which sent several ministers to Pennsylvania. The church established itself as an independent church at its first synod meeting, held in Lancaster, Pa., in 1793. It adopted the Heidelberg Catechism as its doctrinal standard. When it merged into the Evangelical and Reformed Church in 1934 it had about 350,000 members.

The Evangelical Synod of North America was founded by six German ministers in 1840 at Gravois Settlement, near St. Louis, Mo. Known in its early years as the Evangelical Union of the West, it changed its name to German Evangelical Synod of North America in 1877, and in 1925 dropped the word German from its name. Some early ministers were from the Evangelical church of Prussia, a union of Lutheran and Reformed churches that gave support to the American church. The Evangelical Synod of North America accepted the Heidelberg Catechism, Luther's Catechism, and the Augsburg Confession as its doctrinal standards. Four other church groups of German background subsequently joined the Evangelical Synod. When it merged into the Evangelical and Reformed Church in 1934, it had 281,598 members.

evangelical church, broadly, any Christian churches preaching the gospel; less broadly, any of the classical Protestant churches or one of their offshoots; but especially, any of certain Protestant churches that stress the preaching of the gospel of Jesus Christ, personal conversion experiences, Scripture as the only basis for faith, and active home and foreign evangelism.

Martin Luther and his followers, who stressed justification by faith in Jesus Christ, called themselves and were known as Evangelicals. During the Reformation, the term Evangelical distinguished the followers of Luther from those of Calvin, who were known as Reformed.

The religious revival that occurred in continental Europe, in Great Britain, and in America in the 18th century was generally referred to as the Evangelical revival. It included Pietism in Europe, the Methodist revival in Great Britain, and the Great Awakening (*q.v.*) in America. Personal religion, conversion experiences, reliance on Scripture, and evangelism were stressed in these movements rather than the sacraments and the traditions of the churches. Also during the Evangelical revival in England, an Evangelical party developed within the Church of England that, unlike the Methodists, did not leave the church (*see* Anglican Evangelical). The Evangelical emphasis within Protestantism remained strong, and Evangelicals gradually recognized their common interests. In London in 1846, the Evangelical Alliance (*q.v.*) was organized by Evangelicals from several denominations and countries.

In the United States in the early 20th century, controversies developed between the liberals and the Fundamentalists in several denominations. Eventually, most of the Fundamentalists preferred to be known as Evangelicals. The National Association of Evangelicals (*q.v.*), an interdenominational association, was organized in 1942. They have continued to stress conservative interpretations of Scripture and doctrine.

Evangelical Church in Germany, The, German DIE EVANGELISCHE KIRCHE IN DEUTSCHLAND (EKD), federation of Lutheran, Reformed, and United (a combination of Lutheran and Reformed) territorial churches in Germany. Organized in 1948 after the difficult years of World War II and the Nazi era (1933–45), it helped the German churches restore themselves, and it reestablished relations with churches outside of Germany.

The territorial churches in Germany had sought closer cooperation among themselves for many years. They had developed out of the changes in church life and organization and the various religious and political settlements brought about by the 16th-century Protestant Reformation. Until 1918 the prince of each German territory was the head of the church in his territory, which was either Lutheran, Reformed, or United. After Germany was defeated in World War I, the German Empire was replaced by the German Republic, and the territorial churches reorganized themselves into self-governing churches. Attempts to gain closer union were made. During the Nazi era the churches cooperated in various ways to resist the government's efforts to control them.

After World War II, a group of territorial church leaders met in August 1945 to consider forming the EKD. The constitution for the new federation was adopted in July 1948 in Eisenach. Its work was limited to that assigned to it by the member churches and primarily involved ecumenical relations, works of mercy, and tasks concerned with the society and government of Germany.

Headquarters of the EKD are in Hannover.

Evangelical Church of Czech Brethren, Czech ČESKOBRATRSKÁ CÍRKEV EVANGELICKÁ, denomination organized in 1917 by uniting Lutheran and Czech Reformed groups. Subsequently, other smaller Protestant groups merged into this church. Its roots go back to the 16th-century Protestant Reformation and to the 15th-century Hussite movement in Bohemia, which was made up of the followers of the reformer Jan Hus. His followers were crushed in 1434, but the movement persisted underground. During the 16th-century Reformation, the Hussites (also called Bohemian Brethren or Unitas Fratrum) emerged again and flourished for a brief period. In 1547 they were again suppressed, and the Jesuits became powerful in Bohemia. Lutheran and Reformed groups made some progress in the country, but the success of the Roman Catholic Counter-Reformation in the 17th century weakened them. Thousands of Protestants fled the country, and many Protestant leaders were executed. Protestants in Bohemia did not regain religious rights until 1781 when Joseph II, the Holy Roman emperor, issued his Edict of Toleration.

The new country of Czechoslovakia was created in 1918 by merging Bohemia, Moravia, Slovakia, and Ruthenia. The Evangelical Church of Czech Brethren became the leading Protestant church in the nation. It was a leader in the fields of theological education and social work. The church and the nation again suffered severely during World War II, and when the Communists gained control of the government in 1948, the Evangelical Church of Czech Brethren made agreements and attempted to work with it. Since 1969 the church has suffered severe repression under the Communist government.

Evangelical Free Church of America, fellowship of independent Christian churches organized in 1950 that developed from several free-church groups made up of members of Scandinavian descent. The Swedish Evangelical Free Mission (later renamed Swedish Evangelical Free Church) was organized in Boone, Iowa, in 1884 by several churches with members of Swedish descent. The present church was organized in 1950 by a merger of the Swedish Evangelical Free Church and the Evangelical Free Church Association, which had formerly been known as the Norwegian and Danish Evangelical Free Church Association.

Church government of the Evangelical Free Church is congregational. Each local congregation is self-governing and elects delegates to the annual conference, which is an advisory body that does not control the activities or beliefs of the local congregations. Church members are expected to have experienced conversion and to live a Christian life, but considerable freedom is allowed in interpretation of doctrine. The church is a member of the National Association of Evangelicals. Headquarters are in Minneapolis, Minn.

Evangelical Lutheran Church in America (ELCA), the largest Lutheran church in North America. The Evangelical Lutheran Church in America was formed in 1988 by the merger of two major Lutheran denominations, the American Lutheran Church and the Lutheran Church in America, along with the much smaller Association of Evangelical Lutheran Churches. The new church cut across ethnic lines and was designed to give Lutherans a more coherent voice in ecumenical discussions with other Christian churches in the United States. At its founding the church had more than 5,000,000 members and comprised about two-thirds of the Lutherans in the United States. Its headquarters is in Chicago.

The constituent churches that formed the Evangelical Lutheran Church in America had themselves a long history of growth, mergers, and consolidations. The Lutheran Church in America, for example, was created in 1962 by the merger of four Lutheran churches. The four were the American Evangelical Lutheran Church, the Augustana Evangelical Lutheran Church, the Finnish Evangelical Lutheran Church (Suomi Synod; organized by Finnish immigrants in 1890), and the United Lutheran Church in America.

Lutheran immigrants to the United States in the 17th and 18th centuries organized congregations that combined in various synodical organizations. In 1820 several of them met to draw up a constitution for a confederation to be known as the General Synod. As Lutheranism expanded, additional synods were formed, and by 1860 the General Synod had a membership of about 164,000, or two-thirds of the Lutherans in the United States.

Cooperative efforts were limited, however, by the slavery question and the American Civil War, which caused the Southern synods to leave the General Synod and establish their own General Synod in 1863. Further disruption was caused by controversy over the Lutheran confessions. Some of the more conservative synods left the General Synod in 1866 and organized in 1867 the General Council, a federation of 11 synods that accepted the Unaltered Augsburg Confession.

Animosities among the three groups gradually subsided, and cooperative activities increased. In 1917 a joint committee of the three general synods, meeting to plan a 400th anniversary celebration of the Reformation, also took up the possibility of organizing a United Lutheran Church in America (ULCA). To this end, a constitution was prepared and accepted in 1918 by all three groups. The Augustana Synod left the General Council, however, and refused to enter the union.

From the time of its founding the ULCA worked for the union of all Lutheran groups in the United States and cooperated with other Lutherans and with ecumenical groups, such as the World Council of Churches. In 1962 it merged with the three other Lutheran groups to form the Lutheran Church in America.

The American Lutheran Church also arose from various mergers. It was created in 1961 by the merger of three churches: the (original) American Lutheran Church, the Evangelical Lutheran Church, and the United Evangelical Lutheran Church. On Feb. 1, 1963, the ALC was joined by the Lutheran Free Church (organized in 1897 by a group that left the United Norwegian Lutheran Church).

The original American Lutheran Church (1930–60) had been organized in Toledo, Ohio, by the merger of three Lutheran synods composed primarily of members of German descent. These were (1) the Evangelical Lutheran Joint Synod of Ohio and Other States, organized in 1818; (2) the Lutheran Synod of Buffalo, organized in 1845 in Milwaukee, Wis., by German immigrants settled primarily around Buffalo, N.Y., and Milwaukee, who began leaving Prussia in 1838 because they refused to take part in a union of Lutheran and Reformed churches ordered by the King of Prussia in 1817; and (3) the Evangelical Lutheran Synod of Iowa and Other States, organized in 1854 in Iowa by Lutheran missionary pastors from Germany who wished to serve the German immigrants in the Middle West.

The Evangelical Lutheran Church was organized in the United States in 1917 as the Norwegian Lutheran Church by the merger of three synods composed of members of Norwegian descent. The United Evangelical Lutheran Church originated in 1896 in Minneapolis, Minn., from the merger of two American churches whose members were largely of Danish descent.

After years of discussions with the United Lutheran Church in America and the Lutheran Church–Missouri Synod, the American Lutheran Church merged with the Evangelical Lutheran Church and the United Evangelical Lutheran Church to form the American Lutheran Church.

The Association of Evangelical Lutheran Churches began in 1976 when a group of ecumenical-minded church leaders broke away from the relatively conservative Lutheran Church-Missouri Synod to form their own association.

Evangelical Lutheran People's Church of Denmark, Danish EVANGELISK-LUTHERESKE FOLKEKIRKE I DANMARK, the established, state-supported church in Denmark. Lutheranism was established in Denmark during the Protestant Reformation.

Christianity was introduced to Denmark in the 9th century by St. Ansgar, bishop of Hamburg. In the 10th century, King Harald Bluetooth became a Christian and began organizing the church, and by the 11th century, Christianity was gradually becoming accepted throughout the country.

In the late Middle Ages the church had become worldly and offered little spiritual leadership. King Christian II (reigned 1513–23) attempted to reform the church, but the Reformation was brought to Denmark by King Christian III (reigned 1536–59), who had known Martin Luther and had become a Lutheran. After winning a civil war, Christian III decreed in 1536 that Denmark would be Lutheran. Roman Catholic bishops and clergy who objected were imprisoned or deposed, and the church's property was confiscated by the government. Johannes Bugenhagen, Lutheran Reformer and theologian at Wittenberg, Ger., came to Copenhagen in 1537 to help organize the Lutheran Church of Denmark.

German Lutheran orthodoxy influenced Danish Lutheranism in the 16th and 17th centuries. In the 18th century the church was influenced by Pietism, the Lutheran movement that began in Germany and encouraged personal religious experience and reform. As a result, missions, orphanages, and schools were established in Denmark. In the 19th century the outstanding figure in the renewal of Danish church life was N.F.S. Grundtvig (*q.v.*). During World War II the Danish clergy resisted the Germans who occupied their land. After the war the Danish Church continued as a state church. Although the king and Parliament have legal control over the Danish Church, in practice the church enjoys considerable independence. It is divided into dioceses, each headed by a bishop. The bishop of Copenhagen also supervises the Lutheran churches in Greenland, which is part of the Danish kingdom.

As in all Scandinavian countries, the church's official membership includes most of the population, although active participation involves only a small percentage of the people.

Evangelical Union: *see* Protestant Union.

Evangelical United Brethren Church (EUB), Protestant church formed in 1946 by the merger of the Evangelical Church and the Church of the United Brethren in Christ. Both of these churches were essentially Methodist in doctrine and church government, and both originated among German-speaking people in Pennsylvania, Maryland, and Virginia after the American Revolution.

The doctrine of the Evangelical United Brethren Church was contained in The Confession of Faith (1962), which was a continuation of the creedal statements of the two groups that merged in 1946. Personal salvation was emphasized, but the church did not stress doctrine and was ecumenical in outlook. In 1966 it approved a plan of union with The Methodist Church, and in 1968 they formed the United Methodist Church (*q.v.*).

Evans, Sir Arthur (John) (b. July 8, 1851, Nash Mills, Hertfordshire, Eng.—d. July 11, 1941, Youlbury, near Oxford, Oxfordshire), British archaeologist who excavated the ruins of the ancient city of Knossos in Crete and uncovered evidence of a sophisticated Bronze Age civilization, which he named Minoan; his work was one of archaeology's major achievements and greatly advanced the study of European and eastern Mediterranean prehistory.

A distinguished scholar, Evans was curator of the Ashmolean Museum, University of Oxford, from 1884 to 1908 and became extraordinary professor of prehistoric archaeology at Oxford in 1909. His interest in ancient coins and the writing on stone seals from Crete lured him to the island for the first time in

Sir Arthur Evans, detail of an oil painting by Sir William Richmond, 1907; in the Ashmolean Museum, Oxford

By courtesy of the Visitors of the Ashmolean Museum, Oxford

1894. The following year he published *Cretan Pictographs and Prae-Phoenician Script.* During an address in 1896 he suggested that the Mycenaean civilization of the Greek mainland had its origins in Crete. Three years later he purchased a tract of land that included the site of Knossos, and after a year's digging he had unearthed palace ruins covering 5½ acres (2.2 hectares). The size and splendour of the findings indicated that Knossos had been an ancient cultural capital. The complex ground plan of the palace suggested the labyrinth associated with the legendary King Minos, prompting Evans to name the civilization Minoan.

Over the course of the next 25 years Evans pursued his investigations. Digging below the Bronze Age ruins, he came upon remains of a Neolithic civilization, thus helping to place Mycenae in historical perspective. His discovery of Egyptian artifacts dating from known historical periods helped him establish the periods of Minoan civilization. Later estimates, however, differ from his.

Knossos also yielded some 3,000 clay tablets bearing one form of Minoan writing, the Linear B script. Evans hoped to decipher this as well as the other forms, the Linear A and the

pictorial; he failed, but a lecture he delivered in 1936 inspired Michael Ventris to begin a successful effort to solve the problem. Evans dealt with all three forms in *Scripta Minoa* (vol. 1, 1909; vol. 2, ed. by J.L. Myres, 1952). *The Palace of Minos,* 4 vol. (1921–36), was his own definitive treatment of his work. Evans received many honours for his discoveries and was knighted in 1911.

Evans, Bill, byname of WILLIAM JOHN EVANS (b. Aug. 16, 1929, Plainfield, N.J., U.S.—d. Sept. 15, 1980, New York, N.Y.), American jazz pianist whose lush harmonies and lyrical improvisation so influenced other jazz pianists of the 1960s and '70s that it became the single most influential style since that of Bud Powell 10 years earlier.

During the 1950s Evans recorded with clarinetist Tony Scott and composer-pianist George Russell, and as a pianist-composer-arranger he was important in the development of mode-based jazz improvisation on the landmark 1959 Miles Davis album *Kind of Blue.* Evans' June 1961 live recording, *The Village Vanguard Sessions,* with bassist Scott LaFaro and drummer Paul Motian, established a major model for free melodic improvisation by exhibiting near-telepathic communication between the members of the trio. Most notable among the albums that won him five Grammy awards are *Conversations with Myself* (1963), a solo effort with overdubs, and *The Bill Evans Album* (1971), the success of which marked a resurgence of popular interest in Evans and his new bassist, Eddie Gomez.

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Evans, Chick, byname of CHARLES EVANS, JR. (b. July 18, 1890, Indianapolis, Ind., U.S.—d. Nov. 6, 1979, Chicago, Ill.), American amateur golfer known for his longevity in competition and for his Evans Scholars Foundation, which offers college scholarships to caddies. Evans himself began his golf career as a caddie and began to attract attention as a player about 1906. He qualified for every U.S. amateur championship tournament from 1907 to 1962.

In 1909 Evans won the Western Amateur, a tournament he would win seven more times in his career, four consecutively. He won the Western Open in 1910 and the French Amateur in 1911 after he had switched from the baseball to the Vardon grip. He finished second in the U.S. Amateur in 1912 and in the U.S. Open of 1914. In 1916 he became the first player to win both of those tournaments in the same year; his Open score of 286 stood as a record for 20 years. In 1917–18 he was the partner of Bobby Jones in a series of exhibition matches for the benefit of the Red Cross. At the age of 80 he was still a popular visitor at major tournaments.

Evans, Dame Edith (Mary) (b. Feb. 8, 1888, London, Eng.—d. Oct. 14, 1976, Cranbrook, Kent) one of the finest actresses of the English-speaking stage during the 20th century.

Evans made her professional debut in 1912 as Cressida in Shakespeare's *Troilus and Cressida,* directed by William Poel. Preferring interesting and difficult portrayals to starring roles, she turned down the lead in Somerset Maugham's *Our Betters* in 1923 for a minor part in George Bernard Shaw's *Back to Methuselah.* In 1925 she joined the Old Vic Theatre company, with which she continued to act for many years.

In her long career Evans acted in a variety of parts and produced a number of plays. Some of her more notable stage roles included Judith Bliss in Noel Coward's *Hay Fever;* Mrs. Millamant in William Congreve's *Way of the World;* the Countess in *The Dark Is Light Enough,* which Christopher Fry wrote for her;

Dame Edith Evans as Mrs. Ross in *The Whisperers,* 1967

By courtesy of Seven Pines Productions Ltd.; photograph, Pictorial Parade—EB Inc.

Gertrude in *Hamlet;* the nurse in *Romeo and Juliet;* and, her most famous role, Lady Bracknell in Oscar Wilde's *Importance of Being Earnest.* Her last stage performance was in a one-woman show in 1974. Her memorable films include *The Importance of Being Earnest* (1952), *Look Back in Anger* (1959), *The Nun's Story* (1959), *Tom Jones* (1963), *The Chalk Garden* (1964), *Young Cassidy* (1965), *The Whisperers* (1967), and *Crooks and Coronets* (1969). She was made a Dame of the British Empire in 1946.

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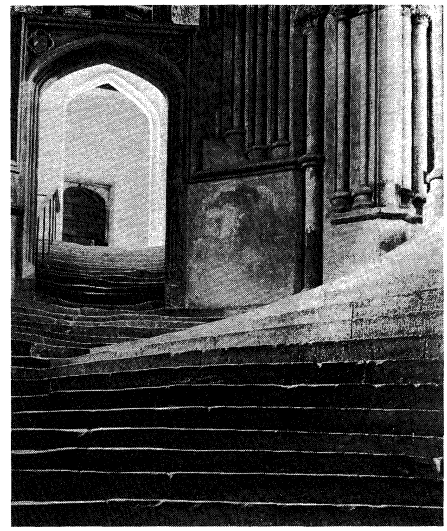
Evans, Frederick Henry (b. June 26, 1853, England—d. June 24, 1943, London), English photographer whose studies of cathedrals of England and France are considered among the world's finest architectural photographs.

Little is known of Evans' early life. He first attracted attention as a London bookseller and self-appointed educator of the local businessmen and clerks who formed the majority of his clientele. Because he accompanied his transactions with informative and stimulating conversation, his shop became known as "the university of the city clerk." During this period he championed the work of two of his steady customers, the dramatist George Bernard Shaw and the artist Aubrey Beardsley, securing for Beardsley his first commission.

In 1898 Evans retired from bookselling to devote all of his time to photographing the cathedrals of England and France. A fastidious craftsman whose goal was the perfect print, he often spent weeks studying the light in a cathedral at various times of day, waiting to catch the precise effect he sought. His style, which



"A Sea of Steps," Wells Cathedral, by Frederick H. Evans, 1903

By courtesy of Evan Evans; photograph, George Eastman House Collection

emphasized a cathedral's immense spaces and infinite variety of light and textures, culminated in his "A Sea of Steps," Wells Cathedral (1903).

A man of strong opinions on many subjects, Evans was constantly involved in controversy. His most violent disputes concerned what he considered to be the proper practice of photography. He believed that the photographic image should never be altered after the film was exposed. Equally abhorrent to him was the tendency emerging in the early 20th century to photograph fleeting situations in modern life. He thought that only static views of idealized beauty were worthy of photography. His advice was largely ignored by younger photographers. He spent the last years of his life virtually forgotten, privately publishing limited editions of his own photographic reproductions of his collection of drawings.

Evans, George Henry (b. March 25, 1805, Bromyard, Herefordshire, Eng.—d. Feb. 2, 1856, Granville, N.J., U.S.), American prolabour social reformer and newspaper editor who sought to enhance the position of workers by agitating for free homesteads.

Evans immigrated with his father to the United States in 1820 and was apprenticed to a printer in Ithaca, N.Y. By the end of the decade, he had founded his own newspaper, the *Working Man's Advocate,* and in 1829 he joined with Robert Dale Owen and Frances Wright to help found the Workingmen's Party.

In his newspaper and later in his book *History of the Origin and Progress of the Working Men's Party* (1840), Evans elucidated his reform program while opposing other reform philosophies. Wages would stay high, he asserted, as long as there was a "safety valve" (*i.e.,* cheap farmland) to draw off excess workers. Believing that land policies could be changed through political action, Evans organized the National Reform Association. Through its numerous state branches, the organization pressed for free homesteads in the West. The group's motto was "Vote yourself a farm," and Congress eventually responded by passing the Homestead Act (1862).

Evans also fought for the abolition of slavery, of imprisonment for debt, and of all types of monopolies (including the Bank of the United States). Unlike many male social reformers of his era, moreover, Evans also advocated equal rights for women.

Evans, George William (b. Jan. 5, 1780, London, Eng.—d. Oct. 16, 1852, Hobart, Tasmania, Australia), English surveyor and explorer notable for his discoveries in the interior of New South Wales, Australia.

As an apprentice to an engineer and architect, Evans learned surveying. In 1796 he emigrated to the Cape of Good Hope, and, after British forces withdrew from there in 1802, he went to New South Wales as a storekeeper. In 1802–03 he was appointed acting surveyor-general of that colony.

In 1804 Evans discovered and explored the Warragamba River. Discharged in 1805 by Governor Phillip King, Evans farmed land granted him earlier but failed and in 1809 was appointed assistant surveyor at Port Dalrymple. In 1812 he explored overland to Jervis Bay, where he surveyed its shores; as a result the Illawara region was settled. In 1812 he explored the interior of New South Wales and was appointed deputy surveyor of lands in Van Diemen's Land (now Tasmania). In the course of his seven-week 1813 expedition to the interior of New South Wales, he became the first European to make a complete crossing of the Great Dividing Range. In 1815 he explored further, discovering the Lachlan River, which he followed as far as Mandagery Creek.

In 1817 he was second-in-command to the surveyor-general John Oxley in an expedition to trace the Lachlan River and in 1818 in an attempt to trace the Macquarie River to its source. He resumed his deputy surveyorship but went with the first party sent to Macquarie Harbour in 1822. He was implicated in charges of corruption against the deputy governor William Sorell and in 1825 resigned his office, took his pension, and returned to London, where he taught art. As an artist, Evans painted scenes set both in settlements and in the bush.

Evans, Gil, original name IAN ERNEST GILMORE GREEN (b. May 13, 1912, Toronto, Ont., Can.—d. March 20, 1988, Cuernavaca, Mex.), Canadian-born composer and arranger who was one of the finest orchestrators in jazz.

A self-taught musician, Evans started his first band in 1933 and then worked as an arranger with Claude Thornhill's band from 1941 to 1948. Between 1948 and 1950 he engaged in a fruitful collaboration with the jazz trumpeter Miles Davis, arranging such cool-jazz classics as "Moondreams" and "Boplicity" for Davis' band. Evans subsequently renewed his collaboration with Davis, doing the writing and arrangements for the latter's albums *Miles Ahead* (1957), *Porgy and Bess* (1958), and *Sketches of Spain* (1959). Evans' own albums included *Out of the Cool* (1961).

Evans created luminous, impressionistic arrangements whose appeal lies in the richness of their textures and tonalities and in their subtly shifting musical structures. In his later years he formed his own bands and embraced rock music, incorporating rock rhythms with an electric sound.

Evans, John (b. March 9, 1814, Waynesville, Ohio, U.S.—d. July 3, 1897, Denver, Colo.), governor of Colorado Territory, 1862–65, founder of Northwestern University (Evanston, Ill.), physician, and railroad promoter.

A graduate of Lynn Medical College, Cincinnati, Ohio (1838), Evans practiced medicine in Indiana, where he helped establish a state hospital for the insane and served as its first superintendent (Indianapolis, 1845–48). While serving as professor of obstetrics at Rush Medical College, Chicago (from 1848), he and Orrington Lunt founded Northwestern University (1851). He went to the Colorado Territory as its second governor in 1862. In 1864 he founded the Colorado Seminary (Methodist), which later became the University of Denver. The Denver Pacific, South Park, and Denver and New Orleans railways were organized and partly financed by Evans. The communities of Evanston, Ill., and Evanston, Wyo., as well as Mount Evans, Colo. (14,260 feet [4,350 m]), are named for him.

Evans, Sir John (b. Nov. 17, 1823, Burnham, Buckinghamshire, Eng.—d. May 31, 1908, Berkhamsted, Hertfordshire), British antiquarian, numismatist, and a founder of prehistoric archaeology.

A partner in a paper manufacturing firm (1850–85), about 1860 Evans began devoting much time to searching for traces of early man in Britain and gathered an outstanding collection of prehistoric stone and bronze implements. He also assembled an exceptional collection of ancient Roman, Anglo-Saxon, and British coins. His major works were *The Coins of the Ancient Britons* (1864); *The Ancient Stone Implements, Weapons, and Ornaments, of Great Britain* (1872; 2nd. ed., 1897); and *The Ancient Bronze Implements, Weapons and Ornaments, of Great Britain and Ireland* (1881). He was knighted in 1892. His son was the archaeologist Sir Arthur (John) Evans.

Evans, Maurice (b. June 3, 1901, Dorchester, Dorset, Eng.—d. March 12, 1989, Rottingdean, East Sussex), British-born stage actor who became one of the best-known Shakespearean actors in the United States in the 1930s and '40s.

Evans acted as an amateur from childhood and obtained his first professional role in 1926. He first achieved recognition as Lieutenant Raleigh in R.C. Sherriff's play *Journey's End* (1929) in London. Evans acted with the Old Vic dramatic company in 1934 and then went to the United States in 1935. There he played lead roles in a series of highly successful Broadway productions of Shakespearean plays directed by Margaret Webster, including *Richard II* and *Henry IV, Part I* in 1937 and, in 1938, the first full-length version of *Hamlet* to be presented in the modern American theatre. In the following years he performed in *Twelfth Night* and *Macbeth* as well on Broadway.

Evans became a U.S. citizen in 1941, and during World War II he entertained U.S. troops in the Pacific with a shortened version of *Hamlet*. After the war he played major roles in the Broadway revivals of four comedies by George Bernard Shaw, notably *Man and Superman* (1947). His greatest commercial success was his role in Frederick Knott's suspense drama *Dial M for Murder* (1952), which ran for 552 performances on Broadway. Evans himself coproduced two Broadway hits, *The Teahouse of the August Moon* (1953) and *No Time for Sergeants* (1955). He re-created many of his stage successes on American television in the 1950s and played roles in several motion pictures.

Evans, Oliver (b. Sept. 13, 1755, near Newport, Del. [U.S.]—d. April 15, 1819, New York, N.Y.), American inventor who pioneered the high-pressure steam engine (U.S. patent, 1790) and created the first continuous production line (1784).

Evans was apprenticed to a wheelwright at the age of 16. Observing the trick of a blacksmith's boy who used the propellant force of steam in a gun, he began to investigate ways to harness steam for propulsion. Before he could successfully pursue this line of research, however, he became involved with a number of other industrial problems. Carding, or combing, fibres to prepare them for spinning was a laborious process constituting a bottleneck in the newly mechanized production of textiles. To speed this operation Evans invented a machine that cut and mounted 1,000 wire teeth per minute on leather, the teeth serving as an improved carding device.

Oliver Evans, portrait by W.G. Jackman, 19th century; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York, gift of Mrs. Van Santvoord Merle-Smith, 1933

In 1784, at the age of 29, he attacked another major industrial production problem, the age-old process of grinding grain. Building a factory outside Philadelphia and adapting five machines, including conveyors, elevators, and weighing scales, he created a production line in which all movement throughout the mill was automatic. Labour was required only to set the mill in motion; power was supplied by waterwheels, and grain was fed in at one end, passed by a system of conveyors and chutes through the stages of milling and refining, and emerged at the other end as finished flour. The system, which reduced costs by 50 percent according to Evans' calculations, much later was widely copied in American flour milling.

When Evans applied for patent protection, first to state governments (1787) and later to the new U.S. Patent Office (1790), he added a third invention, his high-pressure steam engine. He continued to work on this for the next several years, envisioning both a stationary engine for industrial purposes and an engine for land and water transport. In 1801 he built in Philadelphia a stationary engine that turned a rotary crusher to produce pulverized limestone for agricultural purposes. The engine that became associated with his name was an original adaptation of the existing steam engine; Evans placed both the cylinder and the crankshaft at the same end of the beam instead of at opposite ends, as had been done previously. This greatly reduced the weight of the beam. An ingenious linkage, which became world famous as the Evans straight-line linkage, made the new arrangement feasible. He saw at once the potential of such an engine for road transportation but was unable to persuade the authorities to permit its use on the Pennsylvania Turnpike—not unnaturally, since it might well have frightened the horses, which at that time provided the main form of transport. Within a few years he had engines doing several other kinds of work, including sowing grain, driving sawmills and boring machines, and powering a dredge to clear the Philadelphia water frontage. Completed by June 1805, his new type of steam-engine scow, called the Orukter Amphibolos, or Amphibious Digger, was 30 feet (9 m) long by 12 feet (3.7 m) wide. In its machinery it embodied the chain-of-buckets principle of his automatic flour mill. Equipped with wheels, it ran on land as well as on water, making it the first powered road vehicle to operate in the United States.

In 1806 Evans began to develop his noted Mars Iron Works, where, over the next 10 years, he made more than 100 steam engines that were used with screw presses for processing cotton, tobacco, and paper. The Navy Yard in Washington, D.C., bought one of Evans' engines, and, when the War of 1812 broke out, Evans and a partner proposed to build a powerful steam warship with a large gun at the bow, thus anticipating John Ericsson's *Monitor* of 50 years later; but the proposal was not accepted.

Evans' last great work, completed in 1817, was a 24-horsepower high-pressure engine for a waterworks. He died shortly after a disastrous fire that destroyed his Mars Iron Works, including his valuable patterns and molds.

His *Young Mill-Wright and Miller's Guide,* which he had written in 1792, continued to sell and had gone through 15 editions by 1860. In another work, *The Abortion of the Young Steam Engineer's Guide* (1805), he forecast the need for government subsidization of technological advances.

Vested interests in horses, as well as poor roads, steep gradients, inadequate springing, and an inadequate technology of materials, hindered the adoption of his ideas for steam engines on roads. Also, because later manufacturers were slow to make use of his innovative manufacturing techniques, Evans was long a somewhat neglected figure. More recently, however, in the allocation of priorities for the development of the high-pressure steam engine, the simultaneity of Evans' work with that of the British genius Richard Trevithick

has been established, and historians have accorded proper credit for his pioneering of the assembly line. (W.H.G.A.)

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Evans, Walker (b. Nov. 3, 1903, St. Louis, Mo., U.S.—d. April 10, 1975, New Haven, Conn.), U.S. photographer, important primarily for documenting the effects of economic depression in the American South and photographically interpreting U.S. folk architecture. His approach to photography was largely formed by the documentary photographs of the French photographer Eugène Atget, whose influence is apparent in Evans' series of photographs, begun in 1930, of 19th-century architecture of New England. In 1934 these photographs were shown in the first one-man show given to a photographer at the Museum of Modern Art in New York City.

In 1935 Evans began to photograph the rural victims of the Great Depression for the Resettlement Administration (later called the Farm Security Administration [FSA]) of the U.S. government. With his large-view camera he recorded virtually every facet of their lives, capturing their pride and individuality as much through their artifacts and dwellings as through their faces. These direct, seemingly artless photographs were collected in the book *American Photographs* (1938; reissued 1975).

In 1936 Evans took leave from the FSA to travel to Alabama with writer James Agee to document the life of sharecroppers for *Fortune* magazine. Although their study never appeared in the magazine, it was published in book form as *Let Us Now Praise Famous Men* (1941; reissued 1966). Evans' photographs appeared without titles or comment, in a section separate from Agee's text, yet the whole constitutes one of the finest collaborations between a photographer and a writer.

From 1945 to 1965 Evans was an associate editor of *Fortune* magazine. He continued to photograph architecture, especially rural churches, but his most remarkable work of those years was a series of photographs of people taken in the New York City subways. Out of courtesy to those his camera had so thoroughly revealed, however, Evans did not publish the photographs in book form, as *Many are Called,* until 1966. He was a professor of graphic design at Yale University from 1965 to 1974, becoming emeritus in 1974.

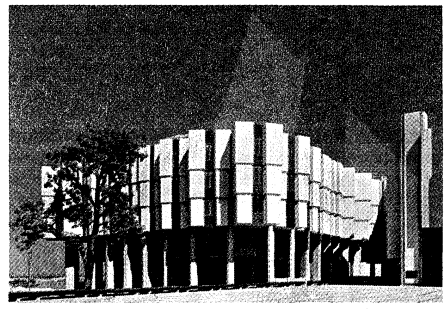
Evans-Pritchard, Sir Edward (Evan) (b. 1902, Crowborough, Sussex, Eng.—d. Sept. 11, 1973), one of England's foremost social anthropologists, especially known for his investigations of African cultures.

After studying modern history at the University of Oxford, he did postgraduate work in anthropology at the London School of Economics and Political Science. He then did fieldwork among the Azande and Nuer of southern Sudan. Two books about these peoples, *Witchcraft among the Azande* (1937) and *The Nuer* (1940), made his reputation. In 1940 he and Meyer Fortes edited a volume of essays, *African Political Systems,* that revolutionized the study of primitive government.

Although Evans-Pritchard was throughout his life a prolific writer, especially on kinship, religion, and the history of anthropology, his later writings were eclipsed by his earlier work. His later writings were often theoretical essays and lectures on the relations between anthropology and other social sciences. These revealed a great depth of scholarship but were often controversial and divergent from modern trends. However, his influence as a teacher in the latter part of his life was considerable, for, under his guidance, the Oxford school of social anthropology attracted students from many parts of the world; and he sponsored fieldwork in Africa and elsewhere as a member of the Colonial Social Science Research Council.

Evans-Pritchard received numerous academic honours. He was a professor of social anthropology at Oxford and a fellow of All Souls College from 1946 to 1970, and he was sub-warden from 1963 to 1965. He was knighted in 1971.

Evanston, city, Cook County, northeastern Illinois, U.S., on Lake Michigan, immediately north of Chicago. Evanston grew up around Northwestern University. A group of Chicago businessmen purchased property along the lakeshore for the university in 1853 under a special state charter of 1851. The university has expanded on landfill. The city was named



Northwestern University Library, Evanston, Ill.
Philip A. Turner

for John Evans, one of the founders of the university.

Evanston is noted as an educational and religious centre. The second assembly of the World Council of Churches was held in Evanston in 1954, and the Ecumenical Institute was established there in 1958. Northwestern University's Technological Institute building was completed in 1942. Other institutions of higher education in Evanston include Garrett-Evangelical Theological Seminary (1855), a United Methodist graduate theological school; Kendall College (1934); the National College of Education (founded in Chicago in 1886 and moved to Evanston in 1926); and Seabury-Western Theological Seminary (Episcopal, 1933).

A number of national organizations headquartered there include the American Academy of Pediatrics, the National Merit Scholarship Corporation, Rotary International, the Woman's Christian Temperance Union (WCTU), and several national boards and agencies of the United Methodist Church. The home of Frances E. Willard, an early advocate of the WCTU, was designated a national landmark in 1966. The Evanston Historical Society is housed in the former home of Charles Gates Dawes, U.S. vice president (1925–29). The Cradle, a nonsectarian adoption home, was founded there in 1923. Grosse Point Lighthouse, built in 1873, is a point of interest.

The city is primarily a residential suburb, with a racially and economically diverse population. Manufactures include paper and steel products, hospital supplies, paint, chemicals, and books. Inc. town, 1863; city, 1892. Pop. (1980) 73,706.

Evansville, city, seat (1818) of Vanderburgh County, southwestern Indiana, U.S., port on the Ohio River (there bridged to Henderson, Ky.), 162 mi (261 km) southwest of Indianapolis. Founded by Hugh McGary, Jr., in 1812, it was named for Robert M. Evans, a colonel of the militia and member of the territorial legislature. Coal deposits and oil fields in an area of fertile farmlands surround the city and, together with the availability of hydropower and its location as a transportation hub, have contributed substantially to its growth as the metropolis of southwestern Indiana and the adjacent areas of Kentucky and Illinois. Diversified manufactures include pharmaceuticals, refrigeration and air conditioning equipment, and aluminum, plastic, and rubber products. The Wabash and Erie Canal was completed (1853) to Evansville (its southern terminus) and connected Lake Erie with the Ohio River. Evansville has a modern river terminal that provides for interchange of barge, rail, and truck traffic. The city contains a modern museum of science and arts and is the seat of the University of Evansville (1854) and Indiana State University–Evansville Campus (1965). Angel Mounds State Memorial, 7 mi east, is a large prehistoric Indian archaeological site. Inc. town, 1819; city, 1847. Pop. (1980) city, 130,496; metropolitan area (SMSA), 309,408.

evaporation (thermodynamics): *see* vaporization.

evaporator, industrial apparatus for converting liquid into vapour. The single-effect evaporator consists of a container or surface and a heating unit; the multiple-effect evaporator uses the vapour produced in one unit to heat a succeeding unit. Double, triple, or quadruple effect evaporators may be required in industrial and steam heating plants.

Some evaporators are used to concentrate a solution by vapourizing and eliminating water, for example in a concentration plant for sugar and syrup. In purification processes, such as the desalination of seawater, evaporators convert the water to vapour, leaving mineral residues in the evaporator. The vapour then is condensed into (desalinated) water. In a refrigeration system, the cooling effect is produced as the rapid evaporation of the liquid refrigerant absorbs heat.

evaporite, type of sedimentary deposit of soluble salts that results from the evaporation of water. The individual minerals in such deposits are also called evaporites.

A brief treatment of evaporite deposits and their constituent minerals follows. For full treatment, *see* MACROPAEDIA: Minerals and Rocks.

Typically, evaporite deposits occur in closed marine basins where evaporation exceeds inflow. The deposits often show a repeated sequence of minerals, indicating cyclic conditions with a mineralogy determined by solubility. The most important minerals and the sequence in which they form include calcite, gypsum, anhydrite, halite, polyhalite, and lastly potassium and magnesium salts such as sylvite, carnallite, kainite, and kieserite; anhydrite and halite dominate. These sequences have been reproduced in laboratory experiments and, therefore, the physical and chemical conditions for evaporite formation are well known.

In contrast to basin deposits, extensive thin-shelf deposits are known and are thought to be the result of shallow, ephemeral seas. Non-marine evaporites formed by streams flowing into closed depressions, expecially in arid regions, give rise to deposits of borates, nitrates, and sodium carbonates. Such deposits occur in Utah and southern California in the United States.

Evaristus, SAINT (b. Antioch?, Syria—d. *c.* 107, Rome; feast day October 6), pope from

c. 97 to *c.* 107 during the reign of the Roman emperor Trajan. He was the fifth pope and the immediate successor of St. Clement I. Though he is usually called a martyr, his martyrdom is unproved.

Evarts, William Maxwell (b. Feb. 6, 1818, Boston—d. Feb. 28, 1901, New York City), U.S. lawyer and statesman who took part successfully in the three greatest public cases of his generation. He served as counsel for Pres. Andrew Johnson in the impeachment trial

Evarts, detail of an oil painting by William Morris Hunt, *c.* 1871; in the Yale University Art Gallery

By courtesy of the Yale University Art Gallery, gift of Harrison Tweed, Mary W. Tweed, Katherine W. Blaine, and Helen Wadsworth

before the U.S. Senate (1868), represented the United States in the "Alabama" arbitration at Geneva (1872), and was chief counsel for the Republican Party in the disputed Hayes–Tilden presidential election (1876).

Educated at Yale and Harvard, Evarts quickly rose to the top of the legal profession and, at the same time, became increasingly active in politics, first as a Whig and then as a Republican. He served as attorney general under President Johnson (July 1868–March 1869), as secretary of state under Pres. Rutherford B. Hayes (1877–81), and as U.S. senator from New York (1885–89).

In 1891, with his health failing, he retired from both political and professional life.

Evatt, Herbert Vere (b. April 30, 1894, East Maitland, New South Wales—d. Nov. 2, 1965, Canberra, Australian Capital Territory), Australian statesman, judge, and writer on law who was a key member of the Labor administrations from 1941 to 1949 and became leader of the party (1951–60). He espoused

Evatt

By courtesy of the Australian Information Service

controversial views in favour of the Australian Communist Party's right to exist and of greater independence from Great Britain and alignment with smaller, especially Asian, democracies.

After achieving a brilliant academic record at the University of Sydney, Evatt served in the New South Wales legislature from 1925 to 1930. He spent 10 years (1930–40) as justice on the high court of Australia and then reentered politics as a federal representative. Appointed attorney general and minister for external affairs when the Labor Party returned to power in 1941, he sought a larger voice for Australia in Allied military decisions in the Pacific. Convinced that the United Nations was essential to Australia's security, he helped write the UN charter, led Australia's delegation to the assembly (1946–48), and served as president of the General Assembly (1948–49). In his association with the UN, he was an ardent spokesman for the rights of small nations.

Evatt assumed Labor Party leadership in 1951 when Joseph Chifley died. He successfully countered Prime Minister Robert Gordon Menzies' attempt to outlaw the Communist Party of Australia, and his opposition to the administration in 1954 over an alleged Soviet espionage case caused the anti-Communist wing of the Labor Party to secede, signalling the decline of the party from national power. Evatt retired from politics in 1960 to become chief justice of New South Wales (1960–62).

Eve: *see* Adam and Eve.

Eveleth, city, St. Louis County, northeastern Minnesota, U.S., in the Mesabi (iron) Range, and gateway to the picturesque Arrowhead country of lakes and mines in the Superior National Forest. It was settled in 1892 and named for Edwin Eveleth, a Michigan lumberman who visited the site in 1885. Following the discovery of iron ore by David T. Adams in 1892, the city's population increased from 2,752 to 7,036 in 1910. Eveleth's taconite mines produce much of the nation's ore. The manufacture of men's underwear is another industry. Nearby is the Leonidas Mine, one of the world's deepest (650 ft [200 m]) underground iron mines. The U.S. Hockey Hall of Fame is in the city. Inc. village, 1893; city, 1902. Pop. (1980) 5,042.

Evelyn, John (b. Oct. 31, 1620, Wotton, Surrey, Eng.—d. Feb. 27, 1706, Wotton), English country gentleman, author of some 30 books on the fine arts, forestry, and religious topics. His *Diary,* kept all his life, is considered an invaluable source of information on the social, cultural, religious, and political life of 17th-century England.

Son of a wealthy landowner, after studying in the Middle Temple, London, and at Balliol College, Oxford, Evelyn decided not to join the Royalist cause in the English Civil War for fear of endangering his brother's estate at Wotton, then in parliamentary territory. In 1643, therefore, he went abroad, first to France and then to Rome, Venice, and Padua, returning to Paris in 1646, where the following year he married Mary, daughter of Sir Richard Browne, Charles I's diplomatic representative to France. In 1652, during the Commonwealth, he returned to England and acquired his father-in-law's estate, Sayes Court, at Deptford. In 1659 he published two Royalist pamphlets.

At the Restoration of the monarchy in 1660, Evelyn was well received by Charles II; he served on a variety of commissions, including those concerned with London street improvement (1662), the Royal Mint (1663), and the repair of old St. Paul's (1666). Far more important was the commission for sick and wounded mariners and for prisoners of war in Charles II's Dutch Wars (1665–67, 1672–74), during which Evelyn exposed himself to plague and incurred personal expenses, reimbursement for which he was still petitioning in 1702. At that time he received help from Samuel Pepys (a navy official and, likewise, a diarist), with whom he formed a lifelong friendship.

Evelyn, oil painting by Robert Walker, 1648

By courtesy of the Trustees of the Will of the late J.H.C. Evelyn

Evelyn served on a council for colonial affairs from 1671 to 1674. He was appointed to the council of the Royal Society by its first and second charters in 1662 and 1663 and remained a lifelong member. In this capacity in 1664 he produced for the commissioners of the navy *Sylva, or a Discourse of Forest-trees, and the Propagation of Timber,* a description of the various kinds of trees, their cultivation, and uses. The study, with numerous modifications, had gone through 10 editions by 1825. In 1662 Evelyn produced *Sculptura,* a small book on engraving and etching, in which he announced a new process, the mezzotint.

About 1670 Evelyn formed a paternal affection for Margaret Blagge, a maid of honour at court, who later secretly married Sidney Godolphin, future lord high treasurer. She died after giving birth to a child in 1678; Evelyn's *Life of Mrs. Godolphin* (1847; ed. H. Sampson, 1939), is one of the most moving of 17th-century biographies.

In 1685, a few months after James II's accession, Evelyn was appointed one of three commissioners for the privy seal, an office he held for 15 months. Evelyn's last important book, *Numismata,* was published in 1697.

His *Diary,* begun when he was 11 years old and first published in 1818 (ed. E.S. de Beer, 6 vol., 1955), was written for himself alone but with relatively little about himself in it. It ranges from bald memoranda to elaborate set pieces. With its descriptions of places and events, characters of contemporaries, and many reports of sermons, it bears witness to more than 50 years of English life and, as such, is of great historical value.

Evemerus (Greek mythographer): *see* Euhemerus.

Even, also spelled EVENS, also called LAMUT, northern Siberian people (12,000 according to the 1979 Soviet census) closely related to the Evenk (*q.v.*) in origin, language, and culture. They inhabit the territory to the north and northeast of the Evenki Autonomous Okrug, where they have influenced and have in turn been influenced by their neighbours. The Even who settled on Kamchatka learned and practiced Chukchi traits; those who mixed with the Yukagirs created an Even–Yukagir population that is bilingual. Other peoples related by similar ties include the Dolgan, who are a nomadic reindeer-breeding group, and the riverine Negidals, who are primarily fishermen and hunters.

evening grosbeak, North American grosbeak species. *See* grosbeak.

evening primrose, any of various species of herbaceous plants of the genus *Oenothera,* of the family Onagraceae, noted for their showy flowers. The name is especially applied to

O. biennis, which occurs widely throughout North America and has been introduced into Europe. The true primrose belongs to the family Primulaceae.

O. biennis is a biennial that grows 90–150 cm (3–5 feet) tall. The leaves are alternate. The flowers are yellow and 2–5 cm (0.75–2 inches) across. It has been grown by geneticists to determine certain principles of heredity.

Evenk, also spelled EVENKI, formerly TUNGUS, the most numerous and widely scattered of the many small nationalities of northern Siberia.

The Evenk numbered about 50,000 in the late 20th century. The majority of them are found in Soviet Siberia and the Soviet Far East—their territory covering the northern taiga from the Ob–Irtysh watershed eastward to the Okhotsk seacoast and Sakhalin, and from the Amur River basin in the south northward to the Arctic Ocean. The Evenk are divided into two large groups; those Evenk who are hunters and reindeer breeders are scattered in the vast area of the northern taiga; those who are horse and cattle pastoralists or sedentary farmers reside in Transbaikalia and northeastern China and Mongolia. Both groups speak a language of the Manchu-Tungus language family.

The Evenk were traditionally organized in clans tracing their descent along paternal lines. The members of a clan had a communal fire and invoked common ancestor spirits in their prayers. They married outside the clan. The clan shaman—a singer, prophet, and healer—was the central figure in Tungus religion.

After the Russian Revolution the Evenk peoples were organized into collective farms; in 1930 the Evenky national (now "autonomous") *okrug* (district) was created. Nomadic Evenk were settled, and their subsistence economy was supplemented by such activities as fur farming, agriculture, and industrial and government occupations.

Articles are alphabetized word by word, not letter by letter

Evenky, also spelled EVENKI, autonomous *okrug* (district), Krasnoyarsk *kray* (region) in the north-central Russian Soviet Federated Socialist Republic, on the Central Siberian Plateau. In the northwestern part of the *okrug,* the Putoran Mountains rise to 5,581 feet (1,701 m) in Mount Kamen. Apart from higher areas with tundra vegetation, the *okrug,* which has an area of 296,400 square miles (767,600 square km), is covered by coniferous forest of larch. Permafrost underlies the poor soils. The climate is severe, with long, cold winters. In the early 1980s the huge area had only 17 villages and one urban settlement, Tura (the administrative centre), inhabited primarily by Russians but also by Evenk, who live by reindeer herding, hunting, and fishing. Only the herders move with the reindeer, the bulk of the population having been settled. The timber resources and mineral deposits are scarcely exploited. Travel is by river in summer and by trails and the Tura airstrip in winter. Pop. (1989 prelim.) 24,000.

Evens (people): *see* Even.

event, notion that became of singular importance in the philosophical speculation about relativity physics. The best-known analyses are those of the 20th-century English philosopher Bertrand Russell, for whom event replaced the vaguer notion of body, and the 20th-century English philosopher Alfred North Whitehead, for whom events were formed by a nexus of actual occasions. In general, in both views, an event is that which occurs at a given time and place.

Everard (personal name): *see under* Eberhard.

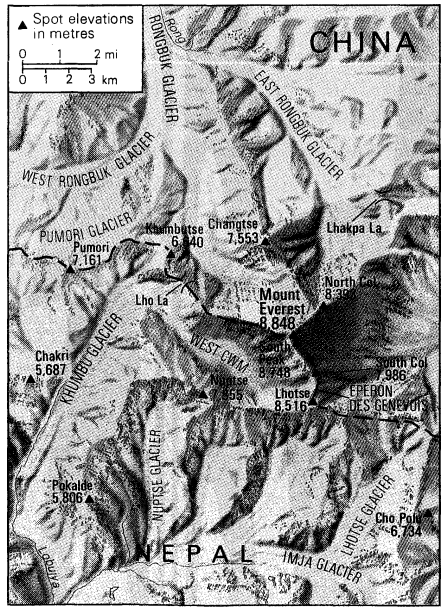
Everdingen, Allart van (b. 1621, Alkmaar, Neth.—d. 1675, Amsterdam), Dutch painter and engraver known for his landscapes recalling the scenery of Scandinavia.

According to the Dutch portrait engraver A. Houbraken, Everdingen studied under Roelant Savery at Utrecht and under Pieter de Molijn at Haarlem. He eventually settled in Amsterdam. His earlier works include some sea pieces, but his characteristic pictures are northern landscapes with mountains, forests, log huts, and waterfalls. These scenes were the result of a visit he made to Sweden soon after 1640, and their motifs inspired Jacob van Ruisdael in his landscapes. Everdingen illustrated Hendrick van Alcmar's *Reynard the Fox* with 57 etchings of animals.

Everest, Sir George (b. July 4, 1790, Gwernvale, Brecknockshire, Wales—d. Dec. 1, 1866, London, Eng.), British geodesist who completed the trigonometrical survey of India, on which depended the accurate mapping of the subcontinent.

Distinguishing himself during engineering training at military schools in England, Everest joined the East India Company in 1806 and served the next seven years in Bengal. During the British occupation of the Dutch East Indies, Everest worked on the survey of Java (1814–16), then returned to India. From 1818 until 1843, except for two leaves to recover his health, he worked on the survey of India, as superintendent from 1823 and as surveyor general from 1830. During his term as surveyor general, Everest introduced the most accurate surveying instruments of the day; in the course of the project, Everest and his predecessors measured the meridional arc of 11.5 degrees from the Himalayas to Cape Comorin, the southern tip of India. Everest was elected a Fellow of the Royal Society in 1827 and knighted in 1861. Mount Everest, the world's highest peak, was renamed in his honour in 1865.

Everest, Mount, Tibetan CHOMOLUNGMA, Chinese (Wade-Giles romanization) CHU-MU-LANG-MA FENG, (Pinyin) QOMOLANGMA FENG, peak on the crest of the Himalayan range in Asia, the highest point on Earth. It lies on the undemarcated Nepal–Tibet (China) border, in the approximate position of 28° N, 87° E. Three barren ridges—the Southeast, Northeast, and West—culminate in two summits at 29,028 feet (8,848 m; Everest) and 28,700 feet (8,748 m; South Peak). The mountain can be seen directly from its northeastern side, where it rises about 12,000 feet (3,600 m) above the Plateau of Tibet. The lesser peaks of Changtse (north; 24,780 feet), Khumbutse (northwest; 21,785 feet), Nuptse I (southwest; 25,771 feet), and Lhotse I (south; 27,940 feet), which rise around its base, hide the summit from Nepal.



Route of Edmund Hillary to the summit of Mount Everest, May 1953

Based on the map published by the Royal Geographical Society

The north face of Mount Everest seen from Rongbuk valley, Tibet

©Art Wolfe—Aperture PhotoBank

The summit of Everest reaches up two-thirds of the way through the earth's atmosphere to the upper layers, where oxygen is thin. Lack of oxygen, powerful winds, and extremely cold temperatures preclude the development of any plant or animal life on the upper slopes. Precipitation falls, during the summer monsoon only, as snow, which lies in powdery drifts. The ice sheets on the flanks of the mountain, which are separated from each other by the main ridges, cover the slopes down to the mountain's base but are slowly retreating because of gradual climatic change. The summit itself is relatively free of snow cover in the winter months because of the force of northwest gale winds.

Individual glaciers around Mount Everest are the Kangshung Glacier (east); the East, main, and West Rongbuk glaciers (north and northwest); the Pumori Glacier (northwest); the Khumbu Glacier (west and south); and the West Cwm, an enclosed valley of ice between Everest and the Lhotse-Nuptse Ridge.

The mountain's drainage pattern radiates southwest, north, and east. The Khumbu Glacier melts into the Lobujya Khola of Nepal, a river flowing southward as the Imja River to its confluence with the Dudh Kosi River. Two Tibetan rivers—the Rong Chu and Karma Chu—originate on Everest's slopes as the Pumori and Rongbuk glaciers and as the Kangshung Glacier, respectively. The Rong Chu and Dudh Kosi river valleys form the northern and southern access routes to the summit.

Because of its commanding size and height, Everest was known in the Tibetan language as Chomolungma, "Goddess Mother of the World." Its identity as the highest point on the earth's surface was not recognized, however, until 1852, when the governmental Survey of India established that fact. In 1865 the mountain—previously referred to as Peak XV—was renamed for a British official, Sir George Everest, who was surveyor general of India from 1830 to 1843. Controversy over the exact altitude of the summit developed because of variations due to snow level, gravity deviation, and light refraction. The figure currently accepted—29,028 feet (plus or minus a fraction)—was established by the Survey of India between 1952 and 1955.

Attempts to climb Everest began with the opening of the Tibetan route in 1920. Seven successive attempts on the Northeast Ridge (1921–38), as well as three missions up the Southeast Ridge (1951–52), failed because of the combined difficulties caused by cold arid air, high winds, difficult terrain, and high altitude.

Everest was finally surmounted in 1953, as the result of efforts by an expedition sponsored by the Royal Geographical Society and the Joint Himalayan Committee of the Alpine Club. Open- and closed-circuit oxygen systems, especially insulated boots and clothing, and portable radio equipment were used by the climbers. Eight camps were established on the route that was taken up the Khumbu Icefall and Glacier, the West Cwm, and the face of Lhotse to the South Col, a rocky ridge at 26,200 ft. From there, on May 29, 1953, Edmund (later Sir Edmund) Hillary of New Zealand and Tenzing Norgay of Nepal ascended the Southeast Ridge, past South Peak, to the summit. Since then, numerous expeditions sponsored by different countries have been undertaken, many of them successfully. In 1963 two Americans reached the summit by the previously unscaled West Ridge, then returned by the South Col, completing the first transverse crossing. Junko Tabei of Japan, escorted by Ang Tsering of Nepal, on May 16, 1975, became the first woman to reach the summit. Everest was first surmounted by the southwest face on Sept. 25, 1975, by two British climbers, and two Japanese made the first ascent by the North Wall on the Tibetan side on May 11, 1980.

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Everett, city, Middlesex County, eastern Massachusetts, U.S., across the Mystic River from Boston. Settled in 1649, it was a part of the town of Malden and was known as South Malden until it was separately incorporated in 1870 and renamed for the orator and statesman Edward Everett. A highly diversified industrial suburb, its port facilities can accommodate oceangoing ships. Manufactures include metal items, transportation equipment, shoes, and chemical, petroleum, and paper products. Its proximity to Massachusetts Institute of Technology and Harvard University has attracted a number of research and development projects, including one for the light anti-tank weapon (LAW), a rocket launcher. Inc. city, 1892. Pop. (1980) 37,195.

Everett, city, seat of Snohomish County, northwestern Washington, U.S., on Puget Sound, at the mouth of the Snohomish River, across from Whidbey Island (west), 28 mi (45 km) north of Seattle. Settled in 1862 and laid out in 1890, it became the western terminus of the Northern Pacific Railway in 1893. Named for the son of C.L. Colby (an investor in the Everett Land Company), it attracted eastern capital and was promoted as a manufacturing centre. Development faltered, but the city exploited local timber and agricultural resources. Its landlocked harbour (Port Gardner) has been developed as a cargo and commercial fishing port. A large Boeing aircraft assembly plant is immediately south. Everett Community College was founded in 1941. Mount Baker-Snoqualmie National Forest is to the east. Inc. 1893. Pop. (1980) city, 54,413; metropolitan area (SMSA), 1,606,765.

Everett, Edward (b. April 11, 1794, Dorchester, Mass., U.S.—d. Jan. 15, 1865, Boston), U.S. statesman and orator who is mainly remembered for delivering the speech immediately preceding Pres. Abraham Lincoln's immortal Gettysburg Address (Nov. 19, 1863) at the ceremony honouring the fallen soldiers of the U.S. Civil War (1861–65).

By 1820 Everett had established a formidable reputation as a lecturer and orator, based on careful preparation, an extraordinary memory, and brilliance of style and delivery. He served in the U.S. House of Representatives (1825–35), as governor of Massachusetts (1835–39), and as U.S. minister to England (1841–45). With his election as president of Harvard in 1846, he withdrew from politics for several years, returning in 1852 as secretary of state during the last four months of Pres. Millard Fillmore's administration. In 1853 he entered the U.S. Senate, but his generally conciliatory stand on the issue of slavery aroused the ire of his Abolitionist constituents, and he resigned the following year.

Everett

By courtesy of the Library of Congress, Washington, D.C.

In 1860 Everett was the unsuccessful vice presidential candidate of the Constitutional Union Party, which sought to bridge sectional differences by stressing common devotion to the Union and the Constitution. His desire for compromise ended with the outbreak of the Civil War, and throughout the conflict he travelled and spoke in support of the Union cause.

Everglades, subtropical saw-grass marsh region covering about 4,000 sq mi (10,000 sq km) of southern Florida, U.S. Through it, water moves slowly from the lip of Lake Okeechobee to mangrove swamps bordering the Gulf of Mexico and the Florida Bay on the west. On the east the marsh reaches near the narrow, sandy belt that includes the Greater Miami metropolitan area, while on the south Everglades National Park borders Florida Bay at the bottom of the peninsula.

Natural environment. The glades occupy a shallow limestone-floored basin that slopes imperceptibly southward at about 1/5 ft per mile about (4 cm per km). Much of it is covered with saw grass (a sedge, the edges of which are covered with minute sharp teeth), which grows to a height of 10 to 15 ft (3 to 5 m). Open water is sometimes found; and there are numerous low islands, or "hammocks," on which a profusion of trees and shrubs grow, including palms, pines, live oaks, cypresses, saw palmettos, and other tropical species. The organic soils, formed from the decay of lush vegetation, range from discontinuous shallow patches to accumulations of peat and muck 8 to 14 ft thick near Lake Okeechobee. The best soils are deep mucks found in a narrow zone along the lakeshore, where a dense tangle of custard apple, or papaw, and moonflower (a morning glory) once grew.

The climate of the glades is tropical savanna or subtropical and is influenced strongly by the southeast trade winds. Monthly mean temperatures range from 63° F (17.2° C) to 82° F (27.8° C), though winter frosts occur on rare occasions. Rainfall averages over 55 in. (1,400 mm) annually, with 75 percent coming between June and October. In winter and spring the glades can be so dry that water disappears into the underlying porous rock.

The mild climate and usual abundance of water provide an environment for myriad birds, particularly such wading birds as herons, egrets, and ibis, as well as for many species of snakes, turtles, and, best known of all, alligators. The "hammocks" served as shelter for deer, wildcats, panthers, bears, smaller mammals, and numerous reptiles. Drainage in the glades has altered the habitats of many species, extending some, as in the case of deer, but shrinking those of water-dependent creatures. An integral part of the ecosystem is a rich variety of insect life.

The Indian inhabitants. To the Indians of the region, the Everglades was known as Pa-May-Okee, "Grassy Water." Its vast areas of open saw grass were used only as passage for dugout canoes and as hunting and fishing territory. The "hammocks," however, were sometimes settled or used as garden sites. Mounds in the vicinity of Belle Glade indicate longtime occupancy there. Calusa peoples penetrated from the Gulf Coast, but little colonization within the glades resulted. Adversely affected by European contacts, the Calusa were largely gone by 1800, although the amalgam of refugee Indian groups that became known as Seminole may have absorbed the last vestiges of the Calusa during the early 19th century.

The Seminole found sanctuary in the swamps and marshes because the white man did not covet the glades at the time. They developed the "chikee," a dwelling without walls, made of a log framework with a thatched roof over a raised platform, that assured maximum ventilation. They planted corn (maize), beans, melons, and squashes on patches of higher ground but gathered nuts, greens, and palmetto hearts. The bulbous roots of the coontie plant were the source of a starchy flour, and hunting and fishing provided much of their sustenance.

In the late 20th century, few of the Seminoles remaining in Florida lived within the Everglades.

Development of the Everglades. After the Seminole Indian Wars, which occurred sporadically from 1817 to 1858, interest in the Everglades centred upon exploitation of its wildlife, especially the heron and egret for their feathers and the alligator for its hide. Drastic reductions in wildlife numbers led to legislation after 1920 that protected "plume birds"; more recently, alligator hunting was similarly restricted.

Drainage remained the principal focus of engineering in the glades for many years. A system of canals and lateral ditches to control Lake Okeechobee has converted about one-fifth of the total area to agricultural use. As the major supplier of many garden vegetables for Northern markets, the Everglades farming district has come to be known as the "Vegetable Kingdom."

To stabilize the farming economy and utilize sugar-mill wastes, beef cattle first became important in the 1950s. In addition to agriculturally oriented activities, sport fishing has been facilitated by highway construction, and Everglades National Park, established in 1947 to protect wildlife habitats in the central and southern glades, attracts increasing numbers of visitors. A boon for the conservationists is the fact that oil drillers have found brine so troublesome a by-product that large-scale exploitation has been abandoned.

In the late 20th century, the Everglades remained the focus of conflict between various interests, as the exploitation of its rich resources continued to threaten the delicate ecological balance of the marsh.

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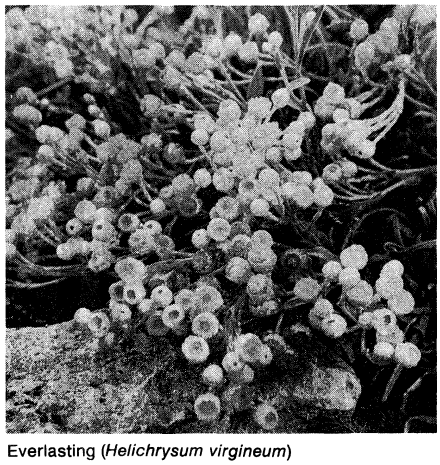
evergreen, any plant that retains its leaves through the winter and into the following summer or through several years. Many tropical species of broad-leaved flowering plants are evergreen, but in cold temperate and Arctic areas the evergreens commonly are cone-bearing shrubs or trees (conifers), such as pines and firs. The leaves of evergreens usually are thicker and more leathery than those of deciduous trees (those that shed their leaves in autumn) and often are needlelike or scalelike in cone-bearing trees. A leaf may remain on an evergreen tree for two years or longer and may fall during any season. An evergreen forest may be needle-leaved, as the coniferous forests of the Northern Hemisphere, or broad-leaved, as the temperate rain forests of the Southern Hemisphere and the broad sclerophyll forests (with thickened, hardened foliage resistant to water loss) of coastal areas of the Northern Hemisphere. Most tropical rain forests contain broad-leaved evergreens. *See also* coniferous forest; chaparral.

evergreen timber conifer (tree): *see* arartree.

everlasting, any of several plants that retain their form and colour when dried and are used in dry bouquets and flower arrangements. Popular everlastings include several species of the family Asteraceae, especially the true everlastings, or immortelles, *Helichrysum* species. *Helichrysum*—native to North Africa, Crete, and the parts of Asia bordering on the Mediterranean—is cultivated in many parts of Europe. The immortelles have one or more whorls of dry, scalelike or membranous bracts (leaves borne below flowers) that preserve their appearance when dried. *Helichrysum* is tufted in its growth, each plant producing 60 or 70 stems, each stem an average of 20 flowers. The bracts are deep yellow, but the flower heads may be dyed a variety of shades. One of the best-known everlastings is the Australian *H. bracteatum,* the strawflower.

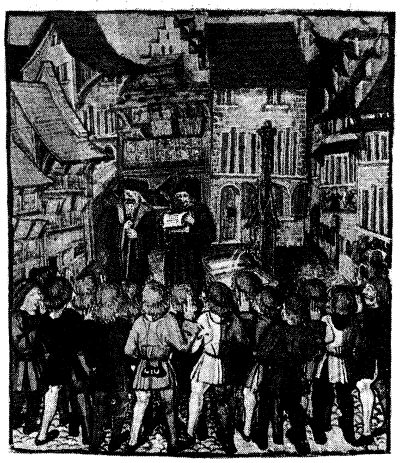
Other plants grown as everlastings include species of *Helipterum* (west Australia and South Africa), *Ammobium* (Australia), *Achyrachaena* (western United States), *Antennaria* (extratropical except Africa), *Gnaphalium* (cosmopolitan), and *Xeranthemum* (south Europe). In North America the pearly everlasting (*Anaphalis margaritacea*) is very widely distributed, occurring in dry soils from Newfoundland to Alaska and south to North Carolina and California. Several members of the family Amaranthaceae are considered everlastings: such are the globe amaranth (*Gomphrena globosa*), with oval heads of white, orange, rose, or violet, and membranous bracts; and the woolflower (*Celosia argentea*), with its elegant, loose pyramidal flower clusters.

Also, many grasses with showy plumes or spikes are classed as everlastings.



Everlasting (*Helichrysum virgineum*)
Valerie Finnis

Everlasting League, also called LEAGUE OF THE THREE FOREST CANTONS, German EWIGE BUND, or DREIWALDSTÄTTERBUND (Aug. 1, 1291), the inaugural confederation from which, through a long series of accessions, Switzerland grew to statehood. The league was concluded by the representatives of three districts, Uri, Schwyz, and Nidwalden, for self-defense against all who should attack or trouble them. The league's formation was prompted by the death (July 15, 1291) of Rudolf I of Habsburg, who earlier in the year had used his position as German king to reinforce Habsburg rights over Schwyz and Unterwalden (Nidwalden and the adjacent Obwalden), which were the original parties to the league. These districts formed the league in order to check any further encroachments and to do whatever they could, by common action, to support anti-Habsburg candidates for the German crown.



Citizens of Luzern taking the oath of the Everlasting League, illumination from the Luzerner Bilderchronik von Diebold Schilling, 16th century; in the Zentralbibliothek Luzern
By courtesy of the Zentralbibliothek Luzern

Evers, Medgar (Wiley) (b. July 2, 1925, Decatur, Miss., U.S.—d. June 12, 1963, Philadelphia, Miss.), American black civil-rights activist, whose murder received national attention and made him a martyr to the cause of civil rights.

Growing up in Decatur, Miss., Evers attended high school in nearby Newton; during World War II he served in the U.S. Army in Europe. Afterward he and his elder brother, Charles Evers (b. 1923), both graduated from Alcorn Agricultural and Mechanical College in 1950. They settled in Philadelphia, Miss., and engaged in various business pursuits—Medgar was an insurance salesman, and Charles operated a restaurant, a gas station, and other enterprises—and at the same time began organizing local affiliates of the National Association for the Advancement of Colored People (NAACP). They worked quietly at first, slowly building a base of support; in 1954 Medgar moved to Jackson to become the NAACP's first field secretary in Mississippi. He traveled throughout the state recruiting members and organizing voter-registration drives and economic boycotts.

During the early 1960s the increased tempo of civil-rights activities in the South created high and constant tensions, and in Mississippi conditions were often at the breaking point. On June 12, 1963, a few hours after President John F. Kennedy had made an extraordinary broadcast to the nation on the subject of civil rights, Medgar Evers was shot and killed in an ambush in front of his home. The murder made Evers, until then a hardworking and effective but relatively obscure figure outside of Mississippi, a nationally known figure. He was buried with full military honours in Arlington National Cemetery and awarded the 1963 Spingarn Medal of the NAACP.

Charles Evers immediately requested and was granted appointment by the NAACP to his brother's position in Mississippi, and afterward he became a major political figure in the state.

A white segregationist, Byron de La Beckwith, was charged with the murder but was set free after two trials resulted in hung juries.

Evershed, John (b. Feb. 26, 1864, Gomshall, Surrey, Eng.—d. Nov. 17, 1956, Ewhurst, Surrey), English astronomer who, in 1909, discovered the horizontal motion of gases outward from the centres of sunspots, a phenomenon sometimes called the Evershed effect.

In 1906 Evershed became assistant director of the Kodaikānal and Madras observatories in India, later becoming director. On an expedition to Kashmir in 1915, he made the first measurements supporting Albert Einstein's prediction that the wavelength of light emitted by a massive body (in this case the Sun) should be increased by an amount proportional to the intensity of the local gravitational field. Evershed retired in 1923, returning to England; in 1925 he built his own solar observatory at Ewhurst. He went on six expeditions to observe total solar eclipses from Norway (1896), India (1898), Algeria (1900), Spain (1905), Australia (1922), and Yorkshire (1927).

Evert, Chris, byname of CHRISTINE MARIE EVERT, also called (1979–87) CHRIS EVERT LLOYD (b. Dec. 21, 1954, Ft. Lauderdale, Fla., U.S.), outstanding American tennis player who dominated the sport in the mid- and late 1970s and remained a major competitor into the late 1980s.

Evert was known for her powers of concentration, her controlled backcourt game, and her two-handed backhand, which she learned at an early age against the advice of her father, a tennis instructor. At age 15, she beat top-ranked Margaret Court at a small tournament in 1970. In 1971 Evert became the youngest player to reach the semifinals of the U.S. championship. She remained an amateur until 1972, and by the late 1980s she had earned nearly $9,000,000 in prize money as a professional.

Evert won the U.S. Open women's singles from 1975 to 1978, making her the first woman since Helen Hull Jacobs to win four consecutive U.S. titles; she also won the U.S. Open in 1980 and 1982. She won the Wimbledon singles in 1974, 1976, and 1981, the French Open singles in 1974, 1975, 1979, 1980, 1983, 1985, and 1986, and the Australian Open singles in 1982 and 1984, for a total of 18 Grand Slam titles. She was married to fellow tennis professional John Lloyd from 1979 to 1987. She officially retired from the game after her defeat at the quarterfinals of the U.S. Open in 1989.

Everyman, an English morality play of the 15th century, probably a version of a Dutch play, *Elckerlyc.* It achieves a beautiful, simple solemnity in treating allegorically the theme of death and the fate of man's soul—of Everyman's soul. Though the morality plays on the whole failed to achieve the vigorous realism of the Middle Ages' scriptural drama, this short play (about 900 lines) is more than an allegorical sermon because vivid characterization gives it dramatic energy. It is generally regarded as the finest of the morality plays.

Evesham, town ("parish"), located in Wychavon district, county of Hereford and Worcester, England. Evesham is situated

on the right bank of the River Avon. The medieval town grew beside the abbey, first established in the 8th century, and the town was controlled and patronized by the abbot until the dissolution of the monasteries (1536–39), when the abbey was almost completely destroyed. On the ridge north of the town in 1265, Henry III's son Edward (later Edward I) intercepted the army of Simon de Montfort, who was defeated and killed. The town's market rights date from 1055, and it was incorporated by James I in 1604. Situated in the middle of a fertile vale, which has become an important fruit-growing area, Evesham is now an important agricultural centre. Pop. (1981 prelim.) 15,271.

Évian-les-Bains, spa and tourist resort, Haute-Savoie *département,* Rhône-Alpes region, eastern France, on the southern shore of Lake Geneva, opposite Lausanne on the Swiss shore of the lake. Lying below the lowest Alpine spurs, it has a mild climate. The spa buildings, the new *hôtel de ville* (town hall), and the casino form the centre of the town. National and international congresses are held in the Palais des Festivités. The town, which is well equipped with large hotels, specializes in lakeside health resorts (for urinary and renal ailments). Until the 19th century Évian had been variously called Aquianum, Vian, Les Vians, and Évians. Its mineral waters, which are bottled for export throughout the world, began to achieve fame early in the 18th century. The first spa buildings were opened in 1839. In 1962 a cease-fire agreement between the French government and the provisional government of Algeria was concluded at Évian. Pop. (1982) 5,919.

evidence, in law, any of the material items or assertions of fact that may be submitted to a competent tribunal as a means of ascertaining the truth of any alleged matter of fact under investigation before it.

A brief treatment of the law of evidence follows. For full treatment, *see* MACROPAEDIA: Procedural Law.

The prevailing methods of resolving disputed issues of fact generally involve persuading some human agency, such as a judge or jury, that a fact asserted is either true or not true. Historically, this has not always been the case. For instance, in pre-Norman England and in other places at certain times, issues were framed in such a way that they could be submitted to the decision of a supernatural agency. Methods for doing this included trial by ordeal, battle, or swearing an oath.

Later, two basic systems of acquiring and presenting evidence emerged. One, the inquisitorial system, is characterized by the active role of the judge, who orders searches for evidence, examines documents, and questions witnesses. This system is generally used in continental European criminal proceedings and, in the Soviet Union and other Socialist nations, in civil proceedings as well.

The second system, the accusatorial or adversary system, is characterized by the relative passivity of the judge; it is the parties and attorneys who are responsible for finding and presenting evidence. This system is used in common-law countries in civil and criminal cases. In continental civil cases a mixed system is used.

The jury system, which began to emerge in the 13th century, strongly affected the law of evidence; the law of evidence has been called the child of the jury. To protect due process and to prevent the jury that hears the evidence from being misled, an extensive body of rules has sprung up regarding the handling of evidence. The result has been to introduce a formalism into the Anglo-American law of evidence.

The classic types of evidence in Anglo-American law are three: tangible physical objects (referred to as real, demonstrative, or objective evidence), documents, and the testimony of witnesses. Common forms of real evidence include the fatal weapon, articles of clothing worn by the accused, samples of related material, and the like. These may be employed as evidence only when properly identified and shown to be relevant and genuine. Objects may also be admitted into court that are less directly connected with the matter, such as blueprints, models, and photographs. Documentary evidence is substantially similar to real evidence in that it consists of tangible physical articles. Such evidence, considered more reliable than the evidence supplied by witnesses, is subject to special rules.

The great bulk of evidence received at a trial, however, is in the form of verbal statements of witnesses. A substantial body of law has consequently developed to regulate this process. Unlike continental European practice, in which the term witness refers only to those with firsthand knowledge of the facts, Anglo-American usage applies it to anyone who gives testimony, including experts and those who identify real and documentary evidence. Almost anyone can be a witness in Anglo-American law, including children and convicted felons; in continental European proceedings, experts and interested parties are not generally considered competent witnesses.

Witnesses who are within the jurisdiction of the court may be summoned by subpoena and compelled to attend and answer questions under threat of fine or imprisonment; attendance is excused only in certain extraordinary cases. Testimony is normally given in response to questions directed to the witness by the lawyers. "Direct examination" is the questioning by the party who called the witness. The direct examiner is usually prohibited from asking leading questions, those that suggest the answer and merely require confirmation. The witness's firsthand knowledge of the facts is to be given rather than an opinion or conclusion drawn from other than firsthand experience (hearsay). A category of witnesses not subject to this restriction is that of experts, who are called for two purposes—to obtain firsthand knowledge of the sort that only specialists can perceive and to express opinions on matters so technical that the judge or jury would have difficulty understanding them without the aid of expert testimony.

In "cross-examination," questions are addressed to the witness by the lawyers of the other party. Under the English system, the witness may be cross-examined on any subject that properly pertains to the case being tried. In U.S. federal courts and in a majority of state courts, inquiry on cross-examination is restricted to subject matter that has been broached on direct examination of the witness. Impeachment is the process of discrediting testimony by showing facts that tend to reflect adversely upon the veracity of the witness's testimony.

English and American law allow some privileges for excusing a witness from being compelled to testify. One of the most significant and fundamental is that against self-incrimination. This includes both the right of a witness to decline to answer questions that will expose him to punishment for the crime and the right of the accused to refuse to give any evidence at all. A confession obtained from an accused may not be used to prove guilt unless it was voluntarily given. Spouses are often excused from giving testimony. Other privileges are accorded for professional confidences; attorneys must refuse to testify about confidential communications with their clients (unless this right is waived by the client), and clergymen are accorded a similar privilege to relevations given in confession in the sacrament of penance. The extent of privileges accorded journalists, if any, is a matter not yet settled.

evidence, circumstantial (law): *see* circumstantial evidence.

evil, problem of, a theological problem that arises for any philosophical or religious view that affirms the following three propositions: (1) God is almighty, (2) God is perfectly good, and (3) evil exists. If evil exists, it seems either that God wants to obliterate evil and is not able to—and thus his almightiness is denied—or that God is able to obliterate evil but does not want to—and thus his goodness is denied.

The theological problem of evil can be solved logically by denying any one of these three propositions. Vedānta Hinduism, Christian Science, and Stoicism have sought to solve the problem by denying the existence of evil. They affirm that evil is mere appearance or is imaginary. The U.S. philosopher William James attempted to solve the problem by denying the almightiness of God. He regarded God as having great but limited power and as being perfectly good. Orthodox Christianity, however, has generally chosen to live with the tension involved in affirming all three propositions. Some, instead of denying the proposition that God is almighty, have defined the proposition to mean that God can do anything that is logically possible. The 17th-century German philosopher Gottfried Wilhelm Leibniz, for example, stated that, because God is limited to that which is logically possible, the existence of evil is necessary in this "best of all possible worlds."

evil eye, glance believed to have the ability to cause injury or death to those on whom it falls; children and animals are thought to be particularly susceptible. Belief in the evil eye is ancient and ubiquitous: it occurred in ancient Greece and Rome; is found in Jewish, Islāmic, Buddhist, and Hindi traditions and in folk cultures and preliterate societies; and has persisted throughout the world into modern times. In many traditions strangers, malformed individuals, and old women are most often accused of casting the evil eye.

The power of the evil eye is sometimes held to be involuntary; a Slavic folktale, for example, relates the story of a father afflicted with the evil eye who blinded himself in order to avoid injuring his own children. More frequently, however, malice toward and envy of prosperity and beauty are thought to be the cause. Thus, in medieval Europe—and in popular superstition today—it was considered unlucky to be praised or to have one's possessions praised, so that some qualifying phrase such as "as God will" or "God bless it" was commonly used.

Measures taken to ward off the evil eye may vary among cultures. For example, some authorities suggest that the purpose of ritual cross-dressing—a practice that has been noted in the marriage ceremonies of parts of India—is to avert the evil eye. Asian children sometimes have their faces blackened, especially near the eyes, for protection. Among some Asian and African peoples the evil eye is particularly dreaded while eating and drinking, because the soul is thought to be more vulnerable when the mouth is open; thus, the ingestion of substances is either a solitary activity or takes place only with the immediate family and behind locked doors. Other means of protection, common to many traditions, include the wearing of sacred texts, amulets, charms, and talismans (which may also be hung upon animals for their protection); certain gestures; and the display of ritual drawings or objects.

Evinrude, Ole (b. April 19, 1877, Norway—d. July 12, 1934, Milwaukee), Norwegian-American inventor of the first commercially successful outboard marine internal-combustion engine.

He began work on this project in 1906 and by 1909 had developed a one-cylinder power plant rated at 1.5 horsepower. Subsequent outboard motors followed his transmission design, which used a vertical drive shaft with bevel gears (a set of two wheellike gears the teeth of which engage at an angle). In 1910 he founded Evinrude Motors in Milwaukee; renamed Outboard Motor Corporation, the firm was merged with Johnson Motor Company in 1936 to form the Outboard Marine Corporation.

The inventor's son Ralph Evinrude (1907–1986) was the chief organizer and first president of the new corporation.

evirato (music): *see* castrato.

Evliya Çelebi, also called DERVIŞ MEHMED ZILLI (b. March 1611, Istanbul—d. *c.* 1684, Istanbul), one of the most celebrated Ottoman travelers, who journeyed for more than 40 years throughout the territories of the Ottoman Empire and adjacent lands.

Son of the chief court jeweler, he was educated in a madrasah (Islāmic college) and a Qur'ān (Koran) school in Istanbul; and, excelling as a Qur'ān reciter, he was shown favour by the reigning sultan, Murad IV. Entering the Ottoman palace school, he developed skills in Arabic, calligraphy, and music.

Under the patronage of the court he began the journeys that took him from Belgrade to Baghdad and from the Crimea to Cairo, sometimes as an official representative of the government and sometimes on his own. The result of these travels was his masterwork, the *Seyahatname* (1898–1939; "Book of Travels"; Eng. trans., first two volumes, *Evliya Efendi, Narrative of Travels in Europe, Asia, and Africa in the 17th Century,* 1846–50). This work is also referred to as the *Tarihi seyyah* ("Chronicle of a Traveler").

Evliya possessed a vivid imagination, occasionally mixing fact and fantasy; he described places he could not possibly have visited, but his fascinating anecdotes and charming style result in entertaining and elucidative reading. One not only learns about the ethnography, history, and geography of the Ottoman Empire and neighbouring lands but also a great deal about the inner workings of the Ottoman government during the 17th century.

Evoluon, in Eindhoven, Neth., science and technical museum, opened in 1966 to mark the 75th anniversary of the founding of Philips Industries. The building is a striking mushroom-shaped structure. Its exhibitions are set in a single large dome on three ring-shaped floors with two balconies. The displays deal with the role of science and technology in society. Visitors are encouraged to participate by operating equipment and models. The upper ring describes problems associated with the rapid growth of world population and emphasizes the importance of science and technology. The second ring is devoted to practical applications of scientific knowledge and the lowest ring with developments in industry.

evolution, theory in biology that postulates that the various types of animals and plants have their origin in other preexisting types and that the distinguishable differences are due to modifications in successive generations. The theory of evolution is one of the fundamental keystones of modern biological theory.

A brief treatment of evolution follows. For full treatment, *see* MACROPAEDIA: Evolution, The Theory of. For a treatment of human evolution in particular, *see* MACROPAEDIA: Evolution, Human.

For a description of the place of evolution in the circle of learning, and for a list of MICROPAEDIA articles on the subject, *see* PROPAEDIA: Part Three, Division I.

In 1721 the French philosopher Montesquieu affirmed his belief that a few early species had multiplied into present ones and that differences between animal species might increase and decrease. This belief that species could change into other species formed the basis of the idea of transmutation, or evolution.

Georges Buffon, an 18th-century naturalist, raised the possibility of the horse being related to the ass, and by 1760 Carolus Linnaeus, the great Swedish taxonomist, had concluded that species could vary. In 1809 Jean-Baptiste Lamarck had studied differences between species and varieties and had drafted an evolutionary tree from tiny animals up to man, with branches showing ancestry shared by different groups.

It was Charles Darwin who presented the treatise on evolution that would revolutionize all later biological study. His observations of related but different species living in adjacent geographical areas, of the structural similarity between living forms and fossil remains in the same area, and of the differences between species living on neighbouring islands in the Galápagos Islands formed the basis of his *Origin of Species* (1859).

The heart of Darwinian evolution is the mechanism of natural selection. It proceeds from the fact that there are a greater number of offspring produced by most organisms than can survive to maturity. A high rate of mortality—through starvation, predation, disease, and accidents—reduces the population of those individuals less adapted to survive. The surviving individuals, which may have the smallest variation that enables them to live longer and reproduce, pass on their advantage to succeeding generations, which may evolve superior means of adaptation.

Darwin lacked an inheritance theory to explain the passing on of advantageous variations from one generation to the next. This gap was filled by the 20th-century science of genetics. In *Genetics and the Origin of Species* (1937), Theodosius Dobzhansky applied Mendelian genetics to Darwinian theory, contributing to the new understanding of evolution as the cumulative action of natural selection on small genetic variations in whole populations of an organism.

Part of the proof of evolution is provided by the fossil record, which shows a succession of gradually changing forms leading up to the present. Structural similarities among living forms also point to common ancestry, as do similarities in the embryonic development of different species. Molecular biology—particularly the study of genes and proteins—provides the most detailed evidence of evolutionary change.

The beginnings of organic ("Darwinian") evolution occurred in primordial waters, when cells were formed by living organisms surrounding organic compounds. As the food supply available in the liquid medium was exhausted, the development of the food-metabolizing process began, converting the primitive units into autotrophs and heterotrophs. Later advances were the organization of chromosomes, DNA, and nuclei for passing on characteristics, greatly expanding the powers of natural selection through adaptation. When multicellular life brought the differentiation of body parts, with differing structures and functions, survival value was enhanced.

When organisms began colonizing land, about 500,000,000 years ago—after billions of years in the water environment—methods of feeding became consequential. Species better able to adapt and colonize new environments would become widespread (adaptive radiation).

The vestige of a tail with which humans are born is evolutionary evidence of an ancestor that was arboreal, a quadruped. The next development in primate evolution, using the hands to swing from branches, was the habit of brachiation. This was followed by the adoption of a terrestrial life by manlike primates, the australopithecines, some 3,000,000 years ago. These beings had some apelike and some human characteristics.

Increased mental powers, brain size, and neurological complexity are characteristics of the genus *Homo,* which includes such extinct manlike forms as Java Man, Peking Man, Heidelberg Man, and other pithecanthropines.

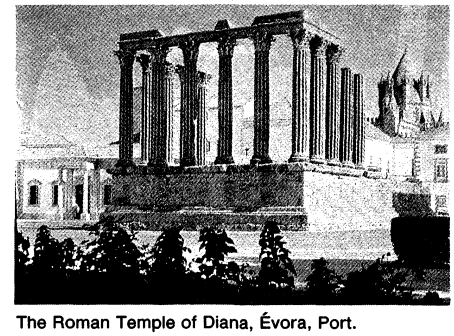
Direct fossil evidence of the earliest members of the human species, *Homo sapiens,* is rather scarce. *Homo sapiens* can be defined by the number of anatomical characteristics its members share, such as a particular cranial capacity, a vertical forehead, a rounded back of the skull, and limb bones adapted to an erect posture and gait.

Although the theory of evolution is accepted by the overwhelming majority of the scientific community, presentation of this theory has aroused considerable controversy from Darwin's time to the present. Most objections have come from theologians, primarily fundamentalists, who feel that Darwin's assertion that species are continually changing conflicts with literal interpretations of the Bible, in particular that all species of living things were created by divine design.

evolution, creative (philosophy): *see* creative evolution.

evolution, cultural: *see* cultural evolution.

Évora, city, capital, and *concelho* (municipality), Évora district, south-central Portugal. It lies in a fertile valley surrounded by low hills, 70 miles (110 km) east of Lisbon. Under its original name of Ebora, the place was from 80 to 72 BC the headquarters of the Roman commander Quintus Sertorius, and it long remained an important Roman military centre. Later it was called Liberalitas Julia because of certain municipal privileges bestowed upon it by Julius Caesar. In *c.* 712 Évora was conquered by the Moors, who named it Jabura; it was not retaken by the Christians until 1166. Its bishopric, founded in the 5th century, was raised to an archbishopric in the 16th, when Évora was often the residence of the Portuguese court. From 1663 to 1665 it was in Spanish hands. In 1832 Dom Miguel, pretender to the Portuguese throne, retreating before Dom Pedro I, took refuge in Évora; and there was signed the Convention of Évora by which he was banished. Fought over for centuries, Évora has a coat of arms that features two severed human heads.



The Roman Temple of Diana, Évora, Port.
Josef Muench

The cathedral, originally a Romanesque building (1186–1204), was restored in Gothic style *c.* 1400. São Francisco church (1507–25) is a good example of the blended Moorish and Gothic architecture known as Manueline. The city's former university, founded in 1559 to succeed the College of the Holy Spirit (Jesuit; founded in 1551), was suppressed in 1759, but the building still houses schools. A government-operated inn, the Pousada dos Lóios, stands in the grounds of the former convent of Lóios (15th century). Just outside the inn

is the small Roman Temple of Diana (a name for which no valid authority exists). The regional museum contains a Roman collection and an art gallery. After 1640 the city became a centre for music study and performance in connection with the cathedral and university. The University Institute of Évora was founded in 1973.

Évora city is of little industrial importance, being primarily an agricultural (corn [maize], apples, hay, and pigs) trade centre, but there is some iron founding, cork processing, and cloth manufacture. It is connected to Lisbon and Faro and to Spain by railroad and highway. The city has a domestic airport.

Évora district (area 2,854 square miles [7,393 square km]) is known for its mules and abounds in cork woods. A fertile agricultural region, it also has iron-ore, copper, and asbestos mines and marble quarries. Pop. (1981) city, 35,117; *concelho,* 51,665; (1988 est.) district, 174,300.

Evpatoriia (Ukrainian S.S.R.): *see* Yevpatoriya.

Evreiskaia autonomous oblast (Russian S.F.S.R.): *see* Yevreyskaya autonomous oblast.

Évreux, town, capital of Eure *département,* Haute-Normandie *région,* northwestern France. It lies west-northwest of Paris, in a pleasant valley on branches of the Iton River, which is a tributary of the Eure.

Évreux was a flourishing city during the Gallo-Roman period. Its bishopric dates from the 4th century. In the Middle Ages the town was sacked or burned down repeatedly in the course of the wars between Normandy and France. In 1940 it was bombed by German aircraft, and the centre of the town burned for nearly a week. In 1944 the area around the railway station was devastated by Allied bombing.

Évreux is an episcopal see with one of the largest cathedrals in France, on which much restoration work has been done because of damage during World War II. Parts of the 12th- to 16th-century edifice have been preserved, including the Gothic choir and the Renaissance main facade. The cathedral's 12th- to 17th-century stained-glass windows are remarkably fine. The former episcopal palace adjoining the cathedral, in late 15th-century Gothic style, is now a museum housing a collection of local archaeological finds. Évreux is an industrial centre, specializing in the manufacture of rubber, textiles, pharmaceutical products, and electrical equipment. Pop. (1982) 45,215.

Evrípou, Porthmós, also called EVRÍPOS (Greece): *see* Euripus.

Évros (Europe): *see* Maritsa River.

Évros, *nomós* (department), northeastern Greece, forming the frontier between Greece and Turkey and bordering Bulgaria to the northwest; it fronts the Aegean Sea to the south. Samothrace island (Thracian: Samos) offshore in the Thracian Sea is administered as a part of the *nomós.* Évros embraces an area of 1,638 square miles (4,242 square km). In its southern half, a combination of low, flat-lying land, fertile soil, and adequate water from the Évros River (from which the *nomós* takes its name) and its tributaries permits the cultivation of excellent crops in the plain, especially cereals, grapes, and tobacco. In contrast, the mountainous terrain of Samothrace's northern districts possesses poor soils supporting mainly olive culture. The hilliest slopes are covered with oaks.

According to Greek legend, the god Poseidon watched the Trojan War from the *nomós'* highest peak, Mount Fengari (5,250 feet [1,600 m]), on Samothrace. The marble sculpture known as the "Nike of Samothrace" (*c.* 190 BC), now housed in the Louvre, Paris, was found on the island. Alexandroúpolis is the capital of Évros; it was founded by the Ottoman Turks under the name of Dedeagach ("Grandfather's Tree") and was renamed after the Macedonian Alexander III the Great in 1919, when the district came under Greek sovereignty. The town is the centre of local tobacco trade; it has an airport and is on the Thessaloníki–Istanbul railway line. Pop. (1981) 148,486.

Evrótas River, historically EUROTAS, also called IRIS, nonnavigable river rising in the Taíyetos Mountains in the southern Peloponnese, Greece. The principal stream of Laconia, it flows south-southeast through the agricultural Laconian plain between the Taíyetos and Párnon ranges and debouches at the head of the Gulf of Laconia northeast of Yíthion after a course of 51 miles (82 km). Although it is fed by minor streams of the Taíyetos range, its principal confluent is the Enunte, which joins it near Sparta.

Evrouin (Neustrian mayor of the palace): *see* Ebroïn.

Évry, new town (French *ville nouvelle*), *département* of Essonne, in north-central France. Évry is approximately 17 miles (27 km) southeast of Paris and is one of several new towns developed outside the capital since 1965. Évry is linked to Paris by highway and railway. The new town encompasses the commune of Évry, formerly Évry-Petit-Bourg, and parts of the communes of Ris-Orangis, Bondoufle, Courcouronnes, and Lisses. Pop. (1982) 29,433.

Evtushenko, Evgenii: *see* Yevtushenko, Yevgeny (Aleksandrovich).

Évvoia (Greece): *see* Euboea.

Evvoïkós Kólpos (Greece): *see* Euboea, Gulf of.

Ewab Islands (Indonesia): *see* Kai Islands.

Ewald, Johannes (b. Nov. 18, 1743, Copenhagen, Den.—d. March 17, 1781, Copenhagen), one of Denmark's greatest lyric poets and the first to use themes from early Scandinavian myths and sagas.

On the death of his father, a poorhouse chaplain, he was sent to school at Slesvig (Schleswig), where his reading of *Tom Jones* and *Robinson Crusoe* aroused his spirit of adventure. In 1758 he went to Copenhagen to study theology, fell in love, and, in search of quickly gained glory, ran away to fight in the Seven Years' War. He returned to find that his beloved Arendse, whom he immortalized as his muse, had married another. He passed his final examination when he was 19 and was already becoming known as a writer of prose and occasional poetry. When finishing *Adam og Eva* (1769), a dramatic poem in the style of French tragedy, he met the German epic poet Friedrich Klopstock, and at about the same time he read Shakespeare's plays and James Macpherson's *Ossian.* Their influence resulted in the historical drama *Rolf Krage* (1770), taken from an old Danish legend that was recorded by the medieval historian Saxo Grammaticus.

Johannes Ewald, engraving by Johan Frederik Clemens, 1779

By courtesy of the Royal Museum of Fine Arts, Solvgade, Copenhagen

Ewald's life began to show signs of serious disorder, especially an addiction to alcohol. In the spring of 1773 his mother and a Pietistic pastor, J.S. Schönheyder, secured his removal from Copenhagen to the relative isolation of Rungsted. There he produced his first mature works: *Rungsteds lyksaligheder* ("The Joys of Rungsted"), a lyric in the elevated new style of the ode; *Balders død* (*The Death of Balder*), a lyric drama on a subject from Saxo and Old Norse mythology; and the first chapters of his memoirs, *Levnet og meninger* ("Life and Opinions"), explaining his enthusiasm for the adventurous and fantastic. In 1775 he was transferred to a still more solitary place near Elsinore, where he went through a religious crisis—a struggle between the Pietistic idea of self-denial and his own proud independence. In 1777 he was allowed to return to Copenhagen. His poetic genius was recognized, and his life became calmer despite increasingly severe illness. On his deathbed he wrote the heroic Pietist hymn "Udrust dig, helt fra Golgotha" ("Gird Thyself, Hero of Golgotha").

Ewald renewed Danish poetry in all of its genres. Of his dramatic works, only *Fiskerne* (1779; "The Fishermen"), an operetta, is still performed. His greatest work in prose is his posthumously published memoirs, in which lyrically pathetic chapters about his lost Arendse intermingle with humorous passages. He is known best as a lyric poet, especially for his great personal odes and for songs such as "Kong Kristian stod ved hø jen Mast" (translated by Henry Wadsworth Longfellow as "King Christian Stood by the Lofty Mast"), which is used as a national anthem, and "Lille Gunver," the first Danish "romance." Though its form is rooted in the classical tradition, Ewald's poetry heralded the works of Adam Oehlenschläger and the Romantic movement by its emotionalism and its use of themes drawn from Old Norse literature.

Ewald, Paul Peter (b. Jan. 23, 1888, Berlin, Ger.—d. Aug. 22, 1985, Ithaca, N.Y., U.S.), German physicist and crystallographer whose theory of X-ray interference by crystals was the first detailed, rigorous theoretical explanation of the diffraction effects first observed in 1912 by his fellow physicist Max von Laue.

Ewald received his doctorate from the University of Munich, where his thesis problem, the passage of light waves through a crystal lattice, led Laue to surmise that interference effects would be produced as the wavelength of the incident radiation approached the interatomic spacing of the crystal. Ewald remained in the forefront of developments in X-ray crystallography and also devised a graphic method of solving the equation described by Sir Lawrence Bragg in 1912, the fundamental law of X-ray scattering, which involves a geometric construction now known as Ewald's sphere. He went to the United States in 1949, and from 1949 to 1957 he served as head of the physics department of the Polytechnic Institute of Brooklyn, N.Y.; from 1957 to 1959 as professor of physics; and as professor emeritus thereafter. In 1960 Ewald was elected to the presidency of the International Union of Crystallography, a position that he held until 1963.

Ewart, William (b. May 1, 1798, Liverpool, Eng.—d. Jan. 23, 1869, Broadleas, near Devizes, Wiltshire), English politician who succeeded in partially abolishing capital punishment.

Ewart was educated at Christ Church College, Oxford (B.A., 1821), was called to the bar in 1827, and sat in the House of Commons from 1828 to 1837 and from 1839 to 1868. His work in Parliament secured the abolition of hanging criminals in chains as a form of

Ewart, engraving by S.W. Reynolds after a portrait by E.V. Rippingille

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

punishment (1834) and of administering capital punishment for cattle stealing and other minor offenses (1837). From 1840 he urged the complete abolition of the death penalty; and in 1864, on his motion, the House of Commons appointed a select committee to consider the subject. (Capital punishment for murder was not abolished in Great Britain until 1965.)

Ewe, peoples living in southeastern Ghana, southern Benin, and the southern half of Togo who speak various dialects of Ewe, a language of the Kwa branch of the Niger–Congo family. Ewe unity is based on language and common traditions of origin: their original homeland is traced to Oyo, in western Nigeria.

Most Ewe are farmers, corn (maize) and yams being their staple foods. Sea fishing is a full-time occupation in some coastal areas. Spinning, weaving, pottery making, and blacksmithing, as well as trading, are all important.

Villages include several patrilineages, in which land ownership and certain political offices are vested; lineage members also share certain spirits and gods. The lineage head, usually its oldest member, administers lineage property, settles disputes, represents the lineage in village affairs, and serves as a priest linking the living members to the ancestors. Among most Ewe the patrilineage is the largest important kinship unit; among the Anlo in coastal Ghana, however, the lineages are segments of larger, dispersed clans. Clan membership is characterized by mutual help and friendliness, shared names, food taboos, and a clan cult. The introduction of a money economy, schools, Christianity, and government courts has weakened the corporate structure of the lineage. The Ewe never formed a single centralized state, remaining a collection of independent communities that made temporary alliances in time of war.

Ewe religion is organized around a creator god, Mawa (called Nana Buluku by the Fon of Benin), and numerous lesser gods. The worship of the latter pervades daily life, for their assistance is sought in subsistence activities, commerce, and war. Belief in the supernatural powers of ancestral spirits to aid or harm their descendants enforces patterns of social behaviour and feelings of solidarity among lineage members. In modern times many Ewe have become Christians.

Ewing, A(lfred) C(yril) (b. May 11, 1899, Leicester, Eng.—d. May 14, 1973, Manchester), British philosopher and educator and an advocate of a Neo-Realist school of thought; he is noted for his proposals toward a general theory of personal and normative ethics (as against the purely descriptive). He proposed a theory of the intuitive knowledge of good and duty ("deontological") that dispensed with the necessity for an essential concept or definition of the good. His principal writings include *Kant's Treatment of Causality* (1924); *Reason and Intuition* (1941); *The Fundamental Questions of Philosophy* (1951); *Ethics* (1953); and *Non-Linguistic Philosophy* (1968). His essays in philosophical journals emphasize Realist theories of knowledge and the possibility of a meaningful metaphysics.

Ewing, Sir (James) Alfred (b. March 27, 1855, Dundee, Angus, Scot.—d. Jan. 7, 1935, Cambridge, Cambridgeshire, Eng.), British physicist who discovered and named hysteresis, the resistance of magnetic materials to change in magnetic force.

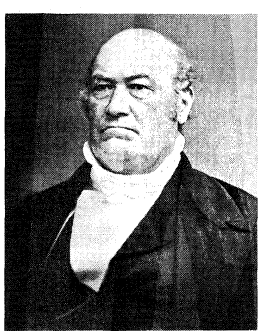
Ewing was professor of mechanical engineering at the University of Tokyo (1878–83) and professor of mechanism and applied mechanics at King's College, Cambridge (1890–1903). In his work on the magnetic properties of iron, steel, and other metals, he succeeded in modifying Wilhelm E. Weber's theory of induced magnetism and constructed a hypothetical model to fit his own theory. In 1890 he observed that in electromagnets using alternating current, the magnetization of the metal lagged behind the changing of the current flow. He conjectured that all molecules are like tiny magnets and explained hysteresis as a resistance of the molecules to rearranging themselves in alignment with the new direction of magnetic force. Ewing wrote a number of papers on thermoelectric properties of metals, on the effects of stress and magnetization on iron, on the crystalline structure of metals, and on seismology. He invented an extensometer (a device for measuring small increases in length of metals), a hysteresis tester, and other apparatus for magnetic testing.

He was director of naval education to the British Admiralty from 1903 until 1916, when he became principal and vice chancellor of the University of Edinburgh. He was knighted in 1911, and from 1914 to 1917 he was in charge of the department of the Admiralty dealing with enemy ciphers.

Ewing, (William) Maurice (b. May 12, 1906, Lockney, Texas, U.S.—d. May 4, 1974, Galveston, Texas), U.S. geophysicist who made fundamental contributions to understanding of marine sediments and ocean basins, using seismic methods.

Studying the structure of the Earth's crust and mantle and making seismic refraction measurements in the Atlantic basins, along the Mid-Atlantic Ridge, and in the Mediterranean and Norwegian seas, Ewing took the first seismic measurements in open seas in 1935. He was among the geophysicists who proposed that earthquakes are associated with the central oceanic rifts that encircle the globe, suggested that sea-floor spreading may be worldwide and episodic in nature, and took the first deep-sea photographs (1939). A professor of geology at Columbia University from 1959 and director of the Lamont Geological Observatory from 1949, he collaborated with others in writing *Propagation of Sound in the Ocean* (1948), *Elastic Waves in Layered Media* (1957), and *The Floors of the Oceans: I. The North Atlantic* (1959).

Ewing, Thomas (b. Dec. 28, 1789, near West Liberty, Va., U.S.—d. Oct. 26, 1871, Lancaster, Ohio), first U.S. secretary of the interior (1849–50), who was also a senator from Ohio (1831–37; 1850–51) and secretary of the treasury (1841). He was both the adoptive father (never formally) and the father-in-law of William Tecumseh Sherman, Union Army general in the U.S. Civil War.



Thomas Ewing

By courtesy of the Library of Congress, Washington, D.C.

After graduation from Ohio University, Athens (1815), Ewing practiced law at Lancaster, Ohio, and entered politics as a Whig. He lost both of his briefly held Cabinet posts upon the deaths of the presidents who had appointed him: William Henry Harrison (d. 1841) and Zachary Taylor (d. 1850). He closed his political career by completing Thomas Corwin's unexpired term in the Senate.

Ewing, a friend of Sherman's deceased father, took the nine-year-old Sherman into his home in 1829. Sherman and Ewing's daughter Ellen were married in 1850.

Ewing's tumour of bone, common malignant tumour of bone marrow, occurring mainly in persons under 30 and affecting males slightly more often than females. The disease appears in the shafts of long bones but never at the growth junction. Symptoms and signs include pain that eventually becomes severe, swelling and tenderness over the growth, fever, and a rise in the white blood cell count. The last two signs are caused by death of the tissue within the tumour because of interrupted blood supply. Ewing's tumour is particularly destructive, metastasizes (seeds itself elsewhere in the body) early, and has a mortality rate of about 95 percent even with radical therapy.

Ẹwondo (people): *see* Yaunde.

Ewostatewos, Latin EUSTATHIUS (d. 1369, Armenia), Ethiopian saint and founder of one of the two great Ethiopian monastic communities.

Ewostatewos and his disciples respected the traditional Judaic customs of the Ethiopian Church concerning the sabbath and impure meats and held the view that the anointing of Jesus after his death brought about a fusion of his human and divine natures (one of the fundamental doctrinal points of Monophysitism—the belief in a single, divine nature of Christ—which is the foundation of the Ethiopian Church). Ewostatewos also was a destroyer of tribal shrines and sought to remove the vestiges of pre-Christian practice remaining in the Ethiopian Church. A zealous pilgrim, he visited Alexandria, Jerusalem, Cyprus, and Armenia.

During Ewostatewos' life, his disciples founded many monasteries, the greatest of which were at Kesache, north of Aksum, and at Bizan, near present Asmera (Asmara). The Bizan monastery undertook leadership of the northern monks, remaining faithful to the Judaic observances even when these fell into disfavour and resulted in persecution from emperors and ecclesiastical authorities. Eustathian monasteries were persecuted until 1404, but *c.* 1450 they were recognized as orthodox by the Ethiopian Church.

Ewry, Ray C. (b. Oct. 14, 1873, Lafayette, Ind., U.S.—d. Sept. 29, 1937, Douglaston, Long Island, N.Y.), U.S. track athlete, the only athlete to win eight gold medals in individual events in the history of the modern Olympic Games.

As a boy, Ewry contracted poliomyelitis and was expected never to walk again. He began his career as a jumper in a successful attempt to regain the use of his legs. At Purdue University, West Lafayette, Ind., the lean, 6-foot 3-inch Ewry was a member of the track and football teams. Later, as a member of the New York Athletic Club, he helped win 15 United States amateur track championships.

Ewry earned three gold medals in the 1900 Olympics in Paris and again in the 1904 games in St. Louis, Mo., winning the standing long jump (discontinued after 1912), the standing high jump (discontinued after 1912), and the standing triple jump (discontinued after 1904). During the 1908 games in London he repeated his triumphs in the standing broad jump and the standing high jump.

ex post facto law, law that purports to retroactively make criminal a certain conduct that was not criminal when done, increases the punishment for crimes already committed, or changes the rules of procedure in force at the time an alleged crime was committed in a way substantially disadvantageous to the accused.

In the United States, the Constitution forbids Congress and the states to pass any ex post facto law. In 1798 it was settled that this prohibition applies only to criminal laws and is not a general restriction on retroactive legislation. Implicit in the prohibition is the notion that individuals be punished only in accordance with standards of conduct they might have ascertained before acting. The clause also serves, in conjunction with the bill-of-attainder clause, as another safeguard against the historic practice of passing laws to punish particular individuals because of their political beliefs. In 1867, in *Cummings* v. *Missouri* and *Ex parte Garland,* the loyalty-test oaths passed after the American Civil War to keep Confederate sympathizers from practicing certain professions, although not really criminal statutes, were condemned both as bills of attainder and as ex post facto laws.

The policies underlying ex post facto laws are recognized in most developed legal systems. They are reflected in the civil law maxim *nulla poena sine lege* ("no punishment without law"), a principle whose roots can be found in Roman law. In England, where Parliament is not prohibited from passing ex post facto laws, the judges, in accord with common-law tradition, have refused to interpret legislation retroactively unless Parliament has clearly expressed such an intention.

Prosecution of Nazi leaders following World War II for the crime of aggressive war (a crime specifically defined for the first time in the Allied charter creating the International Military Tribunal for war criminals) provoked extensive discussion over the scope and applicability of the principle against retroactive criminal laws.

exact equation, type of differential equation that can be solved directly without the use of any of the special techniques in the subject. A first-order differential equation (of one variable) is called exact, or an exact differential, if it is the result of a simple differentiation. The equation $P(x,y)y' + Q(x,y) = 0$ (or in the equivalent form $P(x,y)dy + Q(x,y)dx = 0$) is exact if $P_x(x,y) = Q_y(x,y)$. In this case, there will be a function $R(x,y)$ the partial x-derivative of which is P and the partial y-derivative of which is Q such that the equation $R(x,y) = c$ (where c is constant) will implicitly define a function y that will satisfy the original differential equation.

For example, in the equation $(x^2 + 2y)y' + 2xy + 1 = 0$, the x-derivative of $x^2 + 2y$ is $2x$ and the y-derivative of $2xy + 1$ is also $2x$, and the function $R = yx^2 + x + y^2$ satisfies the conditions $R_x = P$ and $R_y = Q$. The function defined implicitly by $yx^2 + x + y^2 = c$ will solve the original equation. Sometimes if an equation is not exact, it can be made exact by multiplying each term by a suitable function called an integrating factor, which will usually be given by $1/(Px \pm Qy)$. For example, if the equation $3y + 2xy' = 0$ is multiplied by $1/5xy$, it becomes $3/x + 2y'/y = 0$, which is the direct result of differentiating the equation in which the natural logarithmic function, written ln, appears: $3 \ln x + 2 \ln y = c$, or equivalently $x^3y^2 = c$, which implicitly defines a function that will satisfy the original equation.

Higher-order equations are also called exact if they are the result of differentiating a lower-order equation. For example, the second-order equation $p(x)y'' + q(x)y' + r(x)y = 0$ is exact if there is a first-order expression $p(x)y' + s(x)y$ such that its derivative is the given equation. The given equation will be exact if, and only if, $p'' - q' + r = 0$, in which case s in the reduced equation will equal $q - p'$. If the equation is not exact, there may be a function $z(x)$, also called an integrating factor, such that when the equation is multiplied by the function z it becomes exact.

Exaltation of the Holy Cross: *see* Holy Cross, Exaltation of the.

examination, in law, interrogation of a witness by attorneys or by the judge. In Anglo-American proceedings this usually begins with direct examination, or, as it is called in England, examination-in-chief, by the party who called the witness. After direct examination, the attorney for the other party may conduct a cross-examination of the same witness, usually designed to cause him to explain, modify, or contradict the testimony he gave on direct examination. It may be followed by redirect examination and even, in some U.S. jurisdictions, by re-cross-examination.

Continental European legal procedure varies from country to country. Examination begins with an interrogation of the witness by the judge. In some countries (*e.g.,* Germany), the witness may then be questioned by the attorneys of both parties. In France attorneys' questions may be put to witnesses only through the president of the court.

exanthem subitum (disease): *see* roseola infantum.

Excalibur, in Arthurian legend, King Arthur's sword. As a boy Arthur alone was able to draw the sword out of a stone in which it had been magically fixed. This account is contained in Sir Thomas Malory's 15th-century prose rendering of the Arthurian legend, but another story in the same work suggests that it was given to Arthur by the Lady of the Lake and that, when the king lay mortally wounded after his last battle, he ordered the faithful Sir Bedivere to go to the water and throw the sword into it. An arm rose to catch it, brandished *Excalibur* three times, and then disappeared.

There was a famous sword in Irish legend called *Caladbolg,* from which *Excalibur* is evidently derived by way of Geoffrey of Monmouth, whose *Historia regum Britanniae* refers to Arthur's sword as *Caliburn.* Malory says that *Excalibur* means "cut-steel."

excavating machine, any machine, usually self-powered, that is used in digging or earth-moving operations of some kind; the power shovel, bulldozer, and grader (*qq.v.*) are examples.

Excelsior diamond, until the discovery of the Cullinan diamond in 1905, the world's largest-known uncut diamond. When found by a worker loading a truck in the De Beers mine at Jagersfontein, Orange Free State, on June 30, 1893, the blue-white stone weighed about 995 carats. After long study the Excelsior diamond was cut (1904) by I.J. Asscher and Company of Amsterdam into 21 stones ranging in weight from less than 1 carat to more than 70 carats.

Excelsior Springs, city, astride the Ray–Clay county line, western Missouri, U.S., 12 miles (19 km) northeast of Kansas City. Founded in 1880, it developed as a health resort noted for its mineral waters. Now, while mainly residential, it still maintains ties with its past through its Hall of Waters (1938), which claims "the world's longest mineral-water bar," and through the sale of bottled waters. Other economic activities are agriculture (corn [maize], oats, and wheat) and light manufactures (chiefly plastic). The birthplace of the outlaw Jesse James, and the Watkins Woolen Mill (1861), a national historic landmark, are a few miles north. Inc. village, 1881; city, 1886. Pop. (1984 est.) 10,526.

excess-profits tax, a tax levied on profits in excess of a stipulated standard of "normal" income. There are two principles governing the determination of excess profits. One, known as the war-profits principle, is designed to recapture wartime increases in income over normal peacetime profits of the taxpayer. The other, identified as the high-profits principle, is based on income in excess of some statutory rate of return on invested capital.

The modern excess-profits tax was first instituted during World War I as a revenue measure and an instrument of curbing excess profits attributable to the war. Excess-profits taxes were levied during World War II and the Korean War (1950–53) in most of the countries whose business earnings were affected by the war. Excess-profits taxes based on the high-profits principle have become part of the peacetime tax structure of a few countries such as Denmark and several South American countries.

The economic effects of an excess-profits tax are usually reckoned in terms of two basic criteria: (1) their efficacy in siphoning off wartime "windfalls" in order to bring about a stabilizing effect on the economy; (2) their effect on economic incentives, production levels, and business expenditure. The integration of an excess-profits tax within the total tax structure of a country, particularly in relation to existing corporation taxes and individual income taxes, and the determination of what is "excess" also pose serious problems.

exchange, bill of, also called DRAFT, or DRAUGHT, short-term negotiable financial instrument consisting of an order in writing addressed by one person (the seller of goods) to another (the buyer) requiring the latter to pay on demand or at a fixed or determinable future time a certain sum of money to a specified person or to the bearer of the bill.

The bill of exchange originated as a method of settling accounts in international trade. Arab merchants used a similar instrument as early as the 8th century AD, and the bill in its present form attained wide use during the 13th century among the Lombards of northern Italy, who carried on considerable foreign commerce. Because merchants (the buyers) usually retained their assets in banks in a number of trading cities, a shipper of goods (the seller) could obtain immediate payment from a banker by presenting a bill of exchange signed by the buyer (who, in so doing, had accepted liability for payment when due). The banker would purchase the bill at a discount from its full amount because payment was due at a future date; the purchasing merchant's account would be debited when the bill became due. Bills could also be drawn directly on the banks themselves. After the seller received his payment, the bill of exchange continued to function as a credit instrument until its maturity, independent of the original transaction.

Bills of exchange are sometimes called drafts, but that term usually applies to domestic transactions only. The term bill of exchange may also be applied more broadly to other instruments of foreign exchange, including cable and mail transfers, traveler's checks, letters of credit, postal money orders, and express orders.

exchange control, governmental restrictions on private transactions in foreign exchange

(foreign money or claims on foreign money). The chief function of most systems of exchange control is to prevent or redress an adverse balance of payments by limiting foreign-exchange purchases to an amount not in excess of foreign-exchange receipts.

Residents are required to sell foreign exchange coming into their possession to the designated exchange-control authority (usually the central bank or specialized government agency) at rates set by the authority. Some systems permit recipients of exchange from certain sources to sell a portion of such receipts in a free market. Because the control authority thus becomes the only foreign-exchange market, it can determine the purposes for which foreign exchange can be spent and to fix the amount that is available for each purpose.

A controlled exchange rate is usually higher than a free-market rate and has the effect of curbing exports and of stimulating imports. By limiting the amount of foreign exchange a resident can purchase, however, the control authority can limit imports and thus prevent a decline in its total gold reserves and foreign balances.

exchange marriage, form of marriage involving an arranged and reciprocal exchange of spouses between two groups. In societies that associate a doctrine of unilineal descent with a consistent rule of postmarital residence, the symmetry of the alliance is often maintained by a systematic exchange of individuals: whenever group A contracts to give a bride to group B, group B will simultaneously contract to give a bride to group A. Often, as among the Australian Aborigines, the ideal model of any marriage contract is that two men of different groups should marry each other's sisters. When this process is repeated by their children or by kin classified as their children, the second alliance is called marriage of cross-cousins (*see* cross-cousin). Such marriages, as well as institutions by which a man gives his sister in marriage in exchange for a bride-price (animals, goods, or currency) that he himself then uses to secure a wife, are widespread and constitute the most common types of exchange marriage.

exchange rate, the price of a country's money in relation to another country's money. An exchange rate is "fixed" when countries use gold or another agreed-upon standard, and each currency is worth a specific measure of the metal or other standard. An exchange rate is "floating" when supply and demand or speculation sets exchange rates (conversion units). If a country imports large quantities of goods, the demand will push up the exchange rate for that country, making the imported goods more expensive to buyers in that country. As the goods become more expensive, demand drops, and that country's money becomes cheaper in relation to other countries' money. Then the country's goods become cheaper to buyers abroad, demand rises, and exports from the country increase.

World trade now depends on a managed floating exchange system. Governments act to stabilize their countries' exchange rates by limiting imports, stimulating exports, or devaluing currencies.

Exchequer, in British history, the government department that was responsible for receiving and dispersing the public revenue. In a more general sense, the term exchequer may refer to any accounting department. The word derives from the Latin *scaccarium,* "chessboard," in reference to the checkered cloth on which the reckoning of revenues took place.

The Exchequer was constituted as a distinct government agency by Henry I at the beginning of the 12th century. The Treasury, with which the Exchequer was in practice joined, dates from before the Norman Conquest (1066), and those officers of the Exchequer who were drawn from the Treasury staff can be traced back to the Domesday Book (1086). The word came quite early to be applied to the two jointly. The lower Exchequer, or receipt, closely connected with the permanent Treasury, was an office for the receipt and payment of money. The upper Exchequer (the *scaccarium* proper) was a court sitting twice a year to regulate accounts. It was closely related to the Curia Regis (the "King's Court," which itself dates from about the Norman Conquest) and was thus probably designed on the Norman pattern. The business of the ancient Exchequer was mainly financial, though some judicial business connected with accounts was also conducted. In time the upper Exchequer developed into the judicial system, while the lower Exchequer became the treasury.

excision, the surgical removal of an organ or structure. The term is sometimes used as a synonym for clitoridectomy, or female circumcision (*see* circumcision).

excitation, in physics, the addition of a discrete amount of energy (called excitation energy) to a system—such as an atomic nucleus, an atom, or a molecule—that results in its alteration, ordinarily from the condition of lowest energy (ground state) to one of higher energy (excited state).

In nuclear, atomic, and molecular systems, the excited states are not continuously distributed but have only certain discrete energy values. Thus, external energy (excitation energy) can be absorbed only in correspondingly discrete amounts.

Thus, in a hydrogen atom, which is composed of an orbiting electron bound to a nucleus of one proton, an excitation energy of 10.2 electron volts is required to promote the electron from its ground state to the first excited state. A different excitation energy (12.1 electron volts) must be supplied to raise the electron from its ground state to the second excited state.

In a somewhat similar way, the protons and neutrons in atomic nuclei constitute a system that can be raised to discrete higher energy levels by supplying appropriate excitation energies. Nuclear excitation energies are roughly 1,000,000 times greater than atomic excitation energies. For the nucleus of lead-206, as an example, the excitation energy of the first excited state is 0.80 million electron volts and of the second excited state 1.18 million electron volts.

The excitation energy stored in excited atoms and nuclei is radiated usually as visible light from atoms and as gamma radiation from nuclei as they return to their ground states. This energy can also be lost by collision.

The process of excitation is one of the major means by which matter absorbs pulses of electromagnetic energy (photons), such as light, and by which it is heated or ionized by the impact of charged particles, such as electrons and alpha particles. In atoms, the excitation energy is absorbed by the orbiting electrons that are raised to higher distinct energy levels. In atomic nuclei, the energy is absorbed by protons and neutrons that are transferred to excited states. In a molecule, the energy is absorbed not only by the electrons, which are excited to higher energy levels, but also by the whole molecule, which is excited to discrete modes of vibration and rotation.

exciton, the combination of an electron and a positive hole (an empty electron state in a valence band), which is free to move through a nonmetallic crystal as a unit.

Because the electron and the positive hole have equal but opposite electrical charges, the exciton as a whole has no net electrical charge (though it transports energy). This makes excitons difficult to detect, but detection is possible by indirect means.

When an electron in an exciton recombines with a positive hole, the original atom is restored, and the exciton vanishes. The energy of the exciton may be converted into light when this happens, or it may be transferred to an electron of a neighbouring atom in the solid. If the energy is transferred to a neighbouring electron, a new exciton is produced as this electron is forced away from its atom.

exclusionary rule, in U.S. law, the principle that evidence seized by police in violation of the Fourth Amendment to the U.S. Constitution may not be used against a criminal defendant at trial.

The Fourth Amendment guarantees freedom from unreasonable searches and seizures—that is, those made without a warrant signed by a judge. The U.S. Supreme Court held in *Wolf* v. *Colorado* (1949) that "security of one's privacy against arbitrary intrusion by the police—which is at the core of the Fourth Amendment—is basic to a free society." However, that unanimous decision, written by Justice Felix Frankfurter, did not extend the exclusionary rule to state courts. During the next decade, approximately half of the states adopted the rule. Later the Supreme Court held in *Mapp* v. *Ohio* (1961) that the rule had to be applied universally to all criminal proceedings. The case signaled a new era, begun by the court under Chief Justice Earl Warren, of applying provisions of the Bill of Rights to the states exactly to the extent that they apply to the federal government.

Exclusive, also called EXCLUSIONIST, in Australian history, member of the sociopolitical faction of free settlers, officials, and military officers of the convict colony of New South Wales, formed in the late 18th and early 19th centuries. The Exclusives sought to exclude Emancipists (former convicts) from full civil rights. Governor Lachlan Macquarie (1810–21) tried to introduce notable Emancipists into the social and political life of the colony, but he was opposed by the Exclusives. Immediately thereafter, imperial policy supported the Exclusionist position. By the 1830s, however, a class of lesser settlers joined with the Emancipists in calling for self-rule for the colony on a broadly representative basis. The Exclusives, who also favoured self-rule, countered this effort by petitioning the home government for a restrictive constitution that would bar Emancipists from any political participation. The constitution that was granted to the colony in 1842 embodied the more democratic scheme, however, and the Exclusive position crumbled.

excommunication, form of ecclesiastical censure by which a person is excluded from the communion of believers, the rites or sacraments of a church, and the rights of church membership, but not necessarily from membership in the church as such. Some method of exclusion belongs to the administration of all Christian churches and denominations, indeed of all religious communities.

Roman Catholicism distinguishes between two kinds of excommunication, that which renders a person *toleratus,* tolerated, and that which renders him *vitandus,* one who is to be avoided. The second and more severe form requires—except for certain crimes that incur it automatically—that the culprit be announced by name in public as *vitandus,* in most cases by the Holy See itself; this is reserved for the gravest offenses. Both kinds of excommunication bar the excommunicated person from the sacraments of the church as well as from Christian burial. There is a specified list, set out in the Codex Juris Canonici (*q.v.*), of actions that incur excommunication; the list was revised in January 1983 by Pope John

Paul II to include abortion, violation of the confidentiality of confession, absolution by a priest of one who has committed a sin with the priest's assistance, profanation of the consecrated communion host, consecration of a bishop without Vatican approval, a physical attack on the pope, and heresy and "abandoning the faith." If an excommunicated person confesses his sin and undergoes penance for it, he is absolved; in some cases this absolution may come from any priest, but in many others it is reserved to the bishop or even to the Holy See alone, save *in periculo mortis* ("in danger of death"). Excommunication should be distinguished from two related forms of censure, suspension and interdict. Suspension applies only to clergy and denies them some or all of their rights; interdict does not exclude a believer from the communion of the faithful but forbids certain sacraments and sacred offices, sometimes to an entire area.

Some churches do not use the term excommunication, preferring to speak of church discipline. Churches holding the Reformed order vest the authority for exercising discipline and, if need be, carrying out excommunication, in the session, which consists of the minister and the elders. The 30th article of the Westminster Confession of 1646 specified "admonition, suspension from the sacrament of the Lord's Supper for a season, and excommunication from the church" as the proper steps of discipline. The Lutheran tradition has followed Martin Luther's catechism in speaking of "the power of the keys" and in defining excommunication as the denial of the communion to public and obstinate sinners; the clergy and the congregation together have the right to exercise such discipline. In the Anglican Church the bishops have the right to excommunicate, but this right is almost never exercised. Where a Congregational polity and the principle of "believers' Baptism" are observed, discipline is often very rigorous. In American denominations of the Free Church tradition the term "churching" a sinner refers to excommunication.

excrement (biology): *see* feces.

excretion, the process by which animals rid themselves of the undigested waste products of food and the nitrogenous by-products of metabolism, regulate their water content, maintain acid–base balance, and control osmotic pressure—the balance between inorganic ions and water. The excretory system promotes homeostasis, the constancy of an organism's internal environment.

For a depiction of some of the structures that make up the human excretory system, shown in relation to other parts of the gross anatomy, *see* the colour Trans-Vision in the PROPAEDIA: Part Four, Section 421.

A brief treatment of the excretory process follows. For full treatment, *see* MACROPAEDIA: Excretion and Excretory Systems.

The mechanisms that evolved to carry out excretory functions differ greatly in various organisms and environments. An animal living in a desert must be able to conserve water in its body, while a freshwater fish needs the capacity to rid itself of large amounts of water.

The primary excretory product is ammonia, derived from the digestion of proteins. Since ammonia is highly toxic, it must be eliminated quickly and efficiently. This poses no problem in small aquatic animals; ammonia is very soluble and passes into the surrounding water by diffusion. In terrestrial animals (and large aquatic ones) ammonia must be converted to less toxic substances—urea in mammals and the insoluble uric acid in insects, birds, and reptiles—before being excreted.

In protozoans an organelle called a contractile vacuole maintains osmotic pressure. Nitrogenous wastes are lost through diffusion. The vacuole appears as an internal sac which fills with clear liquid, discharges its contents outside the cell, then fills again.

The nephridia constitute the excretory organs of invertebrates like annelids (segmented worms). Typically the nephridia are paired tubules, one pair occurring in each segment of the worm's body. One end of the nephridium opens into the body cavity and the other to the outside environment. Since these organisms function as aquatic animals, they may lose nitrogenous wastes through their integument or via the nephridia. Fluid enters the nephridium from the body cavity and is probably propelled by cilia. As the waste fluid passes it becomes more dilute through reabsorption of body salts. It passes to the exterior through the nephridiopore.

The excretory organ of mollusks is the renal gland, a wide tube opening at one end into the sac surrounding the heart and at the other end to the exterior environment. The urine is formed through filtration of the blood, and its composition altered by reabsorption and secretion.

The paired coxal glands of aquatic arthropods pass from the coelomic sac where blood filtration occurs to external openings at the base of limbs, notably the antennae.

Insects have evolved a very different type of excretory system. Malpighian tubules (varying in number from 2 to 100 depending upon species) open at one end into the blood space (body cavity) and at the other into the rectum, part of the alimentary canal. The primary urine is formed not by filtration but secretion of ions and water from the blood. In the rectum the composition of the urine is changed radically; soluble urate is converted to insoluble uric acid, and water and the soluble products of digestion are reabsorbed.

Birds, like reptiles and insects, excrete uric acid into a continuation of the alimentary canal. Some marine birds have, in addition, salt glands (modified tear glands) which remove excess salt from their bodies and discharge the concentrated solution through the nostrils.

Amphibians store large quantities of dilute urine in a large bladder which acts as a water reserve when the animal is on land.

Freshwater fish must overcome the problem posed by water entering the body through osmosis and salts leaching out. To compensate, they produce large volumes of dilute urine and take in salts from the water through specialized cells in their gills. Nitrogenous wastes, for the most part, are diffused as ammonia through the skin. Marine fish, on the other hand, lose water through the skin and take in salt by osmosis. This is because their blood is only half as saline as seawater. They are unable to produce a highly concentrated urine, so they maintain homeostasis by swallowing great amounts of seawater and eliminating salt through specialized gill cells.

The human excretory or urinary system is typical of that of all mammals. It consists of two kidneys where urine is produced by filtration, secretion, and reabsorption; the ureters, tubes that transport the urine; the bladder where the urine is stored; and the urethra through which the urine is voided.

In humans, kidneys are paired, bean-shaped organs about five inches long, located in the small of the back. The concave portion lies nearest the backbone and is deeply cleft by the hilus through which arteries, veins, nerves, and lymphatics enter the kidney sinus. A cross section of the kidneys shows them to be made up of a darker outer cortex and inner medulla composed of rough cones with apexes projecting into the sinus.

The functional units of the kidney are called nephrons, of which there are about a 1,000,000 in each kidney. They are made up of the renal corpuscle, or Bowman's capsule (a double-walled cup), the proximal tubule, Henle's loop, and the distal tubule.

Urine formation begins in Bowman's capsule, which encloses a dense cluster of microscopic blood vessels, the glomerulus. Under the driving force of blood pressure, plasma filters from the blood. Proteins and about 80 percent of the water are held back in this process. The filtrate passes through the inner wall of the capsule and moves into the tubule.

These tubules are an inch or two long. The proximal tubule passes from Bowman's capsule in the renal cortex into the medulla and makes a U-turn (Henle's loop). The distal convoluted tubule then reenters the cortex and joins with several other distal tubules to form a collecting tubule, which carries the urine to the renal pelvis and the ureters. The ureters move the urine to the bladder in peristaltic waves.

The filtrate entering the tubule is different in composition from urine. In the proximal tubule almost all the water, salts, and glucose are reabsorbed by the network of blood vessels surrounding it. Concentration is effected in the constricted loop of Henle. The distal tubule regulates water, electrolyte, and hydrogen ion content of the filtrate. Uric acid is actively secreted into the filtrate here.

The two ureters (10–12 inches long) enter the hollow muscular bladder where urine collects until it is voided through the urethra in urination (or micturition). The urethra differs in males and females. In human males it is about eight inches long and is also the channel for semen in ejaculation. In women it is only one or two inches long and carries only urine.

Malfunction of the excretory system can lead to dehydration or edema, and the dangerous buildup of waste and toxic substances.

Acute renal failure is one of the primary diseases of the kidney. It is characterized by sudden failure of renal function so that little or no urine is produced, and water and waste products accumulate in the body. It may be caused by hemorrhage or shock leading to greatly decreased blood supply to the kidneys and resulting in renal necrosis (tissue death). A second cause is the accumulation of toxins in the kidney.

Inflammatory diseases of the kidney (pyelonephritis, glomerulonephritis), high blood pressure, and obstruction of the lower urinary tract can lead to chronic renal failure. In this disease there is progressive degeneration of the nephrons resulting in uremic poisoning from the accumulated wastes.

Both acute and chronic renal failure may be treated by dialysis, an artificial filtration of the blood through semi-permeable membranes to remove urea and other wastes, or by transplantation of another human kidney from a donor.

The excretory tract is subject to benign and malignant tumours, infections and inflammations, and obstruction by calculi. The last are stones composed of inorganic substances (largely calcium, phosphate, or oxylate), or organic matter like uric acid.

Exe, River, river in southwest England, rising from its source on Exmoor in Somerset, only 5 mi (8 km) from the Bristol Channel, and flowing southward 60 mi across Devon to its estuary beginning at Exeter and into the English Channel at Exmouth. The Exe is an important river for angling (salmon and trout), and yachting is popular on the estuary. Upstream, there are paper and flour mills along its banks.

Execias (Greek artist): *see* Exekias.

executive agreement, an agreement between the United States and a foreign government that is less formal than a treaty and is not subject to the constitutional requirement for ratification by two-thirds of the Senate. The Constitution does not specifically give a presi-

dent power to conclude executive agreements; he may be authorized to do so by Congress, or he may do so on his sole authority, derived from his power to conduct foreign relations.

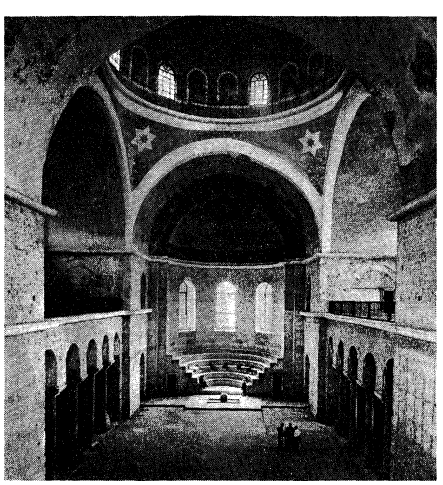
The majority of executive agreements have been made pursuant to a treaty or act of Congress. At times, however, presidents have used this device to achieve purposes that would not command the support of two-thirds of the Senate, as when Pres. Franklin D. Roosevelt, after the outbreak of World War II but before U.S. entry into the conflict, gave Great Britain 50 overage destroyers in exchange for the right to use certain bases. Since executive agreements are made on the authority of the incumbent president, they do not necessarily bind his successors.

executor, in law, person designated by a testator—*i.e.*, a person making a will—to direct the distribution of his estate after his death. The system is found only in countries using Anglo-American law; in civil-law countries the estate goes directly to the heir or heirs. The executor is usually a surviving spouse or other relative and achieves his position in most states even before the will is entered into probate, the judicial proceedings for determining the validity of the will. In all instances he is required to post a bond with the court as assurance that he will not abscond with the assets. He is required to dispose of the property in accordance with the provisions of the will. He must collect all debts due to the estate, as well as pay all those that are owed by the testator. He must then distribute the assets to heirs and legatees. If there is no will and no real estate and the heirs are able to agree upon the distribution of the estate, then an executor is not needed.

exedra, also spelled EXHEDRA, in architecture, semicircular or rectangular niche with a raised seat; more loosely applied, the term also refers to the apse (*q.v.*) of a church or to a niche therein.

In ancient Greece exedrae were commonly found in the parts of major cities that had been reserved for worship, such as the Acropolis in Athens. Scholars and poets held discussions in the walled recesses, which were also used for rest and contemplation.

Exedrae were often constructed in Roman buildings, as in the Minerva Medica in Rome, where they were added in the 4th century to strengthen the supports of the heavy dome. Roman exedrae of both rectangular and semicircular design were sometimes topped with semidomes and often fronted with monumental columns or pilasters. In the Pantheon at Rome, for example, three semicircular and four rectangular exedrae were constructed around the main interior wall, probably to house statues of the gods of the seven known planets. The exedra directly across from the entrance is domed; each of the remaining six exedrae is faced with two marble columns. Exedrae were also built outside Rome and Greece; an example can be seen in Istanbul in the 6th-century Byzantine churches of SS. Sergius and Bacchus and St. Irene.



Exedra, Church of St. Irene, Istanbul, rebuilt by Justinian in the mid-6th century and again after 740

J. Powell, Rome

exegesis, the critical interpretation of the biblical text to discover its intended meaning. Both Jews and Christians have used various exegetical methods throughout their history, and doctrinal and polemical intentions have often influenced interpretive results; a given text may yield a number of very different interpretations according to the exegetical presuppositions and techniques applied to it. The study of these methodological principles themselves constitutes the field of hermeneutics (*q.v.*).

A brief treatment of exegesis follows. For full treatment, *see* MACROPAEDIA: Biblical Literature and Its Critical Interpretation.

Interpretation of the Bible has always been considered a prerequisite for Jewish and Christian theological doctrine, since both faiths claim to be based upon the "sacred history" that makes up a major portion of the Bible. The other portions of the Bible—prophecy, poetry, proverbs, wisdom writings, epistles—are primarily reflections upon this sacred history and its meaning for the religious communities that grew out of that history. To that extent the nonhistorical writings of the Bible are themselves critical interpretations of the sacred history, and in large measure they form the basis for all other biblical exegesis.

The largest portion of the Bible is the Hebrew Bible, which is common to both Jews and Christians and is grounded in the history of the people of Israel. Christians add to this the New Testament (in contrast to the "Old Testament" of the Hebrew Bible), much of which is concerned with the interpretation of the Hebrew Bible in the light of the Christian community's experience of Jesus. Some Christians also include in their Bible the books of the Apocrypha (from the Greek, "hidden away"). These are books and portions of books that were excluded from the Hebrew Bible but that appeared in its Greek translation, known as the Septuagint, which was compiled around the 2nd century BC. The Septuagint includes books translated from Hebrew originals (*e.g.*, Ecclesiasticus, Tobit) and books originally composed in Greek (*e.g.*, Wisdom of Solomon); these books are sometimes considered to be of doctrinal value because the Septuagint was the "authorized version" of the early church.

Although at times the Hebrew and Greek of the Bible have been treated as sacred languages, and the history contained in the text has been regarded as somehow different from "ordinary" history, most forms of biblical exegesis employed in the modern era are applicable to many other bodies of literature. Textual criticism is concerned with establishing, as far as is possible, the original texts of the biblical books from the critical comparison of the various early materials available. For the Hebrew Bible, these materials are Hebrew manuscripts from the 9th century AD onward and the Hebrew texts from the Qumran community of the Dead Sea region, which date from the 5th to the 2nd century BC. Other sources are the major translations of the Hebrew texts into Greek (the Septuagint), Syriac (the Peshitta), and Latin (the Vulgate). For the New Testament, the textual materials are Greek manuscripts from the 2nd to the 15th century, ancient versions in Syriac, Coptic, Armenian, Georgian, Ethiopic, and other languages, and citations in early Christian writers. These manuscripts are usually divided into various "families" of manuscripts which seem to lie within a single line of transmission.

Philological criticism is the study of the biblical languages in respect to grammar, vocabulary, and style, to ensure that they may be translated as faithfully as possible. Literary criticism classifies the various biblical texts according to their literary genre. It also attempts to use internal and external evidence to establish the date, authorship, and intended audience of the various biblical texts. For example, different strains of tradition in the Pentateuch (the first five books of the Hebrew Bible) have been connected with different stages in the development of Israelite religion. In the New Testament, literary criticism has concentrated upon the relationship between the gospels attributed to Matthew, Mark, and Luke, which are called Synoptic (*i.e.*, presenting a common view) because they are based to a large extent upon the same traditions about the ministry of Jesus.

Tradition criticism attempts to analyze the various sources of the biblical materials in such a way as to discover the oral traditions which lie behind them, and to trace their gradual development. Form criticism is to some extent the offspring of tradition criticism, and has become the major exegetical method of the current century. Its basic assumption is that literary material, written or oral, assumes certain forms according to the function the material serves within the community which preserves it. The content of a given narrative is an indication both of its form—miracle story, controversy, or conversion story, for example—and of the narrative's use within the life of the community. Often a narrative will serve a variety of functions within various life settings over a period of time, and its proper analysis will reveal the development of the narrative into its final form.

Redaction criticism examines the way the various pieces of the tradition have been assembled into the final literary composition by an author or editor. The arrangement and modification of these pieces of tradition can reveal something of the author's intentions and the means by which he hoped to achieve them.

Historical criticism places the biblical documents within their historical context and examines them in the light of contemporary documents. History of religions criticism in much the same way compares the religious beliefs and practices expressed by the biblical texts to the trends discernible within world religion in general. The features of Israelite religion, for example, are often compared to those of other ancient Middle Eastern religions, while early Christianity may be examined in comparison to Gnosticism, an esoteric religious philosophy based on the absolute dualism of evil matter and good spirit that was popular in the 1st and 2nd centuries.

Exekias, also spelled EXECIAS (fl. *c.* 550–525 BC), Greek potter and painter who, with the Amasis Painter, is considered the finest of black-figure masters of the mid-6th century BC and is one of the major figures in the history of the art. His name is found on 11 vases. The commonest inscription on the vases is "Exekias epoiēsen me" ("Exekias made me"). In two instances, on an amphora (a two-handled wine container) in the Vatican and on an amphora in Berlin, there is written, "Exekias egraphse kapoiēse me" ("Exekias made and decorated me"). These inscriptions are evidence that Exekias was both potter and painter.

On Exekias' amphora in the Vatican, the vase represents Achilles and Ajax playing a board game on one side. On the other side is a young man, Castor, with his horse, Kyllaros; other figures are his mother, Leda, his father, Tyndareus, and his twin brother, Pollux (Polydeuces).

The second amphora "made and decorated" by Exekias is at Berlin. On one side Heracles is shown wrestling with the Nemean lion. On the other side are two Attic warriors, Demophon and Akamas, the sons of Theseus. This was

"Dionysus Crossing the Sea," interior of a kylix (shallow drinking cup) by Exekias, *c.* 535 BC; in the Staatliche Antikensammlungen und Glyptothek, Munich

Hirmer Fotoarchiv, Munchen

probably one of Exekias' earliest works. Parts of it have been restored.

It is not certain how many of the nine remaining vases inscribed as "made by" Exekias were also painted by him.

Some unsigned vases have been attributed to Exekias on the basis of their stylistic relation to the Vatican amphora. Foremost among these are an amphora in Boulogne, Fr., illustrating the death of Ajax, and a calyx krater (a vessel used for mixing wine with water) at Athens. This calyx krater is probably the earliest example of this pottery shape, which may have been Exekias' own invention.

In addition to vases, Exekias was responsible for a set of clay plaques, about 15 inches high, of funerary scenes, designed to decorate a tomb. A kylix (a shallow drinking cup) now in Munich, of a type just coming into use in Exekias' time, also carries the potter's signature and depicts Dionysus reclining in a ship.

exercise, the training of the body to improve its function and enhance its fitness.

A brief treatment of exercise follows. For full treatment, *see* MACROPAEDIA: Exercise and Physical Conditioning.

The benefits of exercising are numerous. People who are physically fit are better able to carry out ordinary activities without fatigue or exhaustion and to resist disease, infection, and undue physical deterioration. Among adults, the health-related benefits of physical fitness—particularly the fitness of the heart muscle—are usually the major concern. Improved cardiovascular and respiratory function can be achieved through a program of aerobic (oxygen-requiring) exercises. In order to obtain these benefits, the exerciser must work his heart at training levels for at least 20 minutes three times a week. An individual's training level, measured in heartbeats per minute, can be reliably estimated by subtracting one's age from 220 and then multiplying the result by 65 percent. Thus the training heart rate for a 35-year-old is about 120 beats per minute. Walking, jogging, cycling, swimming, and exercise dancing are popular forms of aerobic training.

In addition to aerobic conditioning, a balanced fitness program should include exercises that build muscular strength and those that increase flexibility (*i.e.,* the range of movement around the joints). Weight training (*q.v.*) can achieve the first objective, as can the performance of push-ups, chin-ups, sit-ups, and other calisthenics that use the body's own weight as a resistance load. Stretching exercises serve to increase flexibility.

Performance-related fitness (as opposed to health-related fitness) is important for individuals who require special skills in coordination, strength, and endurance. Athletes, for example, usually develop their muscles more fully. In most cases, the muscle tissues simply become harder and stronger as more fibres in the tissue are brought into use. Muscles do not increase in size unless they are deliberately forced to by repetitive contractions.

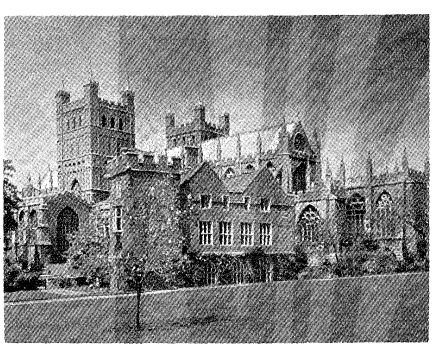
Although there is no definitive evidence that exercise prolongs life, several epidemiological studies have shown that increased levels of physical activity are correlated with lowered risk of coronary heart disease, the major killer of adults in developed countries. Regular exercise has also been shown to be of benefit in controlling type II (adult-onset) diabetes and in lowering high blood pressure in at least some persons. The benefits of exercise do not, however, last more than a few months after the cessation of regular training. Even athletes who have attained a high level of conditioning will regress rapidly to a pre-training level once exercising stops.

The desirable amount of activity for fitness varies from person to person according to the factors of age, build, health, and gender. Too much excercise can cause wear on the joints, leading to articular disease in later life, but this is a condition found most commonly in top-ranking athletes. The pitfall of most beginners is simply overexercising. Many people experience stiffness after the first few days of exercise, but this is harmless and transient. Those who are overweight, past middle age, or suffer from heart disease should consult a physician prior to starting any exercise program.

Exeter, district (city), county of Devon, England, on the River Exe about 10 mi (16 km) above the river's entry into the English Channel. It has an area of 17 sq mi (45 sq km). The community derived its early importance from its position at the river crossing.

An early British tribe, the Dumnonii, made Exeter their centre, and it was taken over by the Romans, who named it Isca Dumnoniorum. Because it was the main town in southwestern England during the Middle Ages, Exeter was subjected to a number of sieges. Alfred the Great (871–899) twice held it against the Danes (877 and *c.* 894), but it was taken in 1003. In 1068, after an 18-day siege, Exeter surrendered to William I the Conqueror.

During the English Civil War, the town declared for Parliament, but it was held by the Royalists from 1643 to 1646. Exeter had become a borough before the Norman Conquest; in 1537 it was created a county in itself and



Cathedral Church of St. Peter at Exeter, Devon

Colour Library International

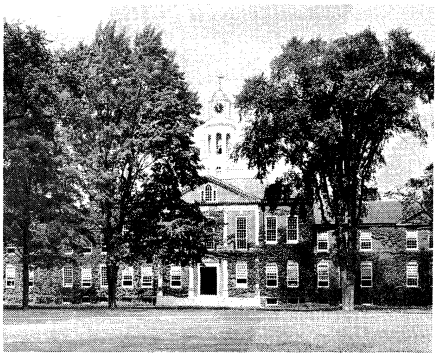
remained so until the reorganization of English local government in 1974. Many trade guilds were incorporated in the city, the first, in 1466, being the tailors' guild.

The Norman cathedral, dedicated to St. Peter, was consecrated in 1133. The present building, begun *c.* 1275, is in the Decorated style and in this way is different from its twin Norman towers. Other notable buildings include the 14th-century Guildhall, rebuilt in 1468–70, and the Norman castle, most of which was demolished in 1744. Exeter's University College (1922) became the University of Exeter in 1955.

The port of Exeter is linked to the sea by canal but is accessible only to small vessels. Among its manufacturing industries, metalworking, leatherworking, and the manufacture of paper and agricultural implements are the most important.

Exeter is one of the best examples of the historic English town, which developed from a Roman–British centre to a medieval cathedral city and county town and now is an administrative and service centre for an extensive region. Pop. (1984 est.) 100,800.

Exeter, town (township), seat of Rockingham County, southeastern New Hampshire, U.S., on the Exeter River at the falls of the



The Phillips Exeter Academy, Exeter, N.H.

Eric M. Sanford

Squamscott, southwest of Portsmouth. The town was founded in 1638 by the Rev. John Wheelwright and a group of exiles from the Massachusetts Bay Colony. During its early years it was a commonwealth independent of the English colonies, but an increasingly unfavourable economic situation forced Exeter to voluntarily submit to the jurisdiction of Massachusetts in 1643. Later in the 17th century the area became part of the colony of New Hampshire. From about 1675 to 1725 the town was subjected to numerous Indian attacks, hindering its growth. A shipbuilding industry subsequently developed. Manufactures now include textiles, leather goods, and electronic equipment.

During the American Revolution, Exeter was a patriot stronghold, and it served as the provincial capital. The Phillips Exeter Academy, a preparatory school, was founded there in 1781. Historic buildings include the Congregational Church (1798) and Cincinnati Memorial Hall (1721), containing personal effects of the George Washington family. Pop. (1982 est.) 11,260.

Exeter Book, the largest extant collection of Old English poetry. Copied *c.* 975, the manuscript was given to Exeter Cathedral by Bishop Leofric (died 1072). It begins with some long religious poems: the *Christ,* in three parts; two poems on St. Guthlac; the fragmentary "Azarius"; and the allegorical *Phoenix.* Following these are a number of shorter religious verses intermingled with poems of types that have survived only in this codex. All the extant Anglo-Saxon lyrics, or elegies, as they are usually called—"The Wanderer," "The Seafarer," "The Wife's Lament," "The

Husband's Message," and "The Ruin"—are found here. These are secular poems evoking a poignant sense of desolation and loneliness in their descriptions of the separation of lovers, the sorrows of exile, or the terrors and attractions of the sea, although some of them—*e.g.*, "The Wanderer" and "The Seafarer"—also carry the weight of religious allegory. In addition, the Exeter Book preserves 95 riddles, a genre that would otherwise have been represented by a solitary example.

The remaining part of the Exeter Book includes "The Rhyming Poem," which is the only example of its kind; the gnomic verses; "Widsith," the heroic narrative of a fictitious bard; and the two refrain poems, "Deor" and "Wulf and Eadwacer." The arrangement of the poems appears to be haphazard, and the book is believed to be copied from an earlier collection.

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

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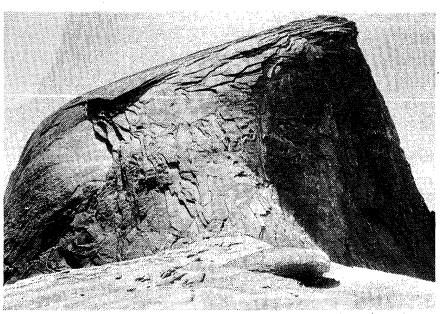
exfoliation, separation of successive thin shells, or spalls, from massive rock such as granite or basalt; it is common in regions that have moderate rainfall. The thickness of individual sheet or plate may be from a few millimetres to a few metres.

Some geologists believe that exfoliation results when rocks formed at depth are exposed at the ground surface; the previous compressional forces would decrease and thus allow the rock to expand by fracturing parallel to the surface. Quite often, however, the fractures are not parallel to the ground surface, and this circumstance is taken as an indication of some other method of formation. Large daily variations in temperature, especially pronounced in deserts, were also credited with producing exfoliation—expansion from heating during the day followed by contraction from rapid cooling at night was thought to cause the separation of thin slabs from large blocks of rock at the surface. This view has been discredited by careful experiments using an electric heating and cooling device; thousands of alternations between temperatures considerably higher and lower than those measured in deserts have failed to produce in samples of rock any fractures detectable even under high magnification.



Half dome displaying exfoliation, Yosemite National Park, California

By courtesy of the U.S. Geological Survey; photograph, F.C. Calkins

Study of thin shells that separate from rock exposed to the weather reveals as a common cause of the separation the slow development of clay minerals, which involves an increase in volume. The outer surface of exposed rock dries rapidly after wetting; but moisture that penetrates into minor crevices stays until some decay is started, and the resultant swelling causes flaking roughly parallel to the outer rock surface.

A small-scale form of exfoliation, called spheroidal weathering, is restricted to boulder-sized rock material and may occur at some depth within the Earth. In this case, rounded boulders are found surrounded by layers of disintegrated material.

exfoliative dermatitis, generalized redness and scaling of the skin that usually arises as a complication of a preexisting skin disease or of an allergy. More rarely, it may be indicative of a systemic disease, such as cancer of the lymphoid tissue. The onset of exfoliative dermatitis is gradual; initial single lesions coalesce into large patches of scaly, red skin that may extend over any part of the body until no healthy skin is left. Hair and nails may lose their lustre and become brittle and fall. Occasionally, a yellow secretion may ooze out of the skin. Itching is variable and may be intense. The continuous shedding of the scales results in a significant loss of body protein. The maintenance of body temperature is also affected, because of the plugging of a majority of sweat ducts; the patient feels cold and feverish. Treatment focusses on the underlying primary disease. Rest and a high protein diet are beneficial. Exfoliative dermatitis is most common in middle life, affecting more men than women, by a ratio of about three to one.

exhaustion, method of, in mathematics, technique invented by the classical Greeks to prove propositions regarding the areas and volumes of geometric figures. Although it was a forerunner of the integral calculus, the method of exhaustion used neither limits nor arguments about infinitesimal quantities. It was instead a strictly logical procedure, based upon the axiom that a given quantity can be made smaller than another given quantity by successively halving it (a finite number of times). From this axiom it can be shown, for example, that the area of a circle is proportional to the square of its radius. The term method of exhaustion was coined in Europe after the Renaissance and applied to the rigorous Greek procedures as well as to contemporary "proofs" of area formulas by "exhausting" the area of figures with successive polygonal approximations.

exhibitionism, derivation of sexual gratification through compulsive display of one's genitals. Like voyeurism (*q.v.*), sexual display is almost universal as a prelude to sexual activity in animals, including humans; it is regarded as deviant behaviour when it takes place outside the context of intimate sexual relations. Exhibitionists are usually not dangerous, although the experience is frequently perceived by the victim as threatening; violence or sexual assault seldom follows the display.

The exhibitionist, almost always male, may obtain gratification from the reaction of disgust or fear on the part of his victim, but this reaction is not always necessary to his excitement. Previously normal individuals sometimes turn to exhibitionism following severe mental trauma or personal loss. The chronic exhibitionist, however, is likely to have a serious personality disorder.

Exhibitionism is the most common form of sexual deviation to come into conflict with the law in Western society. Nearly all of those arrested for exhibitionism are men; the disorder, if it exists at all in women, is seldom evident. Some experts suggest that female exhibitionism is not uncommon, but is not identified as deviant behaviour because there are socially acceptable ways for women to display their bodies.

Exile, Babylonian: *see* Babylonian Exile.

exile and banishment, prolonged absence from one's country imposed by vested authority as a punitive measure. Exile and banishment probably originated among early peoples as a means of punishment. The offender was made an outcast and deprived of the comfort and protection of his group. Exile was practiced by the Greeks chiefly in cases of homicide, although ostracism (*q.v.*) was a form of exile imposed for political reasons. In Rome, exile (*exsilium*) was originally a means to circumvent the death penalty. Before a death sentence was pronounced, a Roman citizen could escape by voluntary exile. Later, exile applied to all gradations of expulsion, whether it was temporary or permanent and whether citizenship was lost and property confiscated or not. In general, the Romans determined punishment by class: banishment was for the upper classes and forced labour for the lower.

From the Anglo-Saxon penalty of outlawry, English law developed the practice of banishing criminals as an alternative to capital punishment. By the 18th century, European countries were removing criminals to penal colonies in America, Australia, and Siberia (*see* penal colony). In the 20th century, political reasons became a frequent basis for exile. *See also* deportation.

Eximbank: *see* Export-Import Bank of the United States.

Existentialism, a family of philosophies devoted to an interpretation of human existence in the world that stresses its concreteness and its problematic character. As a self-conscious movement it is primarily a 20th-century phenomenon, embracing Martin Heidegger, Karl Jaspers, Jean-Paul Sartre, Gabriel Marcel, and Maurice Merleau-Ponty, but its characteristic features occur earlier, especially in the 19th-century thinkers Friedrich Nietzsche and Søren Kierkegaard. Edmund Husserl and W.F. Hegel, though not Existentialists, are major influences, the latter mainly by virtue of reaction against him.

A brief treatment of Existentialism follows. For full treatment, *see* MACROPAEDIA: Philosophical Schools and Doctrines.

Though often seen as an irrationalist revolt against traditional philosophy, Existentialism is largely a coherent development within it. For several reasons it rejects epistemology and the attempt to ground human knowledge. Firstly, human beings are not solely or even primarily knowers; they also care, desire, manipulate, and, above all, choose and act. Thus Heidegger regards objects not primarily as "things" for cognition—this is a derivative characteristic—but as tools for use; Merleau-Ponty holds that lived experience begins with one's experience of one's own body.

Secondly, the self or ego, required by some if not all epistemological doctrines, is not a basic feature of the prereflective experience. It emerges from one's experience of other people. The cognizing ego presupposes rather than infers or constitutes the existence of external objects.

Finally, man is not a detached observer of the world, but "in the world." He "exists" in a special sense in which entities like stones and trees do not; he is open to the world and to objects in it. Contrary to Descartes's view, however, he is open to them without any intermediary stratum of ideas or sensations. There is no distinct realm of consciousness, on the basis of which one might infer, project, or doubt the existence of external objects. Their rejection of Cartesian dualism is one reason why Existentialists are concerned with being rather than knowing, and why they argue that phenomenology is also ontology.

The claim that man exists in this unique sense also means that he is open to a future which he determines by his choices and actions; he is free. Other entities—stones, trees, tigers—have a fixed nature or essence that determines what they are and what they do. In contrast, neither as a species nor as individuals do human beings have such an essence that governs their conduct. Man makes himself what he is by his choices, choices of ways

of life (Kierkegaard) or of particular actions (Sartre). Even when he seems simply to be acting out a "given" role or following "given" values—given, for example, by God or by society—he is in fact choosing to do so, for there are no given values that can determine, in and of themselves, rationally or causally, man's choices. It does not follow that the choices available are unlimited. His "being in the world" implies that man is "thrown" (Heidegger) into a specific situation, and not all the choices that that seems to leave open are in fact possible; but which ones are possible and which are not cannot be known in advance. Existentialists have inferred, controversially, that man's choices are not explicable, physically or otherwise, and have rejected scientific Materialism. They have also argued that the openness of the future and the specificity of individuals and of their situations elude rationalist philosophical systems. This is another reason for their concern with "being." Being contrasts not only with knowing, but also with abstract concepts, which cannot fully capture what is individual and specific.

Since man's choices cannot, in their view, be rationally grounded, Existentialists do not propose, except incidentally, an ethic in the sense of a set of rules or values, but rather a framework in which action and choice are to be viewed. This framework does not tell one what to choose, but it does imply that there are right and wrong ways of choosing. One can be authentic or inauthentic (Heidegger), act in bad faith or with sincerity (Sartre). To act in bad faith is, for example, to follow the herd unquestioningly, or to suppose that given values, given institutions, or one's own character curtails one's choices. It is especially in the face of "limit situations" (Jaspers) such as death, struggle, guilt, or anxiety that one becomes aware of one's responsibility as an agent, as well as of the ultimate inexplicability of the world in which one must act.

Existentialism has had an enormous influence outside philosophy, on, for example, psychology (Jaspers, Ludwig Binswanger, R.D. Laing) and—although it is compatible with atheism (Heidegger, Sartre), as well as with Christianity (Kierkegaard, Marcel)—on theology (Karl Barth, Paul Tillich, Rudolf Bultmann). Existentialism as such entails no particular political doctrines, but its stress on responsibility and its aversion to conformism and to whatever impairs human freedom can be conducive to political activism (Sartre). Although most Existentialists have disregarded Kierkegaard's exclusive recommendation of "indirect communication," the importance of specific situations and autonomous choices implies that existential truths can be conveyed in drama and fiction as well as in direct philosophical discourse; the concerns of the movement have inspired a large body of imaginative literature (Sartre, Camus, de Beauvoir). In addition, the philosophy has provided a means of articulating and interpreting these same themes as discerned in works of literature from all periods (*e.g.*, Sophocles, Shakespeare, Dostoyevsky, Faulkner).

Exmoor, high moorland in northwestern Somerset and northern Devon, England, that forms a national park 265 sq mi (686 sq km) in extent. It borders the Bristol Channel on the north and has an exceptionally beautiful coastline of rugged headlands interspersed with narrow, wooded valleys, or coombs. Inland, beyond the fringe of farms, lies a bleak, misty plateau of heather moors, mostly more than 1,000 ft (300 m) above sea level, with Dunkery Beacon (1,706 ft) as the highest feature. The moors remain grazing grounds for hardy Exmoor ponies and Exmoor horned sheep, and wild red deer are still hunted there. There the River Exe rises, and flows south to the English Channel. Tourism is important to the local economy, and Lynton, Lynmouth, and Porlock are the main centres.

Exmouth, locality, East Devon district, county of Devon, England, on the east side of the mouth of the River Exe on the English Channel. Its fort, commanding the estuary to the north, was captured by the Parliamentarians in 1646 during the Civil War. The older fishing and shipbuilding settlement has grown as a seaside resort and residential town and is much frequented as a yachting centre. Pop. (1981 prelim.) 28,787.

Exmouth Gulf, inlet of the Indian Ocean in Western Australia, between North West Cape and the mainland. It is 55 mi (90 km) long north to south and 30 mi across the mouth and has a maximum depth of 72 ft (22 m). Fishing, pearling, prawning, and tourism are the main local industries, and drilling for oil has taken place in the region. Nearby Cape Range National Park is important for the conservation of the rare yellow-footed rock wallaby. The west coast was charted by the Dutch navigator Abel Tasman in 1644. The gulf was named for Admiral Viscount Exmouth by Lieut. Phillip Parker King, who surveyed the coast (1818) in HMS "Mermaid." The town of Exmouth was established in 1967 as a residential and service centre for the U.S. Naval Communications Station at North West Cape.

exobiology, also called XENOBIOLOGY, or ASTROBIOLOGY, a branch of biology that deals with the search for extraterrestrial life, especially intelligent life, outside the solar system. The word exobiology was coined by the U.S. geneticist Joshua Lederberg; the word commonly used in the Soviet Union translates into English as astrobiology.

Remote astronomical observations of a planet or other body provide information about its physical environment, but the determination of the presence of life is much more difficult. Techniques are designed to detect life-forms, artifacts produced by intelligent life, waste products of metabolic reactions, remnants of former life, prebiological molecules that may represent early evolutionary stages, or substances such as carbon that are necessary for life as it is experienced on Earth. Earth-based communication efforts have ranged from sending coded radio transmissions and pictorial diagrams by satellite to monitoring radio emissions from stars and starlike objects for long periods of time.

exocrine gland, gland that secretes via a duct opening on an internal or external surface of the body, in contrast to an endocrine gland, which secretes directly into the circulatory system. *See* oil gland; salivary gland; sweat gland; tear duct and gland.

Exodus, the liberation of the People of Israel from slavery in Egypt in the 13th century BC, under the leadership of Moses; also, the Old Testament book of the same name. The English name of the book derives from the Septuagint (Greek) use of "exodus" to designate the deliverance of the Israelites from Egyptian bondage and their safe passage through the Sea of Reeds (traditionally mislocated as the Red Sea). The Hebrew title of the work is Shemot (Names).

Chapters 1–18 narrate the history of the Egyptian bondage, the Exodus from Egypt, and the journey to Mt. Sinai under the leadership of Moses. The second half of the book tells of the Covenant that was established between God and Israel at Sinai and promulgates laws for the ordering of Israel's life.

Since Exodus continues the sacred story of the divine promise to Israel begun in Genesis, it must be seen as part of a larger literary unit that is variously understood to include the first four, five, or six books of the Bible.

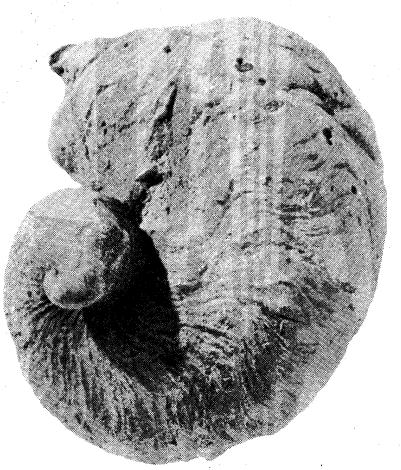
Scholars have identified three literary traditions in Exodus, designated by the letters J, E, and P. The J strand, so called because it uses the name Yahweh (Jahweh in German) for God, is a Judaean rendition of the sacred story, perhaps written as early as 950 BC. The E strand, which designates God as Elohim, is a version of the sacred story from the northern kingdom of Israel, about 900–750 BC. The P (Priestly) strand, so called because of its cultic interests and regulations for priests, is usually dated in the 5th century BC and is regarded as the law upon which Ezra and Nehemiah based their reform. Each of these strands preserves materials much older than the time of their incorporation into a written work. Exodus thus conserves extremely old oral and written history. *See also* Torah; biblical interpretation.

exogamy and endogamy, practices controlling the relation of the sexes and the selection of marital partners. Exogamous groups enjoin their members to marry outside the group, sometimes even specifying the outside group into which members must marry. Conversely, marriage outside a specific group may be forbidden, and for this restriction the term endogamy is used; more loosely it applies to a tendency to marriage within a group. Endogamy, rare among nonliterate societies, is characteristic of aristocracies and religious and ethnic minorities in industrialized societies, but it is also a notable characteristic of the caste system in India and of class-conscious nonliterate societies such as that of the Masai of East Africa.

Exogamy, more characteristic of nonindustrial societies, is usually based on ties of kinship, clan, or moiety (*see* dual organization) rather than on political or territorial lines. Since exogamous rules usually characterize unilineal descent groups, in which descent is reckoned either patrilineally or matrilineally, the marriage prohibition will apply only to one side of the family. Thus, some blood relations will inevitably be available for marriage.

The severity of enforcement of endogamous and exogamous restrictions varies greatly—from being an offense incurring capital punishment to one deserving only mild disapproval.

Exogyra, extinct molluscan genus common in shallow-water marine deposits of Jurassic to Cretaceous age (between 190,000,000 and 65,000,000 years old). *Exogyra* is characterized by its very thick shell, which attained massive proportions. The left valve, or shell, is spirally twisted, whereas the right valve is flattish and much smaller. A distinctive longitudinal pattern of ribbing is well developed in the left valve, and pitting is common.



Exogyra arietina, collected at Griffiths Ravine, Texas
By courtesy of the Buffalo Museum of Science, Buffalo, N.Y.

exophthalmic goitre: *see* Graves' disease.

exophthalmos, also spelled EXOPHTHALMUS, also called PROPTOSIS, abnormal protrusion of one or both eyeballs. The condition in most cases results from accumulation of fluid in the fatty tissues that cushion the eyeball in its socket, or orbit. The usual cause of this swelling of the orbital tissue is Graves' disease, a type of hyperthyroidism (oversecretion of thyroid hormone), but it may also follow the spread of infection from the paranasal sinuses or the teeth. Less common causes of exophthalmos include hemorrhage or aneurysm of the internal carotid artery and congenital glaucoma or severe myopia.

True exophthalmos may be divided into simple and malignant forms. In both, edema (swelling) is frequent in the outer half of the upper lids, the lower lids, and adjacent areas. In simple exophthalmos, eye movements are not grossly abnormal, but lid lag may be present, and conjunctival involvement is minimal or absent. Visual acuity is normal, and there is no double vision. In malignant exophthalmos, the eyes are more prominent, the conjunctival swelling is marked, the eyes cannot be moved normally, and double vision is frequent; these various abnormalities are progressive; visual acuity becomes reduced, and the survival of the eyes is threatened.

exorcism, an adjuration addressed to evil spirits to force them to abandon an object, place, or person; technically, a ceremony used in both Jewish and Christian traditions to expel demons from persons who have come under their power. The rites and practices of preliterate people to ward off or to expel evil spirits are also a form of exorcism, though they are sometimes considered witchcraft.

In the Christian tradition, Jesus expelled demons by a word and stated that this act was a sign of the coming of God's Kingdom. His followers, and others as well, drove out demons "in his name." In the first two centuries of the Christian Era, the power of exorcism was considered a special gift that might be bestowed on anyone, lay or cleric. About AD 250, however, there appeared a special class of the lower clergy, called exorcists, to whom was entrusted this special function. About the same time, exorcism became one of the ceremonies preparatory to Baptism, and it has remained a part of the Roman Catholic baptismal service.

The exorcism of persons possessed by demons is carefully regulated by canon law in the Roman Catholic Church, and the elaborate rite is contained in the Roman ritual.

exoskeleton, rigid or articulated envelope that supports and protects the soft tissues of certain animals. The term includes the calcareous housings of sessile invertebrates such as clams but is most commonly applied to the chitinous integument of arthropods, such as insects, spiders, and crustaceans. The arthropod exoskeleton, formed from the epidermis, is composed of an outer lipoprotein layer over chitinous horny and flexible layers. In terrestrial species this covering has small breathing holes (spiracles). By preventing dehydration the exoskeleton has allowed arthropods, especially insects, to invade most terrestrial habitats. The flexible joints in the exoskeleton of creatures such as the lobster allow great freedom of movement. An exoskeleton does not grow; it must be molted regularly and a new one secreted, at which time the animal is soft and vulnerable to both predators and environmental changes.

exosphere, outermost region of the atmosphere, where the number of molecules is so low that the probability of collisions between molecules is very small. The particles are acted upon only by the gravitational field of the Earth and follow what are called ballistic trajectories. The base of the exosphere has been estimated to be between 500 and 1,000 kilometres (300 and 600 miles) above the Earth's surface. Its outer boundary is defined as that level where the molecular density falls off to that typical of the interplanetary medium of our solar system, approximately 5,000 kilometres (3,000 miles) above the Earth's surface. Because from this region atmospheric molecules have an appreciable chance to escape to outer space, the base of the exosphere is called the critical level of escape; but because most molecules have speeds considerably lower than the escape velocity, the rate of escape is quite low.

exostosis (medicine): *see* osteochondroma.

exotoxin, a poisonous substance secreted by certain bacteria. The term is now sometimes restricted to poisonous proteins that are antigenic—*i.e.,* that stimulate the formation of antibodies—and formed by gram-positive bacteria. *Compare* endotoxin.

expanding universe, dynamic state of the extragalactic realm, the discovery of which has transformed 20th-century cosmology. The development of general relativity and its application to cosmology by Albert Einstein, Wilhelm de Sitter, and other theoreticians, along with the detection of extragalactic redshift (a shift to the longer wavelengths of light from galaxies beyond the Milky Way) by Vesto Slipher, led to the realization in the 1920s that the distant galaxies are receding and the universe is expanding. The discovery of the 3-degree background radiation in 1965 by Arno A. Penzias and Robert W. Wilson is regarded as convincing evidence that the universe originated between 10,000,000,000 and 20,000,000,000 years ago in a very dense and hot state referred to as the big bang (*see* big bang model).

Observations so far have not succeeded in determining whether the universe is open (of infinite extent in space) or closed (of finite extent) and whether the universe in the future will continue to expand indefinitely or will eventually collapse back into an extremely dense, congested state. *See also* cosmology.

Consult the INDEX *first*

experimental psychology, a method of studying psychological problems; the term generally connotes all areas of psychology that use the experimental method. The experimental method as it applies to psychology is an attempt to account for the activities of animals (including man) and the functional organization of their mental processes by manipulating variables that may give rise to behaviour; it is primarily concerned with discovering laws that describe manipulable relationships.

The areas of study in psychology that lean heavily on the experimental method include those of sensation and perception, learning and memory, motivation, and physiological psychology. There are experimental branches in most areas, however, including child psychology, clinical psychology, educational psychology, social psychology, and even parapsychology. Usually the experimental psychologist deals with normal, intact organisms; but in physiological psychology, studies are often conducted with organisms modified by surgery, radiation, drug treatment, or long-standing deprivations of various kinds; or with organisms who naturally present organic abnormalities or emotional disorders. The experimental psychologist often finds that his problems overlap those of physiologists, neurophysiologists, radiologists, biochemists, zoologists, pharmacists, physicists, and geneticists. *See also* physiological psychology; psychophysics.

experimentalism (philosophy): *see* instrumentalism.

exploration, the investigation of the Earth for scientific, commercial, or military purposes. By the last quarter of the 20th century, virtually all of the Earth's surface had been explored, and attention was largely directed toward its subsurface regions and its oceans, particularly the deep ocean floor. The exploration of outer space also became a major point of interest at this time (*see also* space exploration).

A brief treatment of the primary aims and methods of terrestrial exploration follows. For full treatment, *see* MACROPAEDIA: Exploration. For a historical overview of the early exploration of the Earth's land areas, *see* European Overseas Exploration and Empires.

The deep interior of the Earth remains a major frontier, since most of the subsurface exploration so far undertaken has been limited to the Earth's uppermost crust. A large number of exploratory projects conducted today involve prospecting for deposits of metals, fossil fuels (*e.g.,* oil, natural gas, and coal), and other commercially important minerals, or a search for recoverable groundwater, for sources of geothermal energy, or for sites geophysically suitable for power plants, factories, and depositories for hazardous wastes.

The methods used in exploring the Earth's subsurface (as well as its surface in many cases) are of two general types: direct and indirect. Direct methods entail drilling, excavating, and sampling. Indirect methods involve geochemical analysis and measurement and geophysical surveys of such phenomena as reflectivity, gravity, magnetism, seismic waves, and heat flow. The indirect approach often begins with radar mapping from aircraft and photographic surveying from Earth-orbiting satellites equipped with optical-mechanical infrared scanners and multispectral scanners. This form of remote sensing may enable investigators to detect groundwater movement, hydrothermal areas, and specific types of subcropping rocks associated with mineral concentrations. Geophysical measurements are widely used in the search for oil and minerals, and in engineering, in building-foundation investigations. Geochemical prospecting techniques are commonly employed to measure trace contents of certain elements in rock, water, vegetation, and other surface materials that may indicate the presence of a buried body of ore in a given area. Indirect studies are usually undertaken first to identify promising sites and are followed by direct methods.

Direct sampling, generally by means of boreholes, is often required to make positive identification of ores, fuels, and other materials. It is also necessary for determining their quantity and for choosing appropriate methods of recovery.

Drilling and other techniques of direct exploration are of somewhat less significance in the scientific study of the deep Earth. The high cost of drilling not only limits the number of boreholes that can be dug but also their depths. To date, the deepest borehole drilled extends less than 20 kilometres into the upper crust. As a consequence, scientific investigators have to rely heavily on geophysical measurements, particularly of seismic waves associated with earthquakes, to secure information about the Earth's interior and its dynamic processes. During the early 1980s seismic investigations of the Appalachian Mountain region of the United States, for example, resulted in important discoveries that are altering current theories about continent formation.

The practical value of ocean exploration has long been established by those countries that exploit the sea's natural resources, transport

goods and people across its surface, or maintain their national security by controlling its lanes. Scientific investigation of the ocean, which includes the study of the physical and chemical properties of seawater, all forms of marine life, and the geological and geophysical features of the ocean floor, has also proved beneficial. Studies of the interaction of the ocean and the atmosphere have enabled scientists to predict more accurately long-term climatic and weather variations. Moreover, undersea exploration of the seafloor and its gravitational and magnetic properties contributed much to the development and widespread acceptance of plate tectonics (*q.v.*), a concept that has not only revolutionized scientific understanding of the Earth's dynamic features but has led to the discovery of rich deposits of valuable metals on the ocean bottom as well. Exploration of the oceanic depths also has resulted in the discovery of previously unknown forms of marine life and made it possible to determine the distribution of diverse fish populations.

Scientific study of the ocean involves the collection of data on ocean currents (surface and bottom); on seawater temperature and salinity; on marine life; and on the topography of the ocean floor. Most exploratory work is carried out from a moving or stationary surface ship. Such a research vessel must be sturdy, stable, and capable of carrying oceanographic winches and various measuring and sampling devices; it must also have adequate deck working space, laboratory facilities, cruising range, and living accommodations for scientists and crew.

The deep-sea drilling vessel "JOIDES Resolution" represents a major advance in research ships. (JOIDES is the acronym for Joint Oceanographic Institutions for Deep Earth Sampling, a geophysics research program.) It is equipped with a computer-controlled dynamic positioning system, which allows it to remain fixed over a specific site while drilling to depths as great as 8,300 m. More important, the facilities of the vessel make it possible to collect cores of sediment and underlying igneous rock from the deepest points of the seafloor.

In recent years submersibles have become widely used for undersea exploration. In 1960 a record manned descent to the Mariana Trench reached 10,740 m below sea level. A submersible has several advantages over a surface ship; most notably it provides a means for direct and detailed observation at various depths.

Unmanned instrument platforms such as buoys are employed in seismic experiments, which are useful in determining the structure and thickness of the Earth's crust beneath the seafloor. Seismic experiments involve the measurement of the rate of propagation of sonic energy from any of several sources to a series of pressure detectors suspended from the buoys. The measurements are made at depths below the influence of wave action.

Remote sensing of the ocean by aircraft and Earth-orbiting satellites is becoming increasingly important because it can provide a more sweeping view of the ocean than can be furnished by slowly moving surface vessels. High-resolution, thermal-infrared data from polar-orbiting satellites, for example, are used to track wave features in currents. In another technique, radar altimeters aboard satellites are utilized to measure sea-surface topography.

Marine life specimens are collected in plankton nets and midwater trawls. Plankton nets can be subdivided into qualitative and quantitative samplers. Qualitative samplers sieve organisms from the water without measuring the volume of water that has passed through it. Quantitative samplers measure the volume and determine the concentration of organisms in a unit volume of water. Some nets can be used only when a ship is stationary; others take samples while a ship is moving. The midwater trawl is used for rapid trawling at great ocean depths and at a speed at which active, fast-swimming fish once caught are unable to swim out of the net.

Explorer, any of the largest series of unmanned U.S. spacecraft, consisting of more than 50 scientific satellites launched from 1958 to 1975. Explorer 1 (launched Jan. 31, 1958), the first space satellite orbited by the United States, discovered the innermost of the Van Allen belts, two zones of charged particles that surround the Earth. Other notable craft in the series include Explorer 36 (Mar. 7, 1968), which tested the possibility of communication by laser in space, and Explorer 52 (May 7, 1975), which was sent out to explore X-ray sources both inside and outside the Milky Way galaxy.

explosion seismology, analysis of vibrations caused by man-made explosions to determine earth structures, generally on a large scale. *See* seismic survey.

explosive, substance or device capable of producing a volume of rapidly expanding gas that exerts sudden pressure on its surroundings.

A brief treatment of explosives follows. For full treatment, *see* MACROPAEDIA: Industries, Chemical Process.

Chemical explosives are the most commonly used, although there also are mechanical and nuclear explosives. A mechanical explosive is one in which a physical reaction is produced, like that caused by overloading a container with compressed air. Nuclear explosives, which produce a sustained nuclear reaction, are by far the most powerful, but their use has been restricted to military weapons, although studies and experiments have been conducted with regard to their controlled use in certain industrial operations.

The principal chemical explosives include black powder, nitroglycerin, dynamite, and trinitrotoluene (TNT). A chemical explosive can be either gaseous, liquid, or solid, although the latter two are generally capable of producing more powerful explosions. There are two basic types of chemical explosives: detonating, or high, explosives; and deflagrating, or low, explosives. Detonating explosives, such as dynamite, decompose rapidly and create high pressure, while deflagrating explosives, although they may burn quickly, produce considerably lower pressures. Detonating explosives also are divided into primary and secondary detonators. Primary explosives are detonated by ignition, for example, a flame or heat-producing impact, whereas secondary explosives require a separate detonator.

Black powder, the first chemical explosive, was invented in China some 1,000 years ago. It is a mixture of saltpetre (potassium nitrate), sulfur, and charcoal, and originally was used exclusively for military purposes. Black powder was not used industrially until the 17th century, when it was adapted to blast out mines in Europe. To be detonated, black powder must be ignited by flame or intense heat; the original fuse systems were thin, trailing lines of the powder itself or crude wicks made of straw or other combustible materials combined with sprinklings of the powder.

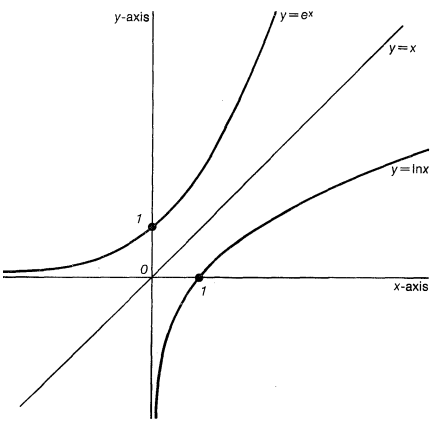
Nitroglycerin and dynamite succeeded black powder as the chief explosives. An Italian chemist, Ascanio Sobrero, discovered nitroglycerin in 1846. The Swedish scientist Alfred Nobel invented dynamite in 1867, the original explosive being a mixture of 75 percent nitroglycerin and 25 percent guhr (a porous, absorbent material that made the product easier to control and safer to use). Nobel developed gelatinous dynamite in 1875 by creating a jelly from the dissolution of a collodion-type nitrocotton in nitroglycerin, producing a more powerful explosive than the straight dynamites and one that proved to be safer. Later, ammonium nitrate was used in dynamite, which made it even more safe to use and less expensive to produce.

Other chemical explosives have been developed over the past 200 years, although their commercial uses have been on a considerably smaller scale. Among them are chlorates and percholates, Sprengel explosives, liquid oxygen explosives (known as LOX), and those made from nitrostarch and from Nitramon and Nitramex. Later explosives have included ammonium nitrate–fuel oil mixtures and water gels.

Two important developments in the history of explosives were the inventions of the safety fuse and the blasting cap. In 1831 William Bickford of England devised the safety fuse, originally a textile-wrapped cord with a black powder core, which for the first time enabled safe, accurately timed detonations. In 1865 Nobel invented the blasting cap, providing the first safe and dependable means for detonating nitroglycerin and thereby considerably expanding its use for industrial purposes. Electrical firing, first used successfully in the late 19th century, allows greater control over timing.

TNT has been the most common conventional military explosive during the 20th century. First used in the Russo-Japanese War in 1905, it became the basis for most of the explosives used in subsequent wars. Other important military explosives include picric acid and ammonium picrate (PETN).

exponential function, in mathematics, a relation of the form $y = a^x$, with the independent variable x ranging over the entire real line, as exponent (exp) of positive a. Probably the most important of the exponential functions is $y = e^x$, sometimes written $y = \exp(x)$, in which e is the base of the natural system of logarithms. By definition x is a logarithm, and



Curves of exponential and logarithmic functions

there is thus a logarithmic function the inverse of the exponential function (*see* the Figure). Specifically, if $y = \exp(x)$, then $x = \ln y$, in which ln is a natural logarithm (*q.v.*). The exponential function $\exp(\pm x)$ is also defined as the sum of the series

$$e^{\pm x} = 1 \pm x + \frac{x^2}{2!} \pm \frac{x^3}{3!} + \frac{x^4}{4!} \pm \frac{x^5}{5!} + \cdots,$$

which converges for all x and in which $n!$ is a product of the first n positive integers. Thus in particular, the constant

$$e^1 = 2.7182818\cdots$$
$$= 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \cdots + \frac{1}{n!} + \cdots.$$

The exponential functions are examples of so-called non-algebraic, or transcendental,

functions. Others are the logarithmic functions and the hyperbolic functions. Exponential functions frequently arise and quantitatively describe a number of phenomena in physics.

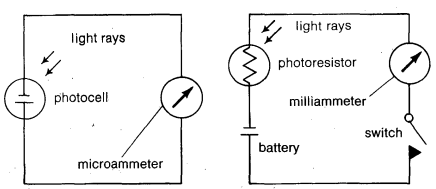
Export-Import Bank of the United States (EXIMBANK), one of the principal agencies of the United States government in international finance, originally incorporated as the Export-Import Bank of Washington on Feb. 12, 1934, to assist in financing United States exports. Legislation of March 13, 1968, changed the name of the bank.

The bank operates four principal programs: (1) direct long-term loans; (2) guarantees (principally to commercial banks); (3) short-term and medium-term insurance; and (4) discount loans to commercial banks. The greatest dollar volume of bank assistance has consisted of direct financing to buyers abroad of American goods and services. This assistance has taken the form of long-term credits to public or private entities for the purchase and export of capital equipment and related services, credits to foreign lending institutions for relending to local enterprises, credits to countries suffering temporary dollar shortages to maintain the flow of U.S. trade, and agricultural commodity credits. Through these programs the bank has become involved in the promotion of development projects in less developed countries.

The Export-Import Bank's loans, which are made in dollars and are repayable in dollars, are extended for specific purposes. The bank is required to encourage and supplement private capital but not compete with it. It is authorized to have outstanding in loans, guarantees, and insurance an aggregate amount not in excess of $40,000,000,000. Operating funds for these loans and other requirements are derived from repayments of principal and interest on loans; guarantee fees and insurance premiums; capital stock of $1,000,000,000; retained earnings; borrowings from the U.S. Treasury of up to $6,000,000,000; and the proceeds of sales of the bank's debentures, promissory notes, and interests in its portfolio of loans. The Export-Import Bank is governed by a five-man board of directors.

exposure meter, also called LIGHT METER, photographic auxiliary device that measures the intensity of light and indicates proper exposure (*i.e.,* the combination of aperture and shutter speed) for film of a specific sensitivity. Modern instruments are of two basic types: the self-generating, or photovoltaic, and the variable resistance, or photoconductive.

The photovoltaic type, usually with a selenium element, converts the incoming light directly into an electric current. A microammeter measures this current and is calibrated



Exposure meter circuits of the (left) photovoltaic and (right) photoconductive type

From *McGraw-Hill Encyclopedia of Science and Technology,* copyright 1971; used with permission of McGraw-Hill Book Co.

to indicate the intensity of the light. Exposure is then set by adjusting dials to control aperture opening and shutter speed, taking into consideration the specific sensitivity of the film.

In the photoconductive type, the element, a cadmium sulfide cell or silicon photodiodes, is connected to a battery-powered circuit and changes its resistance with variations in the light intensity. The change in current is measured by a milliammeter calibrated to read light intensity.

The exposure meter is incorporated into the camera mechanism of most modern hand cameras. The operator of a semiautomatic camera model sets the correct exposure by adjusting the exposure controls to align two pointers in the viewfinder; in fully automatic cameras, the exposure is adjusted by the camera mechanism itself.

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

Expressionism, artistic style in which the artist seeks to depict not objective reality but rather the subjective emotions and responses that objects and events arouse in him. He accomplishes his aim through distortion, exaggeration, primitivism, and fantasy and through the vivid, jarring, violent or dynamic application of formal elements. In a broader sense Expressionism is one of the main currents of art in the later 19th and the 20th centuries, and its qualities of highly subjective, personal, spontaneous self-expression are typical of a wide range of modern artists and art movements. Expressionism can also be seen as a permanent tendency in Germanic and Nordic art from at least the Middle Ages, particularly in times of social change or spiritual crisis, and in this sense it forms the converse of the rationalist and classicizing tendencies of Italy and later of France.

More specifically, Expressionism as a distinct style or movement refers to a number of German artists, as well as Austrian, French, and Russian ones, who became active in the years prior to World War I and remained so throughout much of the interwar period.

The roots of the German Expressionist school lay in the works of Vincent Van Gogh, Edvard Munch, and James Ensor, each of whom in the period 1885–1900 evolved a highly personal painting style. These artists used the expressive possibilities of colour and line to explore dramatic and emotion-laden themes, to convey the qualities of fear, horror, and the grotesque, or simply to celebrate nature with hallucinatory intensity. They broke away from the literal representation of nature in order to express more subjective outlooks or states of mind.

The second and principal wave of Expressionism began about 1905, when a group of German artists led by Ernst Ludwig Kirchner formed a loose association called Die Brücke ("The Bridge"; *see* Brücke, Die). The group included Erich Heckel, Karl Schmidt-Rottluff, and Fritz Bleyl. These painters were in revolt against what they saw as the superficial naturalism of academic Impressionism. They wanted to reinfuse German art with a spiritual vigour they felt it lacked, and they sought to do this through an elemental, primitive, highly personal and spontaneous expression. Die Brücke's original members were soon joined by the Germans Emil Nolde, Max Pechstein, and Otto Müller. The Expressionists were influenced by their predecessors of the 1890s and were also interested in African wood carvings and the works of such Northern European medieval and Renaissance artists as Albrecht Dürer, Matthias Grünewald, and Albrecht Altdorfer. They were also aware of Neo-Impressionism, Fauvism, and other recent movements.

The German Expressionists soon developed a style notable for its harshness, boldness, and visual intensity. They used jagged, distorted lines; crude, rapid brushwork; and jarring colours to depict urban street scenes and other contemporary subjects in crowded, agitated compositions notable for their instability and their emotionally charged atmosphere. Many of their works express frustration, anxiety, disgust, discontent, violence, and generally a sort of frenetic intensity of feeling in response to the ugliness, the crude banality, and the possibilities and contradictions that they discerned in modern life. Woodcuts, with their thick jagged lined and harsh tonal contrasts, were one of the favourite media of the German Expressionists.

The works of Die Brücke artists stimulated Expressionism in other parts of Europe. Oskar Kokoschka and Egon Schiele of Austria adopted their tortured brushwork and angular lines, and Georges Rouault and Chaim Soutine in France each developed painting styles marked by intense emotional expression and the violent distortion of figural subject matter. The painter Max Beckmann, the graphic artist Käthe Kollwitz, and the sculptors Ernst Barlach and Wilhelm Lehmbruck, all of Germany, also worked in Expressionist modes. The artists belonging to the group known as the Blaue Reiter (*q.v.*) are sometimes regarded as Expressionists, although their art is generally less overtly emotional, more harmonious, and more concerned with formal and pictorial problems than that of Die Brücke artists.

Expressionism was a dominant style in Germany in the years immediately following World War I, where it suited the postwar atmosphere of cynicism, alienation, and disillusionment. Some of the movement's later practitioners, such as George Grosz and Otto Dix, developed a more pointed, socially critical blend of Expressionism and realism known as the Neue Sachlichkeit (*q.v.*). As can be seen from such labels as Abstract Expressionism and Neo-Expressionism, the spontaneous, instinctive, and highly emotional qualities of Expressionism have been shared by several subsequent art movements in the 20th century.

Expressionism in literature arose as a reaction against materialism, complacent bourgeois prosperity, rapid mechanization and urbanization, and the domination of the family within in pre-World War I European society. It was the dominant literary movement in Germany during and immediately after World War I. In forging a drama of social protest, Expressionist writers aimed to convey their ideas through a new style. Their concern was with general truths rather than with particular situations, hence they explored in their plays the predicaments of representative symbolic types rather than of fully developed individualized characters. Emphasis was laid not on the outer world, which is merely sketched in and barely defined in place or time, but on man's inner mental life; hence the imitation of life is replaced in Expressionist drama by the ecstatic evocation of states of mind. The leading character in an Expressionist play often pours out his woes in long monologues couched in a concentrated, elliptical, almost telegrammatic language that explores youth's spiritual malaise, its revolt against the older generation, and the various political or revolutionary remedies that present themselves. The leading character's inner development is explored through a series of loosely linked tableaux, or "stations," during which he revolts against traditional values and seeks a higher spiritual vision of life.

August Strindberg and Frank Wedekind were notable forerunners of Expressionist drama, but the first full-fledged Expressionist play was Reinhard Johannes Sorge's *Der Bettler* ("The Beggar"), which was written in 1912 but not performed until 1917. The other principal playwrights of the movement were Georg Kaiser, Ernst Toller, Paul Kornfeld, Fritz von Unruh, Walter Hasenclever, and Reinhard Goering, all of Germany.

Expressionist poetry, which arose at the same time as its dramatic counterpart, was similarly nonreferential and sought an ecstatic, hymnlike lyricism that would have considerable

associative power. This condensed, stripped-down poetry, utilizing strings of nouns and a few adjectives and infinitive verbs, eliminated narrative and description to get at the essence of feeling. The principal Expressionist poets were Georg Heym, Ernst Stadler, August Stramm, Gottfried Benn, Georg Trakl, and Else Lasker-Schüler of Germany and the Czech poet Franz Werfel. The dominant theme of Expressionist verse was horror over urban life and apocalyptic visions of the collapse of civilization. Some poets were pessimistic and contented themselves with satirizing bourgeois values, while others were more concerned with political and social reform and expressed the hope for a coming revolution. Outside Germany, playwrights who used Expressionist dramatic techniques included the American authors Eugene O'Neill and Elmer Rice.

Strongly influenced by Expressionist stagecraft, the earliest Expressionist films set out to convey through decor the subjective mental state of the protagonist. The most famous of these films is Robert Wiene's *The Cabinet of Dr. Caligari* (1919), in which a madman relates to a madwoman his understanding of how he came to be in the asylum. The misshapen streets and buildings of the set are projections of his own crazy universe, and the other characters have been abstracted through makeup and dress into visual symbols. The film's morbid evocation of horror, menace, and anxiety and the dramatic, shadowy lighting and bizarre sets became a stylistic model for Expressionist films by several major German directors. Paul Wegener's second version of *The Golem* (1920), F.W. Murnau's *Nosferatu* (1922), and Fritz Lang's *Metropolis* (1927), among other films, present pessimistic visions of social collapse or explore the ominous duality of human nature and its capacity for monstrous personal evil.

While some classify the composer Arnold Schoenberg as an Expressionist because of his contribution to the Blaue Reiter almanac, musical Expressionism seems to have found its most natural outlet in opera. Among early examples of such Expressionist works are Paul Hindemith's operatic settings of Kokoschka's proto-Expressionist drama, *Mörder, Hoffnung der Frauen* (1919), and August Stramm's *Sancta Susanna* (1922). Most outstanding of the Expressionist operas, however, are two by Alban Berg: *Wozzeck,* performed in 1925, and *Lulu,* which was not performed in its entirety until 1979.

The decline of Expressionism was hastened by the vagueness of its longing for a better world, by its use of highly poetic language, and in general the intensely personal and inaccessible nature of its mode of presentation. The partial reestablishment of stability in Germany after 1924 and the growth of more overtly political styles of social realism hastened the movement's decline in the late 1920s. Expressionism was definitively killed by the advent of the Nazis to power in 1933. They branded the work of almost all Expressionists as degenerate and forbade them to exhibit or publish and eventually even to work. Many Expressionists went into exile in the United States and other countries.

Consult the INDEX *first*

expressway, also called THROUGHWAY, THRUWAY, PARKWAY, FREEWAY, SUPERHIGHWAY, or MOTORWAY, major arterial divided highway that features two or more traffic lanes in each direction, with opposing traffic separated by a median strip; elimination of grade crossings; controlled entries and exits; and advanced designs eliminating steep grades, sharp curves, and other hazards and inconveniences to driving. Frequently expressways have been constructed over completely new routes, passing near but not through large centres of population, on more or less direct lines between desired termini. Their advantages include high speed, greater safety, comfort and convenience for drivers and passengers, and lower vehicle operating costs. Many of these new express highways, especially in the United States, are toll roads, but that is an incidental, not an essential, feature.

Aerial view of a cloverleaf interchange on a Los Angeles expressway, called a freeway

Union Pacific Railroad Photo

In 1924 Italy began the construction of toll motor highways, or *autostrade,* that soon totaled 320 miles (515 km) in length. Although these did not attain the standards of later express highways, they did incorporate the features of limited access and elimination of grade crossings. They were built and owned by private companies and paid for by tolls and advertising. The first true express highways, the autobahns, were built in Germany. Although the idea originated and plans were formulated between 1930 and 1932, a national network, the *Reichsautobahnen,* totaling 1,310 miles (2,110 km) by 1942, was built by the Nazi regime for both economic and military purposes. The only other European country to undertake construction of express highways before World War II was The Netherlands. In the United States the Pennsylvania Turnpike and the Merritt Parkway in Connecticut were completed shortly before the nation's entrance into the war in 1941.

After the war the express highway movement gained momentum, slowly at first because of financial difficulties and the urgency of post-war reconstruction, then more rapidly. By 1950 eight U.S. states had toll roads that met express highway standards and totaled more than 750 miles (1,210 km). After that date virtually every state constructed some express highway mileage on either a toll or a toll-free basis. In Great Britain the Special Roads Act of 1949 provided a network of about 700 miles (1,130 km) of new "motorways," a total subsequently extended to more than 1,000 miles (1,600 km). France built several short express highways, or *autoroutes,* in the 1950s to facilitate egress from its major cities but, with governmental policy favouring rail travel, did not undertake major programs of new construction until the 1960s and '70s. West Germany resumed construction of the autobahns in 1957, with three four-year plans for federal highways. By 1970 it had about one-fourth of the European total. In 1964 Italy completed the *Autostrada del Sole,* stretching almost 500 miles (800 km) from Milan to Naples, to which numerous branches, spurs, and extensions were added. Other European countries and Japan also built express highways. Even some developing countries in Africa and Latin America built short stretches in the vicinity of their capital cities.

The most ambitious of all express highway systems was the National System of Interstate Highways of the United States. Recognizing the military value of highways as well as the need for a vast program of highway improvement, Congress authorized the project in 1944 but did not appropriate special funds for it until several years later. Originally limited to 40,000 miles (64,400 km), the system incorporated existing express highways built to its specifications, whether toll or free; but by far the largest part resulted from new highway construction financed mainly by the federal government. In 1956 Congress authorized $25,000,000,000 of federal funds, approximately 90 percent of the total estimated cost, to be expended over a 12-year period. In fact, however, unit costs more than doubled, and the construction program fell behind schedule. The Highway Act of 1968 extended the total mileage to 44,000 miles (70,800 km) and the building program to 1974. Thereafter, the building of expressways in the United States continued—but at a slower rate.

expropriation (property law): *see* eminent domain.

exsolution, in mineralogy, process through which an initially homogeneous solid solution separates into at least two different crystalline minerals without the addition or removal of any materials. In most cases, it occurs upon cooling below the temperature of mutual solubility or stability of the solution. The sodium-rich feldspar albite ($NaAlSi_3O_8$) and the potassium-rich feldspar orthoclase ($KAlSi_3O_8$), for example, may exist in a homogeneous solid solution above 650° C (1,200° F), but below that temperature exsolution will occur.

extemporization (music): *see* improvisation.

extended family, an expansion of the nuclear family (parents and dependent children), usually built around a unilineal descent group (*i.e.,* a group in which descent through either the female or the male line is emphasized). The extended family system often, but not exclusively, occurs in regions in which economic conditions make it difficult for the nuclear

family to achieve self-sufficiency. Cooperation being necessary, aid is recruited, usually either from the patrilineal kin or the matrilineal kin. In traditional China, for example, the extended family ideally consisted of the nuclear family of the head of the household, his unmarried daughters, his sons and their families, his sons' sons' families and unmarried daughters, and so forth. The extended family may include more distant kin, but the uncles, aunts, or cousins usually belong to the same clan as members of the core lineage.

The relationships between members of the extended family are such that the form of address a person employs consists of an extension of nuclear family terms to a wider circle of relatives within the resident clan. In a matrilineal family, for example, a person might refer to his maternal uncle as "father" and to the latter's children as "brothers" and "sisters." The extended family does not necessarily live in the same dwelling, but normally the members live close together and work in teams.

It is common for the senior kin to assume the role of mate selection for those of marriageable age, who are considered too inexperienced to make a proper choice. Qualities sought in a spouse by the interested kin in an extended family include work ability, capacity to adapt, procreative power, status, and financial worth.

In common usage, the term extended family has been given a variety of meanings. It may, for example, refer to a household that includes other kin in addition to the members of the nuclear family (known in anthropological terminology as a conjugal family), or it may be loosely applied to mean all living consanguineal kin. *Compare* nuclear family.

extension (logic): *see* intension and extension.

extensive agriculture, in agricultural economics, system of crop cultivation using small amounts of labour and capital in relation to area of land being farmed. The crop yield in extensive agriculture depends primarily on the natural fertility of the soil, terrain, climate, and the availability of water.

Extensive agriculture is distinguished from intensive agriculture in that the latter, employing large amounts of labour and capital, enables one to apply fertilizers, insecticides, fungicides, and herbicides and to plant, cultivate, and often harvest mechanically. Because extensive agriculture produces a lower yield per unit of land, its use commercially requires large quantities of land in order to be profitable. This demand for land means that extensive agriculture must be carried on where land values are low in relation to labour and capital, which in turn means that extensive agriculture is practiced where population densities are low and thus usually at some distance from primary markets. *Compare* intensive agriculture.

extensor muscle, any of the muscles that increase the angle between members of a limb, as by straightening the elbow or knee or bending the wrist or spine backward. The movement is usually directed backward, with the notable exception of the knee joint. In humans, certain muscles of the hand and foot are named for this function. In the hand these include the extensor carpi radialis brevis, extensor carpi radialis longus, and extensor carpi ulnaris, which run from the humerus (bone of the upper arm) along the back of the forearm to the metacarpal bones at the back of the hand and which extend the wrist; the extensor digitorum, which runs from the humerus to a common tendon attached to all of the fingers and which extends the fingers; the extensor indicis, which acts upon the index finger; and the extensor pollicis brevis and extensor pollicis longus, which run from the radius and ulna (bones of the forearm), respectively, and act upon the thumb.

Extensors in the foot include the extensor digitorum longus and extensor digitorum brevis, which originate at the upper and lower parts of the lower leg and act through long tendons upon the toes, and the extensor hallucis brevis and extensor hallucis longus, which act upon the great toe. The longus muscles of the foot also aid upward flexion of the foot at the ankle. *Compare* flexor muscle.

extenuating circumstance, circumstance that diminishes the culpability of one who has committed a criminal offense and so can be considered to mitigate the punishment.

Many Anglo-American legal systems do not prescribe minimum punishments for all crimes. The judge is thus free to consider all the circumstances in setting the punishment up to a prescribed maximum. Some special circumstances automatically reduce an offense to one of lesser degree; for example, provocation of the accused by the victim reduces first-degree murder to manslaughter or second-degree murder. In England, the jury may reduce a charge of murder to manslaughter if the accused is found to be suffering diminished responsibility (distinguished from insanity, which permits acquittal).

Civil-law countries make much more use of prescribed minimum sentences for crime and consequently have had to develop more formal doctrines of extenuating circumstances. The Italian penal code gives a list of extenuating circumstances, such as that the accused acted from motives of honour, that he committed the offense in a state of intense emotion caused by grave misfortune, or that before the trial he repaired the injury by giving compensation. The French and Japanese penal codes provide for reduction of punishment according to a prescribed scale when the jury or court finds extenuating circumstances.

extermination camp, German VERNICHTUNGSLAGER, German Nazi concentration camp that specialized in the mass annihilation (*Vernichtung*) of unwanted persons in the Third Reich and conquered territories; the victims were mostly Jews but also included Gypsies, some Slavic races, alleged mental defectives, and others. The major camps were in Poland and included Auschwitz, Belzec, Chełmno, Majdanek, Sobibor, and Treblinka (*qq.v.*). At its peak, Auschwitz, the most notorious of the camps, housed 100,000 persons; the poison-gas chambers could accommodate 2,000 at one time; and 12,000 could be gassed and incinerated each day. Prisoners who were deemed able-bodied were initially used in industrial-labour battalions or in the tasks of genocide until they were virtually worked to death and then exterminated. *See also* Holocaust.

Exterminator, byname OLD BONES (foaled 1915), American racehorse (Thoroughbred), a dependable and durable horse who won 50 of 100 races in eight seasons. Because of the length of his career and his extraordinary ability to win sprints and long-distance races under heavy weights, some horsemen considered him superior to Man o' War, his greatest contemporary and doubtless the fastest American horse of the time. (The two never raced against each other.) A chestnut gelding sired by McGee (an English-bred stallion) out of Fair Empress and foaled in Kentucky, Exterminator raced with little success as a two-year-old, but in 1918 he won the Kentucky Derby. He finished second and third 17 times each.

external auditory canal, also called EXTERNAL AUDITORY MEATUS, OF EXTERNAL ACOUSTIC MEATUS, passageway that leads from the outside of the head to the tympanic membrane, or eardrum membrane, of each ear. The structure of the external auditory canal is the same in all mammals. In appearance it is a slightly curved tube that extends inward from the floor of the auricle, or protruding portion of the outer ear, and ends blindly at the eardrum membrane, which separates it from the middle ear. The outside third of the canal wall consists of cartilage, and the inner two-thirds of the wall are made of bone. The canal is nearly 1 inch (2.5 cm) in length and is lined with skin that extends to cover the tympanic membrane. Tiny hairs directed outward and modified sweat glands that produce cerumen (earwax) help to discourage insects from entering the ear.

exterritoriality: *see* extraterritoriality.

extinction, in biology, the dying out or termination of a race or species. Extinction occurs when a species can no longer reproduce at replacement levels. Most extinctions are thought to have resulted from environmental changes that affected the species in either of two ways. The doomed species might not have been able to adapt to the changed environment and thus perished without descendants; or it may have adapted but, in the process, may have evolved into a distinctly new species. The effect of humans on the environment, through hunting, collecting, and habitat destruction, has become a significant factor in plant and animal extinctions.

Although extinction is an ongoing feature of the Earth's flora and fauna (the vast majority of species ever to have lived are extinct), the fossil record reveals the occurrence of a number of mass extinctions, each involving the demise of vast numbers of species. One such mass extinction occurred at the end of the Cretaceous period, some 66,000,000 years ago, when the dinosaurs and much of the marine life of the day perished. Evidence points to the impact of an asteroid hitting the Earth as the cause of the Cretaceous extinctions. It is suspected that catastrophic events—such as an asteroid impact—may have triggered other mass extinctions as well. In fact, mass extinctions appear to have taken place approximately every 26,000,000 years, which has led some paleontologists to propose that a cyclical cosmic event causes these periodic die-offs.

extinguisher moss, any of the plants of the genus *Encalypta* (order Bryales), which form large tufts on limestone rocks, ledges, and walls. About eight species are native to North America. They are usually 1 to 3 cm (0.4 to 1.2 inches) tall, with erect capsules (spore cases) borne on setae (stalks) about 5 to 10 mm (0.2 to 0.4 inches) long. The calyptra (hoodlike covering) of each capsule resembles a candle snuffer, or extinguisher, and extends below the capsule; in *E. ciliata* the calyptra is fringed.

extortion, the unlawful exaction of money or property through intimidation. Extortion was originally the complement of bribery, both crimes involving interference with or by public officials. But extortion and, to a limited extent, bribery have been expanded to include actions by private citizens as well.

Extortion may include threats of harm to a person or his property, threats to accuse him of a crime, or threats to reveal embarrassing information. Some forms of threat are occasionally singled out for separate statutory treatment under the designation "blackmail."

The scope given to the offense of extortion in a particular legal system is determined partly by the content of the related offense of robbery. Robbery is typically confined to taking property from the person or presence of the victim by violence or by threat to do an immediate physical harm. More remote and less terrifying threats fall within the province of the extortion and blackmail statutes. It is sometimes said that in extortion the victim

consents, although under duress, while in robbery his will is overwhelmed so that there is no consent; but this is an extremely tenuous distinction.

The crime of extortion is defined to exclude bargaining processes that are lawful; for example, a union official may threaten to call a strike for higher wages. Such threats are criminal only if used to obtain money or property for the personal gain of the actor. *See also* bribery.

extracellular fluid, in biology, body fluid that is not contained in cells. It is found in blood, lymph, body cavities lined with serous (moisture-exuding) membrane, the cavities and channels of the brain and spinal cord, and the muscular and other body tissues. It differs from intracellular fluid (fluid within the cells) in that it generally has a high concentration of sodium and low concentration of potassium, while intracellular fluid is high in potassium and low in sodium.

extract printing (textile industry): *see* discharge printing.

extradition, process by which one state, upon the request of another, effects the return of a person for trial for a crime punishable by the laws of the requesting state and committed outside the state of refuge. The request itself distinguishes extradition from other measures—such as banishment, expulsion, and deportation—for the forcible removal of undesirable persons.

According to the principle of territoriality of criminal law, a state does not apply its penal statutes to acts committed outside its boundaries except in the protection of special national interests. In view of the solidarity of nations in the repression of crime, however, states are usually willing to cooperate in bringing a criminal to justice.

Extradition is regulated within countries by extradition acts and between countries by diplomatic treaties. Belgium passed the first act in 1833. Such acts specify extraditable crimes, clarify the procedures and safeguards, and stipulate the relationship between the act and international treaties.

The laws of the various nations differ greatly as to the relationship between acts and treaties. In the United States, extradition must fall under the provisions of a treaty as long as Congress has not legislated to the contrary. This is also the case in England, Belgium, and The Netherlands. On the other hand, the French extradition act has application on its own terms, in matters not regulated in treaties. Germany and Switzerland extradite apart from a formal convention so long as their governments and the requesting state have exchanged declarations of reciprocity. Most nations grant extradition even in the absence of binding international obligations.

Some principles of extradition are common to many countries. Most states decline any obligation to surrender their own nationals. Germany, The Netherlands, Belgium, France, and Switzerland prohibit such extradition. In Argentina, England, and the United States, nationals may be extradited only if the governing treaty authorizes it.

Another common principle is that of double criminality, under which extradition will be barred unless it is for an offense punishable in the surrendering state. Countries also generally recognize the right of asylum for political offenders. The characterization of an offense as political, however, is subject to widely divergent definitions.

Under the principle of speciality, surrender is made on condition that the requesting state not convict or punish the individual for any crime different from that for which he was extradited. This protection may be waived by the extraditing state.

extrasensory perception (ESP), perception that occurs independently of the known sensory processes. Usually included in this category of phenomena are telepathy, or thought transference between persons; clairvoyance, or supernormal awareness of objects or events not necessarily known to others; and precognition, or knowledge of the future. Scientific investigation of these and similar phenomena dates from the late 19th century, with most supporting evidence coming from experiments involving card guessing. Subjects attempt to guess correctly the symbols of cards hidden from their view under controlled conditions; a better-than-chance percentage of correct calls on a statistically significant number of trials is considered to be evidence of ESP. Although many scientists continue to doubt the existence of ESP, people who claim this ability are sometimes used by investigative teams searching for missing persons or things.

extraterritoriality, also called EXTERRITORIALITY, or DIPLOMATIC IMMUNITY, in international law, the immunities enjoyed by foreign states or international organizations and their official representatives from the jurisdiction of the country in which they are present. Extraterritoriality extends to foreign states or international organizations as entities and to their heads, legations, troops in passage, war vessels, mission premises, and other assets. It exempts them, while within the territory of a foreign sovereign, from local judicial process, police interference, and other measures of constraint. The term stems from the fiction that such persons or things are deemed not to be within the territory of the sovereign where they are actually present. This doctrine was originated by the French jurist Pierre Ayraut (1536–1601) and gained wide currency because of its adoption by the classical writers on the law of nations such as Hugo Grotius (1583–1645) and Samuel von Pufendorf (1632–1694). The word extraterritoriality or its foreign equivalent was not in use until the end of the 18th century. It gained a place in the legal vocabulary through its use, if not creation, by Georg Friedrich von Martens (1756–1821), whose treatise on the law of nations, published in 1788, acquired international repute and was promptly translated into several languages, including English.

The actual scope of the immunities comprised in the doctrine of extraterritoriality depends, according to the circumstances, on principles of customary international law as applied in a particular country, on specific statutory or executive regulation, or on international agreements. The right has been extended to provide certain exemptions from local jurisdiction to merchant ships in foreign waters.

One of the classical cases leading to the emergence of the extraterritoriality doctrine was that of a foreign sovereign visiting a friendly country. It became recognized that no local jurisdiction, whether criminal or civil, could be exercised over the sovereign. The rule was later extended to republican heads of state.

The extraterritoriality of ambassadors and other diplomatic representatives is likewise of long standing. When, for example, during the reign of Queen Anne of Great Britain, the Russian ambassador was arrested for debt, an international incident ensued, and the famous Act Preserving the Privileges of Ambassadors (1708) was passed. The United States enacted a substantially identical statute in 1790. A United Nations Conference on Diplomatic Intercourse and Immunities, held in Vienna in 1961, resulted in the signing of a Convention on Diplomatic Relations.

There appears to be general agreement that a diplomatic agent, during the term of his office, is totally exempt from both criminal and civil jurisdiction in the state where he is accredited. According to the Vienna Convention, this immunity extends both to the family of the diplomatic agent and to his staff. The mission and residential premises of diplomatic agents are immune not only from process by creditors but also from being entered by the police and other law enforcement officers. Whether and under what conditions they may be used to grant asylum to outsiders is controversial. An Inter-American Convention (1954) sanctions diplomatic asylum for political offenders and refugees.

Foreign consular officers do not enjoy exemptions from the local administration of justice to the same extent as the staffs of foreign diplomatic missions, and the law governing consular immunities is less a matter of settled customary international rules than of bilateral or multilateral treaties.

The United Nations, as a legal entity, its officials, and the members of the delegations of the member states to the United Nations enjoy extensive procedural, fiscal, and other immunities from the jurisdiction of the countries where they are present. In the vast majority of the member nations, the matter is regulated by the Convention on the Privileges and Immunities of the United Nations, adopted by the General Assembly in 1946. Separate and special arrangements, however, govern in the United States and Switzerland because the United States includes the UN headquarters and Switzerland has UN offices at Geneva. In the United States the ranking resident representatives of the member states, as well as such resident members of their staffs as are agreed upon, are entitled, within the country, to the customary diplomatic immunities. Accordingly, for instance, they or their spouses may not be charged in U.S. courts with traffic violations. The officers and employees of the United Nations, if reported to and accepted as such by the State Department, are likewise entitled to certain privileges and exemptions. Their jurisdictional immunities are considerably more restricted, however, as they extend only to acts performed by them in their official capacity. *See also* consul.

Consult the INDEX *first*

extratropical cyclone, also called WAVE CYCLONE, storm system formed in middle or high latitudes, in regions of large horizontal temperature variations called frontal zones. Extratropical cyclones present a contrast to the more violent cyclones or hurricanes of the tropics, which form in regions of relatively uniform temperatures.

According to the polar-front theory, extratropical cyclones develop when a wave forms on a frontal surface separating a warm air mass from a cold air mass. As the amplitude of the wave increases, the pressure at the centre of disturbance falls, eventually intensifying to the point at which a closed cyclonic circulation begins. The decay of such a system results when the cold air from the north in the Northern Hemisphere, or from the south in the Southern Hemisphere, on the western side of such a cyclone sweeps under all of the warm tropical air of the system so that the entire cyclone is composed of the cold air mass. This action is known as occlusion.

Typical weather sequences are associated with extratropical cyclones. Stations ahead of the approaching front side of the wave, called the warm front, normally experience increasingly thickening and lowering clouds, followed by precipitation, which normally persists until the centre of the cyclone passes by the station. If the station is located far to the south of the cyclone centre, then usually only a relatively short period of precipitation occurs during the passage of the back side of the wave, called the cold front. In middle latitudes, many ex-

tratropical cyclones normally exist around the globe at any given time. These storms tend to form in preferred locations and follow typical paths, although exceptions to these typical patterns often occur. *Compare* tropical cyclone.

extrauterine pregnancy: *see* ectopic pregnancy.

Extremadura, also spelled ESTREMADURA, *comunidad autónoma* (autonomous community) and historic region of Spain encompassing the southwestern Spanish provinces of Cáceres and Badajoz. It was established by the statute of autonomy in 1983 and has an area of 16,063 square miles (41,602 square km).

During the Christian reconquest of the Iberian Peninsula, the name Extremadura was used during static periods to refer to the zones outside of Moorish territory; it denoted a set region, but its borders fluctuated with the fortunes of conquest. In the 10th and 11th centuries the border approximated the line of the Duero River from Soria in the east to the Atlantic coast near Coimbra in modern Portugal. About 1086 the name Extremadura was transferred to a newly conquered region to the south, which included Salamanca, Segovia, and Ávila. This, at first, was described as "Extremadura beyond the Duero" to distinguish it from the older region of the same name.

Leon, following its southern expansion between 1157 and 1230, also had a province called Extremadura, which stretched southward from Ciudad Rodrigo to beyond Badajoz. In the 12th and early 13th centuries, therefore, both Leon and Castile had Extremaduran provinces, administered as separate entities by each kingdom. Later, in the reign of Ferdinand III of Castile and Leon, this separate administration was abandoned, and from the later European Middle Ages the term was applied to a region only slightly larger than the combined area of the two modern provinces. The region came under the jurisdiction of the royal audiencia, or high court, of Extremadura in 1790, and the present-day provinces were created in 1833.

Extremadura is bordered by Portugal to the west. Spain's Central Plateau extends south from the province of Salamanca into the province of Cáceres and declines gradually into the eroded flatlands of Cáceres. To the northeast Cáceres is bounded by the province of Ávila. The mountains of Toledo mark the border with the province of Toledo to the west. The Tagus River drains much of the province of Cáceres, while the Guadiana River is primarily associated with the province of Badajoz. Both rivers flow chiefly through flatlands. The basin of the Guadiana runs from the province of Ciudad Real west through the plains of Badajoz.

The soils of the southern plains of the basin tend to be thin, supporting only marginal grainfields and thickets of scrub. The Sierra Morena rises in the south along the border with the Andalusian provinces of Córdoba, Sevilla, and Huelva. Annual precipitation is moderate, exceeding 20 inches (500 mm) outside the eastern zones of the province of Badajoz, where it is only slightly less. The continental climate of the Central Plateau extends into Extremadura but is modified somewhat by Atlantic influences, which travel up the Tagus River valley.

The population of the province of Badajoz follows an Andalusian pattern of settlement, being concentrated in large, widely spaced towns. The population of the province of Cáceres, however, tends to cluster in small villages in the valleys. The population of Extremadura has been sparse since the Muslim occupation. Large numbers of underemployed agricultural workers have emigrated since 1900, leaving behind an ever more aging population.

The countryside remains partitioned into latifundios (large estates), which are primarily farmed by landless day labourers. Land reform was attempted under the Second Republic (1931–1936) but was largely reversed by the subsequent government of General Francisco Franco. Extremadura has been a major transhumant zone since the 13th century, and animal husbandry continues to account for a large fraction of the region's agricultural output. Sheep and pigs are the chief livestock and are steadily displacing goats. Significant agricultural reform was not undertaken until the late 18th century. The government allowed vineyards and olive groves to be enclosed in 1779 and extended this protection to all arable lands in 1788. The cultivation of wheat increased appreciably during the 19th century, and grapes and olives became important crops after 1860. Dry farming now predominates, with winter wheat a major crop. The Plan Badajoz, initiated in 1952, has brought about a modest increase in the land area under irrigation. Forestry is of growing importance but has yet to fully exploit the region's extensive forests of beech, oak, and chestnut.

Extremadura's industrial sector is underdeveloped, with most industries processing primary products. Flour is milled throughout the region, and the introduction of cotton has given rise to a modest textile industry. Extremadura's service sector is similarly underdeveloped. The cities of Badajoz and Ciudad Real were linked by railroad in 1868, and the city of Cáceres was linked to Lisbon and Madrid in 1881. Extremadura remains, however, an isolated and peripheral region of Spain that has generally poor communications with the industrial centres of the nation. The leading commercial centres of Extremadura are Cáceres, Badajoz, Mérida, and Plasencia. Pop. (1988 est.) 1,097,801.

extremum, plural EXTREMA, in mathematics, any point at which the value of a function is largest (a maximum) or smallest (a minimum). There are both absolute and relative (or local) maxima and minima. At a relative maximum the value of the function is larger than its value at immediately adjacent points, while at an absolute maximum the value of the function is larger than its value at any other point in the interval of interest. At relative maxima inside the interval, if the function is smooth rather than peaked, its rate of change, or derivative, is zero. The derivative may be zero, however, at a point where the function has neither a maximum nor a minimum, as in the case for the function x^3 at $x = 0$. One way to determine this is by going back to the original definition and finding the value of the function at immediately adjacent points. For example, the function $x^3 - 3x$ has the derivative $3x^2 - 3$, which equals 0 when x is ± 1. By testing nearby points, such as 0.9 and 1.1, the function is seen to have a relative minimum when x is 1 and, similarly, a relative maximum when x is -1. There is also a second-derivative test: if the derivative of a function is zero at a point, then the function will have a relative maximum or minimum if the second derivative at that point is less than or greater than 0, respectively, the test failing if it equals 0. Relative maxima can also occur at points at which the derivative fails to exist, and these points must also be tested.

The theory of extrema applies to practical problems of optimization such as finding the dimensions for a container that will hold the maximum volume for a given amount of material used in its construction. Locating the extreme points also aids in graphing functions.

extrinsicism, in philosophy or theology or both, the tendency to place major emphasis on external matters rather than on more profound realities. In terms of morals and ethics, it tends to stress the external observance of laws and precepts, with lesser concern for the ultimate principles underlying moral conduct.

In Christian thought, for example, this is illustrated by the tendency to define the church in terms of such exterior elements as its social structure, rituals, and the obligations it imposes on the faithful, rather than to view it as an essentially spiritual entity. Historically, extrinsicism has been an especially important factor in disputes over the nature of supernatural grace. Roman Catholic doctrine holds that grace effects an interior transformation, in opposition to the 5th-century Pelagian heresy, which emphasized salvation by works alone, and to the teaching of those Reformers who saw grace as a totally extrinsic acceptance of the sinner by God.

extrovert, also spelled EXTRAVERT, personality type, according to theories of the Swiss psychiatrist Carl Jung, characterized by outgoingness in attention and interest, responsiveness to other persons, and impulsiveness; an extrovert is the opposite of an introvert (*q.v.*). An extreme extrovert may become aggressive and overdependent on group acceptance, losing independence in actions and thoughts. Subsequent research has placed most persons between Jung's two types—*i.e.,* no one can be accurately described as wholly extrovert or introvert.

extrusive rock, any rock derived from magma (molten silicate material) poured out or ejected at the surface of the Earth. Such rocks are distinct from the intrusive ones, which are rocks that have been emplaced at depth in the Earth's crust. Both lava flows and pyroclastic rocks are extrusive; they are commonly glassy (obsidian) or finely crystalline (basalts and felsites). Most extrusive rocks have an intrusive mineralogical or chemical equivalent from which they differ mainly in their degrees of crystallinity. Rock classifications usually distinguish extrusive and intrusive rocks according to the recognizability of mineral constituents in a hand specimen.

Exxon Corporation, formerly (until 1972) STANDARD OIL COMPANY (NEW JERSEY), one of the world's largest corporations in terms of sales, with investments and operations in petroleum and natural gas, coal, nuclear fuels, chemicals (raw materials, solvents, plastics), and such ores as copper, lead, and zinc. It also operates pipelines and one of the world's largest fleets of tankers and other ships. Exxon engages in every phase of the petroleum industry from oil fields to service stations. It is headquartered in Irving, Texas, a suburb of Dallas.

The company was founded in 1882 by the Standard Oil trust (*see* Standard Oil Company and Trust) and in 1899 became the holding company for all companies previously grouped in the trust. In 1911 the U.S. Supreme Court ordered it to divest itself of 33 of its American subsidiaries.

Meanwhile, the New Jersey company had become a "multinational" corporation. In 1888 it organized Anglo-American Oil Co. (predecessor of Esso Petroleum Co.) to market oil in the British Isles and, two years later, acquired a major interest in the German firm that would become Esso AG. In 1898 it gained control of Imperial Oil Limited, Canada's leading oil company. A few of the many later acquisitions (complete or partial) included Humble Oil & Refining Co. (1919), Tropical Oil Co. of Colombia (1920), Standard Oil Co. of Venezuela (1921), Creole Petroleum Co. of Venezuela (1928), Turkish (now Iraq) Petroleum Co. (1928), and Arabian American Oil Co. (1948).

In 1926 the New Jersey company introduced the trade-name Esso and applied it to many of its products and companies. Other Standard Oil companies, however, later contested the name in the courts and succeeded in barring its use in several states. Thus, in 1972,

Standard Oil Company (New Jersey) became Exxon Corporation; and many subsidiaries and affiliates, such as Humble, also switched to the Exxon name. Many foreign affiliates, however, retained the Esso name.

Exxon operates in more than 80 countries and manages or tends interests in about 70 refineries in North America, Latin America, Europe and Africa, the Middle East, the Far East, and the Pacific.

Eyadema, (Etienne) Gnassingbe (b. Dec. 26, 1937, Pya, Togoland [now Togo]), soldier who became president of Togo after a military takeover in January 1967.

Eyadema joined the French army in 1953, served in Indochina, Dahomey, Niger, and Algeria (1953–61), and had attained the rank of sergeant when he returned to Togo in 1962. When President Sylvanus Olympio refused to take 626 Togolese veterans of French wars into Togo's tiny army, a group of them, including Eyadema, murdered him in an otherwise almost bloodless military coup (January 1963) and installed a civilian, Nicolas Grunitzky, as president. After an abortive coup by members of the Ewe tribe of southern Togo in November 1966, the army took over directly in January 1967, and in April made its chief, Eyadema, president and minister of national defense. He invited past political exiles to return, and in 1969 he set up a new unity party (the Togolese People's Rally) and became its president. He was elected to the presidency of Togo in one-party elections held in 1979 and 1985.

Eyadema's long rule brought a measure of stability to Togo, and his nationalization of the country's phosphate industry in 1974 produced increased state revenues for development. The economic gains achieved in the 1970s were largely negated in the 1980s, however, by governmental mismanagement and corruption.

Eyasi, Lake, lake, northern Tanzania. It lies west of Lake Manyara and approximately 95 miles (155 km) southwest of Arusha. At an elevation of about 3,400 feet (1,040 m), the lake covers an area of about 400 square miles (1,050 square km) and occupies the bottom of a bowllike depression in a region of volcanic activity. The walls of the lake are purple lava enclosing a broad expanse of white alkaline shallows with some fresh water at depths below 33 feet (10 m). The lake has no outlet; its main inlet is the Sibiti River on the southwest. The lake drains an area of about 25,300 square miles (65,500 square km). Greater and lesser flamingos inhabit the lake shore in vast flocks.

Eybeschütz, Jonathan (b. *c.* 1690, Kraków, Pol.—d. 1764, Altona, Den.), rabbi and religious scholar noted for his bitter quarrel with Rabbi Jacob Emden, a dispute that split European Jewry and ended the effectiveness of rabbinic excommunication during Eybeschütz's time.

As a rabbi in a number of European towns, Eybeschütz became a celebrated master of the Talmud (the rabbinical compendium of law, lore, and commentary), and he attracted a large, fiercely loyal corps of disciples. He was also learned in Kabbala, an esoteric form of Jewish mysticism.

When Eybeschütz accepted the pulpit in the triple community of Altona, Hamburg, and Wandsbek (then a domain of the Danish king), the women there hoped that his reputed mystic powers would save them from death in childbirth. He gave them amulets that were claimed to have contained, among other incantations, a prayer in cipher to Shabbetai Tzevi (1626–76), the most famous of the false Jewish messiahs, who had tried to abolish the Talmud. One of these amulets fell into the hands of Rabbi Jacob Emden, a strict follower of the Talmud, who publicly denounced the amulet's maker (without specifying Eybeschütz) as a heretic.

The Polish rabbinate sided with Eybeschütz, the German with Emden. Charges and countercharges, appeals to the Danish king and to the civil courts, brawls between the adherents of each side, and excessive use by opposing rabbis of excommunication all figured in a dispute that masked a more fundamental opposition—between those who saw the pseudomessianic movement as a danger to Judaism and those who saw it as a fulfillment of Judaism. Eybeschütz succeeded in maintaining his rabbinic post, if not actually in triumphing over Emden. The quarrel in which he had played a leading role weakened rabbinic authority among the people, and repercussions were felt for a long time to come.

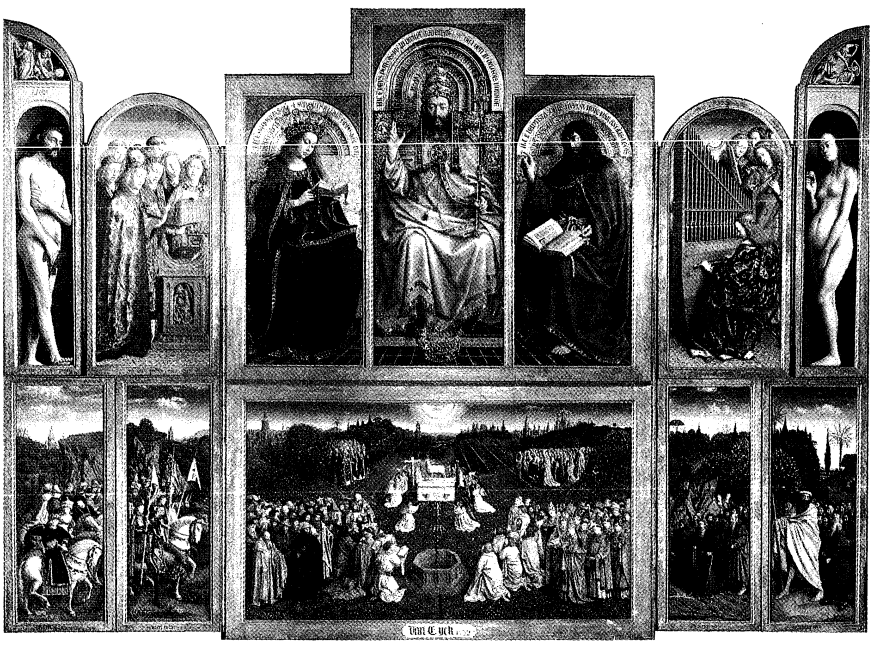
Eyck, Jan van (b. before 1395, Maaseik, Bishopric of Liège, Holy Roman Empire [now in Belgium]—d. before July 9, 1441, Bruges), Flemish painter who perfected the newly developed technique of oil painting. His naturalistic panel paintings, mostly portraits and religious subjects, made extensive use of disguised religious symbols. His masterpiece is the altarpiece in the cathedral at Ghent, the "Adoration of the Lamb" (1432). Hubert van Eyck is thought by some to have been Jan's brother.

Jan van Eyck must have been born before 1395, for in October 1422 he is recorded as the *varlet de chambre et peintre* ("honorary equerry and painter") of John of Bavaria, count of Holland. He continued to work in the palace of The Hague until the count's death in 1425 and then settled briefly in Bruges before he was summoned, that summer, to Lille to serve Philip the Good, duke of Burgundy, the most powerful ruler and foremost patron of the arts in Flanders. Jan remained in the duke's employ until his death. On behalf of his sponsor he undertook a number of secret missions during the next decade, of which the most notable were two journeys to the Iberian Peninsula, the first in 1427 to try to contract a marriage for Philip with Isabella of Spain and a more successful trip in 1428–29 to seek the hand of Isabella of Portugal. As a confidant of Philip, Jan may have participated directly in these marriage negotiations, but he also was charged to present the duke with a portrait of the intended.

In 1431 Jan purchased a house in Bruges and, about the same time, married a woman named Margaret, about whom little more is known than that she was born in 1406 and was to bear him at least two children. Residing in Bruges, Jan continued to paint, and in 1436 he again made a secret voyage for Philip. After his death in 1441 he was buried in the Church of Saint-Donatian, in Bruges.

Securely attributed paintings survive only from the last decade of Jan's career; therefore, his artistic origins and early development must be deduced from his mature work. Traditionally, Jan has been acclaimed the founder of Flemish painting, and scholars have sought his artistic roots in the last great phase of medieval manuscript illumination. It is clear that the naturalism and elegant composition of Jan's later painting owe much to such early 15th-century illuminators as the anonymous Boucicaut Master and Pol, Herman, and Jehanequin de Limburg (the "Limburg Brothers"), who worked for the Burgundian dukes. A document of 1439 reports that Jan van Eyck paid an illuminator for preparing a book for the duke; but central to the discussion of his ties to manuscript illustration has been the attribution to Jan of several miniatures, identified as Hand G, in a problematic prayer book known as the Turin-Milan Hours (Museo Civico, Turin, Italy). So long as these "Eyckian" miniatures were dated in the 1420s or even earlier, Jan's authorship seemed indubitable; but recent investigations strongly indicate that these miniatures were painted at least 20 years later and, hence, that they are by an imitator. With the elimination of the Turin-Milan Hours from Jan van Eyck's early oeuvre, his connections with International Gothic style illumination appear to have been less direct than had been thought.

Certainly as important for Jan's artistic formation were the panel paintings of Robert Campin (*c.* 1378–1444), a Tournai painter whose important role in the history of Flemish art has only recently been reestablished. Jan must have met Campin at least once, when he was feted by the Tournai painter's guild in 1427, and from Campin's art he seems to have learned the bold realism, the method of disguised symbolism, and perhaps the luminous



"The Adoration of the Lamb," or "Ghent Altarpiece," by Jan and Hubert van Eyck, 1432, polyptych with 12 panels, oil on panel, in the Cathedral of Saint-Bavon, Ghent, Belg.

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oil technique that became so characteristic of his own style. In contrast to Campin, who was a Tournai burgher, Jan was a learned master at work in a busy court, and he signed his paintings, the first Flemish artist to do so. The majority of Jan's panels present the proud inscription "IOHANNES DE EYCK," and several bear his aristocratic motto, "*Als ich chan*" ("As best I can"). It is small wonder that Campin's reputation faded and his influence on Jan was forgotten, and it is of little surprise that many of Campin's achievements were credited to the younger master.

Despite Jan van Eyck's having signed 9 paintings and dated 10, the establishment of his oeuvre and the reconstruction of its chronology present problems. The major difficulty is that Jan's masterpiece, the "Adoration of the Lamb" altarpiece, has a wholly questionable inscription that introduces Hubert van Eyck as its principal master. This has caused art historians to turn to less ambitious but more secure works to plot Jan's development, including, most notably: the "Portrait of a Young Man" ("Leal Souvenir") of 1432, "The Marriage of Giovanni Arnolfini and Giovanna Cenami (?)" of 1434, the "Madonna with Canon van der Paele" of 1434–36, the triptych "Madonna and Child with Saints" of 1437, and the panels of "St. Barbara" and the "Madonna at the Fountain," dated, respectively, 1437 and 1439. Although they fall within a brief span of seven years, these paintings present a consistent development in which Jan moved from the heavy, sculptural realism associated with Robert Campin to a more delicate, rather precious, pictorial style.

On stylistic grounds there seems little difficulty in placing the "Ghent Altarpiece" at the head of this development as indicated by the date 1432 in the inscription, but the question of Hubert's participation in this great work has yet to be resolved. The inscription itself is definite about this point: "The painter Hubert van Eyck, greater than whom no one was found, began [this work]; and Jan, his brother, second in art [carried] through the task . . . " On the basis of this claim, art historians have attempted to distinguish Hubert's contribution to the "Ghent Altarpiece" and have even assigned to him certain of the more archaic "Eyckian" paintings, including "The Annunciation" (Metropolitan Museum of Art, New York City) and "The Three Marys at the Tomb" (Museum Boymans-van Beuningen, Rotterdam). A problem arises, however, because the inscription itself is a 16th-century transcription, and earlier references make no mention of Hubert. Albrecht Dürer, for instance, praised only Jan van Eyck during his visit to Ghent in 1521; and as late as 1562 the Flemish historian Marcus van Vaernewyck referred to Jan alone as the creator of the altarpiece. Furthermore, a recent philological study casts serious doubt on the dependability of the inscription. Thus, Hubert's participation is highly suspect, and any knowledge of his art must await new discoveries.

On the other hand, there is little doubt that Hubert did exist. A "meester Hubrechte de scildere" (Master Hubert, the painter) is mentioned three times in the City Archives of Ghent, and a transcription of his epitaph reports that he died on Sept. 18, 1426. Whether this Hubert van Eyck was related to Jan and why in the 16th century he was credited with the major share of the "Ghent Altarpiece" are questions that remain unanswered.

The confusion concerning his relationship to Hubert, the doubt about his activities as an illuminator, and the reemergence of Robert Campin as a preeminent master do not diminish the achievement and significance of Jan van Eyck. He may not have invented painting with oils as early writers asserted, but he perfected the technique to mirror the textures, light, and spatial effects of nature. The realism of his paintings—admired as early as 1449 by the Italian humanist Cyriacus D'Ancona, who observed that the works seemed to have been produced "not by the artifice of human hands but by all-bearing nature herself"—has never been surpassed. For Jan, as for Campin, naturalism was not merely a technical tour de force, however. For him, nature embodied God, and so he filled his paintings with religious symbols disguised as everyday objects. Even the light that so naturally illuminates Jan van Eyck's landscapes and interiors is a metaphor of the Divine.

Because of the refinement of his technique and the abstruseness of his symbolic programs, the successors of Jan van Eyck borrowed only selectively from his art. Campin's foremost student, Rogier van der Weyden, tempered his master's homey realism with Eyckian grace and delicacy; in fact, at the end of his career, Campin himself succumbed somewhat to Jan's courtly style. Even Petrus Christus, who may have been apprenticed in Jan's atelier and who finished the "Virgin and Child, with Saints and Donor" (Frick Collection, New York City) after Jan's death, quickly abandoned the intricacies of Jan's style under the influence of Rogier. During the last third of the century, the Netherlandish painters Hugo van der Goes and Justus van Gent revived the Eyckian heritage, but, when such early 16th-century Flemish masters as Quentin Massys and Jan Mabuse turned to Jan's work, they produced pious copies that had little impact on their original creations. In Germany and France the influence of Jan van Eyck was overshadowed by the more accessible styles of Campin and Rogier, and only in the Iberian Peninsula—which Jan had visited twice—did his art dominate. In Italy his greatness was recognized by Cyriacus and by the humanist Bartolomeo Facio, who lists Jan—together with Rogier and the Italian artists Pisanello and Gentile da Fabriano—as one of the leading painters of the period. But Renaissance artists, as painters elsewhere, found him easier to admire than to imitate.

Interest in his painting and acknowledgment of his prodigious technical accomplishment have remained high. Jan's works have been copied frequently and have been avidly collected. He is referred to in the Treaty of Versailles, which specifies the return of the "Ghent Altarpiece" to Belgium before peace with Germany could be concluded after the end of World War I. (H.L.Ke.)

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Articles are alphabetized word by word, not letter by letter

eye, specialized sensory organ capable of light reception and, in vertebrate animals, able to receive visual images that are then carried to the visual centre in the brain.

A brief treatment of eyes and vision follows. For full treatment, *see* MACROPAEDIA: Sensory Reception.

Eyes fall broadly into two categories: direction (non-image-forming) and image-forming. The term ocellus is broadly applied to any simple eye and also to the eyespot, an eyelike structure of certain one-celled organisms. Direction eyes are found in many worms, mollusks, cnidarians, echinoderms, and other invertebrates. Such eyes have in common the possession of one or more (usually many) light-sensitive cells and a partial shield of pigment cells. Often the shield is cup-shaped and nearly surrounds the sensors. In bilaterally symmetrical animals the eyes are usually paired. Image-forming eyes are found in certain mollusks (cephalopods, some bivalves), most arthropods, and nearly all vertebrates. Two basic types of image-forming eyes occur, simple and compound.

The basic components of the simple eye are the lens and the retina, the former focusing impinging light as an image on the latter. Light-sensitive cells of the retina transmit to the brain signals of varying intensity, depending on the intensity of light on their part of the image.

The compound eye, found only in arthropods, is most highly developed in insects and crustaceans. It consists of a number of closely packed elements, called ommatidia, each of which is essentially a separate eye. Each ommatidium consists of a hexagonal, rectangular, or circular tube with a lens and a sensory element (rhabdomere). The rhabdomere may receive light through its own lens alone or through several adjacent lenses. In either case, the overlap of the fields of adjacent lenses results in the arthropod's seeing a multiple image, which is partially integrated in the brain.

The human eye is roughly spherical with opaque sides and back and with a transparent front, through which the light rays pass. The eyeball houses the retina, a layer of nerve tissue made up of millions of light receptors, and all of the structures needed to focus light onto it. The sclera, the tough outer shell of the eyeball, is composed of dense fibrous tissue; a segment of the sclera, the cornea, is modified to allow light to pass into the eye and to aid in focusing. The eyeball is filled with a transparent jellylike material, the vitreous humour, which maintains its spheroidal shape.

Immediately beneath the sclera is an underlying vascular layer, the choroid, which supplies nutrients to all parts of the eye and which also contains the ciliary body, a muscular structure that alters the shape of the lens in focusing. Within the choroid lies the retina. The scleral surface on exposed areas of the eye is covered with a mucous membrane, the conjunctiva, which protects the eye from becoming dry.

The transparent cornea, where the focusing process begins, is curved to a much greater extent than the rest of the eyeball. Behind the cornea is the anterior chamber, filled with a watery fluid called the aqueous humour, and the iris, a muscular curtain that opens and closes to regulate the amount of light entering the eye through the pupil, an opening at the iris' centre. The aqueous humour flows through the pupil into the posterior chamber, a small space between the iris and the lens.

The shape of the lens is controlled by the action of the ciliary body, altering the focal length of the lens as needed. The lens focuses an image onto the rods and cones (receptor cells) of the retina at the back of the eye. Much of the image is projected onto the fovea, a structure near the centre of the retina where large numbers of cones give maximum sharpness of vision. The receptors record the image and transmit it to the optic nerve, which exits from the eyeball behind the optic disk on its way to the visual centres of the brain.

Some common disorders of vision are myopia (nearsightedness), hyperopia (farsightedness), and astigmatism. In myopia the lens' point of focus falls in the vitreous body, so that when light reaches the retina it is out of focus. Conversely, the point of focus in hyperopia would fall behind the retina. Astig-

matism results from defects in the corneal curvature. The effects of these disorders can be ameliorated with the aid of eyeglasses or contact lenses. Other disorders include night blindness and colour blindness (*qq.v.*).

There are many different diseases that can affect the eyes, including ones that attack eye muscle control and those that cause the degeneration of the retina (resulting in a tunnellike, narrowing field of vision, or a field of vision where the periphery is clear but the centre dark). Glaucoma is a more common disease, especially among older people. It is the result of an increase in the pressure of the fluids in the eye and can lead to loss of vision.

eye for an eye, in law and custom, the principle of retaliation for injuries or damages. In ancient Babylonian, biblical, Roman, and Islāmic law, it was a principle operative in private and familial settlements, intended to limit retaliation, and often satisfied by a money payment or other equivalent. *See also* talion.

eye tooth: *see* canine tooth.

eye worm (species *Loa loa*), common parasite of humans and other primates in central and western Africa, a member of the class Nematoda (phylum Aschelminthes). It is transmitted to humans by the deerfly, *Chrysops* (the intermediate host), which feeds on primate blood. When the fly alights on a human victim, the worm larva drops onto the new host's skin and burrows underneath. The larva migrates through the bloodstream, commonly locating in the eye or in other tissues just under the skin. The adult worm is about 5 cm (2 inches) long. The movement of the worm beneath the skin may cause itching or sometimes swellings as large as a hen's egg.

Within the human host the adult female worm produces large numbers of microscopic, active embryos called microfilariae, which enter the host's blood or lymph vessels. Some of these are ingested by a deerfly as it sucks blood and, after about two weeks, complete a series of growth stages. As infective larvae, they move to the insect's proboscis to await an opportunity to transfer to a new human host.

eyeglasses, also called GLASSES, or SPECTACLES, lenses set in frames for wearing in front of the eyes to aid vision or to correct such defects of vision as myopia, hyperopia, and astigmatism. In 1268 Roger Bacon made the earliest recorded comment on the use of lenses for optical purposes, but magnifying lenses inserted in frames were used for reading both in Europe and China at this time, and it is a matter of controversy whether the West learned from the East or vice versa. In Europe eyeglasses first appeared in Italy, their introduction being attributed to Alessandro di Spina of Florence. The first portrait to show eyeglasses is that of Hugh of Provence by Tommaso da Modena, painted in 1352. In 1480 Domenico Ghirlandajo painted St. Jerome at a desk from which dangled eyeglasses; as a result, St. Jerome became the patron saint of the spectacle-makers' guild. The earliest glasses had convex lenses to aid farsightedness. A concave lens for myopia, or nearsightedness, is first evident in the portrait of Pope Leo X painted by Raphael in 1517.

In 1784 Benjamin Franklin invented bifocals, dividing his lenses for distant and near vision, the split parts being held together by the frame. Cemented bifocals were invented in 1884, and the fused and one-piece types followed in 1908 and 1910, respectively. Trifocals and new designs in bifocals were later introduced, including the Franklin bifocal revived in one-piece form.

Originally, lenses were made of transparent quartz and beryl, but increased demand led to the adoption of optical glass, for which Venice and Nürnberg were the chief centres of production. Ernst Abbe and Otto Schott in 1885 demonstrated that the incorporation of new elements into the glass melt led to many desirable variations in refractive index and dispersive power. In the modern process, glass for lenses is first rolled into plate form. Most lenses are made from clear crown glass of refractive index 1.523. In high myopic corrections, a cosmetic improvement is effected if the lenses are made of dense flint glass (refractive index 1.69) and coated with a film of magnesium fluoride to nullify the surface reflections. Flint glass, or barium crown, which has less dispersive power, is used in fused bifocals. Plastic lenses have become increasingly popular, particularly if the weight of the lenses is a problem, and plastic lenses are more shatterproof than glass ones. In sunglasses, the lenses are tinted to reduce light transmission and avoid glare. *See also* contact lenses; lens.

eyelid, movable shield of skin and tissue that protects the eyeball from mechanical injury and helps to provide the moist chamber essential for the normal functioning of the conjunctiva and cornea. The conjunctiva is the mucous membrane that lines the eyelid and covers all the visible portion of the eyeball except the cornea, the transparent part of the eyeball that reveals the iris and the pupil. Each eyelid contains a fibrous plate, called a tarsus, that gives it structure and shape; muscles, which move the eyelids; and glands, which secrete lubricating fluids. The lids are covered with skin, lined with mucous membrane, and bordered with a fringe of hairs, the eyelashes. The lids move through the action of a circular lid-closing muscle, the orbicularis oculi, and of the lid-raising muscle, the levator of the upper lid. Impulses for closing come by way of the facial (seventh cranial) nerve, and for opening by way of the oculomotor (third cranial) nerve. The lid borders are kept lubricated by the oily secretion of the lid glands. This barrier of grease keeps the normal amount of tears from spilling over onto the cheek.

eyespot, also called STIGMA, a heavily pigmented region in certain one-celled organisms that apparently functions in light reception. The term is also applied to certain light-sensitive cells in the epidermis (skin) of some invertebrate animals (*e.g.*, worms, starfishes).

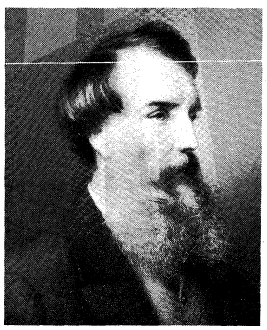
In the green one-celled organism *Euglena,* the eyespot is located in the gullet, at the base of the flagellum (a whiplike locomotory structure). A cup-shaped mass of pigment rods shields a sensitive area of the flagellar base from light coming from the direction of the opposite end of the organism. The light-sensitive region apparently influences flagellar motion in such a manner that the organism moves toward light.

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

Eylau, Battle of (Feb. 7–8, 1807), one of the engagements in the Napoleonic War of the Third Coalition. The first major deadlock suffered by Napoleon, the battle was fought around the East Prussian town of Eylau (modern Bagrationovsk, Russian S.F.S.R.), 23 miles (37 km) south of Königsberg (Kaliningrad). The 76,000 Russians and Prussians under Leonty Leontyevich Bennigsen confronted 74,000 men under Napoleon shortly after the Russians launched an unexpected winter offensive. An initial unplanned battle on February 7 cost each side about 4,000 casualties without accomplishing anything. On the morning of the 8th, Napoleon had only 41,000 men to the Russians' 63,000, and he fought a delaying action until his reinforcements arrived. Napoleon tried to stem the Russian advances by cavalry attacks. The first of these was beaten back in a blinding snowstorm, with heavy losses. Meanwhile, three Russian columns headed for the weak French lines, threatening to overwhelm them.

Napoleon ordered a 10,700-man cavalry reserve under Joachim Murat to charge the advancing columns and the Russian centre. In one of the greatest cavalry charges in history, they halted the Russian attack, slashed through the Russian centre in two columns, re-formed in a single column in the Russian rear, and plunged through the re-forming lines again. This attack enabled Napoleon to hold his centre and overcome the crisis. During the next six hours both sides received reinforcements. The stalemate continued until exhaustion ended the fighting at 10 PM. Each army had lost between 18,000 and 25,000 men. Bennigsen retired during the night.

Eyre, Edward John (b. Aug. 5, 1815, Hornsea, Yorkshire, Eng.—d. Nov. 30, 1901, near Tavistock, Devon), English explorer in Australia for whom Lake Eyre and the Eyre



Eyre, engraving by Charles Tomkins after a portrait by Charles Mercier

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Peninsula (both in South Australia) are named. He was subsequently a British colonial official.

Emigrating from England for reasons of health, Eyre reached Australia in March 1833. As a sheep farmer he became a pioneer "overlander," driving stock from Sydney to Adelaide. He explored the desert northwest of Adelaide and then (June 1840–July 1841) made an extremely hazardous journey around the Great Australian Bight. For several years he served as a magistrate and protector of Aborigines, whose language and customs he learned.

After leaving Australia in 1845, Eyre was lieutenant governor of New Zealand (1846–53) and of St. Vincent, in the West Indies (1854–60). His service as acting governor of the Leeward Islands (1860–61) and of Jamaica (1861–64) was rewarded with his permanent appointment as governor of Jamaica. On Oct. 11, 1865, a revolt by blacks began at Morant Bay, and, in the repression that followed, the total of executions passed 400. Eyre then caused the island's legislature to abolish itself and the Jamaican constitution (Jan. 17, 1866), whereupon Jamaica became a crown colony. After both commending Eyre for crushing the rebellion and censuring him for taking excessive reprisals, the British government recalled him in July 1866. Eyre's behaviour sparked an intense controversy among prominent British intellectuals; John Stuart Mill, Herbert Spencer, and Thomas Henry Huxley advocated his trial for murder, while his side was taken by Thomas Carlyle, John Ruskin, and Alfred, Lord Tennyson. A grand jury in London declined to indict him for murder (June 1868), and he was acquitted in a civil case brought against him by a Jamaican.

Eyre, Lake, great salt lake in central South Australia, with a total area of 3,700 square

miles (9,600 square km). It lies in the southwestern corner of the Great Artesian Basin, a closed inland basin about 440,150 square miles (1,140,000 square km) in area that is drained only by intermittent streams. Normally dry but susceptible to occasional flooding, the lake occupies the lowest part of the Australian continent. Lake Eyre was first sighted by a European in 1840—Edward John Eyre, after whom it was named. The lake's extent had been determined by the 1870s.

Lake Eyre, whose lowest part lies about 50 feet (15 m) below sea level, consists of two sections. Lake Eyre North, 90 miles (144 km) long and 40 miles (65 km) wide, is joined by the narrow Goyder Channel to Lake Eyre South, which is 40 miles long and about 15 miles (24 km) in width.

Evidence from the western side of Lake Eyre strongly suggests that the present saline depression resulted from a downfaulting in the earth's surface about 30,000 years ago, which blocked off an earlier outlet to the sea. Water reaching the lake now evaporates very rapidly, and the surface of the lake bed has a thin crust of salt deposited by water that has evaporated.

Lake Eyre is normally dry, and it fills completely only an average of twice in a century, but partial, minor fillings happen much more frequently after lesser rains in the region. When completely filled, the lake takes about two years to dry up again. Lake Eyre is situated in a region of very low and intermittent rainfall amounting to less than 5 inches (125 mm) annually. The lake is fed by a vast internal continental drainage basin, but evaporation rates in the region are so high that most of the rivers in the basin dry up before reaching the lake. Consequently, the waters of the Diamantina and other rivers can feed the lake only when they are in flood after heavy rains.

The thin salt crust of Lake Eyre thickens in the lake's southern portions, where it is as much as 18 inches (46 cm) thick. The crust is a coarsely crystalline aggregate composed almost entirely of sodium chloride, hard and rigid, and is capable in parts of supporting heavy vehicles. The crust is invariably damp and saturated with ground brine. The extremely level surface of the salt crust has been used in attempts to break world land-speed records, notably in 1964, when Donald Campbell drove at a speed of more than 400 miles per hour (644 km/h) in *Bluebird II*.

Eyre Peninsula, large promontory of South Australia, projecting into the Indian Ocean. A broad-based triangular formation about 200 miles (320 km) on each side, it extends from a base along the Gawler Ranges and lies between the Great Australian Bight to the west and Spencer Gulf to the east. Generally sandy and rocky, it rises from an irregular coastline to a maximum elevation of 1,550 feet (472 m) at Nukey Bluff in the Gawler Ranges. Whereas the northern section has extremely hot summers, the south has a mild climate most of the year. Sighted in 1802 by the English explorer Matthew Flinders, it was named after Edward John Eyre, who explored the region (1838–41). The peninsula supports wheat, sheep, and barley; iron is extracted in the Middleback Ranges (northeast). There are numerous resort and fishing towns along the coasts.

Eyskens, Gaston (b. April 1, 1905, Lier, Belg.—d. Jan. 3, 1988, Louvain), economist and statesman who as Belgian premier (1949–50, 1958–61, and 1968–72) settled crises concerning aid to parochial schools and the accelerating independence movement in the Belgian Congo (now Zaire).

A professor of economics at the University of Louvain from 1931, Eyskens entered the Belgian Parliament in 1939 as a member of the Catholic (now Social Christian) Party. He served as minister of finance (1945–49) and as premier of a Social Christian-Liberal coalition government (1949–50). He resigned during the controversy over the exiled King Leopold III's proposed return, when anti-Leopold Liberals withdrew from the Cabinet.

Chosen in 1958 to head another coalition government, Eyskens settled a long-standing dispute by enacting the Schools Pact, which granted equal financial aid to public and parochial schools. In 1960, realizing that Belgium could no longer handle the political and economic problems of the Belgian Congo, he persuaded Parliament to grant independence to that colony. Belgium's internal economic problems, as well as the bloody civil war that followed the Congo's independence, toppled his government in the March 1961 election. After again serving as minister of finance (1965–1966), he began a third term as premier in June 1968. Unable to put into effect a paragraph in the new Belgian constitution that provided for regionalization of the country, he resigned in November 1972. From 1973 to 1980 he was chairman of the board of the Kredietbank NV in Brussels.

Eystein I MAGNUSSON, Norwegian ØYSTEIN MAGNUSSON (b. 1088/89—d. Aug. 22, 1122), king of Norway (1103–22) whose reign with his brother Sigurd I Jerusalemfarer was the longest joint rule in the history of Norway.

An illegitimate son of Magnus III Barefoot, Eystein succeeded to the throne in 1103 with his younger brothers Sigurd I and Olaf (IV); the latter, a child, died in 1115, but Sigurd outlived Eystein. While Sigurd was off on crusades in Moorish Spain and the Holy Land in 1107–11, Eystein served Norway with great ability, gaining territory from Sweden, building churches, and fostering internal progress.

Eysteinn Ásgrímsson (Icelandic poet-monk): *see* Ásgrímsson, Eysteinn.

Ezekiel, also spelled EZECHIEL, Hebrew YEḤEZQEL (fl. early 6th century BC), prophet-priest of ancient Israel and the subject and in part the author of an Old Testament book that bears his name. Ezekiel's early oracles (from *c.* 592) in Jerusalem were pronouncements of violence and destruction; his later statements addressed the hopes of the Israelites exiled in Babylon. The faith of Ezekiel in the ultimate establishment of a new covenant between God and the people of Israel has had profound influence on the theology of Judaism and Christianity.

Ezekiel's ministry was conducted in Jerusalem and Babylon in the first three decades of the 6th century BC. For Ezekiel and his people, these years were bitter ones because the remnant of the Israelite domain, the little state of Judah, was eliminated by the rising Babylonian empire under Nebuchadrezzar (reigned 605–562 BC). Jerusalem surrendered in 597 BC. Israelite resistance was nevertheless renewed, and in 587–586 the city was destroyed after a lengthy siege. In both debacles, and indeed again in 582, large numbers from the best elements of the surviving population were forcibly deported to Babylonia.

Before the first surrender of Jerusalem, Ezekiel was a functioning priest probably attached to the Jerusalem Temple staff. He was among those deported in 597 to Babylonia, where he was located at Tel-abib on the Kebar canal (near Nippur). It is evident that he was, among his fellow exiles, a person of uncommon stature. Ezekiel's religious call came in July 592 when he had a vision of the "throne-chariot" of God. He subsequently prophesied until 585 and then is not heard of again until 572. His latest datable utterance can be dated about 570 BC, 22 years after his first.

These two periods of prophesying, separated by 13 years, represent various emphases in Ezekiel's message. His earlier oracles to the Jews in Palestine were pronouncements of God's judgment on a sinful nation for its apostasy. Ezekiel said that Judah was guiltier than Israel had been and that Jerusalem would fall to Nebuchadrezzar and its inhabitants would be killed or exiled. According to him, Judah trusted in foreign gods and foreign alliances, and Jerusalem was a city full of injustice. Pagan rites abounded in the courts of the Temple. In addition to making these denunciations, Ezekiel prophesied that the pagan nations that neighboured Judah, such as Egypt and Tyre, would likewise fall at the hands of Nebuchadrezzar.

After the fall of Jerusalem and his period of silence, Ezekiel now addressed himself more pointedly to the exiles and sought to direct their hopes for the restoration of their nation. His theme changed from the harsh judgment of God to the promise of the future. Ezekiel prophesied that the exiles from both Judah and Israel would return to Palestine, leaving none in the Diaspora. In the imminent new age a new covenant would be made with the restored house of Israel, to whom God would give a new spirit and a new heart. The restoration would be an act of divine grace, for the sake of God's name. Ezekiel's prophecies conclude with a vision of a restored Temple in Jerusalem. The Temple's form of worship would be reestablished in Israel, and each of the ancient tribes would receive appropriate allotments of land. In contrast to those hoping for national restoration under a Davidic king, Ezekiel envisaged a theocratic community revolving around the Temple and its cult as the nexus of the restored Jewish state.

More than any of the classical biblical prophets, Ezekiel was given to symbolic actions, strange visions, and even trances (although it is quite gratuitous to deduce from these, and from his words "I fell upon my face" [1:28], that he was a cataleptic). He eats a scroll on which words of prophecy are written, in order to symbolize his appropriation of the message (3:1–3). He lies down for an extended time to symbolize Israel's punishment (4:4ff). He is apparently struck dumb on one occasion for an unspecified length of time (3:26). As other prophets have done before him, he sees the God-to-People relationship as analogous to that of husband to unfaithful wife and therefore understands the collapse of the life of Judah as a judgment for essential infidelity.

There are striking conflicts among scholars in their assessment of the personality of Ezekiel. By some he has been seen as a fanatic and, in the way of fanatics, arrogant and aggressively intolerant. By others he has been described as possessing a well-endowed, versatile mind, aware of the problems and doubts of the people he addresses, and sensitive to the life about him. There is wide agreement that he profoundly shaped the Judaism that was reformed in the centuries that followed, especially in the influence of chapters 40–48 upon the postexilic reconstruction and reorganization of Judaism.

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Ezekiel, The Book of, also called THE PROPHECY OF EZECHIEL, one of the major prophetical books of the Old Testament. According to dates given in the text, Ezekiel received his prophetic call in the fifth year of the first deportation to Babylonia (592 BC) and was active until at least 571 BC. Most of this time was spent in exile.

The literary history of the book is much debated, but its final form exhibits a threefold

theme: threats against Judah and Jerusalem (chapters 1–25), threats against foreign nations (chapters 25–32), and prophecies of restoration and hope (chapters 33–44). Dates supplied throughout the book indicate that this arrangement of materials roughly corresponds to the chronological development of Ezekiel's ministry (although the arrangement also suggests a threefold eschatological [end of the world] theme that has led some scholars to question the traditional dates). The threats against Judah and Jerusalem belong to the period from Ezekiel's call (593 BC) to the fall of Jerusalem (586 BC); the threats against the foreign nations belong to the period immediately after the fall (586–585 BC); and the prophecies of restoration belong to the period thereafter. Most of the material is undoubtedly genuine, although a few later additions are discernible.

The book is valuable for understanding the life of the exiles of Babylon. Having been cut off from Jerusalem and its Temple where alone Yahweh dwelled and could be worshipped, the deportees were faced with a crisis of faith and practice. Ezekiel attempted to sustain his fellow exiles by striving to keep alive their traditional religious beliefs and by fostering a spirit of unity with one another. His prophecies did much to dispel the notion that Yahweh dwelled exclusively in Jerusalem; he emphasized the importance of individual responsibility, and he urged that the sabbath be kept holy by cessation from work—for the holiness of the day was a special sign of Yahweh's relationship with his people. By being faithful, the exiles were promised that Israel would be restored.

Ezhov, Nikolay Ivanovich (Russian Communist): *see* Yezhov, Nikolay Ivanovich.

Ezion-geber, modern TALL AL-KHALĪFAH, seaport of Solomon and the later kings of Judah, located at the northern end of the Gulf of Aqaba in what is now Ma'ān *muḥāfaẓah* (governorate), Jordan. The site was found independently by archaeologists Fritz Frank and Nelson Glueck. Glueck's excavations (1938–40) proved that the site had been a fortified settlement surrounded by strong walls from the 10th to the 4th century BC. It was almost certainly founded about 950 BC by Solomon, who used it both as a port for his trade with Ophir and as a large-scale copper refinery.

Ezra, Hebrew 'EZRA' (fl. 5th–4th century BC, Babylon and Jerusalem), religious leader of the Jews who returned from exile in Babylon, reformer who reconstituted the Jewish community on the basis of the Torah (Law, or the regulations of the first five books of the Old Testament). His work helped make Judaism a religion in which law was central, enabling the Jews to survive as a community when they were dispersed all over the world. Since his efforts did much to give Jewish religion the form that was to characterize it for centuries after, Ezra has with some justice been called the father of Judaism; *i.e.,* the specific form the Jewish religion took after the Babylonian Exile. So important was he in the eyes of his people that later tradition regarded him as no less than a second Moses.

Knowledge of Ezra is derived from the biblical books of Ezra and Nehemiah, supplemented by the Apocryphal (not included in the Jewish and Protestant canons of the Old Testament) book of I Esdras (Latin Vulgate form of the name Ezra), which preserves the Greek text of Ezra and a part of Nehemiah. It is said that Ezra came to Jerusalem in the seventh year of King Artaxerxes (which Artaxerxes is not stated) of the Persian dynasty then ruling the area. Since he is introduced before Nehemiah, who was governor of the province of Judah from 445 to 433 BC and again, after an interval, for a second term of unknown length, it is sometimes supposed that this was the seventh year of Artaxerxes I (458 BC), though serious difficulties are attached to such a view. Many scholars now believe that the biblical account is not chronological and that Ezra arrived in the seventh year of Artaxerxes II (397 BC), after Nehemiah had passed from the scene. Still others, holding that the two men were contemporaries, regard the seventh year as a scribal error and believe that perhaps Ezra arrived during Nehemiah's second term as governor. But the matter must be left open.

When Ezra arrived the situation in Judah was discouraging. Religious laxity was prevalent, the Law was widely disregarded, and public and private morality was at a low level. Moreover, intermarriage with foreigners posed the threat that the community would mingle with the pagan environment and lose its identity.

Ezra was a priest and "a scribe skilled in the law." He represented the position of stricter Babylonian Jews who had been upset by reports of laxity in Judah and desired to see matters corrected. Ezra set out in the spring at the head of a sizable caravan and arrived four months later. Ezra apparently had official status as a commissioner of the Persian government, and his title, "scribe of the law of the God of heaven," is best understood as "royal secretary for Jewish religious affairs," or the like. The Persians were tolerant of native cults but, in order to avert internal strife and to prevent religion from becoming a mask for rebellion, insisted that these be regulated under responsible authority. The delegated authority over the Jews of the satrapy (administrative area) "beyond the river" (Avar-nahara), or west of the Euphrates River, was entrusted to Ezra; for a Jew to disobey the Law he brought was to disobey "the law of the king."

The order in which Ezra took the various measures attributed to him is uncertain. He probably presented the Law to the people during the Feast of Tabernacles in the autumn, most likely in the year of his arrival. He also took action against mixed marriages and succeeded in persuading the people to divorce their foreign wives voluntarily. His efforts reached their climax when the people engaged in solemn covenant before God to enter into no more mixed marriages, to refrain from work on the sabbath, to levy on themselves an annual tax for the support of the Temple, regularly to present their tithes and offerings, and otherwise to comply with the demands of the Law.

Nothing further is known of Ezra after his reforms. The 1st-century Hellenistic Jewish historian Josephus states in his *Antiquities* that he died and was buried in Jerusalem. According to another tradition, he returned to Babylonia, where his supposed grave is a holy site. (Jo.Br.)

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Ezra, Fourth Book of, also called EZRA APOCALYPSE: *see* Esdras, Second Book of.

Ezra, Greek: *see* Esdras, First Book of.

Ezra and Nehemiah, books of, also spelled ESDRAS and NEHEMIAS, two Old Testament books that together with the books of Chronicles formed a single history of Israel from the time of Adam. Ezra and Nehemiah are a single book in the Jewish canon. Roman Catholics long associated the two, calling the second "Esdras alias Nehemias" in the Douay-Confraternity. Later works, *e.g.,* the Jerusalem Bible, maintain separate identities but associate the books. Protestants treat them separately.

The connection of Ezra–Nehemiah with I and II Chronicles is clear from the repetition of the closing verses of II Chronicles in the opening verses of Ezra. The uniformity of language, style, and ideas of the two books and Chronicles mark the entire work as the product of a single author, known as the Chronicler. He belongs to a period after the Babylonian Exile, probably about 350–300 BC.

Ezra 1–6 treats the return of the exiles and the rebuilding of the Temple of Jerusalem. The work of Ezra and Nehemiah in reconstituting the life of the people following the Exile is told in Ezra 7–Nehemiah 13. Textual dislocations raise a question about the chronological sequence of Ezra and Nehemiah to which there is no solid answer.

The activity recounted in Ezra 7 to Nehemiah 13 represents the Chronicler's view of how the life of his people should be organized in the postexilic period with a religious revival in conformity with Mosaic laws.

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

Ezzelino III DA ROMANO, Ezzelino also spelled ECCELINO (b. April 25, 1194—d. Oct. 1, 1259, Soncino, Lombardy), Italian noble and soldier who was *podestà* (feudal mayor) of Verona (1226–30, 1232–59), Vicenza (1236–59), and Padua (1237–56). A skilled commander and successful intriguer, he expanded and consolidated his power over almost all northeast Italy by aiding the Holy Roman emperor Frederick II and the pro-imperial Ghibellines in their struggle against the papist party, the Guelfs. His legendary cruelty is dealt with in Dante's *Inferno.*

Given Trevignano by his father in 1223, Ezzelino allied himself with other local nobles and seized Verona two years later. After becoming *podestà* of the city in 1226, he at first favoured the Lombard League in its struggle with the emperor Frederick II. As the result of the league's endeavours to reconcile various factions, Ezzelino resigned as *podestà* (1230). When political considerations persuaded him to join Frederick, he recaptured Verona in 1232. His position was constantly menaced by the neighbouring cities of Mantua, Padua, and Brescia, but the arrival of imperial troops in May 1236 and of Frederick himself in August assured the despot's suzerainty.

Thereafter Ezzelino rapidly expanded his power. In November 1236 he aided the Emperor in subduing Vicenza, which was mercilessly pillaged. A few months later he took Padua himself. Having helped Frederick gain the important victory over the Lombards at Cortenuova (1237), he was the next year given the hand of Frederick's illegitimate daughter Selvaggia. In the name of the Emperor, Ezzelino began the elimination of his own enemies, some of whom were loyal to Frederick.

When Frederick died in 1250, Ezzelino was sufficiently powerful to maintain his territories. After excommunicating him as a heretic, Pope Innocent IV mounted a crusade against him. Supported by Venice, the pro-papal Guelfs took Padua in 1256. Although Ezzelino captured Brescia in 1258, two powerful allies subsequently defected to the Guelfs. Ezzelino failed to seize Milan and was wounded and captured in battle at Cassano in September 1259. Refusing food or medical aid, he died four days later.

F-4, also called PHANTOM II, two-seat, twin-engine, jet fighter aircraft and attack bomber originally developed for the U.S. Navy but later adopted by the U.S. Air Force and 10 other countries. The first F-4 was delivered in 1960 by McDonnell-Douglas, and the plane was in frontline service in the Navy and Air Force until the early 1970s. When retired it was the most successful combat aircraft since World War II. But its retirement was only from Navy carrier and Air Force service. It was manufactured until 1979 in various modifications for specialized missions including that of missile fighter, as the F-4G Advanced Wild Weasel. In its original versions the Phantom II had a wingspan of 38 feet 5 inches (11.7 m; 27 feet 6.5 inches [8.4 m] folded for carrier stowage) and a length of 58 feet 3 inches (17.7 m). It was powered with two General Electric J79 series turbojet engines with afterburners, and its maximum speed was 1,500 miles per hour (2,413 km/h). Its ceiling is 62,000 feet (19,000 m), but special altitude efforts have flown it at close to 100,000 feet (30,000 m). The early F-4s were armed with a 20-millimetre cannon and up to eight air-to-air missiles controlled by a radar fire control mechanism in the nose of the plane. Alternative loads of up to eight tons of conventional or nuclear bomb or rocket pods could be attached under the wings and fuselage.

F-16, also called FIGHTING FALCON, lightweight jet fighter aircraft developed in the mid-1970s for the U.S. Air Force after sustained competition among designers. The airplane that eventuated was subsequently adopted by four NATO countries as well.

The airplane is a multi-role fighter with a wingspan of 31 feet (9.45 m) and a length of 47 feet 7.7 inches (14.5 m). It is a mid-wing monoplane powered by a single Pratt & Whitney F100 series turbofan engine with afterburner, capable of delivering 25,000 pounds of thrust and driving the airplane at more than Mach 2 (two times the speed of sound) at 40,000 feet (12,000 m), with a ceiling of 50,000 feet (15,000 m).

The F-16 is armed with a multi-barrel 20-millimetre cannon and a variety of air-to-air or air-to-surface missiles. It can carry up to 15,200 pounds (6,900 kg) of bombs, rockets, or auxiliary fuel tanks on external mounting points. Even fully loaded its gross weight is only 33,000 pounds (15,000 kg), compared with almost 55,000 pounds (25,000 kg) for a fully loaded F-4. The gunsight of the F-16 projects on an image of the target a constantly updated tracing of the projectile's course if it were fired.

F-86, also called SABRE, or SABREJET, U.S. single-seat, single-engine jet fighter used extensively during the Korean War. It was built by North American Aviation, Inc. A prototype first flown in October 1947 became, in the spring of 1948, the first U.S. fighter to exceed the speed of sound. F-86As began arriving in Korea in December 1950 and soon achieved a notable superiority over Soviet-built, Chinese-flown MiG-15s in history's first large-scale jet fighter combats.

The F-86 was the first American jet fighter to be designed with swept-back wings. Its wing span was 37 feet 1 inch (11.3 m), and its length was 37 feet 6 inches (11.45 m). Its top speed was 690 miles per hour (1,100 km/h), and its service ceiling was 50,000 feet (15,000 m). The F-86 was armed with six .50-calibre machine guns and had provisions for bombs and rockets. Some F-86s were built under license in Canada, Japan, Italy, and Australia, and many were used in other NATO air forces besides that of the United States. The last F-86 to be built was delivered to the U.S. Air Force in December 1956.

F-100, also called SUPER SABRE, jet fighter aircraft, the first developed for the U.S. Air Force to exceed the speed of sound in level flight. It was operational from 1953 to 1973. It was made by North American Aviation, Inc., and it became the principal tactical fighter of the U.S. Tactical Air Command and was adopted by various NATO countries. The F-100C had a wingspan of 38 feet (11.58 m) and was 47 feet (14.33 m) long. It was a single-seat, low-wing monoplane with wings swept back 45 degrees. Its maximum speed was 822 miles per hour (1,323 km/h) at 35,000 feet (11,000 m), and its ceiling was over 50,000 feet (15,000 m). The Super Sabre was armed with four 20-millimetre cannons. Under the wings it could carry up to 6,000 pounds (2,700 kg) of bombs or a variety of air-to-air and air-to-surface rockets and missiles. The F-100 saw extensive service in the Vietnam War.

F-104, also called STARFIGHTER, jet day fighter aircraft built by Lockheed Aircraft Corporation for the U.S. Air Force but adopted by a total of 15 NATO and other countries. It was widely adapted for use as a fighter-bomber. The F-104 had a wingspan of 21 feet 11 inches (6.68 m) and a length of 54 feet 9 inches (16.7 m). It was a single-seat, single-engine midwing monoplane, powered with a General Electric J79 series turbojet engine with afterburner delivering 15,800 pounds of thrust. Its normal top speed was about Mach 2.1 (*i.e.,* about 1,550 miles per hour [2,500 km/h]) at 35,000 feet (11,000 m). In special efforts the F-104 set a series of world records (later broken) of speeds in excess of 1,400 miles per hour (2,253 km/h) and altitudes well above 100,000 feet (30,000 m).

It saw first-line use by the U.S. Air Force beginning in 1958–60. More than 2,400 were eventually produced. Most other countries began replacing the F-104 in the late 1970s. It was armed with an internal six-barreled 20-millimetre cannon and Sidewinder air-to-air missiles with various alternative combinations of bombs and missiles on wing pylons and fuselage.

F region, highest region of the ionosphere, at altitudes greater than 160 km (100 miles); it has the greatest concentration of free electrons and is the most important of the ionospheric regions. The charged particles in the F region consist primarily of neutral atoms split into electrons and charged atoms. Although its degree of ionization persists with little change through the night, there is a change in the ion distribution. During the day two layers can be distinguished: a small layer, F_1, and above it a more highly ionized, dominant layer, F_2. At night they become one at about the level of the F_2 layer, also called the Appleton layer. This region reflects radio waves with frequencies up to about 30 megahertz; the exact value depends on the peak amount of the electron concentration, typically 10^6 electrons per cubic centimetre, though with large variations caused by the sunspot cycle.

FA: *see* Football Association.

Fa-ch'ang (Buddhist painter): *see* Mu-ch'i Fa-ch'ang.

Fa-hsiang, school of Chinese Buddhism derived from the Indian Yogācāra school. *See* Yogācāra.

Fa-hsien, Pinyin FAXIAN, original name SEHI (fl. AD 399–414), Chinese Buddhist monk whose pilgrimage to India in 402 initiated Sino-Indian relations and whose writings give important information about early Buddhism. After his return to China he translated into Chinese the many Sanskrit Buddhist texts he had brought back.

Sehi, who later adopted the spiritual name Fa-hsien (Splendour of Religious Law), was born at Shansi during the 4th century AD. Living at the time of the Later Ch'in emperor Wen-huan Ti, when Buddhism enjoyed an imperial favour seldom equaled in Chinese history, he was stirred by a profound faith to go to India, the "Holy Land" of Buddhism, in order to visit the sites of the Buddha's life and to bring back Buddhist texts that were still unknown in China. The record of his journeys—*Fo Kuo Chi* ("Record of Buddhist Kingdoms")—contains valuable information not found elsewhere concerning the history of Indian Buddhism during the early centuries AD. Because of the fairly detailed descriptions of Fa-hsien's journeys, it is possible to envision Buddhist India before it was reconquered by the counterreforms of Hinduism and eclipsed by the Muslim invasion.

Fa-hsien first crossed the trackless wastes of Central Asia. After arriving at Khotan, an oasis centre for caravans, he crossed the Pamirs. In northwestern India, which he entered in 402, Fa-hsien visited the most important seats of Buddhist learning: Udyāna, Gandhāra, Peshāwar, and Taxila. Above all, however, he was attracted by eastern India, where Buddha had spent his life and had taught his doctrines. His pilgrimage was completed by visits to the most holy spots: Kapilavastu, where Buddha was born; Buddh Gaya, where Buddha acquired the supreme Enlightenment; Banares (Vārānasi), where the Buddha preached his first sermon; and Kuśinagara, where the Buddha entered into the perfect Nirvāṇa (Enlightenment). Everywhere Fa-hsien was amazed at the extraordinary flowering of the Buddhist faith.

Then he stayed a long time at Pāṭaliputra, conversing with Buddhist monks, studying Sanskrit texts with Buddhist scholars, and transcribing the Vinaya (rules of discipline for the monks) of the Mahāsaṅghika school—a dissident group of the Hīnayāna (Lesser Vehicle) born from the Council of Vesālī (*c.* 383 BC) that later became the Mahāyāna (Greater Vehicle). He also acquired another version of the Vinaya worked out by the Sarvāstivāda school—an early Buddhist group that taught the equal reality of all mental states (past, present, and future)—and the famous *Mahāparinirvāṇa-sūtra,* a text glorifying the eternal, personal, and pure nature of Nirvāṇa—on which the Nirvāṇa school in China then based its doctrines. When he had deepened his knowledge of Buddhism and was in possession of sacred texts that were not yet translated into Chinese, he decided to go back to China. Instead of once more taking the overland route, however, Fa-hsien took the sea route, first sailing to Ceylon, at that time one of the most flourishing centres of Buddhist studies. There, by securing the Mahīśāsakā Vinaya—a recension of the Hīnayāna Vinaya—and a selection of the Sarvāstivāda canon, he added to the number of Buddhist texts that he had collected.

After a two-year stay in Ceylon, he set sail for China, but the perils of the sea were as great as the hardships and dangers of desert and mountain he had faced in coming to India. A violent storm drove his ship onto an island that was probably Java. He took another boat bound for Canton. Instead of landing at the south China port, Fa-hsien's ship was driven astray by another storm and was finally blown to a port on the Shantung Peninsula. In all, Fa-hsien spent more than 200 days at sea. After returning to his homeland, Fa-hsien resumed his scholarly tasks and translated into Chinese the Buddhist texts he had taken so much trouble to bring back. He strengthened Chinese Buddhism by providing his countrymen with a better knowledge of these texts.

(H.A./Ed.)

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Abel Remusat, *Foe Koue Ki* (1836); H.A. Giles, *The Travels of Fa-hsien* (1877); and J. Legge, *Travels of Fa-Hsien* (1886).

Fa Ngum, also spelled FA NGOUN (b. 1316—d. 1374), founder and first king of the Lao kingdom of Lan Xang who created the first unified state of the Lao people.

Fa Ngum was the grandson of Souvanna Khamphong, the last in a long line of local rulers of the principality of Muang Swa, later called Luang Prabang, on the upper Mekong River. According to local legend, Souvanna Khamphong banished Fa Ngum's father for having seduced one of Khamphong's concubines. The family is said to have fled to the Cambodian capital at Angkor, where Fa Ngum was reared and married a Khmer princess.

In about 1350 Fa Ngum and his father raised an army in Cambodia and fought their way through the numerous Lao principalities of the southern and central Mekong River valley, in the course of which his father died. Fa Ngum continued on to the conquest of Xieng Khouang and then, in 1353, took Muang Swa, forced the abdication of Souvanna Khamphong, and proclaimed himself king of the expanded kingdom of Lan Xang ("a million elephants"). Small Lao principalities to the north recognized his suzerainty, but he had to fight to gain the allegiance of the south. His major conquest was of the kingdom of Vientiane, which fell in 1356. Before his death, Fa Ngum's empire extended through virtually the entire area of what was to become Laos, plus the Black River valley of present northern Vietnam and the northern and eastern edges of the Khorat Plateau of present Thailand. He could administer such a vast area only by manipulating personal relationships with countless local chiefs and rulers, and it would be some generations before regular administrative institutions were evolved.

During Fa Ngum's reign Theravāda Buddhism of the Sinhalese school was introduced into Laos, perhaps from Cambodia; and it is believed that the Prabang Buddha image, which served as the kingdom's palladium and gave Luang Prabang its new name, was brought from Ceylon.

By the last years of his reign, Fa Ngum had become insensitive to growing public dissatisfaction with constant warfare and demands for labour service. His ministers finally deposed him in 1373 and exiled him to the principality of Nan in present Thailand, where his ashes are interred. He was succeeded by his son Un Heuan, who ruled as Sam Saen Thai.

Fa-tsang, Pinyin FAZANG, Wade–Giles romanization HSIEN-SHOU (b. 643, Ch'ang-an, China—d. 712, Ch'ang-an), Buddhist monk usually considered to be the founder of the Hua-yen school of Buddhism in China because he systematized its doctrines. Basically, the Hua-yen school taught that all phenomena are related. Hence every living being possesses the Buddha-nature within, and the universality of life is thus affirmed.

According to legend, Fa-tsang aided the great Buddhist thinker and pilgrim Hsüan-tsang in translating some of the *sūtras* (Buddhist Scriptures) that the master had brought back with him from India. But Fa-tsang disagreed with Hsüan-tsang's contention that not all sentient beings possess the Buddha-nature and left him. He then turned to the *Hua-yen ching* ("Garland of Flowers Classic")—*Avataṃsaka-sūtra* in Sanskrit—and soon became master of that text. His reputation led to repeated invitations to lecture on that *sūtra* within the Imperial palace. As a result, Fa-tsang served as preceptor to four rulers and was especially favoured by the empress Wu Hou (ruled 690–705). The Hua-yen school spread to Japan, where it is known as Kegon. Its philosophy exercised considerable effect there on the development of Neo-Confucian thought.

Fabaceae, also called LEGUMINOSAE, pea family of flowering plants, within the order Fabales. The group consists of some 600 genera of trees, shrubs, vines, and herbs and is worldwide in distribution. Most woody species are tropical; herbaceous (*i.e.,* nonwoody) species occur mainly in temperate regions. The leaves usually are pinnately compound (feather formed), sometimes trifoliate (with three leaflets), or palmate (the leaflets radiating from a common point). The leaves of a few species are simple or reduced to scales. The fruit is typically a legume, or pod, which splits open as it dries, releasing the seeds.

Fabales, order of flowering plants, belonging to the class known as dicotyledon (*q.v.*; characterized by two seed leaves). It consists of 720 genera and more than 20,000 species in three families. The characteristic fruit of many members is a pod or legume consisting, in essence, of an ovary that is a tightly folded leaf, as in a pea pod. It normally splits into two halves when mature. In economic importance, this order is surpassed only by the grass order (Poales).

A brief treatment of Fabales follows. For full treatment, *see* MACROPAEDIA: Angiosperms.

Roots of most members of the Fabales harbour nitrogen-fixing bacteria in a cooperative arrangement whereby otherwise unusable nitrogen gas in the atmosphere is converted into the soluble nitrates that are required for the synthesis of proteins. The cultivation of crops such as peanuts and soybeans directly increases the world's protein supply; animals grazing on fodder plants such as alfalfa and clovers provide protein less directly. All leguminous plants leave residues of nitrates in the soil, thereby benefitting other crops grown in rotation.

Fabales are widely distributed on all habitable continents. Many genera are predominantly tropical or subtropical, with significant extensions into the temperate zones. Members such as the broad bran (*Vicia faba*) produce better crops in Canada than in warmer temperate regions. Representatives that are adapted to dry regions include the mesquite (Prosopis) of the southwestern United States and the wattle (*Acacia*) of Australia. The herb *Neptunia oleracea* of India is grown underwater.

The three families of the Fabales are a natural group and thus easily recognizable. Leaves of many members appear feathery; leaflets arise on both sides of an axis (central stalk), producing pinnate, or in some cases, bipinnate leaves. Leaf blades are connected to the stem by a petiole (leaf stalk) with two stipules (leaflike structures) placed at the juncture of petiole and stem. Stipules may be larger than leaflets (as in peas) or in the form of spines (as in many genera of desert plants).

Flowers in this order are almost universally showy—if not individually, then by clustering. In the Mimosaceae, petals are alike and radiately displayed, but in the Caesalpinaceae and the Fabaceae, flowers have a papilionaceous (butterfly) shape unique to legumes. The production of a pod (legume), even by members of the Fabales that do not possess a butterfly-shaped flower, emphasizes the unity of the order.

The Mimosaceae family contains 3,000 species in 60 genera and consists chiefly of trees and shrubs. Most of them possess bipinnate leaves, small flowers (showy, when clustered), and petals alike in shape and size (radially symmetrical). The fruits of some members remain closed (indehiscent) at maturity. *Acacia,* with 900 species, and *Mimosa,* with 600 species, generally inhabit deserts and savannas of subtropical regions.

Economically important species of *Acacia* include the silver wattle (*A. dealbata*), cultivated for its fragrant oils; *A. senegal,* which yields gum arabic; and *A. catchu,* which yields black cutch, a khaki dye.

Leaves and leaflets of the "sensitive plant" (*Mimosa pudica*), a common greenhouse plant, fold rapidly when touched. A swollen region at the base of each unit has greater internal space on one side than on the other. A touch stimulates the draining of water from loosely-packed cells, causing the swollen region to lose pressure. This results in the folding of leaflets at these "hinge-joints." Other legumes respond similarly, and leaves of many legumes fold at night.

Leaves of the Caesalpiniaceae are once- or twice-pinnate; in the bud, the largest petal is innermost, and the keel petals are fully separate. Fruits may ripen dry as pods or as samaras (winged fruits); a few are drupes (having a stony layer covering the seed). The 160 genera and 3,000 species comprising this family are nearly all trees or shrubs that are distributed worldwide.

Genera of the Caesalpiniaceae valued for durable timber include the honey-locust (*Gleditsia triacanthos*) and the Kentucky coffee tree (*Gymnocladus dioica*), both native to warmer areas of eastern North America, where they attain heights of more than 100 feet (30 metres). Seeds of the latter have been used as a substitute for coffee beans. Both are valuable shade trees.

Valued plants of the Caesalpiniaceae include about 500 species of senna (*Cassia*), native to eastern North America, northeast Africa, and India. Leaves of several species are laxative, and *C. acutifolia* is cultivated for medicinal use in India. Cassias are among the showiest trees and shrubs in the tropics.

The Fabaceae family constitutes one of the greatest assemblages of agriculturally important plants. It consists of 15,000 species in 500 genera with worldwide distribution. Many genera, such as the cultivars (horticultural varieties) of the garden pea (*Pisum sativum*) and alfalfa or lucerne (*Medicago sativa*), are adapted to cool climates.

The Fabaceae is distinguished from the mimosa family by its papilionaceous flower and from the Caesalpiniaceae by the basal joining of keel petals. Most of its members bear leaves that are pinnate or are reduced to three leaflets. Pods (legumes) of many genera are constricted, allowing the dispersal of segments containing one seed each. Other species produce drupes, samaras, or burrs.

Peanuts (groundnuts; *Arachis hypogaea*) and soybeans (*Glycine max*) support the economies of many nations in temperate and tropical regions, largely because of proteins and edible oils contained in their seeds. Green and dry fodder is provided not only by alfalfa, but also by several clovers (red, *Trifolium;* white, *Melilotus*), by vetches (*Vicia* species), and by cowpeas (*Vigna* species). The broad bean, or horsebean, (*Vicia faba*), native in northern Africa and southwest Asia, is the bean of antiquity. This cool-weather plant is widely used as a cover crop, green manure, and forage. Central America was the centre of origin for *Phaseolus* beans; *P. vulgaris,* the kidney, snap, green, and pinto beans; *P. lunatus,* the sieva or lima bean; *P. limensis,* the lima bean, with its many bush forms; and *P. coccineus,* the perennial scarlet runner bean, with its bright scarlet flowers.

Seeds of *Phaseolus* and other legumes produce phytohemaglutinin, a large-molecule protein that clots certain human blood types and has other medical applications.

Useful ornamental shrubs of the Fabaceae include several cultivars of *Amorpha fruticosa,* native from Saskatchewan to Florida. Other shrubby plants with showy flowers are the brooms, *Cytisus* and *Genista.* Herbaceous (nonwoody) ornamental members include species of *Canavalia* (jack bean), *Lupinus* (lupine), *Dolichos* (hyacinth bean), and *Vigna* (snail flower).

A few of the 1,000 species of *Astragalus,* the milk vetch, are poisonous to livestock on the prairies of the central United States. *A. wootonii* and similar species, sometimes known as locoweed, absorb selenium from the soil and form organic compounds, which are highly toxic to sheep and cattle.

In all three families of Fabales, flowers occur in inflorescences (clusters) rather than singly. They may be elongate, branched, compacted into heads, or grouped in loose clusters. Flower parts are generally in fives. Sepals form a lobed, bell-shaped calyx, and petals are either separate and uniform or papilionaceous. Flower colours in this order range from white to purple. The 10 stamens, useful in classification, are separate or joined in various combinations in consistent patterns according to the genus. The pistil (female) consists of a single carpel with a flattened ovary and, often, a style that ends in a pollen-receptive stigmatic surface.

Insects, especially bees, are the agents of pollination, but flowers of the tropical genus *Parkia* are pollinated by bats. Following pollination, the ovule becomes the seed and the ovary the fruit. In the peanut, the ovary is pushed into the ground following pollination, when its base elongates. The indehiscent pot matures below ground.

Faber, Cecilia Böhl de: *see* Caballero, Fernán.

Faber, Frederick William (b. June 28, 1814, Calverly, Yorkshire, Eng.—d. Sept. 26, 1863, London), British theologian, noted hymnist, and founder of the Wilfridians, a religious society living in common without vows.

He was elected fellow of University College, Oxford, in 1837. Originally a Calvinist, he became a disciple of John Henry Newman

Frederick William Faber, engraving by Joseph Brown
BBC Hulton Picture Library

(later cardinal) and, in 1843, was appointed rector of Elton, Huntingdonshire. He converted to Roman Catholicism in 1845 and soon after founded the Wilfridians, a community at Birmingham, Warwickshire, which was merged in the Oratory of St. Philip Neri, with Newman as superior. In 1849 a branch of the community was established in London, over which Faber presided until his death.

He is remembered chiefly as a hymnist, some of his most popular hymns being "Hark! Hark, my soul" and "My God, how wonderful thou art." His writings include *Lives of Modern Saints* (1847), *The Foot of the Cross* (1858), and *Notes on Doctrinal Subjects* (2 vol., 1866).

Faber, (Johann) Lothar von and John Eberhard (respectively b. 1817—d. 1896; b. Dec. 6, 1822, Stein, Bavaria—d. March 2, 1879, New York City), German brothers who expanded a family pencil business into a worldwide firm preeminent in the manufacture of writing products and art supplies.

Taking over a pencil business started by his great-grandfather Kaspar Faber (died 1784) near Nürnberg, Lothar von Faber established branches of the company throughout Europe and in the U.S. and contracted (1856) for exclusive control of all graphite being mined in east Siberia at that time. He won (1881) a patent of nobility and an appointment as councillor of state for his services to German industry.

His brother, John Eberhard, went to the U.S. in 1849 and built a Faber manufacturing plant, the first large-scale U.S. pencil factory, in 1861 to serve an American market previously supplied by exports from his brother's plant in Europe. The German branch of the firm passed out of Faber hands in 1903, while the Eberhard Faber Pencil Company, incorporated in the U.S. in 1898, remained under family control.

Faber, Peter, French PIERRE LEFEVRE, or PIERRE FAVRE, Latin PETRUS FABER (b. April 13, 1506, Vilaret, Savoy—d. Aug. 1, 1546, Rome), French Jesuit theologian and a cofounder of the Society of Jesus, who was tutor and friend of Ignatius Loyola at Paris. He was appointed professor of theology at Rome by Pope Paul III (1537), founded Jesuit colleges at Cologne and in Spain, and was a delegate to the Council of Trent.

Faber Stapulensis, Johannes: *see* Lefèvre d'Étaples, Jacques.

Fabergé, Peter Carl, original name KARL GUSTAVOVICH FABERGÉ (b. May 18, 1846, St. Petersburg, Russia—d. 1920 Lausanne, Switz.), one of the greatest goldsmiths, jewellers, and designers in Western decorative arts.

Of Huguenot descent, Fabergé was educated in Germany, Italy, France, and England. His father had already established himself in St. Petersburg by 1842 as a jeweller, dealing also in fine decorative objects, a tradition Peter Carl continued after inheriting the family business in 1870. He soon began to manufacture decorative objects, later showing his works in Moscow's Pan-Russian Exhibition (1882). His international reputation was swiftly established, and European royalty, particularly Russian, patronized him.

Assisted by his sons and by associates headed by the Swiss artisan François Berbaum, Fabergé gained recognition as a brilliant designer, specializing in such precious and semiprecious materials as gold, silver, malachite, jade, lapis lazuli, and gems. He made a bold change from the exclusive design and manufacture of conventional jewelry to the creation of objects of fantasy. Much of his work was inspired by the decorative arts executed under King Louis XVI of France. Soon other independent workshops opened under his supervision at Moscow, Kiev, and London; outstanding among the artisans he hired was the master craftsman Michael Perchin.

Fabergé's workshop soon became famous for exquisite and ingenious masterpieces: flowers, figure groups, bibelots, animals, and, above all, the celebrated imperial Easter eggs, which became the delight of Russian and other royalty throughout Europe and Asia. Emperor Alexander III commissioned the first of the eggs for his tsaritsa in 1884, and Alexander's successor, Nicholas II, continued the tradition. Fabergé's studios created outstanding works of imaginative delicacy until the Russian Revolution of 1917; then his world ended, for the new government would not tolerate any object of luxury, and he died in exile.

Gold and enamel cigarette box by Fabergé, 1913; in the Wernher Collection, Luton Hoo, Bedfordshire
By courtesy of The Lady Zia Wernher, Luton Hoo, England

Fabian, SAINT, Latin FABIANUS (d. Jan. 20, 250, Rome; feast day January 20), pope from 236 to 250. The successor to St. Anterus, Fabian is said to have divided Rome into seven districts assigned to the seven deacons and to have founded several churches in France. His appointment of notaries to register the deeds of the martyrs reflected the increasing precision with which the Roman Church began to keep records during his time. Martyred during the persecution of the Roman emperor Decius, he was buried in the catacomb of St. Calixtus; his body was later moved to St. Sebastian's, where his tomb was found in 1915.

Fabian, Warner: *see* Adams, Samuel Hopkins.

Fabian Society, Socialist society founded in 1883–84 in London, having as its goal the establishment of a democratic Socialist state in Great Britain. The Fabians put their faith in evolutionary Socialism rather than in revolution.

The name of the society is derived from the Roman general Fabius Cunctator, whose patient and elusive tactics in avoiding pitched battles secured his ultimate victory over stronger forces. Its founding is attributed to Thomas Davidson, a Scottish philosopher, and its early members included George Bernard Shaw, Sidney Webb, Annie Besant, Edward Pease, and Graham Wallas. Shaw and Webb, later joined by Webb's wife, Beatrice, were the outstanding leaders of the society for many years. In 1889 the society published its best known tract, *Fabian Essays in Socialism,* edited by Shaw. It was followed in 1952 by *New Fabian Essays,* edited by Richard H.S. Crossman.

The Fabians at first attempted to permeate the Liberal and Conservative parties with Socialist ideas, but later they helped to organize the separate Labour Representation Committee, which became the Labour Party in 1906. The Fabian Society has since been affiliated with the Labour Party.

The national membership of the Fabian Society has never been very great (at its peak in 1946 it had only about 8,400 members), but the importance of the society has always been much greater than its size might suggest. Generally, a large number of Labour members of Parliament in the House of Commons, as well as many of the party leaders, are Fabians; and in addition to the national society, there are scores of local Fabian societies.

The principal activities of the society consist in the furtherance of its goal of Socialism through the education of the public along Socialist lines by means of meetings, lectures, discussion groups, conferences, and summer schools; carrying out research into political, economic, and social problems; and publishing books, pamphlets, and periodicals. In 1931 the New Fabian Research Bureau was established as an independent body. The bureau and the society amalgamated in 1938 to form a new and revitalized Fabian Society. In 1940 the Colonial Bureau of the Fabian Society was established, and it produced a continuous stream of discussion and writing on colonial questions. The Fabian International Bureau was started in 1941 to cater to the growing

concern of Fabians with foreign policy and the great issues of war and peace.

Fabiola, SAINT (b. Rome—d. *c.* 399, Rome; feast day December 27), Christian noblewoman credited with founding the first public hospital in western Europe.

After her conversion to Christianity, she worked closely with St. Jerome, dedicating her wealth and life to the church. In addition to the hospital founded in Rome, she later founded, with St. Pammachius, a hospice for pilgrims at Porto, Italy, the first of its kind. She supported monasteries throughout Italy and the Mediterranean islands. Familiar with Hebrew, Greek, and Latin, she studied the Scriptures under Jerome, whom she followed to Bethlehem (395), where she lived with SS. Paula and Eustochium. At Fabiola's request, Jerome wrote a treatise on the priesthood of Aaron, on the priestly dress, and on the 42 stopping places of the Israelites in the desert. When the Huns threatened to invade Palestine, Fabiola returned to Rome (396).

Fabius Ambustus, Quintus (fl. early 4th century BC), Roman politician and commander who, according to tradition, was responsible for the sack of Rome by the Gauls in or soon after 390.

He and two other Fabii were sent as ambassadors to the Gauls while a Gallic army was besieging Clusium. After Quintus Fabius involved his group in a skirmish, the offended Gauls demanded that Rome surrender the culprits to them. By way of reply, however, the Romans elected the three men tribunes with consular power in the following year. As a result, the Gauls marched on Rome, triumphed at the battle of the Allia River, and captured the city.

Fabius Maximus Cunctator, Quintus (d. 203 BC), Roman commander and statesman whose cautious delaying tactics (whence the surname Cunctator, meaning "delayer") during the early stages of the Second Punic War (218–201) gave Rome time to recover its strength and take the offensive against the invading Carthaginian army of Hannibal. Fabianism has come to mean a gradual or cautious policy.

Fabius was consul in 233 and 228 and censor in 230. He may have been a Roman emissary to Carthage in 218 to demand reparations for Hannibal's seizure of Saguntum, in Spain. After Hannibal's victory over the Romans at Lake Trasimene (217), Fabius was elected dictator; he then initiated his strategy of attrition against the invaders. Manoeuvring among the hills, where Hannibal's cavalry was useless, he cut off his enemy's supplies and harassed him incessantly. Fabius' tactics aroused controversy in Rome and a quarrel with Minucius Rufus, his master of the horse. The people then divided the command between Minucius and Fabius. True to his strategy of exhaustion, Fabius allowed Hannibal to ravage Campania. After the end of his dictatorship, the Romans again attempted to annihilate the invaders. The result was a disastrous Roman defeat at Cannae (216) and the reintroduction of Fabian strategy. Elected consul for a third and fourth time (215 and 214), Fabius commanded troops in Campania. In his fifth consulship (209) he captured Tarentum (modern Taranto), which Hannibal had held for three years. Fabius strenuously but unsuccessfully opposed Publius Cornelius Scipio's preparations for an invasion of Africa (205). By the time of his death he had been a pontifex for 12 years and an augur for 62.

Quintus Fabius Maximus Cunctator portrait on a Roman coin, *c.* 233 BC; in the British Museum

Peter Clayton

Fabius Pictor, Quintus (fl. *c.* 200 BC), one of the first Roman prose historians.

A member of the Senate, he fought against the Carthaginians in the Second Punic War (218–201) and was sent on a mission to the Oracle of Delphi after the disastrous Roman defeat at Cannae (216). His history, now lost, was an account of the development of Rome from the earliest times. Fabius wrote it in Greek, partly because he sought to justify Roman policy to the Greeks. The later historians Polybius, Dionysius, and Livy all used Fabius' work as a source. Fragments of the history are published in Felix Jacoby's *Fragmente der griechischen Historiker* (1957).

fable, allegorical tale, usually featuring animals that behave and speak as human beings, told in order to highlight the follies and weaknesses of man. A moral—or lesson for behaviour—is woven into the story and often explicitly formulated at the end.

A brief treatment of fable follows. For full treatment, *see* MACROPAEDIA: Literature, The Art of.

The Western tradition of fable effectively begins with Aesop (6th century BC), about whom little is known. Modern editions contain up to 200 "Aesop" fables, but there is no way of tracing their actual origins. Among the classical authors who developed the Aesopian model were the Roman poet Horace, the Greek biographer Plutarch, and the Greek satirist Lucian.

Fable flourished in the Middle Ages, as did all forms of allegory, and a notable collection of fables was made in the late 12th century by Marie de France. The medieval fable gave rise to an expanded form known as the beast epic—a lengthy, episodic animal story replete with hero, villain, victim, and an endless stream of heroic endeavour, parodying epic grandeur. The most famous of these is a 12th-century group of related tales called *Roman de Renart* whose hero is Renart, or Reynard, the Fox (German: Reinhart Fuchs), symbol of cunning man. In the Renaissance, Edmund Spenser made use of this kind of material in "Mother Hubberd's Tale" (1591). John Dryden's poem *The Hind and the Panther* (1687) revived the beast epic as an allegorical framework for serious theological debate.

The fable has traditionally been of modest length, however, and the form reached its zenith in 17th-century France in the work of Jean de La Fontaine, whose theme was the folly of human vanity. His first collection of *Fables* in 1668 followed the Aesopian pattern, but his later ones, accumulated during the next 25 years, satirized the court and its bureaucrats, the church, the rising bourgeousie—indeed the whole human scene. His influence was felt throughout Europe, and in the Romantic period his outstanding successor was the Russian Ivan Andreyevich Krylov.

The fable found a new audience during the 19th century in the rise of literature for children. Among the celebrated authors who employed the form were Lewis Carroll, Kenneth Grahame, Rudyard Kipling, Hilaire Belloc, Joel Chandler Harris, Beatrix Potter, and, though not writing primarily for children, Hans Christian Andersen, Oscar Wilde, Antoine Saint-Exupéry, J.R.R. Tolkien, and James Thurber. A more sobering modern use of fable is to be found in George Orwell's *Animal Farm* (1945), a scathing allegorical portrait of Stalinist Russia.

The oral tradition of fable in India may date as far back as the 5th century BC. The *Pañcatantra,* a Sanskrit compilation of beast fables, has survived only in an 8th-century Arabic translation known as the *Kalīlah wa Dimnah,* after two jackal-counselors to the lion king. It was translated into many languages including Hebrew, from which in the 13th century John of Capua made a Latin version.

In China the full development of fable was hindered by traditions of thought that prohibited the Chinese from accepting any notion of animals behaving and thinking as human beings. Between the 4th and 6th century, however, Chinese Buddhists adapted fables from Buddhist India as a way to further the understanding of religious doctrines. Their compilation is known as *Po-yü ching.*

In Japan the 8th-century histories *Koji-ki,* ("Records of Ancient Matters") and *Nihonshoki* ("Chronicles of Japan") are studded with fables, many on the theme of small but intelligent animals getting the better of large and stupid ones. The form reached its height in the Kamakura period (1192–1333). In the 16th century, Jesuit missionaries introduced Aesop's fables into Japan and their influence has persisted into modern times.

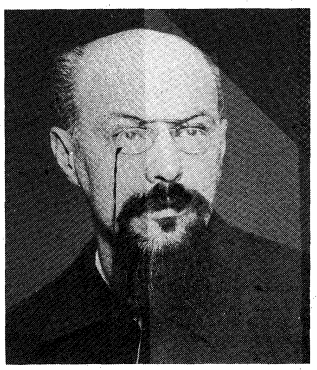
Consult the INDEX *first*

fabliau, plural FABLIAUX, medieval French narrative poem written for entertainment and characterized by vivid detail and realistic observation. About 150 fabliaux are extant. Many of them are based on elementary jokes or puns—such as one called *Estula,* which can either be a person's name or mean "Are you there?"—or on wry situations, such as one tale in which a man is rescued from drowning but has his eye put out by the boat hook that saves him. The majority of fabliaux are erotic, and the merriment provoked often depends on situations and adventures that are either indecorous or frankly obscene. Recurring characters include the cuckold and his wife, the successful or unsuccessful lover, and the naughty priest. The theme of guile is often treated, frequently to show the deceiver deceived.

It was once widely held that fabliaux represented the literature of the bourgeois and common people. This, however, is unlikely, since they contain a substantial element of burlesque (or mockery and parody) that depends, for its appreciation, on considerable knowledge of courtly society, love, and manners. They also presuppose something like scorn for those of humble rank who ape their betters.

Some of the subject matter in the fabliaux can be paralleled in other times and other countries: many of the plots stem from folklore, some have classical affinities, and a few can be traced to Oriental sources. But many of the tales are so simple that they could have arisen spontaneously. The earliest fabliau, *Richeut,* dates from *c.* 1175, but the main period of their composition was the 13th century, with an extension into the first half of the 14th. Most fabliaux are 200 to 400 lines in length, though there are extremes of fewer than 20 lines and of more than 1,300. Their authors included amateur writers (notably Philippe de Beaumanoir) and professionals (*e.g.,* Jehan Bodel and Rutebeuf). Verse tales analagous to the fabliaux exist in other languages. Chaucer's "Reeve's Tale," for example, is based on a known fabliau, and several of the other comic *Canterbury Tales* may have origins in fabliaux.

Fabre, Émile (b. March 24, 1869, Metz, Fr.—d. Sept. 25, 1955, Paris), French playwright and administrator of the Comédie-Française (1915–36) who developed it into a vehicle for classical and contemporary repertory.



Émile Fabre, 1914
H. Roger-Viollet

The son of a stage manager, Fabre began writing and producing plays at the age of 13. *Comme ils sont tous* (1894; "As They All Are") was his first success, followed by a series of popular political and social satires: *L'Argent* (1895; "Silver"), *La Vie publique* (1905), *Les Ventres dorés* (1905; "The Golden Bowels"), and *Les Sauterelles* (1911; "The Grasshoppers"), which attacked colonial administration. Other plays included a series of family tragedies and adaptations of two novels by Honoré de Balzac.

Fabre, Jean Henri (b. Dec. 22, 1823, Saint-Léons, Fr.—d. Oct. 11, 1915, Sérignan-du-Comtat), French entomologist famous for his study of the anatomy and behaviour of insects.

Largely self-taught, Fabre was appointed a teacher at the *lycée* of Carpentras, Fr. (1842), was made physics teacher at the *lycée* of Ajaccio, Corsica (1843–51), and was given a teaching position at the *lycée* of Avignon (1853).

Fabre did important research on the insect orders Hymenoptera (*e.g.*, bees and wasps), Coleoptera (*e.g.*, beetles), and Orthoptera (*e.g.*, grasshoppers, crickets). Based on his observations of the paralyzing actions of wasps in response to stimulating zones in their prey, he described the importance of inherited instinct as a behaviour pattern in insects. In 1866 he isolated from the madder plant a colouring substance, later identified as alizarin, which became useful as a biological stain. He wrote many books to popularize science. Although Fabre never accepted the theory of evolution, his work was respected by Darwin.

Fabre d'Églantine, Philippe(-François-Nazaire) (b. July 28, 1750, Carcassonne, Fr.—d. April 5, 1794, Paris), French political dramatic satirist and prominent figure in the French Revolution; as deputy in the National Convention he voted for the death of Louis XVI. He added the appellation d'Églantine to his surname, Fabre, after falsely claiming that he had won a golden eglantine in a literary competition. After publishing the poem *Étude de la nature* (1783; "Study of Nature"), he wrote many comedies, the most celebrated—*Le Philinte de Molière* (1790), a sequel to Molière's *Misanthrope*—in which the major characters are drawn as a politically dangerous aristocrat and a virtuous Republican. His best known work is the song "Il pleut, il pleut, bergère" ("It's raining, it's raining, shepherdess"), a song which French children still sing today.

Although Fabre had little knowledge of astronomy, he was in charge of the committee that drew up the Republican calendar. Fabre was guillotined in 1794, having aroused the enmity of Maximilien Robespierre, as being too moderate in his views.

Fabre d'Églantine, detail from an oil painting by Jean-Baptiste Greuze; in the Louvre, Paris
H. Roger-Viollet

Fabriano, town, Ancona province, in Marche (The Marches) region, central Italy. The town was the home of a minor school of painting founded in the late 14th century by Allegretto Nuzi and Gentile da Fabriano; frescoes by the former decorate the local cathedral. A Romanesque-Gothic mayoral palace (1255) and a municipal art gallery are other notable buildings. The town was severely damaged during the fighting in World War II. It has manufactured paper, its principal product, since medieval times. Pop. (1981 prelim.) mun., 28,616.

Fabriano, Gentile da: *see* Gentile da Fabriano.

Fabrici, Geronimo: *see* Fabricius ab Aquapendente, Hieronymus.

Fabricius, Johann Albert (b. Nov. 11, 1668, Leipzig—d. April 30, 1736), German classical scholar and the greatest of 18th-century bibliographers.

In 1689, after two years at the University of Leipzig, Fabricius graduated as master of philosophy and published anonymously his *Decas decadum, Sive plagiariorum et pseudonymorum centuria,* a survey of 100 writers accused of plagiarism or literary mystification. In 1694 he became librarian in Hamburg to J.F. Mayer, an antipietist theologian, and from 1699 until his death he taught at the gymnasium there as professor of ethics and rhetoric.

Though he produced editions of Dio Cassius (completed by his son-in-law, H.S. Reimar, 1750–52) and Sextus Empiricus (1718) and a collection of biblical apocrypha, Fabricius is remembered primarily as a bibliographer. He began by compiling a *Bibliotheca Latina* (1697; revised by J.A. Ernesti, 1773–74), of which the first three books discuss the principal classical authors from Plautus to Jordanes. Brief biographies are followed by notes on extant and lost works, editions, and translations. The fourth book deals with early Christian writings, minor historians, and treatises on language, rhetoric, law, and medicine. But Fabricius' masterpiece is his *Bibliotheca Graeca* (1705–28; revised by G.C. Harles, 1790–1812), which extends from pre-Homeric times to 1453. Individual authors receive fuller treatment than in the Latin work. There are, for example, accounts of the Homeric *scholia* and Homer's ancient and Byzantine critics and imitators. Each volume contains in its appendixes some works there printed for the first time; these include the grammar of Dionysius Thrax, Porphyry's life of Plotinus, and speeches by Libanius. He also produced a *Bibliotheca antiquaria* (1713), which surveys writings on Hebrew, classical, and Christian antiquities; the *Centifolium Lutheranum* (1728–30), an account of 200 writers on the Reformation; and finally the *Bibliotheca Latina mediae et infimae aetatis* (1734–36; supplementary volume by C. Schottgen, 1746, ed. by J.D. Mansi, 1754), which provided a foundation for the new study of medieval Latin.

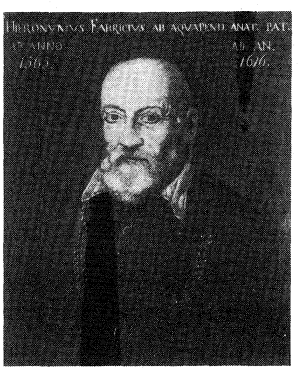
Fabricius, Johann Christian (b. Jan. 7, 1745, Tøndern, Den.—d. March 3, 1808, Kiel), Danish entomologist known for his extensive taxonomic research based upon the structure of insect mouthparts rather than upon their wings. He also advanced theoretical propositions that were progressive for his time, particularly his view that new species and varieties could arise through hybridization and by environmental influence on anatomical structure and function.

After studying at Altona and Copenhagen, Fabricius went to Uppsala, Swed., to become a student of Carolus Linnaeus, who admired his work. Although famous for his entomological studies, Fabricius was appointed professor not only of natural history but also of economics and finance at the University of Kiel in 1775. His most important works include *Systema Entomologiae* (1775), *Genera Insectorum* (1776), *Philosophia Entomologica* (1778), *Betrachtungen über die allgemeinen Einrichtungen in der Natur* (1781; "Considerations upon the Universal Arrangements in Nature"), *Species Insectorum* (1781), *Entomologia Systematica* (1792–98), and *Resultate natur-historischer Vorlesungen* (1804; "Results of Natural History Lectures").

Johann Christian Fabricius, engraving by G.L. Lahde, 1805
By courtesy of Det Kongelige Bibliotek, Copenhagen

Fabricius, Johannes (b. Jan. 8, 1587, Resterhafe, Neth.—d. *c.* 1615), Dutch astronomer who may have been the first observer of sunspots (1610/1611) and was the first to publish information on such observations. He did so in his *Narratio de maculis in sole observatis et apparente earum cum sole conversione* (1611; "Account of Spots Observed on the Sun and of Their Apparent Rotation with the Sun"). The son of the astronomer David Fabricius, Johannes used a camera obscura as well as a telescope in his study of the Sun.

Fabricius ab Aquapendente, Hieronymus, Italian GERONIMO, or GIROLAMO, FABRIZIO, or FABRICI (b. May 20, 1537, Acquapendente, Italy—d. May 21, 1619, Padua), Italian sur-



Fabricius ab Aquapendente, oil painting by an unknown artist
Alinari—Art Resource/EB Inc.

geon, an outstanding Renaissance anatomist who helped found modern embryology.

He spent most of his life at the University of Padua, where he studied under the eminent anatomist Gabriel Fallopius. As Fallopius' successor to the chair of surgery and anatomy (1562–1613), Fabricius built a reputation that attracted students from all of Europe. The English anatomist William Harvey was his pupil. In *De Venarum Ostiolis* (1603; "On the Valves of the Veins"), Fabricius gave the first clear description of the semilunar valves of the veins, which later provided Harvey with a crucial point in his famous argument for circulation of the blood.

Fabricius' *De Formato Foetu* (1600; "On the Formation of the Fetus"), summarizing his investigations of the fetal development of many animals, including man, contained the first detailed description of the placenta and opened the field of comparative embryology. He also gave the first full account of the larynx as a vocal organ and was first to demonstrate that the pupil of the eye changes its size.

Fabricius Luscinus, Gaius (fl. 3rd century BC), Roman commander and statesman whose incorruptibility and austerity were frequently regarded as models of the early Roman virtues.

Originally from Aletrium in Latium, Fabricius settled in Rome and *c.* 285 negotiated a dispute for the Romans with the people of Tarentum. He was consul in 282 and 278 and censor in 275. During the first consulship he rescued Thurii from defeat by the Lucanians and Bruttians—peoples of southern Italy. After Pyrrhus, king of Epirus in Greece, invaded Italy and defeated the Romans at Heraclea (280), Fabricius was sent to negotiate the ransom and exchange of prisoners. According to tradition, Fabricius so impressed Pyrrhus by refusing to accept a bribe that the King released the prisoners without ransom. As a further example of his unshakable integrity, Fabricius was reported to have suppressed a plot to poison Pyrrhus. The Roman general negotiated a peace with Pyrrhus in 275 and later won a series of victories over the Samnites, Lucanians, and Bruttians.

Fabritius, Barent (b. 1624, Middenbeemster, Neth.—d. 1673, Amsterdam), Dutch painter of portraits and of biblical, mythological, and historical scenes.

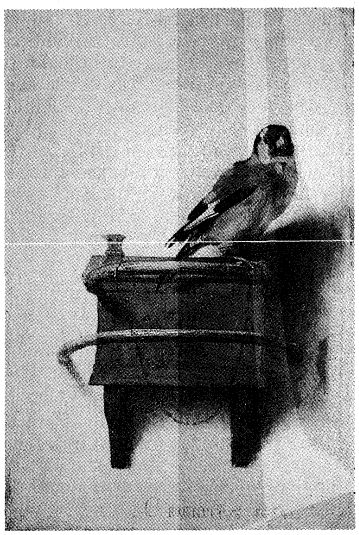
He was the son of a schoolmaster and at first became a carpenter, whence his Latinized name Fabritius (from Latin *faber*, "carpenter"). His early works, dating from the 1650s, are based on Rembrandt's style of the 1640s, with deepened use of colour and of light and shade. He was also influenced by the work of his more famous older brother Carel Fabritius. Variously during his career Fabritius worked in Amsterdam, Leiden, and London.

"Portrait of the Van der Helm Family," by Barent Fabritius, 1655; in the Rijksmuseum, Amsterdam

By courtesy of the Rijksmuseum, Amsterdam

Fabritius, Carel (baptized Feb. 27, 1622, Middenbeemster, Neth.—d. Oct. 12, 1654, Delft), Dutch Baroque painter of portraits, genre, and narrative subjects whose concern with light and space influenced the stylistic development of the mid-17th-century school of Delft.

He was the son of a schoolmaster, who is said to have been a part-time painter, and both Carel and his brother Barent became painters; both took the name Fabritius from their original trade of carpentry (Latin *faber*, "carpenter"). In the early 1640s Carel Fabritius studied under Rembrandt and became one of his most significant and successful pupils. From about 1650 onward he worked in Delft and in 1652 entered the painters' guild there. He died of injuries received when the Delft powder magazine exploded; the same explosion is thought to have destroyed many of his paintings.



"The Goldfinch," oil on panel by Carel Fabritius, 1654; in the Mauritshuis, The Hague

By courtesy of the Mauritshuis, The Hague

The earliest work definitely attributed to Fabritius, "Raising of Lazarus" (National Museum, Warsaw), is still very much in the manner of Rembrandt. But by 1648, when the portrait of Abraham de Potter (Rijksmuseum, Amsterdam) was painted, his originality and independence of spirit had already asserted itself. Unlike Rembrandt, whose figures characteristically emerge from a dark background and are modelled by the action of light, Fabritius silhouetted his figures against light backgrounds and specialized in depicting the subtlety of daylight effects; in this he influenced both Pieter de Hooch and Jan Vermeer (who is thought to have been his pupil).

Fabritius seems to have first established a reputation for painting mural decorations with illusionistic perspective effects; "A View in Delft, with a Musical Instrument Seller's Stall" (1652; National Gallery, London) may possibly reflect this type of work, for it is thought to once have been part of a peep show or a perspective box. "The Goldfinch" of 1654 (Mauritshuis, The Hague) is one of his best known works and a unique composition in the tradition of 17th-century Dutch painting. An early portrait in the Boymans-van Beuningen Museum, Rotterdam, and a late portrait, from 1654, in the National Gallery, London, usually are regarded as self-portraits.

Fabrizi, Nicola (b. April 4, 1804, Modena, Italian Republic—d. March 31, 1885, Rome), one of the most militant and dedicated leaders of the Risorgimento, the movement aimed at the unification of Italy.

As a young man, Fabrizi helped plan and execute the 1831 Milan rising against the Austrians. Unsuccessful in his attempt to revive the revolution in Modena, he was forced to flee but was captured by the Austrians and imprisoned in Venice. Freed in May 1832, he went to Marseille, where he joined the revolutionary group "Young Italy," whose founder, Giuseppe Mazzini, became his friend and political ally.

After an ill-fated attempt to stir up an insurrection in Savoy (February 1834), Fabrizi went to Spain to fight the conservative and clerical followers of Don Carlos, who claimed the Spanish throne. Proceeding to Malta, a refuge for Italian revolutionaries, he founded the "Italian Legion," another militant secret society.

From 1848 onward Fabrizi took an even more active part in the revolution. He helped Francesco Crispi organize the Sicilian revolution of 1848 and fought in defense of Venice and Rome. After his return to Malta, he helped prepare another Sicilian revolution, which erupted in 1860. He contributed to the victory of the revolutionary forces and was appointed governor of Messina and minister of war in Garibaldi's dictatorship at Palermo. Named general, he helped suppress brigands in the province of Avellino in southern Italy.

Elected deputy to the Italian parliament in 1861, Fabrizi sat on the extreme left. In 1862 on his way to Sicily to persuade Garibaldi to give up his march on Rome, he was arrested by the king of Italy's lieutenant in Naples. From 1866 to 1867 he fought in the Italian war against Austria as Garibaldi's chief of staff. Thereafter, he limited his activity to the Italian parliament, where he worked diligently to maintain unity among the quarrelling leftist leaders.

Fabrizio, Geronimo: *see* Fabricius ab Aquapendente, Hieronymus.

Fabry, Charles (b. June 11, 1867, Marseilles—d. Dec. 11, 1945, Paris), French physicist who discovered in the upper atmosphere the ozone layer that acts as a screen protecting life on the surface of Earth from most of the harmful effects of ultraviolet radiation from the Sun.

Fabry joined the staff of Marseilles University in 1894. His early studies centred on light interference, in which a primary research instrument was the Fabry–Pérot interferometer, invented in 1896 in collaboration with Alfred Pérot. This instrument was widely used for the measurement of the wavelengths of light and related studies. While applying it to study the light spectra of the Sun and stars, Fabry demonstrated that solar ultraviolet radiation is filtered out by an ozone layer in the upper atmosphere.

In 1921 Fabry became professor of physics at the Sorbonne and later was the first director of the Institut d'Optique, Paris. His works include *Les applications des interférences lumineuses* (1923; "The Applications of Optical Interference") and *Physique et Astrophysique* (1935; "Physics and Astrophysics").

Fabry's disease, also called ANGIOKERATOMA CORPORIS DIFFUSUM, sex-linked hereditary disease in which a deficiency in the enzyme alpha-galactosidase A results in abnormal deposits of a glycosphingolipid (ceramide trihexoside) in the blood vessels. These deposits in turn produce heart and kidney disturbances resulting in a marked reduction in life expectancy. Distinctive clusters of dark red granules in the skin on the abdomen and knees of victims led early students of the disease to consider it a skin disorder, as the alternative name reflects; later findings indicated the kidney involvement and blood lipid deposits that

are the more significant characteristics of the disease. Treatment attempts have been aimed primarily at relief of the intense burning pain typical of the disease. Kidney failure is the most common cause of death, which occurs at an average age of 40 in the predominantly male victims.

fabula Atellana (Latin: "Atellan play"), the earliest native Italian farce, presumably rustic improvisational comedy featuring masked stock characters. The farces derived their name from the town Atella in Campania, Italy, and seemed to have originated among Italians speaking the Oscan dialect. They became a popular entertainment in ancient republican and early imperial Rome, by which time they were performed in Latin but possibly spiced with Oscan words and place-names. Originally based on scenarios handed down by tradition, they became a literary genre in the 1st century BC, but only a few fragments survive of works by Lucian Pomponius of Bononia, Novius, and other writers. It had stock characters: Maccus, the clown; Bucco (Fat-cheeks), the simpleton; Pappus, the old fool; Dossennus, whose name has been taken to mean hunchback; and Manducus, perhaps meaning the Glutton. There is no record of these farces after the 1st century AD, but certain of the stock characters of the 16th-century Italian commedia dell'arte reflect the influence of the Atellan plays.

fabula palliata, plural FABULAE PALLIATAE, any of the Roman comedies that were translations or adaptations of Greek New Comedy. The name derives from *pallium*, a Greek cloak, and means roughly "play in Greek dress."

The comedies retained the Greek stock characters and conventionalized plots of romantic intrigue as a framework to the satire of everyday contemporary life. The *fabula palliata* became something more than mere translation in the works of Plautus, who introduced Roman manners and customs, Italian place-names, and Latin puns into the Greek form, writing in a style that is characterized by boisterous humour, nimbleness and suppleness of diction, and high spirits. Terence, though closer in spirit to his Greek originals, often combined materials from two different plays into one. His style is graceful and correct, more polished but less lively than that of Plautus, and his characters are well delineated. Statius Caecilius, famed for his emotional power and well-constructed plots, and Sextus Turpilius, who kept close to Greek models, are other prominent representatives. By the 2nd century BC, the *fabula palliata* was replaced by the *fabula togata* (from the Roman toga, "play in Roman dress"), but no complete work survives of this naturalized Roman comedy. It is through the *fabula palliata* of Plautus and Terence that Greek New Comedy was preserved and influenced succeeding generations of comedy in Europe from the Renaissance on.

faburden (music): *see* fauxbourdon.

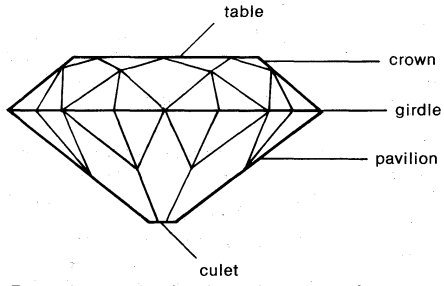
Facchinetti, Giovanni Antonio (pope): *see* Innocent IX.

face, front part of the head, which, in vertebrates, houses the sense organs of vision and smell as well as the mouth and jaws.

During evolution from prehuman, apelike forms to the modern human (*Homo sapiens*), the face became smaller in relation to the overall size of the head. While brain and braincase (cranium) nearly doubled in volume, the jaws became shorter and the teeth simpler in form and smaller in size. In consequence, the face receded beneath the forehead. Thus modern man exhibits an essentially vertical profile, in marked contrast to the protruding snout or facial muzzle of the gorilla, the chimpanzee, and, to a lesser extent, extinct early hominids. The recession of the tooth-bearing portion of the jaws beneath the forehead left two distinctively human features: a prominent, projecting nose and a clearly defined chin. The facial features characteristic of the major physical groupings of mankind (Caucasoid, Mongoloid, Negroid) resulted from the same evolutionary processes responsible for creating racial differences generally within the species.

In individual development the human face and braincase follow different patterns of growth. The brain and braincase attain 90 percent of adult size by the age of six years, while the face grows more slowly in concurrence with the enlargement of the nasal passages and the eruption of both sets of teeth. Viewed in profile, the face at birth is less than one-fifth the size of the braincase; by adulthood it has increased to nearly one-half. Facial dimensions increase most in depth, next in height (length), and least in width. The more sturdy appearance of the male face, as compared with the lighter features of the female face, is produced by the greater development of male facial musculature and the enlargement of the facial sinuses in adolescence.

facet, flat, polished surface on a cut gemstone, usually with three or four sides. The widest part of a faceted stone is the girdle; the girdle lies on a plane that separates the crown, the stone's upper portion, from the pavilion, the stone's base. The large facet in the crown parallel to the girdle is the table; the very small one in the pavilion also parallel to the girdle is the culet. Certain stones, such as mogul cut diamonds (egg-shaped jewels faceted without regard for symmetry or brilliancy) or drop cut



Faceted stone showing the various parts of a cut gem

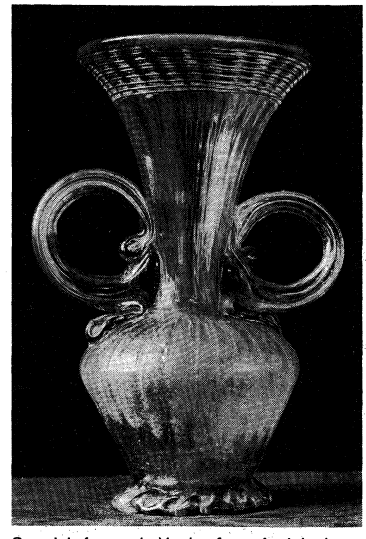
stones, have neither a girdle, a crown, nor a pavilion. In others, the crown and the pavilion are identical—*e.g.*, baguette cut stones.

facial nerve, nerve with three types of nerve fibres: (1) motor fibres to the superficial muscles of the face, neck, and scalp and to certain deep muscles, known collectively as the muscles of facial expression; (2) sensory fibres, carrying impulses from the taste sensors in the front two-thirds of the tongue and general sensory impulses from tissues adjacent to the tongue; and (3) parasympathetic fibres (part of the autonomic nervous system) to the ganglia (groups of nerve cells) governing the lachrymal (tear) glands and certain salivary glands.

facies, sedimentary: *see* sedimentary facies.

façon de Venise (French: "Venetian fashion"), style of glass made in the 16th and 17th centuries at places other than Venice itself but using the techniques that had been perfected there. It may be outwardly so similar as to be difficult to distinguish from Venetian glass (*q.v.*) proper. The prestige of Venetian glass was so great in the rest of Europe that French, German, Bohemian, Netherlandish, Spanish, and English glassmakers evolved their versions of Venetian style.

The importance that *façon de Venise* assumed for major European glasshouses as a selling line was substantial. The earliest notable glass made in England other than primitive forest glass was *façon de Venise*; a Venetian émigré, Jacopo Verzelini (1522–1606) produced it in London from 1573 and was granted a royal privilege for glassmaking in 1575. He had been preceded by eight Venetian workers who set


Spanish *façon de Venise* from Andalusia or Castile, 17th century; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London

up in London in 1545. At Antwerp Venetian influence was strong and the glass industry (in the 16th century) was started with Venetian workmen. Spanish 17th-century glass differs from its Venetian counterparts only in degree of technical perfection. However, at the end of the 17th century the prestige of Venetian glass declined in Europe.

facsimile transmission, process involving the transmission and reproduction of photographs, maps, drawings, and other graphic matter. Its basic principles were outlined by Alexander Bain, a Scottish clockmaker and inventor, in a British patent in 1843. Many different equipment designs have been proposed over the years, but practically all are based on the scanning of the original copy, one elemental area at a time, and representing the shade or tone of each area by a specified amount of electric current. The current, transmitted as a signal over regular telephone lines or via microwave relay, is used by the receiver to reproduce an image of the elemental area in the proper position and the correct shade. The original is scanned by optical means, but there are various types of recording.

Facsimile transmission has many different applications. Meteorological stations, for example, employ the process to reproduce photographs of cloud cover and infrared images of sea-surface temperature variations from signals transmitted by orbiting weather satellites. Newspaper publishers rely on facsimile transmission to secure nearly all photographs of events outside their respective communities. Local clinics and hospitals use it to send radiographs (X-ray photographs) to radiological interpretation centres.

Fact, Theatre of, also called DOCUMENTARY THEATRE, German dramatic movement that arose during the early 1960s, associated primarily with Rolf Hochhuth, Peter Weiss, and Heinard Kipphardt. Their political plays examined recent historical events, often through official documents and court records. Their concern that the West, and especially Germany, was forgetting the political horrors of the Nazi era led them to explore themes of guilt and responsibility in recent history. Hochhuth's *The Deputy* (1963) gained world

attention by indicting Pope Pius XII for not taking a public stand against the Nazi extermination of the Jews; Weiss's *The Investigation* (1965) presented extracts from official hearings on the Auschwitz concentration camp; and Kipphardt's *In the Matter of J. Robert Oppenheimer* (1964) recreated the American inquiry into Oppenheimer's loyalty because of his opposition to the development of the hydrogen bomb.

Theatre of Fact playwrights sought to cut through official versions of recent history by using the techniques of advocacy journalism and by a reliance on edited documentary sources. Their work stimulated political drama in Europe and North America, and plays dealing with the Vietnam war, the Chicago Conspiracy Trial, the Pueblo incident, and other such events appeared throughout the 1970s.

Facta, Luigi (b. Nov. 16, 1861, Pinerolo, Italy—d. Nov. 5, 1930, Rome), Italy's last prime minister before the Fascist leader Benito Mussolini gained power (Oct. 31, 1922).

After studying law, Facta became a journalist before he was elected deputy in 1891. He served as undersecretary first of justice and then of the interior in Giovanni Giolitti's coalition Cabinet (1903–05). In succeeding ministries he was three times minister of finance and during the first six months of 1919 was minister of justice.

Facta formed his own Cabinet in February 1922 but was defeated by an anti-Fascist coalition in July for not taking sufficiently strong action against Mussolini's Fascists. No other politician was willing, however, to form a Cabinet in a country so dangerously racked by industrial and Socialist agitation and by Fascist terrorism. Facta, therefore, on August 1, introduced a reconstituted government. Heading a divided Cabinet and lacking personal courage, he failed to give precise orders when the Fascists marched on Rome (October 28), even though the chief of staff and the military commandant of Rome were prepared to quell the impending insurrection. Pressured by Liberal leaders, Facta belatedly proclaimed a state of siege and ordered the army to protect the government (October 28). King Victor Emmanuel III, however, refused to sign the decree. Facta was forced to resign, clearing the way for the Fascist ascendancy.

factorial, in mathematics, the product of all positive integers less than or equal to a given number and denoted by that number and an exclamation point. Thus, factorial seven is written 7!, meaning $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7$. Factorial zero is arbitrarily defined as equal to 1, despite the fact that 1 also is the value of factorial one.

Factorials are commonly encountered in the evaluation of permutations and combinations and in the coefficients of terms of binomial expansions. *See also* binomial theorem; permutations and combinations.

factoring, in finance, selling of accounts receivable on a contract basis by the business holding them—in order to obtain cash payment of the accounts before their actual due date—to a specialized agency known as a factor. The factor then assumes full responsibility for credit analysis of new accounts, payments collection, and credit losses. Factoring differs from borrowing in that the accounts receivable and the responsibility for their collection are actually sold rather than merely offered as loan collateral. Factoring is used especially by highly seasonal industries to shift the functions of credit and collection to a specialized agency.

Prior to the 20th century a factor was a business agent whose functions included warehousing and selling the commodities consigned to him, accounting to his principals for the proceeds, guaranteeing the credit of purchasers, and sometimes making cash advances to his principals before the actual sale of the goods. His services were of particular value in foreign trade, and, for this reason, factors became important in the great period of colonial exploration and development.

Although most modern factoring is in the textile field, factors are also used extensively in the shoe, furniture, hardware, and other industries, and the trade areas in which factors operate have increased. Factors are concentrated mainly in New York City, but their clients are scattered throughout the U.S. and Europe. Although factors have almost always been entirely commercial enterprises, some banks have entered the field through the acquisition of established factoring organizations, as well as by opening their own factoring departments.

factory ship, also called MOTHER SHIP, in whaling, large ship equipped to process raw whale for various consumer uses. It functions as the main ship in a fleet sent to waters far distant from home port to kill and prepare whales for market.

Factory ships produce whale oil and sperm oil, convert the bones to meal, tan the skin for leather, process the liver for vitamins, and cook, can, or freeze the meat for eating. These ships are so efficient that their worldwide use has threatened a number of whale species with extinction.

The Soviet Union and Japan have the largest whaling fleets centred on factory ships; Norway also operates a large fleet in the Antarctic. The Soviet *Sovietskaia*-class whalers displace more than 33,000 tons.

The present-day factory ship is an automated, greatly enlarged version of the early whaler that sailed into remote waters and processed only whale oil on board, discarding the carcass.

facula, in astronomy, bright granular structure on the Sun's surface, slightly hotter or cooler than the surrounding photosphere. A sunspot always has an associated facula, though faculae may exist apart from spots. Faculae are visible in ordinary white light near the Sun's limb (apparent edge), where the photospheric background is dimmer than near the centre of the disk. The extensions of faculae up into the chromosphere become visible over the entire disk in spectroheliograms taken at the wavelengths of hydrogen or ionized calcium vapour. When seen thus away from the limb they are called chromospheric faculae or plages.

Fadden, Sir Arthur William (b. April 13, 1895, Ingham, Queensland, Australia—d. April 21, 1973, Brisbane), accountant, politician, and for a short time prime minister of Australia (1941).

Active in local and state government as a young man, he was a member of Parliament (1936–58) and leader of the Country Party (1941–58). In the cabinet he served as minister for air and civil aviation (1940) and as treasurer (1940–41, 1949–58); he also served for five weeks as prime minister upon the resignation of Robert Gordon Menzies (later Sir Robert Menzies). He was knighted in 1951 and retired from politics in 1958.

Fadeyev, Aleksandr Aleksandrovich, pseudonym of ALEKSANDR ALEKSANDROVICH BULGYA, Fadeyev also spelled FADEEV (b. Dec. 24 [Dec. 11, old style], 1901, Kimry, near Kalinin, Russia—d. May 13, 1956, Moscow), Russian novelist, a leading exponent and theoretician of proletarian literature, also a high Communist Party functionary influential in literary politics.

Fadeyev passed his youth in the Urals and in eastern Siberia, receiving his schooling in Vladivostok. He joined the Communist Party

Fadeyev
Novosti Press Agency

in 1918 and fought in Siberia against both the White armies and the Japanese. Out of this experience he wrote his first important novel, *Razgrom* (1927; *The Nineteen,* 1929). It deals with a ragged band of 19 Red guerrilla fighters trapped between the Whites and the Japanese. Each of the 19 characters is treated in the round. Especially notable is the portrait of their leader, the positive hero Levinson, a disciplined Communist who conceals his own fears and weaknesses and leads his unlikely army to a successful escape. Siberia is also the setting of a long unfinished multi-volume novel *Posledny iz Udege* (1929–41; "The Last of the Udege").

After becoming a member of the board of the Union of Soviet Writers, Fadeyev wrote little fiction. In 1946 he became general secretary and chairman of the executive board of the Writers' Union, posts he held until 1954. After World War II he published *Molodaya gvardiya* (1946, rev. 1951; "The Young Guard"), dealing with youthful guerrilla fighters in the German-occupied Ukraine. It was at first highly praised but was later denounced for omitting the role played by party members in the Resistance, and Fadeyev rewrote it. The extent to which Fadeyev was responsible for the purges of writers and artists in the 1930s and '40s has not been ascertained. But he zealously supported the Zhdanov cultural purge (1946–48), personally attacking Pasternak and Zoshchenko. When Stalin died, Fadeyev eulogized him as "the greatest humanist the world has ever known." After the official denunciation of Stalin in 1956, Fadeyev climaxed a long drinking bout by committing suicide.

Faenza, Latin FAVENTIA, city, Ravenna province, in the Emilia-Romagna region of northern Italy, on the Lamone River, southeast of Bologna. In the 2nd century BC it was a Roman town (Faventia) on the Via Aemilia, but excavations show Faenza to have had a much earlier origin. It was subject to many barbarian attacks but became an independent commune at the beginning of the 12th century and withstood an eight-month siege by Frederick II in 1240–41. In 1313 Faenza was taken by the Francesco Manfredi family, which retained possession until it was captured by Cesare Borgia in 1501. It then remained part of the Papal States, except for the brief domination of Napoleon (1797–1814), until it was annexed to the Kingdom of Sardinia in 1859, passing to the Italian kingdom in 1861.

In the medieval period and most notably in the 15th and 16th centuries, Faenza was famous for the production of majolica (glazed pottery; *see* Faenza maiolica). Examples of ceramics of every age and origin are contained in the city's International Museum of Ceramics (founded 1908), completely rebuilt after World War II. Faenza preserves traces of the Roman rectangular plan, surrounded by 15th-century walls. Notable landmarks are the Piazza Vittorio Emanuele, including its cathedral, begun in 1474 by Giuliano da Majano, with an incomplete facade; the medieval palaces of the Podestà and of the Commune;

and the civic museum and art gallery. Industries include artistic handicrafts (ceramics, gold, wrought copper, wood) and machine building; fruit and wine are exported. Pop. (1981 prelim.) mun., 54,904.

Faenza maiolica, maiolica also spelled MAJOLICA, tin-glazed earthenware produced in the Emilia district of Italy from the late 14th century. Early Faenza ware is represented by green and purple jugs decorated with Gothic lettering and heraldic lions, and by Tuscan oak leaf jars. The first significant maiolica piece, a wall plaque, is dated 1475. Typical Renaissance motifs appear on 15th-century ware, the colours of which include clean dark blues, a rich orange, and a copper green. Vases with a peacock-feather design and ware incorporating wavy rays are characteristic of Faenza, as is a form of globular two-handled jar. Later a light-blue (*berettino*) ground was popular. In the early 16th century the *istoriato* style of decoration (history painting, or scenes from the Bible, mythology, and legend) became popular at Faenza. The finest wares produced by the factory date from the last quarter of the 15th century to around mid-16th century.

Faenza maiolica dish, *c.* 1490; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

Faenza ware, much of which was exported, is thought to be the origin of the French word *faience* (tin-glazed earthenware).

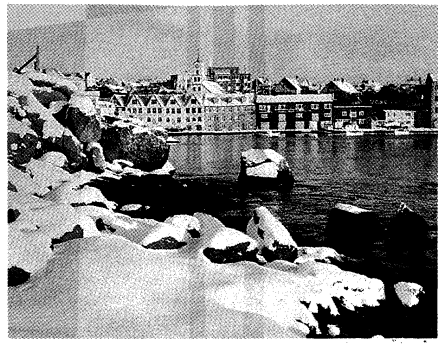
faerie: *see* fairy.

Faerie Queene, The, one of the great long poems in the English language, written in the 16th century by Edmund Spenser. As originally conceived the poem was to have been a religious-moral-political allegory in 12 books, each consisting of the adventures of a knight representing a particular moral virtue; for example, Book I recounts the legend of the Red Cross Knight, or Holiness. The knights serve the Faerie Queene, who represents Glory and Queen Elizabeth I. The first installment of the poem (Books I–III) was published in 1590; the second (Books IV–VI), in 1596. The first folio edition appeared in 1609.

Formally, the poem owes its whole being to the Italian romance form; for example, the division into books and cantos and the inventive energy of the *entrelacement* (the continually bifurcating and infolded narrative). The poem is written in what came to be known as the Spenserian stanza: eight lines of 10 syllables followed by one 12-syllable line, rhyming ababbcbcc.

Faeroe Islands, also spelled FAROE ISLANDS, Danish FAERØERNE, Faeroese FØROYAR, group of islands in the North Atlantic between Iceland and the Shetland Islands. They form a self-governing community within the kingdom of Denmark. There are 17 inhabited islands and numerous islets and reefs (total area 540 sq mi [1,399 sq km]). The principal islands are Streymoy (Strømø), Eysturoy (Østerø), Vágar (Vågø), Sudhuroy (Suderø), Sandoy (Sandø), and Bordhoy (Bordø). The capital is Tórshavn (Thorshavn) on Streymoy. The population in 1984 was estimated at 44,800.

The article that follows is a summary of



The harbour at Tórshavn on Streymoy, Faeroe Islands, Denmark

W. Ferchland—Bruce Coleman Inc.

significant detail about the Faeroe Islands. For information about regional aspects of the Faeroe Islands, *see* MACROPAEDIA: Denmark.

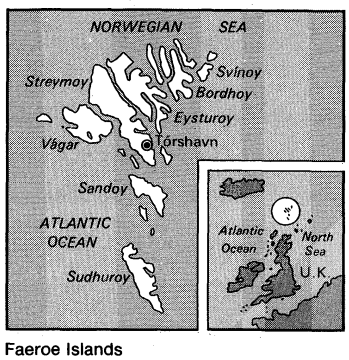
For current history and for statistics on society and economy, *see* the article "World Affairs" and BRITANNICA WORLD DATA, respectively in the *Britannica Book of the Year.*

The land. Comprising volcanic rocks covered by a thin layer of moraine or peat soil, the islands are high and rugged with perpendicular cliffs (highest at Slaettaratindur [2,894 ft, or 882 m] on Eysturoy) and flat summits separated by narrow ravines. The coasts are deeply indented with fjords, and the narrow passages between islands are agitated by strong tidal currents.

The climate is oceanic and mild, with little variation in temperature and frequent fog and rain (about 60 in. [1,500 mm] per year). There are no toads, reptiles, or indigenous land mammals; rats and mice have come with ships. Seabirds are numerous and an important economic resource—the puffin as food and the eider for feathers. Natural vegetation is moss, grass, and mountain bog. The islands are naturally treeless because of strong westerly winds and frequent gales, but some hardy trees have been planted in sheltered plantations. Because of the warm Atlantic Drift, the harbours are relatively free of ice.

The people. The Faeroese are of Scandinavian origin, descendants of Norwegian Vikings who colonized the islands *c.* AD 800. The people live in small settlements almost all of which are on the coasts. The capital, Tórshavn, had a population in 1982 estimated at 14,000. The main language is Faeroese, most closely related to Icelandic and western Norwegian; Danish is taught in all schools. Most islanders are Lutherans belonging to the Danish national church. The population tripled between 1801 and 1901 and has more than doubled since then. About one-fourth of the total population is less than 14 years of age.

The economy. Since 1900 the islands have evolved from an agricultural (primarily sheep-raising) peasant community into a modern economy based on fishing and related industries, especially the export of dried cod. The fishing limit was extended to 200 nautical mi (370 km) in 1977. Economic supplements to this base include fowling and sheep



Faeroe Islands

raising (wool is exported or used in a small, home-spinning and knitting industry). Coal is mined on Sudhuroy. Only about 6 percent of the land is cultivated; the main crops include potatoes, other vegetables, and grass for sheep. Fuels, basic manufactures, and transport equipment are the major imports. The main harbour is at Tórshavn and there is an airport on Vágar. There are regular shipping communications with Denmark, Iceland, and, in the summer, the Shetland Islands.

Administrative and social conditions. The islands are a self-governing territory within the Danish state and send two representatives (elected every four years) to the Folketing, the Danish unicameral legislature. The Faeroe Islands Parliament (Lagting) has 32 elected members, who in turn elect an administrative body (Landsstyre) headed by a chairman. Foreign policy, defense, and the monetary and judicial systems are overseen by the Folketing. A commissioner represents the Danish crown in the islands. Education is based on the Danish system. The islands have several hospitals and good medical services.

History. The name first appeared as Faereyiar (*c.* 1225), meaning "sheep islands," which presumably led to the national symbol, a ram. First settled by Irish monks (*c.* 700), the islands were colonized by the Vikings (*c.* 800) and were Christianized by the King of Norway (*c.* 1000). The remains of a Gothic cathedral, begun by Bishop Erlend (1269–1308) but never completed, are at Kirkjubøur (Kirkebø). The Faeroes became a Norwegian province in 1035 and passed to Denmark with the rest of Norway in 1380. Separated from Norway administratively in 1709, they were attached to the diocese of Zealand and became a Danish royal trade monopoly, which inhibited economic development.

Early Faeroese oral literature became the basis for modern nationalism in the 19th century and led to the creation of a written Faeroese language by a folklorist, Venceslaus Ulricus Hammershaimb. Nationalist agitation hastened the restoration of the old Faeroese Lagting (a combined jury and parliament) in 1852 and the end of the trade monopoly in 1856. A Home Rule Party was formed in 1906. The Faeroese language was authorized to some extent in schools and churches in 1912 and, in 1938, became the single language of instruction, if the teacher so wished. During World War II Great Britain controlled the Faeroes while the Germans occupied Denmark, a situation that gave impetus to the demands for home rule. After the Lagting elections of 1946 reversed the majority vote for independence in an earlier plebiscite, negotiations began again in Copenhagen. In 1948 the islands were granted self-government under the authority of Denmark, with their own flag and their own unit of currency (the krona); Faeroese was given equality of status with Danish. The Faeroese Academy in Tørshavn, offering instruction in Faeroese language and culture, opened in 1965.

Faeroese language, also spelled FAROESE, Faeroese FØROYAR, language spoken in the Faeroe Islands; it belongs to the West Scandinavian group of the North Germanic languages. Faeroese preserves more characteristics of Old Norse than any other language except modern Icelandic, to which it is closely related. The written language was established by the Faeroese linguist and folklorist Venceslaus Ulricus Hammershaimb in 1846. By 1912 it was authorized for use in some schools and churches, and in 1938 Faeroese, rather than Danish, became the sole language of instruction if the teacher so desired. Ballads make up the greater part of Faeroese traditional literature. Unintelligible to other Scandinavians,

the language is notable for its many diphthongs, which developed from older, simple vowels. *See also* Old Norse language.

faery: *see* fairy.

Faes, Pieter van der (Baroque portraitist): *see* Lely, Sir Peter.

Faesi, Robert (b. April 10, 1883, Zürich—d. Sept. 18, 1972, Zollikon, Switz.), Swiss poet, dramatist, short-story writer, and literary critic, noted for his trilogy of novels on Zürich life and for important critical studies of literary figures.

Faesi for many years (1922–53) combined his literary activity with a professorship of German literature at the University of Zürich. His poems in the collections *Aus der Brandung* (1917; "From the Surge") and *Der brennende Busch* (1928; "The Burning Bush") are socially significant products of World War I and postwar Expressionism. His *Füsilier Wipf* (1917, rev. 1938), the story of a soldier of World War I, became popular as a film. The *Zürcher Idylle* (1908, rev. 1950; "The Zürich Idyll") and one of his most important works, the epic saga *Die Stadt der Väter, Die Stadt der Freiheit, Die Stadt des Friedens*, 3 vol. (1941–52; "The City of the Fathers," "The City of Freedom," "The City of Peace"), deal with Zürich life during the 18th century, including the period of the French Revolution. In 1949 Faesi wrote the libretto for Willy Burkhard's opera *Die schwarze Spinne* ("The Black Spider"). Faesi also wrote important critical studies of Rainer Maria Rilke, Gottfried Keller, Thomas Mann, and others. His correspondence with Mann was published in 1962.

Fagaceae, the beech family, constituting the order Fagales, with 10 genera of ornamental, timber, and nut-bearing trees and shrubs, native to temperate and subtropical regions, including beech (*Fagus*), false beech (*Nothofagus*), chestnut (*Castanea*), chinquapin (*Castanea* and *Castanopsis*), tanbark oak (*Lithocarpus*), and oak (*Quercus*).

A brief treatment of Fagaceae follows. For a full treatment, *see* MACROPAEDIA: Angiosperms.

Male flowers appear as catkins on the same tree with the female flowers, which are arranged singly or in clusters and subtended by a whorl of scales that forms a husk enclosing the fruit or nut. Beeches, some false beeches, chestnuts, and chinquapins have one or more nuts in a prickly bur; oaks and tanbark oaks have a single acorn in a scaly cup.

Făgăraş, Hungarian FOGARAS, town, Braşov *judeţ* (county), central Romania, north of the Făgăraş Mountains, a range of the Transylvanian Alps (Southern Carpathians), on the Olt River. First mentioned in documents in 1291, Făgăraş became a military centre during the Middle Ages. The Făgăraş Castle, built during the 15th century and now restored to its original form, is one of the outstanding examples of medieval Transylvanian architecture. The town is an important centre of the Romanian chemical industry, based on nearby natural-gas deposits. Pop. (1985 est.) 40,008.

Făgăraş Mountains, Romanian MUNŢII FĂGĂRAŞ, mountain range, the highest section of the Transylvanian Alps (Southern Carpathians), south-central Romania. Their steep northern face rises above 8,000 feet (2,450 m) in a distance of 6 miles (10 km) and overlooks the Făgăraş Depression, through which flows the Olt River over a gentler gradient south to the Carpathian foothills. The mountains are heavily glaciated, with lakes, fretted peaks, and morainic deposits. The Olt breach defines the western end, the Bran Pass the eastern. Moldoveanu (8,346 feet [2,544 m]) and Negoiu (8,317 feet [2,535 m]) are the highest peaks. On the northern face many short streams fall precipitously into the Olt; on the southern face rise several rivers, the major one being the Argeş. The 30-mile- (48-kilometre-) long range is relatively isolated and inaccessible in comparison with the rest of the Transylvanian Alps.

Faguet, Émile (b. Dec. 17, 1847, La Roche-sur-Yon, Fr.—d. June 6, 1916, Paris), French literary historian and a provocative critic with a traditional approach, oriented toward the moral issues of his time.

Faguet was appointed to a chair at the Sorbonne in 1890 and elected to the French Academy in 1900. He contributed to a number of major French journals. Prejudiced against those people and periods that did not meet

Faguet
H. Roger-Viollet

his standards, he was relatively unconcerned with purely aesthetic values and the general tendencies of an age. His judgments on poetry often lacked sensitivity.

Faguet's most remarkable work is *Politiques et moralistes du XIX siècle*, 3 vol. (1891–1900; "Moralists and Political Thinkers of the 19th Century"). In addition to writing analytical works on literature, Faguet acted as drama critic (1888–1907) for the *Journal des Débats*. Among his nonliterary works are noted his *L'Anticléricalisme* (1906), *Le Pacifisme* (1908), and *Le Féminisme* (1910).

Faguibine, Lake, French LAC FAGUIBINE, isolated lake in Mali, west of Timbuktu (Tombouctou). It lies north of the Niger River in the Macina depression, and it is reached by branches of the Niger in times of flood. It reaches a length of about 70 miles (113 km).

Fagunwa, D(aniel) O(lorunfemi) (b. 1903 or *c.* 1910, Okeigbo, near Ondo, Yorubaland, Southern Nigeria—d. Dec. 9, 1963, near Bida, Nigeria), Yoruba chief whose series of fantastic novels made him Nigeria's most popular writer. He was also a teacher.

Fagunwa's first novel, *Ogboju Ode Ninu Igbo Irunmale* (1938; later translated as *The Forest of a Thousand Daemons* by Nigerian playwright Wole Soyinka), was the first full-length novel published in the Yoruba language. His second novel, *Igbo Olodumare* ("The Forest of God"), was published in 1949. His other novels are *Ireke Onibudo* (1949; "The Sugarcane of the Guardian"), *Irinkerindo Ninu Igbo Elegbeje* (1954; "Wanderings in the Forest of Elegbeje"), and *Adiitu Olodumare* (1961; "The Secret of the Almighty"). He also wrote a number of short stories and two travel books.

Fagunwa's works characteristically take the form of loosely constructed picaresque fairy tales containing many folklore elements: spirits, monsters, gods, magic, and witchcraft. Fagunwa's language is vivid: a sad man "hangs his face like a banana leaf," a liar "has blood in his belly but spits white saliva." Every event points to a moral; this moral tone is reinforced by his use of Christian concepts and of traditional and invented proverbs. His imagery, humour, wordplay, and rhetoric reveal an extensive knowledge of "deep" (classical) Yoruba. He was also influenced by such Western works as John Bunyan's *The Pilgrim's Progress*, which were translated into Yoruba by missionaries.

A reaction to Fagunwa's work set in among some Yoruba intellectuals, who accused him of lacking realism. His lack of concern with contemporary social issues is more than balanced, however, by his knowledge of the Yoruba mind, his careful observation of the manners and mannerisms of his characters, and his skill as a storyteller. His influence can be detected in the writings of his fellow Nigerians Amos Tutuola and Wole Soyinka.

Fahd ibn ʿAbd al-ʿAzīz as-Saʿūd (b. 1923, Riyadh, Arabia), king of Saudi Arabia from 1982. As crown prince and as an active administrator, he had been virtual ruler during the preceding reign (1975–82) of his mild-mannered half brother King Khālid.

Fahd was the first son of Hassa Sudairi after her remarriage to the founder of the kingdom, Ibn Saʿūd. Once thought of as a lazy and hedonistic youth, he was named minister of education in 1953 and established a system of public elementary and secondary education. Later he began for himself an earnest program of self-improvement, making up for his lack of formal education. In 1962 he was made minister of the interior and, in 1967, second deputy premier as well. In 1975 King Khālid, upon his accession, named him crown prince. He was a consistent advocate of modernization and established a corps of Western-trained technicians to oversee industrial diversification. He was also the principal architect of Saudi Arabian foreign policy in the 1970s and '80s that sought to counterbalance Soviet influence in the Middle East by providing financial aid to moderate states, notably Egypt. He opposed the Camp David accords between Israel and Egypt, and in 1980 he called for a jihad (holy war) against Israel following its annexation of East Jerusalem. In 1981, however, he announced an eight-point plan for a Middle East peace settlement that implied recognition of Israel's right to live within secure boundaries; the plan failed to gain Arab endorsement.

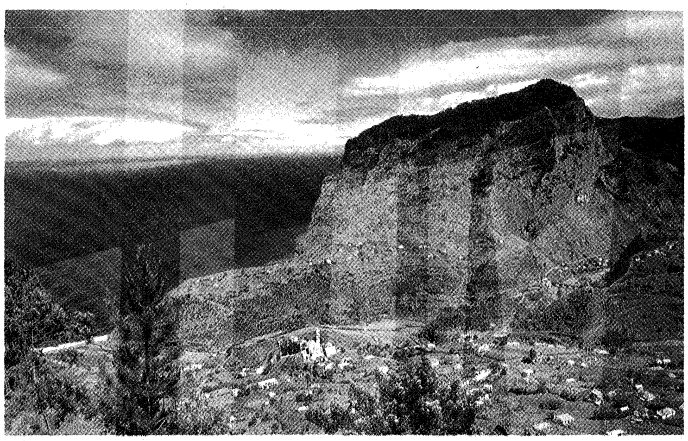
Fahrenheit, Daniel Gabriel (b. May 24, 1686, Gdańsk, Pol.—d. Sept. 16, 1736, The Hague), German physicist who invented the alcohol thermometer (1709) and mercury thermometer (1714); he introduced the Fahrenheit thermometric scale, still commonly used in the United States.

Fahrenheit spent most of his life in the Netherlands, where he devoted himself to the study of physics and the manufacture of precision meteorological instruments. He discovered, among other things, that water can remain liquid below its freezing point and that the boiling point of liquids varies with atmospheric pressure.

Fahrenheit temperature scale, scale based on 32° for the freezing point of water and 212° for the boiling point of water, the interval between the two being divided into 180 parts. The 18th-century German physicist Daniel Fahrenheit originally took as the zero of his scale the temperature of an equal ice–salt mixture and selected the value 96° for normal body temperature; the final scale required an adjustment of this to 98.6°.

Until the 1970s the Fahrenheit scale was in general common use in the English-speaking countries; the Celsius scale was used in most other countries and for scientific use worldwide. Since that time, however, most English-speaking countries have officially adopted the Celsius scale. The conversion formula for a temperature expressed on the Celsius (°C) scale to its Fahrenheit (°F) representation is: $°F = (9/5 \times °C) + 32$.

Faial Island, formerly FAYAL ISLAND, Portuguese ILHA DO FAIAL, Portuguese island



Mount Guia overlooking the town of Horta, on Faial, Azores
V. Phillips—Shostal/EB Inc.

forming part of the Azores archipelago, in the North Atlantic Ocean. Its area of 67 square miles (173 square km) was increased by 1 square mile (2.5 square km) because of volcanic activity in 1957–58. The centre of the island comprises a perfectly shaped volcano, Mount Gordo. Faial (meaning "beech wood") was named for the wax myrtle, once abundant, which its discoverers mistook for beech trees. A small valley, Flamengos, recalls the Flemish settlers who colonized the island in the 16th century.

The women of Faial produce fine lace from *agave* thread, execute carvings in snow-white fig-tree pith, and weave fine baskets. Grains, fruit, and olives are grown, and cattle raising and dairying are other important economic activities. The island is in the administrative district of Horta, and its capital, the town of Horta, is Faial's main seaport; other towns of importance include Cedros and Feteira. Pop. (1986 est.) 16,100.

Faidherbe, Louis(-Léon-César) (b. June 3, 1818, Lille, Fr.—d. Sept. 29, 1889, Paris), governor of French Senegal in 1854–61 and 1863–65 and a major founder of France's colonial empire in Africa. He founded Dakar, the future capital of French West Africa.

Faidherbe, lithograph by A. Néraudau, 1873
By courtesy of the Bibliotheque Nationale, Paris

Early life and career. After graduating from the École Polytechnique, Faidherbe joined the corps of military engineers in 1840. He spent three undistinguished years, from 1843 to 1846, in Algeria. In 1847 he was posted to Guadeloupe, where his reserved and prickly temperament and his strong Republican sympathies alienated both the colonists and his fellow officers, and he was recalled. He returned to Algeria in 1849 and assumed his first independent command; his work now won commendation, and after further service in Kabylie he was made chevalier of the Légion d'Honneur.

In 1852 he was transferred to Senegal as deputy director of engineers and soon impressed the local merchant community as a capable and energetic administrator. Two years later, at the age of 36, he was promoted to the rank of major and appointed governor of Senegal.

As governor, Faidherbe was alarmed by the growing power of the militant Islāmic leader al-Ḥājj ʿUmar Tal on the frontiers of Senegal. Abandoning the cautious policies of his predecessors, Faidherbe took the offensive against all those who threatened French primacy. In a series of well-executed campaigns, some undertaken against the wishes of the Paris government, he subjugated the Moorish tribes in the north, drove the forces of al-Ḥājj ʿUmar off the lower Sénégal River, and extended French control south toward the Gambia. By 1861 he had transformed his colony from a collection of scattered trading posts into the dominant political and military power in this region of West Africa.

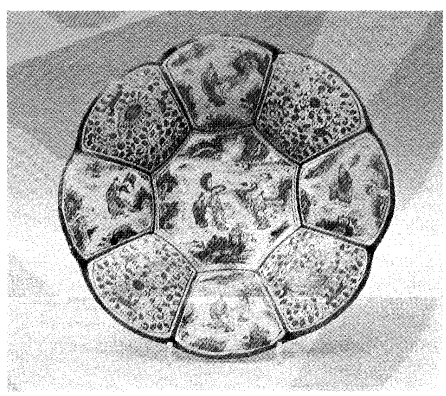
Colonial policies. Faidherbe was no mere conquistador; he possessed a real sympathy for his African subjects and a genuine concern for their welfare. He was also an uncompromising enemy of slavery in all its forms. He sought to improve indigenous society without destroying it, and to this end he maintained the traditional authority of the chiefs while training their sons to become more efficient agents of French rule.

Faidherbe's ambition was to make Senegal the cornerstone of a vast French African empire that he hoped might one day rival British India in its commercial development. During his first period of office he encouraged experimental farming, founded Dakar, and built Médina on the upper Sénégal as a base for further expansion inland. When he reassumed the governorship in 1863, after another tour of duty in Algeria, his principal objective was the extension of French power to the Niger River and ultimately to Timbuktu and beyond. The French government, however, rejected his proposals for territorial expansion as too expensive. Nevertheless, his farsighted policies laid the foundations for the West African federation that was finally created at the turn of the 20th century.

Later career. Faidherbe left Senegal in 1865 and returned again to Algeria. Recalled to France after the outbreak of the Franco-German War, he was appointed commander in chief of the Army of the North in December 1870. Faidherbe realized the hopelessness of his task, but, as a good Republican, he remained loyal to the government of national defense and fought with skill and tenacity. In 1871 the three northern *départements* of Pas-de-Calais, Somme, and Nord all elected him to the National Assembly with overwhelming majorities, but he resigned almost immediately because of the assembly's anti-Republican proceedings. He was defeated in the senatorial elections of 1876 but was elected Republican senator for the Nord in 1879 and held the seat until 1888. As a final recognition of his services, he was made grand chancellor of the Légion d'Honneur in 1880.

By then, Faidherbe could no longer participate actively in political life, for years of service in Africa and the rigours of the northern campaign had left him paralyzed and half blind. He retained his interest in West African affairs, however, and continued to exert some influence over them.

faience, also spelled FAÏENCE, or FAYENCE, tin-glazed earthenware made in France, Germany, Spain, and Scandinavia (as distinguished from that made in Italy, which is called Faenza maiolica, and that made in The Netherlands and England, which is called delft). Tin-glazed ware was originally produced in Moorish Spain and 15th-century Italy, and the French name faience is probably derived from Faenza, an Italian centre of maiolica production during the Renaissance. Until the late 17th century tin glaze was applied to unfired ware and then placed in a high-temperature kiln. Colours were limited to the few that could tolerate high heat until the 18th century, when a low-fire overglaze enamel was used. Little faience for domestic use was manufactured after the early 19th century because of the popularity of creamware and porcelain, both of which were more durable.



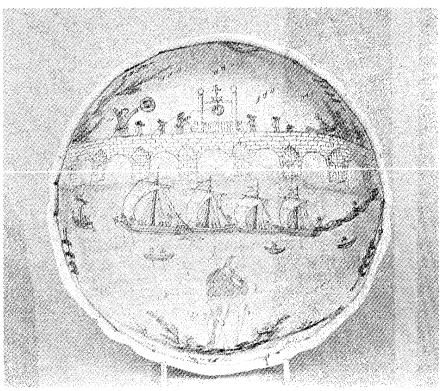
German faience lobed dish painted with chinoiserie in blue and manganese, Frankfurt am Main, *c.* 1690; in the Victoria and Albert Museum, London
By courtesy of the Victoria and Albert Museum, London; photograph, EB Inc.

faience blanche, type of French pottery of the late 16th and early 17th century; it copied *bianchi di Faenza,* a sparsely decorated Faenza maiolica (tin-glazed earthenware), which appeared about 1570 as a reaction to an overornamented pictorial style. In the simpler form, much of the white area was left exposed, the decoration being merely a central figure or a coat of arms with a conventional wreath around the margin. Nevers and Lyon, where Domenico Tardessir of Faenza set up as a potter in 1574, soon became centres for the popular white tin-glazed earthenware, which then came to be known as faience. *Faience blanche,* which was unaffected and utilitarian, was for common use; it supplied the basis of an extensive industry in France that lasted into the 19th century.

faience fine, fine white English lead-glazed earthenware, or creamware, imported into France from about 1730 onward. Staffordshire "salt glaze" was imported first, followed by the improved Wedgwood "Queen's ware" and the Leeds "cream-coloured ware." It was cheaper than French faience, or tin-glazed earthenware, and more durable and was there-

fore subjected to heavy tariffs in 1741 and 1749. A Franco-British treaty of 1786, placing a nominal duty on imported creamware, practically ruined the ordinary faience industry of France, and its extinction was completed for domestic use in the first half of the 19th century by the growth of indigenous makers of *grès façon d'Angleterre* (or *faience fine*). Some of these factories had employed expatriate English potters, such as the Leigh brothers who managed a factory at Douai, whose products resemble and are often mistaken for Leeds ware. Despite its name, *faience fine* is not true faience but a lead-glazed earthenware.

faience parlante, in French pottery, a popular 18th-century ware, principally plates, jugs, and bowls, brightly decorated with freely

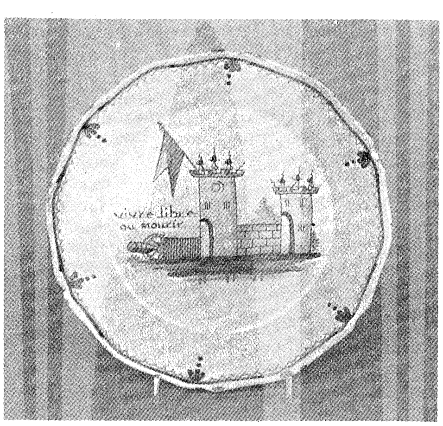


French *faience parlante* bowl, Nevers, *c.* 1790; in the Victoria and Albert Museum, London

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

drawn social themes. The range includes owners' names, bacchic or facetious references, Masonic and trade emblems, quotations from songs and proverbs, urban views, and allegorical designs, such as "L'Arbre de l'amour" ("Tree of Love"), as well as commemorative themes celebrating such events as the ascent of the Montgolfiers' balloon in 1783. Nevers, Fr., was the outstanding centre of *faience parlante* (literally "talking faience").

faience patriotique, French 18th-century earthenware, chiefly plates and jugs, decorated with themes drawn from the French Revolution and its ideology or from national political events. The first example of a *faience patriotique* was a Moustiers dish occasioned by the Battle of Fontenoy in 1745, but it was the Revolution that inspired the greatest production of *faience patriotique.* A number of early plates displayed the Royalist fleur-de-



French *faience patriotique* plate inscribed "vivre libre ou mourir," Nevers, *c.* 1793; in the Victoria and Albert Museum, London

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

lis, but these were soon replaced by countless Republican phrases and symbols. Made throughout the country, mostly at Nevers and notably at Rouen, Paris, and Beauvais, as well as in the Vendée, in Auxerre and Artois, and in the Midi, the great volume of *faience patriotique* covered the total range of Revolutionary imagery. Lively, naive, and colourful ceramic pictures proliferated—the Gallic cock, the Phrygian cap, plows and oak trees, draped flags, and the Bastille—as did slogans pertaining to liberty, the Third Estate, agriculture, and the rights of man. Although produced in vast numbers, *faience patriotique* has inspired many forgeries and replicas.

Fain, Agathon-Jean-François, Baron (b. Jan. 11, 1778, Paris—d. Sept. 16, 1837, Paris), French historian, secretary, and archivist to the *cabinet particulier* of Napoleon, who is best-known for his personal reminiscences of Napoleon's reign. His works are very important sources for the history of the French empire.

Before his appointment to the emperor's cabinet in 1806, Fain had worked since 1795 in various state archives. Napoleon made him a baron in 1809 and in 1813 appointed him his private secretary. During the Hundred Days in 1815 he resumed this post but then retired to private life. In 1830 King Louis-Philippe appointed him occasional administrator of the civil list and first secretary of his cabinet.

Fain, lithograph by Lemercier, after a portrait by Henri Grévedon

H. Roger-Viollet

During his retirement Fain published his reminiscences, most notably *Manuscrit de 1814, contenant l'histoire des six derniers mois du règne de Napoléon* (1823; "Notebook of 1814, Containing the History of the Last Six Months of Napoleon's Reign") and similar "Notebooks" for 1813 and 1814, as well as for 1794–95 (the Revolutionary year III). Fain's memoirs were published posthumously in 1908.

fainting, loss of consciousness owing to a temporary decrease in the blood supply to the brain. *See* syncope.

fair, a temporary market where buyers and sellers gather to transact business. A fair is held at regular intervals, generally at the same location and time of year, and usually lasts for several days or even weeks. Its primary function is the promotion of trade. Historically, fairs displayed many different kinds of products in specific commodity or industrial groupings. A more modern type of fair, in which participation is confined to exhibitors representing one industry or even just specialized segments of an industry, gained in popularity during the 20th century and is now known as a trade fair (*q.v.*).

Historically, fairs were created to solve the early problems of distribution. They provided an opportunity for the demonstration of skills and crafts, for the exchange of ideas, and for the bartering of goods. They concentrated supply and demand in certain places at certain times. Fairs were a fixture of the Roman Empire, and the Romans introduced markets and fairs into northern Europe to encourage trade within their conquered provinces. When the Roman Empire disintegrated in the late 5th century, virtually all organized commerce in Europe ceased until the late 7th century. Trade revived under Charlemagne, and fairs eventually evolved from some of the local markets, particularly at points of major caravan route intersections and wherever people congregated for their religious festivals. The methods of commerce introduced at such fairs became widespread, and the rules of the fair eventually became the basis of European business law.

The largest of the fairs became quite important. The fair at Saint-Denis near Paris had already risen to prominence in the 7th century, and the Easter fairs at Cologne were equally popular in the 11th century. From the mid-12th century on for several hundred years, the fairs of Champagne reigned supreme among the important fairs of Europe. Products from all over Europe and beyond, including furs from Russia, drugs and spices from the Orient, cloth from Flanders, and linens from southern Germany, were traded there. Important fairs also arose at Lyon, Geneva, and at Stourbridge in England. Among other fairs of historical interest were those at Kinsai in China, which flourished during Europe's Dark Ages; the great Aztec fair which the Spanish conquistadores found on the present-day site of Mexico City; and the Nizhny Novgorod fair in central Russia. These fairs all succeeded because they were located on great highways of communication and in some cases on the routes of holy pilgrimages.

In almost every civilization, as commerce became standardized, transportation was organized, and cities grew large enough to require daily markets, fairs have become less important. Sometimes they evolved into religious festivals or into places of recreation and amusement. Others were ruined by the excessive taxation of greedy rulers, and still others, particularly in modern times, have simply been suppressed; the Soviet Union abolished all of its 17,500 fairs in 1930 as being "unsuited to the Soviet economic and political objective." The commerce of Western Europe during the feudal era was largely based on fairs, but with the coming of the Industrial Revolution the vitality of the great fairs was sapped; many perished, and the character of many others changed. One remaining vestige of such fairs is found in the county, agricultural, and livestock fairs that are still popular in the United States and in Europe. Older specialty fairs evolved into the modern trade fair.

Fair Deal, in U.S. history, President Harry S. Truman's liberal domestic reform program, the basic tenets of which he had outlined as early as 1945. In his first postwar message to Congress that year, Truman had called for expanded social security, new wages-and-hours and public-housing legislation, and a permanent Fair Employment Practices Act that would prevent racial or religious discrimination in hiring. Preoccupied with problems of inflation and of conversion to a peacetime economy, however, Congress paid little heed to the proposals, though in 1946 it did pass the Employment Act, clearly stating the government's responsibility for maintaining full employment and establishing a three-man Council of Economic Advisers to help assure a continuing healthy national economy. After his surprise victory at the polls in November 1948, Truman reasserted (Jan. 20, 1949) his reform proposals under the catchphrase Fair Deal. The economy-minded 81st Congress would agree to legislate only a few of the President's recommendations; however, it raised the minimum wage, promoted slum clearance, and extended old-age benefits to an additional 10,000,000 persons.

Fair Labor Standards Act, also called WAGES AND HOURS ACT, the first act in the United States prescribing nationwide compulsory federal regulation of wages and hours, sponsored by Sen. Robert F. Wagner of New York and signed on June 14, 1938, effective October 24. The law, applying to all industries engaged in interstate commerce, established a minimum wage of 25 cents per hour for the first year, to be increased to 40 cents within seven years. No worker was obliged to work, without compensation at overtime rates, more than 44 hours a week during the first year, 42 the second year, and 40 thereafter.

Fair Oaks, Battle of (1862): *see* Seven Pines, Battle of.

fair-trade law, in the United States, any law allowing manufacturers of branded or trademarked goods (or in some instances distributors of such products) to fix the actual or minimum resale prices of these goods by resellers. The designation "fair-trade law" is peculiar to the United States; the practice described in them is known elsewhere as price maintenance (*q.v.*) or resale price maintenance.

When first tested in U.S. courts in 1922, resale price maintenance agreements were found to violate the Sherman Anti-Trust Act of 1890 with its prohibition of monopolies. In countries lacking such prohibitions, especially in Great Britain, the practice became widespread, enforced by trade associations and groups of trade associations; but in the United States the practice was limited in interstate commerce to the mere suggestion of prices to dealers, without effective power of enforcement. A turning point came in the United States when the California Fair Trade Act of 1931 was amended in 1933 to include a so-called nonsigners' clause, whereby prices agreed upon by a manufacturer and contracting dealers were made binding upon all resellers. Influenced by the depressed markets of the 1930s, 44 states enacted similar laws, which were intended to protect independent retailers from price-cutting by large chain stores and thus prevent the loss of employment in the distributive trades. These statutes were supported in 1937 by the passage of the Miller-Tydings Amendment to the Sherman Anti-Trust Act, which exempted price maintenance agreements from antitrust laws. When World War II began, U.S. manufacturers had more authority over pricing than thoses in most other countries.

By the 1960s, the complexity of marketing channels in the highly industrialized countries made enforcement of such agreements by manufacturers impracticable, and the practice entered a worldwide decline. At the same time, increasing doubts as to its propriety caused it to be banned or severely limited in some countries. In the United States, as opposition to fair-trade laws gained ground, many states repealed them, and in 1975 the few that remained were repealed by an act of Congress.

Fairbairn, Stephen (b. Aug. 25, 1862, Melbourne—d. May 16, 1938, London), British oarsman, coach, and writer who enjoyed great success at Cambridge University.

After attending Wesley College in Australia, Fairbairn continued his education and first achieved rowing prominence at Jesus College, Cambridge. He rowed for Cambridge in the 1880s and in 1931 titled his autobiography *Fairbairn of Jesus.*

As a coach at Cambridge he enjoyed great success with an innovative approach. The orthodox system emphasized body swing as the main source of power; Fairbairn's stroke concentrated on leg drive, arm pull, and smooth blade work. His stroke was short on the water, and his technique demanded a high degree of physical fitness. Fairbairn's influence was felt internationally and led to a number of equipment modifications and developments. Slides were lengthened, swivel rowlocks replaced fixed pins, and crews sat in straight lines rather than in staggered positions. In 1926 Fairbairn organized the first Head of the River Race on the Thames, which quickly became a fixture in the sport. His *Rowing Notes* (1926) is considered a seminal rowing book.

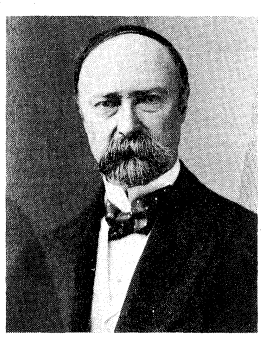
Fairbairn, Sir William, 1ST BARONET (b. Feb. 19, 1789, Kelso, Roxburghshire, Scot.—d. Aug. 18, 1874, Moor Park, Surrey, Eng.), Scottish civil engineer and inventor who did pioneering work in bridge design and in testing iron and finding new applications for it.

From 1817 to 1832 he was a millwright at Manchester, in partnership with James Lillie. In 1835 he established a shipbuilding yard at Millwall, London, where he constructed several hundred vessels. In 1844 he introduced the Lancashire boiler with twin flues. He was the first to use wrought iron for ship hulls, bridges, mill shafting, and structural beams. He also experimented with the strength of iron and the relative merits of hot and cold blast in iron manufacture. In 1845 he joined Robert Stephenson in designing two tubular railway bridges in Wales: the Britannia Bridge, spanning the Menai Strait, and the Conwy Bridge over the River Conwy. The Britannia Bridge, employing a type of box girder or plate girder that came into worldwide use, was partly rivetted by hydraulic machines designed by Fairbairn.

Fairbairn became a baronet in 1869. His youngest brother, Sir Peter (1799–1861), founded in Leeds an establishment to make textile machinery and machine tools and was knighted in 1858.

Fairbanks, city, east central Alaska, U.S., on the Chena River (tributary of the Tanana). It was founded in 1902 during a gold strike and was named for Sen. (later Vice Pres.) Charles Warren Fairbanks. It lies at the midway point on the 800-mi (1,300-km) north–south trans-Alaskan oil pipeline from the Prudhoe Bay fields to the Valdez terminal. As the northern terminus of the Alaska and Richardson highways and Alaska Railroad and the southern terminus of the Steese and Elliott highways, Fairbanks has become the main supply centre for the booming oil business; it was the construction headquarters for the pipeline. Mining, lumbering, and fur trading are traditional economic activities, augmented by tourism and servicing nearby Ft. Wainwright (previously Ladd Army Air Corps Field, 1938) and Eielson Air Force Base (1943). The University of Alaska (1917) is at College, 3 mi northwest. The Golden Days Celebration (July), the 800-mi Yukon Marathon, (a small-boat race; June), and the North American Championship Sled Dog Races (March) are annual events. Inc. 1903. Pop. (1980) 22,645.

Fairbanks, Charles Warren (b. May 11, 1852, Union County, Ohio, U.S.—d. June 4, 1918, Indianapolis, Ind.), U.S. Republican politician and vice president under Pres. Theodore Roosevelt (1905–09); he was sometimes referred to as "the last of America's log-cabin statesmen."



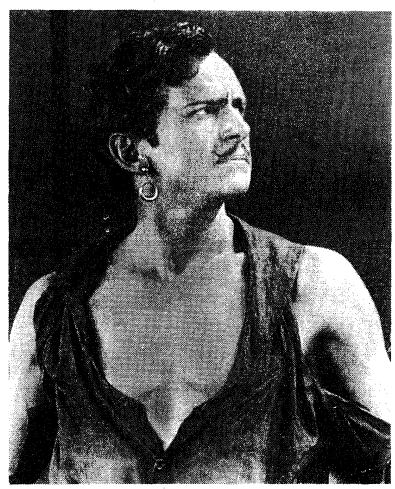
Charles Fairbanks

By courtesy of the Library of Congress, Washington, D.C.

From his origins in a one-room cabin, Fairbanks rose to prominence as an Indiana railway attorney, having been admitted to the bar in 1874. He became the chief power in the state Republican Party from 1896 until his death. In the U.S. Senate (1897–1905), he was quietly effective and quickly became acknowledged as the principal spokesman for that body.

As a staunch conservative from a "doubtful" state, Fairbanks was chosen in 1904 as Roosevelt's running mate to balance the ticket. He served his term in office without incident. When the party was divided in 1912 by the Progressive Movement, he supported the regular nominee, William Howard Taft, instead of Roosevelt. He also ran unsuccessfully for vice president on the 1916 ticket headed by Charles Evans Hughes.

Fairbanks, Douglas, original name DOUGLAS ELTON ULMAN (b. May 23, 1883, Denver, Colo., U.S.—d. Dec. 12, 1939, Santa Monica, Calif.), U.S. motion-picture actor and producer who was one of the first and greatest of the swashbuckling screen heroes. His athletic prowess, gallant romanticism, and natural sincerity made him "King of Hollywood" during the 1920s.



Douglas Fairbanks in *The Black Pirate*

EB Inc.

After college study he began playing stage bit parts and by 1914 had become a popular Broadway actor. Fairbanks made his first film, *The Lamb* (1915), under the direction of D.W. Griffith and in 1917 became head of his own producing company. Among his many popular pictures were: *The Mark of Zorro* (1920), *The Three Musketeers* (1921), *Robin Hood* (1922), *The Thief of Bagdad* (1924), *The Black Pirate* (1926), *The Iron Mask* (1929), and *The Taming of the Shrew* (1929), in which he costarred with Mary Pickford, the popular leading lady to whom he was married from 1920 to 1935.

With Pickford, Charlie Chaplin, and others, he founded the United Artists Corporation in 1919 as a distribution outlet for independently produced films. In 1936 Fairbanks publicly announced his retirement from acting but continued as a producer until his death three years later.

Douglas Fairbanks, Jr. (b. Dec. 9, 1909, New York City), his son by his first wife, Anna Beth Sully, was a debonair leading man in the late 1930s and '40s who played roles similar to his father's. He later became an independent television producer in Great Britain and company director internationally.

Fairchild, David Grandison (b. April 7, 1869, Lansing, Mich., U.S.—d. Aug. 6, 1954,

Coconut Grove, Fla.), U.S. botanist and agricultural explorer who supervised the introduction of many useful plants into the United States.

In 1888 he graduated from Kansas State University of Agriculture, Manhattan, and, after some graduate work at the University

Fairchild, 1930

By courtesy of W.A. Archer and the Hunt Institute, Pittsburgh

of Iowa, Iowa City, and at Rutgers College (now the State University of New Jersey), New Brunswick, he joined the section of plant pathology of the United States Department of Agriculture (USDA) in Washington, D.C., in 1889. From 1893 to 1896 he studied in Italy, Germany, and Java. He helped W.T. Swingle organize the section of foreign seed and plant introduction of the USDA in 1897–98 and served the section in various capacities until his death.

During his term as administrator in charge (1904–28) many kinds of plants were introduced into the country.

Fairchild wrote several books, including *Exploring for Plants* (1930), an account of the Allison Vincent Armour expeditions for the USDA, and the autobiographical *The World Was My Garden* (1938). His collection of tropical trees and other plants is maintained at the Fairchild Tropical Garden, Coconut Grove, Fla.

Fairfax, city, seat, but administratively independent, of Fairfax County, northeastern Virginia, U.S., just southwest of Washington, D.C. It developed after 1800 with the construction of the county courthouse and relocation of the county seat from Alexandria. The wills of George and Martha Washington are displayed in the courthouse wing. Early known as Earp's Corner, it was incorporated as the town of Providence in 1805 and in 1859 was renamed for Thomas, Lord Fairfax. Reincorporated as a town in 1874, it became a city in 1961. Fairfax is the site of George Mason University (1957), originally a branch campus of the University of Virginia. Fairfax is mainly residential with some light manufactures (optical lenses, instruments, prefabricated buildings). Pop. (1980) 19,390.

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

Fairfax, Edward (b. *c.* 1575, Leeds, Yorkshire, Eng.—d. Jan. 27, 1635), English poet whose *Godfrey of Bulloigne or the Recoverie of Jerusalem* (1600), a translation of *Gerusalemme liberata,* an epic poem by his Italian contemporary Torquato Tasso, won fame and was praised by John Dryden. Although translating stanza by stanza, Fairfax freely altered poetic detail. The poem influenced the development of the couplet. It also influenced the poets Edmund Waller and Milton, whose tonal harmonies Fairfax often anticipated.

Among Fairfax' other works were 12 eclogues, of which only two and most of a third are known to have survived. The finest, "Hermes and Lycaon," is a singing match between worldly and spiritual lovers.

Fairfax (of Cameron), Ferdinando Fairfax, 2nd Baron (b. March 29, 1584, Yorkshire, Eng.—d. March 14, 1648, Yorkshire), general who fought on the parliamentarian side in the English Civil Wars and who was father of Thomas, 3rd Baron Fairfax, and parliamentarian commander in chief.

The son of the 1st Baron Fairfax, he was trained as a soldier in the Netherlands. He commanded a foot regiment in the first Bishop's War (1639) but took no part in the campaign of 1640. He shared the resentment of other Yorkshire gentlemen over heavy demands for billeting and other services made upon them and became a moderate parliamentarian in the Civil War. He was member of Parliament for Boroughbridge in seven Parliaments and for Yorkshire in the Long Parliament, and was member of the committee which presented the Grand Remonstrance to Charles I (November 1640).

From 1642 to 1644 he commanded in several battles in Yorkshire. Governor of York in July 1644, he took Pontefract in December, but resigned his command after the passing of the Self-Denying Ordinance. Fairfax died in Yorkshire from an accident in 1648.

Fairfax (of Cameron), Thomas Fairfax, 3rd Baron (b. Jan. 17, 1612, Denton, Yorkshire, Eng.—d. Nov. 12, 1671, Nun Appleton, Yorkshire), commander in chief of the Parliamentary army during the English Civil Wars between the Royalists and Parliamentarians. His tactical skill and personal courage helped bring about many of the Parliamentary victories in northern and southwestern England.

The son of Ferdinando, 2nd Baron Fairfax of Cameron, he attended Cambridge University and from 1629 to 1631 fought with the Dutch against the Spaniards. Fairfax participated in the Bishops' Wars (1639 and 1640) against the Scots and was knighted in January 1640. (He succeeded to his father's title in 1648.)

On the outbreak of the Civil War he and his father joined the Parliamentarian cause, Sir Thomas being appointed to command the cavalry in his native Yorkshire. He occupied Leeds in January 1643 and captured Wakefield in May, but after his defeat at Adwalton Moor on June 30 almost all of Yorkshire fell to the Royalists. With Oliver Cromwell's assistance, Fairfax counterattacked and secured the north through victories at Winceby, Lincolnshire (October 1643), and Marston Moor, Yorkshire (July 1644). He was seriously wounded in the siege of Helmsley Castle, Yorkshire (September 1644).

In February 1645 he was appointed commander in chief of the New Model Army. It is Fairfax who deserves much of the credit for organizing and training this effective fighting force. In his decisive victory over Charles I at Naseby, Northamptonshire (June 14, 1645), Sir Thomas displayed his renowned reckless daring. He then marched into the southwest and defeated the only remaining Royalist army at Langport, Somerset (July 1645).

Fairfax had hoped a limited monarchy could be established, but, when the Royalists again took up arms in 1647, he crushed their forces at Maidstone, Kent, and starved Colchester, Essex, into submission. Fairfax disapproved of the purge of Parliament by his soldiers in December 1648, and he refused to serve on the commission that condemned Charles I to death, an event he sought to prevent. He agreed to become a member of the Council of State of the newly formed Republic.

In 1650 Fairfax resigned as commander in chief in protest over the proposed invasion of Scotland. He then retired from politics, but in 1657 he quarrelled bitterly with his old friend Cromwell, now Lord Protector. After Cromwell's death in September 1658, he helped Gen. George Monck restore Parliamentary rule in the face of opposition from the army. Fairfax was a member of the Parliament that invited Charles I's son to return to England as King Charles II in 1660, but the desecration of Cromwell's remains by Charles II in 1661 incensed him. Thereafter, he took no further part in public affairs. See M.A. Gibb, *The Lord General: A Life of Thomas Fairfax (1938).*

Fairfield, city, seat of Solano County, north central California, U.S., adjoining Suisun City to the south, 45 mi (72 km) northeast of San Francisco. Lying between the Coast Range foothills and Suisun Bay, it was founded as the county seat in 1859 by Robert Waterman, a clipper-ship captain who named it for his hometown in Connecticut. After 1957 traditional crop production (fruits, cereals) and livestock raising were increased by irrigation provided by the Monticello Dam. Other assets to Fairfield's economy are wineries, the manufacture of small boats, explosives, and textiles, and the nearby Travis Air Force Base. Solano Community College (1945) is in Suisun City. Inc. city, 1938. Pop. (1980) city, 58,099, metropolitan area (SMSA), 334,402.

Fairfield, urban town (township), Fairfield County, southwestern Connecticut, U.S., on Long Island Sound, adjoining Bridgeport (northeast). It includes Southport, a village on Mill River. Possibly named for Fairfield, Kent, Eng., it was settled in 1639 by Roger Ludlow, who in 1637 had been a participant in the so-called Pequot War that nearly destroyed the Pequot Indians. In July 1779 Fairfield was burned by the British and Hessians under Gen. William Tryon. Although known as a summer resort, the town also has machinery and textile manufactures. Fairfield University was founded in 1942. The Fairfield Historical Society displays decorative objects of local significance. Pop. (1980) 54,849.

Fairfield, Cicily Isabel: *see* West, Dame Rebecca.

Fairhaven, urban town (township), Bristol County, southeastern Massachusetts, U.S., on Buzzards Bay, across the Acushnet River from New Bedford. The site was settled in 1652 by John Cooke, who, with John Winslow, purchased a tract of land (Sconticut) from the Indian chief Massasoit. After 1740 the community (then known as Oxford, and part of New Bedford) was a centre of whaling operations. Herman Melville sailed (1841) from Fairhaven on the "Acushnet" on a voyage that inspired his first adventure novel, *Typee* (1846). With the decline of whaling in the mid-19th century, fishing and boatbuilding became the economic mainstays. Fairhaven was the home port of Capt. Joshua Slocum, the first man to circumnavigate the globe alone (1895–98); he recounted his adventures in *Around the World in the Sloop Spray* (1903). The town was set off from New Bedford and incorporated in 1812. It is now a summer resort and residential suburb with some light manufacturing. Pop. (1980) 15,759.

Fairmont, city, seat (1842) of Marion County, northern West Virginia, U.S., where the Tygart Valley River and the West Fork come together to form the Monongahela River, 19 mi (30 km) southwest of Morgantown. The original settlement (1793), near the Scioto-Monongahela Indian Trail, was incorporated in 1820 as Middletown, which merged in 1843 with nearby Palatine to form Fairmont. The arrival of the Baltimore and Ohio Railroad in 1852 provided the impetus to open the first commercial mine in the rich Monongahela Valley

bituminous coalfield. At nearby Monongah in 1907 a disastrous mine explosion took 359 lives. Coal remains the city's chief industrial product, together with coal-mining machinery, glass, aluminum, and fluorescent lamps. Fairmont State College was founded in 1865. Prickett's Fort and Valley Falls state parks are nearby. Pop. (1988 est.) 21,821.

Fairuz Sapur (ancient town, Iraq): *see* Anbar.

Fairway (foaled 1925), English racehorse (Thoroughbred) who, though a successful racer, became best known as a sire. An outstanding stud, he sired Blue Peter and Watling Street. Fairway was foaled by Scapa Flow and sired by Phalaris. Lord Derby owned him, and Frank Butters trained him at Newmarket. As a two-year-old, he won three of his four races. As a three-year-old, he won four of five races. In his last racing year, 1929, he won five out of six races. Unusually successful at stud, he was the top stallion in 1936, 1939, 1943, and 1944, siring winners of 394 horse races, including Watling, the 1942 Derby winner, before being retired from stud in 1945.

Fairweather, Mount, highest peak (15,299 feet [4,663 m]) in British Columbia, Canada. The mountain is located on the Alaska border in the Fairweather Range of the St. Elias Mountains, at the southwestern end of the Glacier Bay National Monument. It was named by Captain James Cook, who saw the peak in 1778 while navigating the bay in "fair weather."

fairy, also spelled FAERIE, or FAERY, in folklore, supernatural being, usually of diminutive human form, who magically intermeddles in human affairs.

While the term fairy goes back only to the Middle Ages in Europe, analogues to these beings in varying forms appear in both written and oral literature, from the Sanskrit Gandharva to the nymphs of Greek mythology and Homer, the jinn of Arabic mythology, and similar folk characters of the Eskimos and other American Indians and of the Samoans.

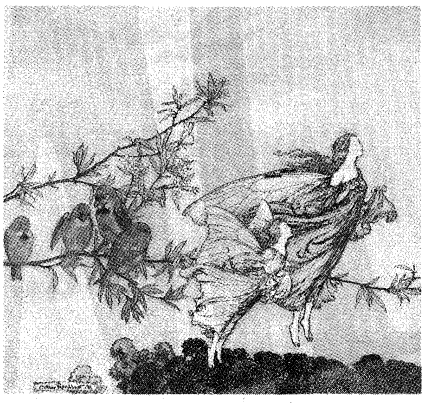
The modern tendency to prettify fairies in children's stories represents a bowdlerization of what was once a serious and even sinister folkloric tradition. The fairies of the past were feared as dangerous and powerful beings who were sometimes friendly to humans but could also be cruel or mischievous.

Fairies were usually conceived as being characteristically beautiful or handsome and as having lives corresponding to those of human beings, though longer. They have no souls and at death simply perish. They often carry off children, leaving changeling (*q.v.*) substitutes, and they also carry off adults to fairyland, which resembles pre-Christian abodes of the dead. People transported to fairyland cannot return if they eat or drink there. Fairy and human lovers may marry, though only with restrictions whose violation ends the marriage and, often, the life of the human. Some female fairies are deadly to human lovers. Fairies have been said to be of human size or smaller, down to a height of 3 inches (7.5 cm) or less. Female fairies may tell fortunes, particularly prophesying at births and foretelling deaths. Several herbs, especially St.-John's-wort and yarrow, are potent against fairies, and hawthorn trees, foxglove, and ragwort are so dear to them that abuse of these plants may bring retribution.

Fairy lore is particularly prevalent in Ireland, Cornwall, Wales, and Scotland. Fairies are common in literature from the Middle Ages on and appear in the writings of the Italians Matteo Boiardo and Ludovico Ariosto, the English poet Edmund Spenser, the Frenchman Charles Perrault, and the Dane Hans Christian Andersen.

See also brownie; dwarf; elf; fairy tale; goblin; kobold; leprechaun; Märchen; pixie.

BIBLIOGRAPHY. A good account of the fairies of Great Britain is Katharine Briggs, *A Dictionary of Fairies* (also published as *An Encyclopedia of Fairies,* 1976).



"The Fairies in Spring," illustration by Arthur Rackham, 1906, from *Peter Pan in Kensington Gardens,* by James Barrie

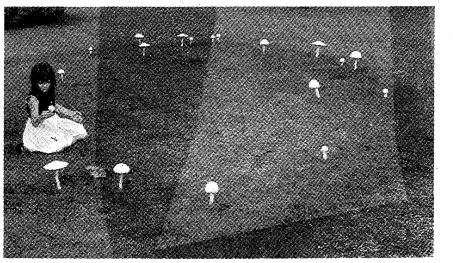
The Bridgeman Art Library/Art Resource, NY

fairy bluebird, any of the numerous bird species that constitute the family Irenidae (order Passeriformes), a taxonomic grouping of disputed composition and in which leafbirds and ioras are sometimes included. Some authors group the fairy bluebirds (*Irena*) with the Old World orioles (family Oriolidae) and place the leafbirds and ioras in the family Chloropseidae. Others place all or most of these birds in the bulbul family (Pycnonotidae; *see* bulbul). The 14 species (fairy bluebirds included) in the family Irenidae are confined to southern Asia and the Philippines. They are 13 to 25 cm (5 to 10 inches) long, with short legs, small feet, and slender bills, which may be slightly curved. The ioras (*Aegithina*) are the smallest members. Males are more colourful than females, particularly among the leafbirds (*Chloropsis*), the males being chiefly green with bright markings. Irenids live mainly in forest treetops, but some are garden birds. All eat fruit and nectar; some take insects. They have bright and varied voices. The nest is a tidy cup with three or four eggs.

(Top) Gold-fronted leafbird (*Chloropsis aurifrons*), (bottom) blue-backed fairy bluebird (*Irena puella*)

Herbert Clarke

fairy ring, a naturally occurring circular ring of mushrooms on a lawn or other location. A fairy ring starts when the mycelium (spawn) of a mushroom falls in a favourable spot and sends out a subterranean network of fine, tubular threads called hyphae. The hyphae grow out from the spore evenly in all directions, forming a circular mat of underground hyphal threads. The mushrooms that grow up from this circular underground mat form a similar pattern above ground. Gradually the underground mycelium at the centre of the circle dies out. Its living outer edges, however, keep growing year by year, and hence the diameter of the ring gradually increases. Over time the ring's underground segments die out, until the ring form on the surface can no longer be discerned.



Fairy ring of mushrooms (*Amanita alba*)

L.N. and Anella Dexter

The fairy rings commonly formed by the field mushroom (*Agaricus,* or *Psalliota, campestris*) often measure about 6 feet (2 m) in diameter. *Marasmius oreades,* which is commonly known as the fairy ring mushroom, forms very large but irregular rings that may attain a diameter of 1,200 feet (365 m).

fairy shrimp, any of the crustaceans of the order Anostraca, so called because of their graceful movements and pastel colours. Some grow to 2.5 cm (about 1 inch) or more in length. They occur in freshwater ponds of Europe, Central Asia, western North America, the drier regions of Africa, and Australia. The most common species in Europe is *Chirocephalus diaphanus;* in North America the most common is *Eubranchipus vernalis.*

Fairy shrimp (*Eubranchipus vernalis*)

William Jahoda—National Audubon Society from Photo Researchers/EB Inc.

fairy slipper (*Calypso bulbosa*), terrestrial orchid native to North America and Eurasia, the only species in its genus. It thrives in cool forests and bogs.

Fairy slipper (*Calypso bulbosa*)
F.K. Anderson—EB Inc.

A fairy slipper plant bears one flower and one dark-green, crinkled leaf that arises from a rounded corm (swollen stem base). The lip of the purplish-pink flower is pouchlike and bears a number of yellow hairs on the upper surface.

fairy tale, wonder tale involving marvellous elements and occurrences, though not necessarily about fairies. The term embraces such popular folktales (*Märchen, q.v.*) as "Cinderella" and "Puss-in-Boots" and art fairy tales (*Kunstmärchen*) of later invention, such as *The Happy Prince* (1888), by the Irish writer Oscar Wilde. It is often difficult to distinguish between tales of literary and oral origin, because folktales have received literary treatment from early times, and, conversely, literary tales have found their way back into the oral tradition. Early Italian collections such as *Le piacevoli notti* (1550; "The Pleasant Nights") of Gianfrancesco Straparòla and the *Pentamerone* (1634–36) of Giambattista Basile contain reworkings in a highly literary style of such stories as "Snow White," "Sleeping Beauty," and "The Maiden in the Tower." A later French collection, Charles Perrault's *Tales of Mother Goose* (1697), including "Cinderella," "Little Red Ridinghood," and "Beauty and the Beast," remains faithful to the oral tradition, while the *Kinder-und Hausmärchen* (1812–15) of the Brothers Grimm are transcribed directly from oral renderings (although often from literate informants). The influence of Perrault and Grimm has been very great, and their versions have been commonly adopted as nursery tales among literate people in the West. For example, Grimm's "Rumpelstiltskin" has replaced the native English "Tom Tit Tot," and Perrault's "Cinderella" has replaced "Cap o' Rushes," once almost equally popular in oral tradition.

Art fairy tales were cultivated in the period of German Romanticism by Goethe, Ludwig Tieck, Clemens Brentano, and E.T.A. Hoffmann and in Victorian England by John Ruskin (*The King of the Golden River,* 1851) and Charles Kingsley (*The Water-Babies,* 1863), but few of these tales have found permanent popularity. The master of the art fairy tale, whose works rank with the traditional stories in universal popularity, is the Danish writer Hans Christian Andersen. Though his stories have their roots in folk legend, they are personal in style and contain elements of autobiography and contemporary social satire.

Twentieth-century psychologists, notably Sigmund Freud, Carl Jung, and Bruno Bettelheim, have interpreted elements of the fairy tale as manifestations of universal fears and desires. In his *Uses of Enchantment* (1976), Bettelheim asserted that the apparently cruel and arbitrary nature of many folk fairy stories is actually an instructive reflection of the child's natural and necessary "killing off" of successive phases of development and initiation.

fairy wren, also called BLUE WREN, or SUPERB WARBLER, any of the 14 species of the Australian genus *Malurus* of the songbird family Maluridae (sometimes placed in the warbler family Sylviidae). These common names, and bluecap, are given particularly to *M. cyaneus,* a great favourite in gardens and orchards of eastern Australia. The male has blue foreparts with black markings. This species, like others of the genus, is about 13 centimetres (5 inches) long, with a narrow blue tail, which is carried cocked up. The bluecap sometimes sings at night as well as by day. The splendid

Splendid fairy wren (*Malurus splendens*)
Graeme Chapman—Ardea, London

fairy wren (*M. splendens*) of Western Australia, unlike the bluecap in the east, avoids settled areas.

Faisal (Arabic personal name): *see under* Fayṣal.

Faisalābād, formerly (until 1979) LYALLPUR, city and district, Sargodha Division, Punjab Province, Pakistan, in the Rechna Doāb upland. The city, the district headquarters, is a distributing centre centrally located in the Punjab plain and connected by road, rail, and air with Multān and Lahore and by air with Lahore and Karāchi. When founded in 1890, it was named after Sir Charles James Lyall, lieutenant governor of the Punjab. It became headquarters of the Lower Chenāb colony and in 1898 was incorporated as a municipality. Industries produce chemical fertilizer, synthetic fibers, drugs and pharmaceuticals, canned products, ghee (clarified butter), oil, soap, textiles, hosiery, sugar, and flour. It is also a wholesale market for cloth and grain. Amenities include two parks, several schools, the West Pakistan Agricultural University (established 1961), and a number of colleges affiliated with the University of the Punjab.

Faisalābād District (area 3,516 sq mi [9,106 sq km]), constituted in 1904, consists of a fertile plain between the Chenāb and Rāvi rivers that is irrigated by the Lower Chenāb Canal. Formerly a part of Multān Division, it was carved from the neighbouring districts of Jhang Maghiāna, Shekhūpura, Multān, and Sāhiwāl. The chief crops are wheat, cotton, and sugarcane. Pop. (1981 prelim.) city, 1,092,000; district, 4,656,000.

faith, Greek PISTIS, Latin FIDES, inner attitude, conviction, or trust relating man to a supreme God or ultimate salvation. In religious traditions stressing divine grace, it is the inner certainty or attitude of love granted by God himself. In Christian theology, faith is the divinely inspired human response to God's historical revelation through Jesus Christ and, consequently, is of crucial significance.

No definition allows for identification of "faith" with "religion." Some inner attitude has its part in all religious traditions, but it is not always of central significance. For example, words in ancient Egypt or ancient (Vedic) India that can be roughly rendered by the general term "religion" do not allow for "faith" as a translation but rather connote cultic duties and acts. In Hindu and Buddhist Yoga traditions, inner attitudes recommended are primarily attitudes of trust in the guru, or spiritual preceptor, and not, or not primarily, in God. Hindu and Buddhist concepts of devotion (Sanskrit *bhakti*) and love or compassion (Sanskrit *karuṇā*) are more comparable to the Christian notions of love (Greek *agapē*, Latin *caritas*) than to faith. Devotional forms of Mahāyāna Buddhism and Vaiṣṇavism show religious expressions not wholly dissimilar to faith in Christian and Jewish traditions.

In biblical Hebrew, "faith" is principally juridical; it is the faithfulness or truthfulness with which persons adhere to a treaty or promise and with which God and Israel adhere to the Covenant between them. In Islām and Christianity, both rooted in this tradition, the notion of faith reflects that view. In Islām, faith (Arabic *īmān)* is what sets the believer apart from others; at the same time, it is ascertained that "None can have faith except by the will of Allāh" (Qur'ān 10:100). The Christian First Letter to the Corinthians similarly asserts that faith is a gift of God (I Cor. 12:8–9), while the Letter to the Hebrews (11:1) defines faith (*pistis*) as "the assurance of things hoped for, the conviction of things not seen." Some scholars think that Zoroastrianism, as well as Judaism, may have had some importance in the development of the notion of faith in Western religion; the prophet Zoroaster (*c.* 628–*c.* 551 BC) may have been the first founder of a religion to speak of a new, conscious religious choice on the part of man for truth (*asha*).

In Christianity the intellectual component of faith is stressed by St. Thomas Aquinas. One of the major issues of the Protestant movement was the theological problem of justification (*q.v.*) by faith alone. Luther stressed the element of trust, while Calvin emphasized faith as a gift freely bestowed by God. A 19th-century German theologian, Friedrich Schleiermacher, wrote of the subjective nature of faith. In the 20th century, theologians, led by Karl Barth, made conscious efforts to turn away from Schleiermacher's subjective interpretation.

Notions of religious trust in India, China, and Japan are as a rule different from the notion of faith in Christianity. The "trust" (Pāli *saddhā*, Sanskrit *śraddhā*) described in the Buddhist Eightfold Path is comparable to the confidence with which a sick person entrusts himself to a physician. The Chinese *hsin* ("confidence, trust, sincerity") is considered to be one of the five principal virtues.

faith, confession of: *see* confession of faith.

faith, defender of the: *see* defender of the faith.

faith healing, recourse to divine power to cure mental or physical disabilities, either in conjunction with orthodox medical care or in place of it. Often an intermediary is involved, whose intercession may be all-important in effecting the desired cure. Sometimes the faith may reside in a particular place, which then becomes the focus of pilgrimages for the sufferers.

Faith in the healing power of natural springs

is long-standing and widespread. In ancient Egypt and Greece, temples erected to Asclepius, the Greek god of medicine, were often near such springs, and festivals in his honour have been located as far apart as Ancyra in Asia Minor and Agrigentum in Sicily. The cult was introduced in Rome to relieve a plague in 293 BC.

In Christianity, faith healing is exemplified especially in the miraculous cures wrought by Jesus (40 healings are recorded) and by his Apostles. The early church later sanctioned faith healing through such practices as anointing and the imposition of hands. Faith healing has also been associated with the intercessionary miracles of saints.

During the 19th and 20th centuries, faith healing has often motivated pilgrimages and healing services in many Christian denominations. The apparent healing gifts of individuals have also attracted wide attention: Leslie Weatherhead, Methodist pastor and theologian, and Harry Edwards, spiritualist, in England; Elsie Salmon, wife of a Methodist minister, in South Africa; Oral Roberts, a converted Methodist and mass-meeting evangelist, Agnes Sanford, wife of an Episcopal rector, and Edgar Cayce, a clairvoyant of Presbyterian background, in the United States. A different approach to the idea of divine healing is represented by the metaphysical healing movement in the United States called New Thought. Phineas P. Quimby and Mary Baker Eddy (a former patient of Quimby's who founded the Christian Science movement) published numerous tracts exhorting their followers to beliefs that stressed the immanence of God and a link between bodily ills and mistaken convictions. Christian Science was unique in its view of sickness as a material state, subject to the transcendental power of the individual's spiritual being.

Faithorne, William (b. *c.* 1616, London, Eng.—d. May 13, 1691, London), English engraver and portrait draftsman noted for his excellent line engravings.

A pupil of the painter Robert Peake the Elder and of the engraver John Payne, Faithorne was captured during the English Civil Wars, imprisoned, and exiled. Returning from Paris to London in 1650, he became a print seller, printer, and engraver, publishing (1662) *The Art of Graving and Etching.* In addition to portrait drawings, he published his maps of London (1658), Virginia, and Maryland. One of his sons, William (1656–1710), became a mezzotint engraver.

Faiyum (Egypt): *see* Fayyūm, al-.

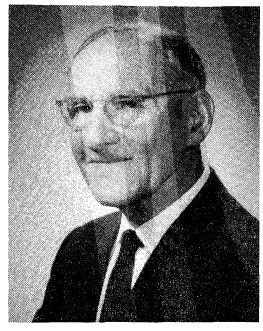
Faizābād (Afghanistan): *see* Feyzābād.

Faizābād, also spelled FYZABAD, town, eastern Uttar Pradesh state, northern India. It lies east of Lucknow, on the Ghāghara River. Faizābād was founded in 1730 by Sādāt ʿAlī Khān, the first nawab of Oudh, who made it his capital but spent little time there. The third nawab, Shujāʿ-ud-Dawlah, resided there and built a fort over the river in 1764; the mausoleums for him and his wife are located in the town. In 1775 the capital of Oudh was moved to Lucknow, and in the 19th century the town fell into decay.

Faizābād has good road and rail connections with Lucknow, Allahābād, Vārānasi, and to other cities of northern India. The town's industries include sugar processing and oilseed milling, and it is a trade centre for agricultural produce. The town has a veterinary college and several museums. The town of Ayodhyā (east) is a suburb.

The area in which Faizābād is situated consists of a strip of fertile, alluvial plain along the south bank of the Ghāghara River. Rice, sugarcane, wheat, and oilseeds are the principal crops. In the town of Tandā, southeast of Faizābād, handloomed cotton cloth is manufactured for export. There is a hydroelectric power station near Sohwāl. Pop. (1981) town, 101,873.

Fajans, Kasimir (b. May 27, 1887, Warsaw, Pol., Russian Empire [now in Poland]—d. May 18, 1975, Ann Arbor, Mich., U.S.), Polish-American physical chemist who discovered the radioactive displacement law simultaneously with Frederick Soddy of Great Britain. According to this law, when a radioactive atom decays by emitting an alpha particle, the atomic number of the resulting atom is two fewer than that of the parent atom. When a beta particle is emitted, the atomic number is one greater.



Fajans, 1966
Sam Sturgis, Ann Arbor, Mich.

After study at the universities of Leipzig, Heidelberg, Zürich, and Manchester, Fajans served on the faculty of the Technical Academy at Karlsruhe in Germany from 1911 to 1917. In 1913, in collaboration with Otto Gohring, he discovered uranium X_2, which is now called protactinium-234*m*. In 1917 he joined the Institute of Physical Chemistry, Munich, where he rose from associate professor to director. From 1936 to 1957, when he retired, Fajans was a professor at the University of Michigan, Ann Arbor. He became a naturalized citizen of the United States in 1942.

Fajardo, town, eastern Puerto Rico, on the Fajardo River lowlands. Founded in 1772, it was the scene of fighting during the Spanish–American War (1898). Its principal manufactures are cigars, furniture, and metal and electronic components. It is linked by railway to San Juan and lies about 2 miles (3 km) from its port, Playa de Fajardo, which exports sugar. The town is a tourist centre. The University of Puerto Rico was founded in 1903 at Fajardo but moved in 1904 to Río Piedras.

The surrounding area is a tobacco- and sugarcane-growing district. Pop. (1984 est.) mun., 33,200.

Fakhr ad-Dīn II (b. *c.* 1572—d. 1635, Constantinople [now Istanbul, Tur.]), Lebanese ruler (1593–1633) who for the first time united the Druze and Maronite districts of the Lebanon Mountains under his personal rule; he is frequently regarded as the father of modern Lebanon.

With the death of Fakhr ad-Dīn's father, Korkmaz, in 1585, a civil war broke out between the two predominant religious–political factions in the region, the Kaysīs and the Yamanis. After Fakhr ad-Dīn and his Kaysī faction emerged victorious in 1591, he became determined to unite the perpetually feuding Maronite and Druze districts. Although he himself was of the Druze religion, he had the support of the Christian Maronites of what is now northern Lebanon, who resented their tyrannical ruler Yūsuf Sayfā. Fakhr ad-Dīn then became locked in a seven-year struggle for supremacy, a struggle that was complicated by the fact that the Ottomans, the nominal rulers, allied themselves first with Fakhr ad-Dīn and then with Yūsuf Sayfā. Finally, with the defeat of Yūsuf Sayfā (1607), the Ottomans recognized Fakhr ad-Dīn's authority.

Because Fakhr ad-Dīn was still uncertain of Ottoman support, however, he allied Lebanon with Tuscany in 1608. The increasing ties with the Tuscans aroused the suspicion of the Ottomans, and they forced Fakhr ad-Dīn into exile (1614–18). After his return he made peace with his old rival Yūsuf Sayfā, cementing it with a marriage alliance.

Fakhr ad-Dīn then continued his conquests, and by 1631 he dominated most of Syria, Lebanon, and Palestine. The Ottomans, wary of his growing power, sent troops against him and defeated him in 1633. Fakhr ad-Dīn fled to the Lebanon Mountains, where he was captured (1634). He was executed in Constantinople. Though Fakhr ad-Dīn's domains were fragmented after his death, the union of the Druze and Maronite districts survived.

Fakhr ad-Dīn ar-Rāzī, in full ABŪ ʿABD ALLĀH MUḤAMMAD IBN ʿUMAR IBN AL-ḤUSAYN FAKHR AD-DĪN AR-RĀZĪ (b. 1149, Rayy, Iran—d. 1209, near Herāt, Khwārezm), Muslim theologian and scholar, author of one of the most authoritative commentaries on the Qur'ān in the history of Islām. His aggressiveness and vengefulness created many enemies and involved him in numerous intrigues. His intellectual brilliance, however, was universally acclaimed and attested by such works as *Mafātīḥ al-ghayb* or *Kitāb at-tafsīr al-kabīr* ("The Keys to the Unknown" or "The Great Commentary") and *Muḥaṣṣal afkār al-mutaqaddimīn wa-al-mutaʾakhkhirīn* ("Collection of the Opinions of Ancients and Moderns").

Ar-Rāzī was the son of a preacher. After a broad education, in which he specialized in theology and philosophy, he traveled from country to country in an area comprising present-day northwestern Iran and Turkistan (U.S.S.R.) and finally settled in Herāt (now in Afghanistan). Wherever he went, he debated with famous scholars and was patronized and consulted by local rulers. He wrote about 100 books and gained fame and wealth. It was said that wherever he rode, 300 of his students accompanied him on foot; when he moved from one city to another, 1,000 mules carried his possessions, and there seemed no limit to his silver and gold.

Ar-Rāzī lived in an age of political and religious turmoil. The empire of the Baghdad caliphs was disintegrating; its numerous local rulers were virtually independent. The Mongols were shortly to invade the region and strike the final blow against the caliphate. Religious unity, too, had long since crumbled: in addition to the division of Islām into two major groups—the Sunnites and the Shīʿites—countless small sects had developed, often with the support of local rulers. Ṣūfism (Islāmic mysticism), too, was gaining ground. Like the philosopher al-Ghazālī, a century earlier, ar-Rāzī was a "middle-roader" who attempted, in his own way, to reconcile a rationalistic theology and philosophy incorporating concepts taken from Aristotle and other Greek philosophers with the Qur'ān (Islāmic scripture). This attempt inspired *al-Mabāḥith al-mashriqīyah* ("Eastern Discourses"), a summation of his philosophical and theological positions, and several commentaries on Avicenna (Ibn Sīnā), as well as his extremely wide-ranging commentary on the Qur'ān (*Mafātīḥ al-ghayb* or *Kitāb at-tafsīr al-kabīr*) which ranks among the greatest works of its kind in Islām. Equally famous is his *Muḥaṣṣal afkār al-mutaqaddimīn wa-al-mutaʾakhkhirīn,* which was accepted from the first as a classic of *kalām* (Muslim theology). His other books, in addition to a general encyclopaedia, dealt with subjects as varied as medicine, astrology, geometry, physiognomy, mineralogy, and grammar.

Ar-Rāzī was not only a persuasive preacher but also a master of debate. His ability to refute the arguments of others, together with his aggressiveness, self-confidence, irritability, and bad temper, made many enemies for him. His worldly success made others jealous of him. Moreover, on occasion he could show extreme malice. With his connivance, his elder brother, who openly resented his success, was imprisoned by the Khwārezm-Shāh (ruler of Turkistan) and died in prison. A famous preacher with whom he had quarrelled was drowned by royal command. It is reported, however, that one incident persuaded him to cease attacks against the Ismāʿīlī—a Shīʿite sect of Islām also known as Seveners because they believe that Ismāʿīl, the seventh imam (spiritual leader), was the last of the imams. After ar-Rāzī had taunted the Ismāʿīlī as having no valid proofs for their beliefs, an Ismāʿīlī gained access to him by posing as a pupil and pointed a knife at his chest, saying: "This is our proof." It has been suggested further that ar-Rāzī's death was not from natural causes, but that he was poisoned by the Karrāmīyah (a Muslim anthropomorphist sect), in revenge for his attacks on them.

Ar-Rāzī loved disputation so much that he went out of his way to present unorthodox and heretical religious views as fully and as favourably as possible, before refuting them. This habit gave his opponents grounds for accusing him of heresy. It was said: "He states the views of the enemies of orthodoxy most persuasively, and those of the orthodoxy most unconvincingly." His thorough presentations of unorthodox views make his works a useful source of information about little-known Muslim sects. He was thus a good "devil's advocate," though he maintained firmly that he championed only orthodoxy.

Ar-Rāzī was a many-sided genius and a colourful personality who was regarded by some Muslims as a major "renewer of the faith." According to tradition, one such was due to appear each century, and al-Ghazālī had been the one immediately before ar-Rāzī. His aim, like al-Ghazālī's, was doubtless to be a revitalizer and reconciler in Islām, but he did not have al-Ghazālī's originality, nor was he often able to make readers aware of his personal religious experience, as al-Ghazālī could. His genius for analysis sometimes led him into long and tortuous arguments, yet he compensated for these shortcomings by his very wide knowledge, which incorporated most disciplines—even the sciences—into his religious writings. In the centuries after his death, Muslim philosophers and theologians were to turn to his works frequently for guidance. (J.A.H.)

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fakir, Arabic FAQĪR ("poor"), originally, a mendicant dervish. In mystical usage, the word fakir refers to man's spiritual need for God, who alone is self-sufficient. Although of Muslim origin, the term has come to be applied in India to Hindus as well, largely replacing *gosvāmin,* sadhu, bhikku, and other designations. Fakirs are generally regarded as holy men who are possessed of miraculous powers, such as the ability to walk on fire. While less influential in urban areas since the spread of education and technology, fakirs retain some hold over the people of the villages and the interior of India. Among Muslims the leading Ṣūfī orders of fakirs are the Chishtīyah, Qādirīyah, Naqshbandīyah, and Suhrawardīyah.

Fakkān (United Arab Emirates): *see* Khawr al-Fakkān.

Falaise, market town of Calvados *département,* Basse-Normandie region, northwestern France. It was the birthplace of William the Conqueror, first of the Norman kings of England, and is famous for a battle in the area (the "Falaise pocket") during the Allied reconquest of France in 1944 in which 50,000 German troops were encircled and taken prisoner. The town lies on the Ante River, about 20 miles (32 km) southeast of Caen. The castle (12th–13th century), formerly the seat of the dukes of Normandy, standing on a high crag overlooking the town, is the oldest fortress in Normandy. The lofty Talbot's Tower was added by the English in the 15th century. In 1944, while still under German occupation, two-thirds of Falaise was destroyed by Allied bombing. It has been well restored. Industries in the town include the manufacture of household appliances. There are an agricultural market and food-processing concerns. Pop. (1982) 8,424.

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Falange, in full FALANGE ESPAÑOLA (Spanish: "Spanish Phalanx"), or (1937–77) FALANGE ESPAÑOLA TRADICIONALISTA Y DE LAS JUNTAS DE OFENSIVA NACIONAL SINDICALISTA ("Traditionalist Spanish Phalanx of the Juntas of the National Syndicalist Offensive"), extreme nationalist political group founded in Spain in 1933 by José Antonio Primo de Rivera, son of the former dictator Miguel Primo de Rivera. Influenced by Italian Fascism, the Falange joined forces (February 1934) with a like-minded group, Juntas de Ofensiva Nacional Sindicalista, and issued a manifesto of 27 points repudiating the republican constitution, party politics, capitalism, Marxism, and clericalism, and proclaiming the necessity of a national-syndicalist state, a strong government and military, and Spanish imperialist expansion.

Despite parades and strident proclamations, the Falange made little headway in its first three years. In the election of February 1936, which brought the Popular Front to power, the Falange polled in Madrid only 5,000 votes out of a total right-wing vote of 180,000, and its only representative in the Cortes, Primo de Rivera himself, was defeated. With the coming to power of the Popular Front and the ensuing rapid polarization of Spanish politics, the Falangists gained increasingly in popularity at the expense of the conservatives and Catholics of the right. Upon the military uprising against the Spanish Republic in July 1936, several of the Falange's principal leaders, including Primo de Rivera, were arrested and shot by Republican firing squads.

But General Francisco Franco found in the Falange a potential political party and an explicit ideology at hand for his use. True, it had to be reconciled with traditionalist, clericalist, and monarchist elements within the Nationalist movement, but this was effected by the decree of April 19, 1937, whereby the Falange, the Carlists, and other right-wing factions were forcibly merged into one body with the cumbrous title of Falange Española Tradicionalista y de las Juntas de Ofensiva Nacional Sindicalista, or Falange for short. General Franco became the Falange's absolute chief and his brother-in-law Ramón Serrano Suñer its chief spokesman. The Falange's membership had grown to more than 250,000 by the time Franco seized control of it in 1937, and more than 150,000 Falangists served in Franco's armed forces during the Civil War.

After the victory of the Nationalists in 1939 and the end of the war, the Falange's radical Fascist ideas were subordinated to the conservative and traditionalist values of Franco's regime. Membership in the Falange became indispensable to political advancement, but it gradually ceased to be identified with the original Falangist ideology as Franco's regime evolved during the late 1940s and '50s.

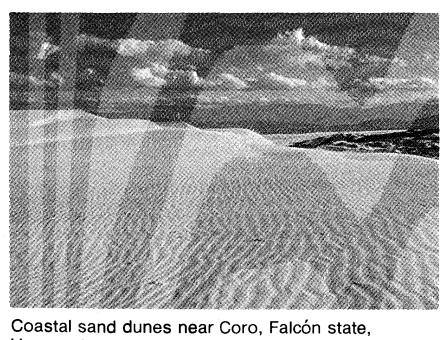
On January 12, 1975, prior to Franco's death, a law was passed permitting the establishment of other "political associations"; thereafter and especially after Franco's death in November, other political parties began to proliferate. The Falange itself had become utterly moribund by this time and was formally abolished on April 1, 1977.

Falasha, an Ethiopian of Jewish faith. The Falasha call themselves House of Israel (Beta Israel) and claim descent from Menelik I, the son of the Queen of Sheba and King Solomon. Their ancestors, however, were probably local Agau peoples in Ethiopia who were converted to Judaism by Jews living in southern Arabia in the centuries before and after the start of the Christian Era. The Falasha remained faithful to Judaism after the conversion of the powerful Ethiopian kingdom of Aksum to Christianity in the 4th century AD, and thereafter the Falasha were persecuted and forced to retreat to the area around Lake Tana, in northern Ethiopia. Despite Ethiopian Christian attempts to exterminate them in the 15th and 16th centuries, the Falasha partly retained their independence until the 17th century, when the emperor Susenyos utterly crushed them and confiscated their lands. Their conditions improved in the late 19th and 20th centuries, at which time about 20,000 Falasha lived in the region north of Lake Tana. Falasha men are ironsmiths and weavers, and some till land that they are not permitted to buy. Falasha women are known for their pottery.

The Falasha have a Bible and a prayer book written in Geʿez, the ancient Ethiopian language. They have no knowledge of the Talmud, but their preservation of and adherence to Jewish traditions is undeniable. They observe the sabbath, practice circumcision, have synagogue services led by priests (*kohanim*) of the village, follow certain dietary laws of Judaism, observe many laws of ritual uncleanness, offer sacrifices on Nisan 14 in the Jewish religious year, and observe some of the major Jewish festivals. Between the mid-1970s and the mid-1980s, the Israeli government secretly airlifted more than 10,000 Falasha from their drought-stricken homeland to resettlement in Israel.

Falca, Pietro: *see* Longhi, Pietro.

Falcón, state, northwestern Venezuela, bounded north by the Caribbean Sea, northwest by the Gulf of Venezuela, west by Zulia state, and south by Lara and Yaracuy states; it includes the Paraguaná Peninsula. Consisting mainly of coastal lowlands and northern Andean outliers, the territory of 9,575 sq mi



Coastal sand dunes near Coro, Falcón state, Venezuela
Georges de Steinheil

(24,800 sq km) is dry and agriculturally poor. Farming (corn [maize], coconuts, and sesame) is restricted to river valleys and mountain terraces; goat raising is widespread, but the higher elevations have been denuded by overgrazing and deforestation. In contrast, the Península de Paraguaná and the area around the state capital, Coro (*q.v.*), have experienced rapid industrialization and growth, and huge oil refineries are situated on the southwestern shore of the peninsula. About two-thirds of Venezuela's total output is produced there and then exported by tanker. Northern Falcón, including the peninsula, is well served by highways. Pop. (1983 est.) 551,873.

falcon, any of nearly 60 species of hawks of the family Falconidae (order Falconiformes), diurnal birds of prey characterized by long, pointed wings and swift, powerful flight. The name is applied in a restricted sense, as true falcons, to the genus *Falco,* which numbers more than 35 species. Falcons occur worldwide. They range in size from about 15 centimetres (6 inches) long in the falconets (*Microhierax*) to about 60 cm (24 in.) in the gyrfalcon (*q.v.*), an Arctic species. In true falcons the female is the larger and bolder and is preferred for the sport of falconry. Falcons have plumes called "flags" on their legs and a notch in the beak that is well developed in the genus *Falco* to form a "tooth."

Falcons commonly nest in holes in trees or on natural ledges on cliffs. The eggs are usually four or five in number and buffy white in colour, speckled and blotched with reddish brown. The incubation period is about 28 or 35 days, and the young are cared for in the nest for as long as 35 days.

The flight of falcons is fast and direct, with the wings digging the air. Some falcons habitually hover with rapid wingbeats while scanning the ground for prey. Some species capture birds, of their own size or smaller, in mid-air. Others live mainly on hares, mice, lizards, and insects.

The bat falcon (*F. albigularis*) of Mexico and Central and South America is a little bird with a dark back, white throat, barred black and white breast, and reddish belly. It preys upon birds.

The forest falcon (*Micrastur semitorquatus*) of tropical America hunts birds and reptiles in the jungles.

The laughing falcon (*Herpetotheres cachinnans*) of the wooded lowlands of Central and South America is a noisy brown bird that eats snakes.

The prairie falcon (*F. mexicanus*), a desert falcon, inhabits canyon and scrub country in western North America.

The falconets (*Microhierax*) and pygmy falcons (*Poliohierax,* or *Polihierax*) are tiny birds of Old World tropics. They eat insects and birds.

The cuckoo falcons, several species of *Aviceda,* are kites of the subfamily Perninae (family Accipitridae). They range over Asia and the South Pacific, hunting at twilight, mainly for insects. Some hunt lizards. *See also* caracara; hobby; kestrel; merlin; peregrine falcon.

Prairie falcon (*Falco mexicanus*) eating a magpie
Shelly Grossman—W.C.I.

Falconet, Étienne-Maurice (b. Dec. 1, 1716, Paris—d. Jan. 24, 1791, Paris), sculptor who adapted the classical style of the French Baroque to a pretty and intimate Rococo ideal. Patronized by Mme de Pompadour, he did work that is the quintessence of taste in the Louis XV period.

"The Bather," marble statue by Étienne-Maurice Falconet, 1757; in the Louvre, Paris
Giraudon—Art Resource/EB Inc.

Falconet was first apprenticed to a carpenter and later became a pupil of the sculptor J.-B. Lemoyne. Nominated director of the Sèvres porcelain factory in 1757, he supplied numerous models to be executed in Sèvres biscuit ware, which gave a character of delicate, mannered grace to a whole phase of his work, as seen in his "Bather" (1757; Louvre). From 1766 until 1778 he was in Russia, summoned by Catherine the Great at Diderot's suggestion. While there, he executed the impressive bronze equestrian statue of Peter the Great. He returned to Paris in 1781 and, suffering a stroke in 1783, produced no sculpture the rest of his life.

Falconetto, Giovanni Maria, also called GIAN MARIA FALCONETTO (b. *c.* 1458, Verona—d. *c.* 1534, Padua), Italian painter and architect. His father, Giacomo Falconetto, a brother, Giovanni Falconetto, and a great uncle, Stefano de Verona, also were noted painters.

Little is known of Falconetto's life. He studied painting in his early years and worked for a time in Rome, where he was associated with the fresco painter Melozzo da Forlì. His paintings and frescoes are noted for mastery of perspective; among the best known are the frescoes decorating the chapel of S. Biagio in the church of SS. Nazaro e Celso in Verona (1497–99).

Falconetto later turned to architecture and worked mostly in Padua, in the service of Alvise Cornaro, an architect who is credited with introducing the Roman Renaissance style to northern Italy. Examples of Falconetto's work include the odeon and loggia (1524) in Cornaro's Palazzo Giustiniani and the Porta S. Giovanni (1528) and the Porta Savonarola (1530), two gates to the city of Padua. His style had a major influence on later Paduan architecture.

falconiform, any member of an order (Falconiformes) of swift, graceful birds known for their predatory or raptorial skill; the group includes eagles, condors, buzzards, kites, caracaras, ospreys, harriers, accipiters, vultures, secretary birds, falcons, hawks, bateleurs, and buteos.

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

On occasion, falconiforms prey on small domestic stock, but mostly they feed on smaller wild birds, rodents and other small mammals, or carrion. A few falcons and hawks are used in the sport of falconry (*q.v.*).

Certain general features are common to all members of this order. Falconiforms are diurnal creatures. Most do not migrate. Although most falconiforms are large, they vary in size from tiny falconets weighing as little as 35 grams (1.2 ounces) to huge vultures and eagles with weights up to 14 kilograms (31 pounds). Females, generally the better hunters in most species, are 10–20 percent larger than the males. The beak is always hooked and is used to tear flesh from prey. The unusually strong feet equipped with long talons are used for killing prey. Sight and hearing are keen, but smell is usually weak.

Falconiforms are found throughout the world (except Antarctica), but are commonest in warm, open country. While food supply exerts some influence on falconiform populations, their density of distribution seems to be limited by territorial behaviour as well. Falconiforms seem to require a large area for each breeding pair.

Large falconiforms are among the longest-lived birds. Ospreys and buteos live an average of 8 to 10 years, but life spans of more than 20 years have been recorded. Smaller falcons and accipiters average a life span of approximately 3 years, but some may reach 10 or 12 years. The larger raptors, such as eagles, can live 18–24 years in the wild. All of these species live much longer in captivity.

The falconiform life cycle consists of four stages, the length of which is directly proportional to the size of the bird. The fledging period, from hatching to first flight, varies from 23 days in small accipiters to 150 days in large condors. The post-fledging period, in which the young stay near the nest and food is brought by the parents, varies from one month to almost a year. The period as a juvenile, when the bird is independent but sexually immature, ranges from about nine months in small species (kestrels and sparrow hawks) to some four years in large eagles, and up to seven years in condors. The sexually mature birds mate, nest, and reproduce.

Falconiforms are daylight hunters. When not hunting, falconiforms rest on perches or soar. As a rule, vultures and eagles seen soaring very high up are not hunting. Toward evening a falconiform may return to a regular roosting site.

All falconiforms fly well. The large species have long and relatively broad wings particularly adapted for soaring flight, and accipiters, swift falcons, and the secretary bird can soar well although these birds rely more on flapping flight. Falcons, especially those that kill other birds, have bullet-shaped bodies and long, pointed wings that facilitate high diving speed to overtake and attack their prey in midair.

Many falconiforms pair for life; others, mostly migrant species, may pair anew each year. The breeding pattern in falconiforms follows that of other bird groups—nuptial display, nest building, incubation, fledging period, and post-fledging period. Breeding time varies from about 3 months in small species to 15 months in the largest birds. Most species perform several types of nuptial displays. Perhaps the most spectacular (though rare) nuptial display is that of some eagles and kites that may lock feet and tumble in a cartwheel toward the ground.

Most species build nests in trees, ledges, cliffs, or, rarely, on the ground. Many species

lay only one egg; few lay more than four. The eggs hatch in the order in which they were laid. Feathers erupt during the fledging period. At about this time most young learn to tear up the prey brought to them by their parents. They make their first flights unaided by parental coaching.

Most falconiforms are directly beneficial to human beings since they feed on pests or carrion. However, many of these bird species are in danger. The spread of agriculture has destroyed many of their habitats, such as forests. DDT and other toxic chemicals used in farming have affected the birds' ability to reproduce. Overcollecting for zoos and museums and for the sport of falconry also continues to have an adverse effect on some species.

Falconiforms have no obvious evolutionary links with other birds. Such evidence as there is suggests that they diverged from their ancestral types 20 million or more years ago and that their relationships with other bird groups have since become obscured.

falconry, also called HAWKING, the sport of employing falcons, other hawks, and sometimes eagles in hunting game.

History. Falconry is an ancient pastime that has been practiced from preliterate times. There is evidence of falconry in Assyria in the 8th century BC. Merchants, adventurers, and crusaders from Europe and England became familiar with falconry in the Orient and on their return home brought falcons and falconers with them. The sport flourished in western Europe and the British Isles in the Middle Ages among the privileged classes. During the 17th century, after the advent of the shotgun and after the enclosure of open lands and numerous social upheavals in the older countries, falconry died out, surviving in Europe largely through the enthusiasm of members of hawking clubs in various countries.

In Great Britain the Falconers' Society of England was founded about 1770 but ceased in 1838 with the death of the then manager, Lord Berners. Because of the scarcity of herons (a main quarry of the club's peregrine falcons in East Anglia) and also partly because of the plowing up of the heath land over which the falconers rode, the centre of English falconry moved to The Netherlands, and in 1839 the Loo Hawking Club, an Anglo-Dutch society under the patronage of King William II of The Netherlands, was formed. In its first eight years, 1,500 herons were taken by its hawks. In 1853, when the royal patronage was withdrawn, the Loo Club expired. Falconry was kept alive in England by a few amateurs and their professional falconers until 1864, when the Old Hawking Club of England was founded, mainly to hawk rooks on the Wiltshire Downs; the club lasted until 1926. The British Falconers' Club, founded in 1927, in the second half of the 20th century had a membership of about 250—more than half in the United Kingdom—but only about 30 kept and flew hawks. The reduction of the rabbit population by myxomatosis and the placing of many of the traditional prey species on the protected list had a profound effect on the sport after World War II. All British birds of prey, including owls, came under the protection of the law, and a license was required from the Home Office before a falconer could take a young hawk for falconry.

Falconry clubs exist in other European countries. The French Club de Champagne went out of existence in 1870, but French falconers are organized in the Association Nationale des Fauconniers et Autoursiers Français. In Germany, the Deutscher Falkenorden (founded in 1923) is a thriving club. Austria has its club, and Italy has the Circolo dei Falconieri d'Italia. In the United States falconry is represented by the North American Falconers Association.

Falconry is still practiced in Libya, and sheikhs in Saudi Arabia and the Persian Gulf states still train their saker falcons to hunt bustard. In Indian and Pakistani Punjab and in the Northwest Frontier Province of Pakistan, falconers fly their falcons at duck and their goshawks at partridge. Japan has a few falconers, who fly their mountain hawk eagles at hare and their goshawks at pheasant.

A revival of interest in the sport occurred after World War II, and, with the reprinting of old treatises on the art, together with magazine articles and television programs on the subject, falconry attracted new adherents.

The birds and the art. Hawks, owls, and eagles are natural predators and kill in order to survive. With skill and patience, they may be trained to kill selected quarry, but none will retrieve game. Some birds, because of their temperament and flight habits, are more desirable for sport than others. The most popular bird has long been the peregrine falcon, which possesses all the desirable traits. It can stand the climatic changes of any country, it is strong and swift, gentle and fierce as required, and when caught wild it is readily trained. Only two groups of hawks (about a dozen species) possess such characteristics—the true falcons, or long-winged hawks, and the accipiters, or short-winged hawks. Among the latter are the goshawk and the European sparrow hawk. Because of the use of agricultural pesticides, the hawks, together with other birds of prey, are on the decline. In the United States, peregrine falcons were virtually extinct because of the use of DDT, but the population recovered by the 1980s after the banning of the pesticide.

Falconry has its own terminology. The male hawk, which is smaller than the female by one-third, is the tiercel. Only the larger female hawk is properly called the falcon. An eyas is a hawk taken from the nest when fully fledged but as yet flightless. Wild-caught immature birds are called passagers because they often are caught when migrating, and adults are haggards. After capture and until ready to be trained, eyases are "at hack." While being hacked the birds are fed regularly on fresh meat, tied to a board or block, always in the same spot. Eyases are seldom used in India and Africa but are commonly used in Europe and the United States.

The long-winged hawks are used in open country, while the short-winged accipiters are better equipped to work hedgerows and woods. Falcons usually kill their quarry in the air, cleanly and at the end of a powerful dive, or stoop, but they do occasionally cling, or "bind to," their prey. The goshawk may perch in a tree watching intently while man and dogs beat the cover. When game is flushed, the goshawk dashes fiercely in pursuit, "binds to" its victim, carrying it to the ground, and then pierces the vital organs with its massive talons. Goshawks are used for hunting hares, rabbits, and pheasants. The smaller accipiters are best for starlings and small game such as partridges and quail.

The falconer must decide whether to use an eyas or a wild-trapped hawk. The novice usually begins with an eyas—legally obtained. Trapping a wild hawk requires patience and skill. One method is to hide in a blind near a bow net set over a wild hawk's kill. As the hawk returns to its kill, the net is pulled with a cord, and if successful the falconer at once removes the bird, attaches leather thongs called jesses to its legs, and covers its eyes with a rufter (soft leather hood used on newly caught birds).

Training begins by carrying the hawk on the heavily gloved fist several hours each day while talking to it gently and stroking its plumage with a feather. When the hawk is able to feed from the fist without the rufter, it is ready to be broken to the hood and to people, dogs, and the life of falconry. Then it is trained to feed from the lure, a padded weight with wings of a pigeon or another bird attached and to which meat is tied. The lure is whirled on a cord and the hawk taught to fly aggressively to it over increasing distances. After this maneuver is mastered, the bird is trained to kill for itself. Now it is ready for hunting. Eyases are trained in much the same way as wild-caught birds.

(F.B.C./M.H.W./C.J.Mo.)

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faldstool, a folding stool commonly composed of two pairs of crossed legs pivoting at the intersection, each pair joined by stretchers near ground level and by a flexible (usually fabric) seat at the top.

It is obvious from early manuscripts depicting rulers seated on faldstools that this form of seating was reserved for people of the highest rank. It was known in ancient Egypt, Rome, and Greece, and it has been suggested that barbarian leaders who usurped Roman rule used the faldstools captured from Roman commanders as thrones or symbols of their newly won power. Before the introduction of permanent seating in medieval churches, faldstools were used by members of the congregation. They were also used as bishops' seats. *See also* scissors chair.

Falémé River, river in western Africa, rising in the uplands of northern Guinea, east of the Fouta Djallon massif, and flowing roughly north-northeast to enter Mali. It then turns northwest to form the Mali–Senegal border for the rest of its course to the Sénégal River, except for a slight detour across a corner of western Senegal. It is approximately 250 miles (400 km) long and, although interrupted by rapids, is partially navigable from July to September. Its basin has a high rainfall, and there is some alluvial gold along its valley. The major towns along the river are Satadougou (Mali) and Kidira (Senegal).

Fali, a people who inhabit the rocky plateaus ringed by the northernmost peaks of the Adamaoua mountains of northern Cameroon. "Fali" is from a Fulani (Peul) word meaning "perched" and describes the appearance of Fali family compounds on the sides of mountains.

The Fali have no traditional centralized political organization. They observe patrilineal descent and virilocal residence. Hamlets and wider villages are inhabited by given lineages and overseen by a chief who is a descendant of the village founder.

The Fali are farmers; their principal crops are millet, chickpeas, peanuts (groundnuts), squash, tobacco, and okra, as well as cotton as a cash crop. Goats, a few sheep, some cattle, and occasionally a horse are kept. Fali women

are known for their pottery and for the pyrographic designs they make on bottle gourds; they also make cotton thread and weave fabrics out of it.

Fali believe in a very abstract supreme deity called Fao. The centre of religious life is the cult of the ancestors. Masks representing the original couple and the most illustrious descendants of a family line are kept in the family compound; in more recent times the masks have often been replaced by sacred stones. Granaries and other buildings are decorated with bas-reliefs and painting to represent cosmological motifs. Fali—like other groups in northern Cameroon—are best known to outsiders for the manner in which they have adapted to their harsh environment: their "sculpted" homes, granaries, and chicken houses seem to be a part of the hillside.

Falier, Marin, Italian MARINO FALIERO (b. 1274—d. April 17, 1355, Venice), leading official in Venice and doge from 1354 to 1355, who was executed for having led a plot against the ruling patricians. His tragic story has inspired several important literary works,

Falier, portrait attributed to the School of Tintoretto; in the Doges' Palace, Venice

Anderson—Alinari from Art Resource/EB Inc.

including the tragedy *Marino Faliero: Doge of Venice* (1821) by the English Romantic poet Lord Byron.

Of patrician family, Falier spent many years in high positions in the Venetian government. During Venice's struggle with Genoa and Hungary for naval predominance in the Adriatic, he commanded in the Venetian victory over the Hungarians at Zara (1348). He continued to defend Venetian interests against these two powerful foes, leading a naval squadron against Genoa (1352) and playing a major role in peace negotiations.

As ambassador at Avignon, Falier was negotiating with Pope Innocent VI (reigned 1352–62) to resolve the dispute with Genoa when he was elected doge in September 1354. The rout of the Venetian fleet by the Genoans at Porto Longe (November 1354) obliged Falier to negotiate a four-month truce. The humiliating defeat and the subsequent truce aroused the hostility of the patricians, engaged in a struggle for power with the doge.

Either personally provoked by a patrician or impelled by purely political reasons, Falier led a plebeian plot to kill all the nobles, whose power would revert to the people and to the doge in particular. The plot was discovered, however, and Falier, along with his accomplices, was tried and executed.

Faliscan language, an Italic language closely related to Latin and more distantly related to Oscan and Umbrian languages (*qq.v.*). Faliscan was spoken by the Falisci in central Italy in a small region northwest of the Tiber River. Falerii, the Faliscan capital, was destroyed by the Romans in 241 BC, and it is likely that the Faliscan language was completely displaced by Latin in the following century. Modern knowledge of Faliscan comes from a small number of inscriptions written in a native Faliscan alphabet derived from Etruscan.

Falisci, ancient people of southern Etruria in Italy who, though Latin in nationality and speech, were culturally closer to the Etruscans. They occupied the region between the Tiber River and Mt. Ciminus, with Falerii (modern Civita Castellana) as their capital. Resistance of the Falisci to Rome began in 437 BC, when they joined with Veii in the Etruscan alliance against the common enemy and ended with the razing of Falerii by the Romans in 241 BC. Objects in early Faliscan graves are indistinguishable from early Etruscan objects. *See also* Faliscan.

Falk, (Paul Ludwig) Adalbert (b. Aug. 10, 1827, Metschkau, Prussia—d. July 7, 1900, Hamm, Ger.), Prussian bureaucrat who as state minister of ecclesiastical affairs in the 1870s aggressively headed German Chancellor Otto von Bismarck's *Kulturkampf* against the Roman Catholic Church.

Appointed Prussian minister of ecclesiastical affairs and education in January 1872, he was commissioned by Bismarck to direct the *Kulturkampf*—or, in the Chancellor's words, "to re-establish the rights of the state in relation to the church." Falk's subsequent legislative program, culminating in the May laws (1873), introduced mandatory civil marriage, undercut clerical influence in educational matters, and enforced various disabilities on the Catholic clergy and laity. In 1878, however, his ministerial position was rendered practically untenable by Bismarck's split with the National Liberal Party, the strongest supporter of the *Kulturkampf*, as well as by the prospects of improved German-papal relations. In September 1879 Falk finally resigned. From 1882 he served as president of the Court of Appeals at Hamm.

Falkberget, Johan Petter, pseudonym of JOHAN PETTER LILLEBAKKEN (b. Sept. 30, 1879, near Røros, Nor.—d. April 5, 1967, Tyvol, near Røros), regional novelist of life in the central eastern mountains of Norway.

The self-educated son of a miner, Falkberget worked in the copper mines himself from the age of eight until he was 27, learning to write at the same time. His novels about the mountain peasants, miners, and railway workers deal realistically with their hard lives, marginal culture, and antagonism to the more comfortable and prosperous valley settlers. His major works are set in the past. *Den fjerde nattevakt* (1923; *The Fourth Night Watch,* 1968) deals with life in Røros between 1807 and 1825. *Christianus Sextus* (1927–35), a trilogy set in the 18th century, dramatizes the history of a mine by that name. In 1940 Falkberget escaped the German occupation of Norway by walking to Sweden, carrying with him the manuscript that was to become his second trilogy, *Nattens brød* (1940–59; "Bread of Night"). In 1960 he received the Cross of St. Olav.

Falke, Gustav (b. Jan. 11, 1853, Lübeck—d. Feb. 8, 1916, Grossborstel, near Hamburg), German poet and novelist prominent among the new lyric poets of the late 19th and early 20th centuries. His verses were influenced by folk songs and the Romantic poets and exhibited a feminine mood as well as a celebration of simple domestic pleasures.

Falke worked first as a bookseller and then as a music teacher (1878) until a pension from the Hamburg government enabled him to devote his time to writing. His best known poems are contained in *Mynheer der Tod* (1892; "Mynheer Death"), *Hohe Sommertage* (1902; "High Summer Days"), and *Frohe Fracht* (1907; "Happy Load"). His novels include *Der Mann im Nebel* (1899; "The Man in the Fog") and *Die Kinder aus Ohlsens Gang* (1908; "The Children from Ohlsen's Passage"). He also published volumes of short stories, *Geelgösch* (1910) and *Der Spanier* (1910; "The Spaniard"), and the autobiographical *Stadt mit den goldenen Türmen* (1912; "City with the Golden Towers").

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

Falkenhayn, Erich (Georg Anton Sebastian) von (b. Nov. 11, 1861, near Graudenz, West Prussia—d. April 8, 1922, near Potsdam, Ger.), Prussian minister of war and chief of the imperial German General Staff early in World War I.

Falkenhayn, 1916

Archiv fur Kunst und Geschichte, West Berlin

Falkenhayn gained military experience as an instructor to the Chinese Army and as a member of the Prussian General Staff in the international expedition of 1900 against the Boxers in China. From July 1913 to January 1915 he was Prussian minister of war, in which office he was responsible for the armament and equipment of the German Army. He ignored some recommendations of Gen. Helmuth von Moltke, chief of the General Staff, who for that reason considered him responsible for the army's failure in France in 1914. On Sept. 14, 1914, after the German retreat from the Marne, William II chose Falkenhayn as Moltke's successor.

Falkenhayn was convinced that the war had to be won in France, chiefly by Germany's standing on the defensive and exhausting her enemies. He seems to have had little interest in defeating Russia; thus he opposed the plan of Field Marshal Paul von Hindenburg and Gen. Erich Ludendorff for an eastern offensive, and, after the Emperor had permitted an offensive to begin on Feb. 7, 1915, Falkenhayn declined to provide adequate reinforcements. Within Germany he greatly improved the system of munitions supply and transportation of troops by rail.

On Aug. 29, 1916, following the long and unsuccessful German assault on the French fortress-city Verdun, Falkenhayn was dismissed as chief of the General Staff by the Emperor in favour of the more aggressive Hindenburg. After leading a German army against Romania for 10 months, Falkenhayn took command of the Central Powers forces (mainly Turkish) in Palestine (July 9, 1917). There he was unable to stop the advance of the British under Gen. Edmund Allenby. Having been succeeded in Palestine by Gen. Otto Liman von Sanders, Falkenhayn commanded an army in Lithuania from March 4, 1918, until the end of the war.

Falkirk, district, Central region, eastern Scotland; created by the reorganization of 1975, it

is the easternmost part of the former county of Stirling and the small westernmost portion (Bo'ness) of the former county of West Lothian. The district, with an area of 112 square miles (291 square km), lies mostly in the plain of the River Forth, which bounds it on the northeast. Falkirk is the seat of the district authority. Grangemouth is a major Scottish port and oil refinery, receiving North Sea oil by pipeline from Cruden Bay, near Aberdeen. Bo'ness, once an important seaport, is a small manufacturing town. Pop. (1987 est.) 143,229.

Falkirk, royal burgh and important industrial town in the district of Falkirk, Central region (which until May 1975 was in the county of Stirling), Scotland. It lies midway between the cities of Edinburgh and Glasgow. Grangemouth, its port, lies 3 miles (5 km) northeast at the termination of the disused Forth-Clyde Canal.

The Roman Antonine Wall runs through the southern part of the burgh, and the suburb of Camelon was the site of a succession of Roman forts. Falkirk's strategic position in central Scotland made it the site of two battles, one (1298) an English, the other (1746) a Scottish victory. Falkirk became a royal burgh in 1646 but lost that privilege for a time after the Rebellion of 1715.

During the 19th century the discovery of local coal, iron ore, and fireclay in the area led to the development of heavy industry. Falkirk is still the Scottish centre for the light (iron) casting trade, and other industries include aluminum rolling, coach building, light engineering, and brewing. Pop. (1981) 36,881.

Falkland, small royal burgh and former royal residence in the district of North East Fife, Fife region (until May 1975 in the county of Fife), Scotland. It is situated at the northern base of the East Lomond Hill (1,471 feet [448 m]). The burgh's 12th-century castle was replaced by the present Falkland Palace, which from the 16th century became a favourite seat of the Scottish court.

Falkland became a royal burgh in 1458, and its charter, which dates from 1160, was renewed in 1595. The burgh's chief industries are linen and linoleum manufacturing. Pop. (1981) 954.

Falkland, Lucius Cary, 2nd Viscount of, LORD CARYE, Cary also spelled CAREY (b. *c.* 1610, Burford Priory, Oxfordshire, Eng.—d. Sept. 20, 1643, Newbury, Berkshire), English royalist who attempted to exercise a moderating influence in the struggles that preceded the English Civil Wars (1642–51) between the royalists and the Parliamentarians. He is remembered chiefly as a prominent figure in the *History of the Rebellion* by his close friend Edward Hyde (afterward Earl of Clarendon).

The son of Sir Henry Cary, lord deputy of Ireland from 1622 to 1629, Cary succeeded his father as Viscount Falkland in 1633. At his manor at Great Tew, near Burford Priory, Falkland surrounded himself with some of the most learned men of his age.

As a member of the Long Parliament, which convened in November 1640, Falkland at first took an active part in the opposition to the policies of King Charles I, going so far as to support the impeachment of the king's chief minister, Thomas Wentworth, Earl of Strafford. At the same time, he sought a compromise between the Anglican, or royalist, and the Puritan factions in Parliament. When the Puritans obtained control of the House of Commons, he broke with Parliament and on Jan. 1, 1642, became Charles I's secretary of state. He saw limited action in the Civil Wars but fell into despair when it became evident the conflict would not end quickly. According to Hyde, Falkland then welcomed death on the battlefield. He was killed in the Battle of Newbury in September 1643.

Falkland Islands, also called ISLAS MALVINAS, British self-governing colony in the South Atlantic Ocean. It lies about 300 miles (480 km) northeast of the southern tip of South America, and a similar distance east of the Strait of Magellan.

The land. The two main islands, East Falkland and West Falkland, and about 200 smaller islands form a total land area of approximately 4,700 square miles (12,200 square km). The capital and only town is Stanley (Port Stanley), on East Falkland. The government of the Falkland Islands administers the British dependent territories of South Georgia, the South Sandwich Islands, and the Shag and Clerke rocks, lying from 700 to 2,000 miles (1,100 to 3,200 km) to the east and southeast of the Falklands.

The English captain John Strong made the first recorded landing in the Falklands, in 1690, and named the sound between the two main islands after Viscount Falkland, a British naval official. The name was later applied to the whole island group. In South America the islands are generally known as Islas Malvinas, after the port of St. Malo from which early French navigators had explored islands.

Ranges of hills run east–west across the northern parts of the two main islands, reaching 2,312 feet (705 m) at Mount Usborne in East Falkland. The coastal topography features many drowned river valleys that form protected harbours. The small rivers occupy broad, peat-covered valleys. The islands' cool and windy climate offers few temperature extremes and only minor seasonal variability. Consistently high west winds average 19 miles (31 km) per hour, while the mean annual average temperature is about 42° F (5° C), with an average maximum of 49° F (9° C) and an average minimum of 37° F (3° C). Precipitation averages 25 inches (635 mm) annually.

The islands' vegetation is low and dense in a landscape with no natural tree growth. White grass (*Cortaderia pilosa*) and diddle-dee (*Empetrum rubrum*) dominate the grasslands. Where livestock grazing has been controlled, coastal tussock grass (*Parodiochloa flabellata*) still covers offshore islands. The chilly, damp climate inhibits the complete decomposition of plant matter and permits the accumulation of deep peat deposits, which are used locally for fuel.

There are no longer any land mammals indigenous to the Falklands, the indigenous wild fox being extinct. About 65 different species of birds, including the black-browed albatross, Falkland pipit, peregrine falcon, and striated caracara breed on the islands. The Falklands are breeding grounds for several million penguins, consisting mostly of Rockhopper, Magellanic, and Gentoo penguins, with smaller numbers of King and Macaroni penguins. Dolphins and porpoise are common, and southern sea lions and elephant seals are also abundant. Fur seals are found at a few isolated sites.

The people. The population of the Falkland Islands is English-speaking and consists of Falklanders of British descent. The pattern of living on the islands is sharply divided between that of small, isolated sheep-farming communities and that of Stanley, the capital. Two-thirds of the population lives in Stanley, including some British scientific and military personnel.

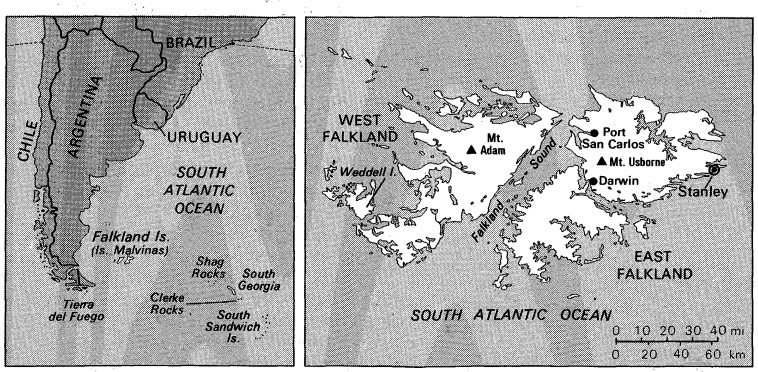
Almost the whole area of the two main islands, outside of Stanley, is devoted to sheep farming. The islands' sheep stations (ranches) vary in size and may be owned by individual families or by companies based in Britain. There are a total of about 700,000 sheep in the islands, producing several thousand metric tons of wool annually, as well as some mutton. The wool is sold in Great Britain and is the colony's main resource. The Falkland Islands Company, incorporated by Royal Charter in 1851, has played a notable part in the economic development of the islands and is still their single largest sheep rancher. Sheep ranching is supplemented by fishing in the adjacent marine waters.

Internal communications is by motor vehicles and a government-operated air service. A coastal freighter travels around the two main islands to deliver supplies and collect the wool clip for transshipment to England. There are regular passenger flights from the Falklands' Mount Pleasant airport to England via Ascension Island. Good external telecommunications are maintained via satellite.

Government and administrative conditions. The islands' government is headed by a governor appointed by the British crown. He is advised by an executive council consisting of senior civil servants and some elected members of the Legislative Council, over which he also presides. There is no unemployment in the Falklands, but a shortage of housing has discouraged immigration. The islands' social welfare system is good, and education is free and compulsory to the age of 15, with a secondary school at Stanley. Free medical service is provided by a hospital in Stanley.

History. The English navigator John Davis in the *Desire* may have been the first person to sight the Falklands, in 1592, but it was the Dutchman Sebald de Weerdt who made the first undisputed sighting of them around 1600. The French navigator Louis-Antoine de Bougainville founded the islands' first settlement, on East Falkland, in 1764. The British, in 1765, were the first to settle West Falkland, but they were driven off in 1770 by the Spanish, who had bought out the French settlement in about 1767. The British outpost on West Falkland was restored in 1771 after threat of war, but then the British withdrew from the island in 1774 for reasons of economy, without renouncing their claim to the Falklands. Spain maintained a settlement on East Falkland (which it called Soledad Island) until 1811.

In 1820 the Buenos Aires government, which had declared its independence from Spain in 1816, proclaimed its sovereignty over the



Falkland Islands and Dependencies

Falklands. In 1831 the American warship USS *Lexington* destroyed the Argentine settlement on East Falkland in reprisal for the illegal arrest of three U.S. ships that had been hunting seals in the area. In early 1833 a British force expelled the few remaining Argentine officials from the island without firing a shot. In 1841 a British civilian lieutenant governor was appointed for the Falklands, and by 1885 a British community of some 1,800 people on the islands was self-supporting. Colonial status was granted to the Falklands in 1892. Argentina regularly protested Britain's occupation of the islands.

After World War II, the issue of sovereignty over the Falkland Islands shifted to the United Nations when, in 1964, the islands' position was debated by the UN committee on decolonization. Argentina based its claim to the Falklands on papal bulls of 1493 modified by the Treaty of Tordesillas (1494), by which Spain and Portugal had divided the New World between themselves; on succession from Spain; on the islands' proximity to South America; and on the need to end a colonial situation. Britain based its claim on its "open, continuous, effective possession, occupation, and administration" of the islands since 1833 and its determination to apply to the Falklanders the principle of self-determination as recognized in the United Nations Charter. Britain asserted that, far from ending a colonial situation, Argentine rule and control of the lives of the Falklanders against their wishes would in fact create one.

In 1965 the UN General Assembly approved a resolution inviting Britain and Argentina to hold discussions to find a peaceful solution to the dispute. These protracted discussions were still proceeding in February 1982, soon after which Argentina's military government invaded the Falklands (on April 2, 1982). This act started the Falkland Islands War (*q.v.*), which ended 10 weeks later with the surrender of the Argentine forces at Stanley to British troops who had forcibly reoccupied the islands. Britain continues to maintain troops on the islands and enforces military-exclusion and fishing-conservation zones extending a considerable distance from their shores. Pop. (1986) 1,919.

Falkland Islands War, also called FALKLANDS WAR, MALVINAS WAR, or SOUTH ATLANTIC WAR, a brief undeclared war fought between Argentina and Great Britain in 1982 over the control of the Falkland Islands and associated island dependencies.

Argentina had claimed sovereignty over the Falkland Islands (which lie 300 miles [480 km] east of its coast) since the early 19th century, but Britain had occupied and administered the islands since 1833 and had consistently rejected Argentina's claims. In early 1982, Argentina gave up on its long-running negotiations with Britain over the issue and instead launched a military invasion of the islands. Argentine troops invaded the Falklands on April 2 of that year and easily overcame the small garrison of British marines there. Argentine troops seized the associated islands of South Georgia and the South Sandwich group (1,000 miles [1,600 km] east of the Falklands) the next day. By late April Argentina had more than 10,000 troops stationed on the Falklands.

In response, the British government under Prime Minister Margaret Thatcher declared a war zone for 200 miles (320 km) around the Falklands and assembled a naval task force with which to retake the islands. On April 25, while the British task force was steaming 8,000 miles (13,000 km) to the war zone via the British-held Ascension Island, a smaller British force retook Georgia Island.

On May 2 the Argentine cruiser *General Belgrano* was sunk by a British submarine as it approached the war zone, and further battles ensued between the land-based Argentine air force and the British naval force. Attempts by both the United Nations and the United States to mediate the crisis at this point proved unsuccessful. Argentine air attacks sank two British destroyers and two frigates but failed to prevent the British from making an amphibious landing near Port San Carlos, on the northern coast of East Falkland, on May 21. From this beachhead the British infantry advanced southward to capture the settlements of Darwin and Goose Green, after which they turned eastward to surround the Falklands' capital of Stanley on May 31. The large Argentine garrison there surrendered on June 14, effectively ending the conflict. The British reoccupied the South Sandwich Islands on June 20.

The British captured about 10,000 Argentine prisoners during the war, all of whom were afterward released. Argentina sustained about 700 men killed, while Britain lost about 250. Argentina's ignominious defeat severely discredited the military government and led to the restoration of civilian rule in that country in 1983.

Falkland Sound, strait in the South Atlantic Ocean, separating East and West Falkland (islands). It extends from northeast to southwest for 50 miles (80 km) and is 1½ miles (in its narrowest passages) to 20 miles (2 km to 32 km) wide. Many small islands lie in the sound.

Falkner, William (Cuthbert) (novelist): *see* Faulkner, William (Cuthbert).

fall (season): *see* autumn.

Fall, Albert Bacon (b. Nov. 26. 1861, Frankfort, Ky., U.S.—d. Nov. 30, 1944, El Paso, Texas), U.S. secretary of the interior under President Warren G. Harding; he was the first American to be convicted of a felony committed while holding a Cabinet post.

Fall had little formal schooling but studied law and, after moving to New Mexico Territory, began to practice in 1889. After a lengthy political career in New Mexico, he was elected to the U.S. Senate in 1912, serving until his appointment as secretary of the interior in 1921. He resigned from the Cabinet two years later and returned to New Mexico.

In 1924 a Senate investigation revealed that Fall had accepted a large bribe to lease to private oil interests, without competitive bidding, naval oil reserve lands in the Teapot Dome reserve in Wyoming and other reserves in California. He was convicted of bribery in 1929 and served nine months of a one-year prison sentence.

fall line, line of numerous waterfalls, as at the edge of a plateau, where streams pass from resistant rocks to a plain of weak ones below. Such a line also marks the head of navigation, or the inland limit that ships can reach from a river's mouth; because navigation is interrupted both upstream and downstream, important cities often occur along the fall line. In the eastern United States, a fall line exists between the Appalachian piedmont and the Atlantic coastal plain; waterfalls or rapids occur on all the principal rivers (*e.g.*, the Delaware, Schuylkill, Patapsco, Potomac, James, and Savannah rivers), and the cities of Trenton, Philadelphia, Baltimore, Washington, Richmond, and Augusta are among those built along this line. Other examples are the extensive fall lines that separate the narrow coastal plains of Africa, Western Australia, Brazil, and India from their interior continental shields.

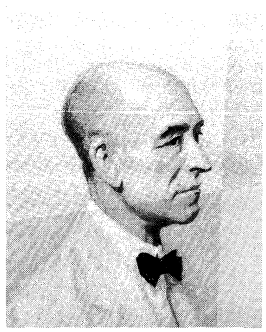
Fall River, city, one of three seats (with New Bedford and Taunton) of Bristol county, southeastern Massachusetts, U.S. It lies on the east shore of Mount Hope Bay, at the mouth of the Taunton River, 18 miles (29 km) southeast of Providence, R.I. Its site was included in Freeman's Purchase, a tract of land bought from the Indians in 1659 by Plymouth colonists and settled in 1686. Originally part of Freetown, it was separately incorporated as the town of Fallriver in 1803. Renamed Troy, it reverted (1831) to its earlier name (derived from the Indian Quequechan, meaning "falling water"). Abundant waterpower, a fine harbour, and a moist climate encouraged textile milling in the town as early as 1811, and by 1871 the city was a leading cotton-textile centre. It was the scene of numerous labour strikes, and its millworkers played a prominent role in the American labour-union movement. Despite relocation trends and some economic diversification, the textile and clothing industries continue to be the city's largest source of employment.

In 1892 Fall River was the site of the notorious ax-murder trial of Lizzie Borden, who was acquitted of hacking her father and stepmother to death. Battleship Cove harbours famous vessels of the U.S. Navy, including the USS *Massachusetts* (the state's official war memorial); the Marine Museum is also there. Bristol Community College was established (1966) in Fall River. Inc. city, 1854. Pop. (1988 est.) city, 89,595; Fall River PMSA, 153,800; Providence-Pawtucket-Fall River CMSA, 1,125,400.

fall wind, large-scale katabatic wind (air currents descending on the lee side of mountains) that remains cold as it flows downslope. The extremely cold winds along the coasts of Antarctica are fall winds; other examples are the bora in the Adriatic region of Italy and Yugoslavia and the mistral in southern France. In populated areas where fall winds occur, homes and orchards are situated on hillslopes to avoid the cold lowland air.

Falla, Manuel de (b. Nov. 23, 1876, Cádiz, Spain—d. Nov. 14, 1946, Alta Gracia, Arg.), the most distinguished Spanish composer of the early 20th century. In his music he achieved a fusion of poetry, asceticism, and ardour that represents the spirit of Spain at its purest.

Falla took piano lessons from his mother and later went to Madrid to continue the piano and to study composition with Felipe Pedrell,



Falla, detail of an oil painting by José María López Mezquita, 1928; in the collection of the Hispanic Society of America

By courtesy of the Hispanic Society of America

who inspired him with his own enthusiasm for 16th-century Spanish church music, folk music, and native opera. In 1905 Falla won two prizes, one for piano playing and the other for a national opera, *La vida breve* (first performed in Nice, Fr., 1913).

In 1907 he moved to Paris, where he met Claude Debussy, Paul Dukas, and Maurice Ravel (whose orchestration influenced his own) and published his first piano pieces and songs. In 1914 he returned to Madrid, where he wrote the music for a ballet, *El amor brujo* (*Love, the Magician;* Madrid, 1915), remark-

able for its distillation of Andalusian folk music. Falla followed this with *El corregidor y la molinera* (Madrid, 1917), which Diaghilev persuaded him to rescore for a ballet by Léonide Massine called *El sombrero de tres picos* (*The Three-Cornered Hat;* London, 1919). *Noches en los jardines de España* (*Nights in the Gardens of Spain;* Madrid, 1916), a suite of three impressions for piano and orchestra, evoked the Andalusian atmosphere through erotic and suggestive orchestration. All these works established Falla internationally as the leading Spanish composer.

Falla then retired to Granada, where in 1922 he organized a *cante hondo* festival and composed a puppet opera, *El retablo de Maese Pedro.* Like the subsequent *Harpsichord Concerto* (1926), containing echoes of Domenico Scarlatti, the *Retablo* shows Falla much influenced by Igor Stravinsky. Falla's style was then Neoclassical instead of Romantic, still essentially Spanish, but Castilian rather than Andalusian. After 1926 he wrote little, living first in Mallorca and, from 1939, in Argentina.

fallacy, in logic, erroneous reasoning that has the appearance of soundness. Among numerous types of logical fallacies that have been noted, some of the better known are: *post hoc ergo propter hoc* ("after this, therefore, because of this"), in which something is assumed to be the cause of something else merely because it was antecedent in time; *ad hominem* ("against the man"), attacking an individual rather than establishing pertinent facts; and *circulus in probando* ("arguing in a circle"; also called *petitio principii,* "begging the question"), attempting to demonstrate a conclusion by means of premises that presuppose that conclusion.

Fälldin, Thorbjörn (b. April 24, 1926, Högsjö, Swed.), politician who was prime minister of Sweden (1976–78, 1979–82).

Largely self-educated, he passed his examination for leaving school in 1945. Active within the Centre Party (formerly the Agrarian Party) from his youth, he became its leader in 1971. He rapidly transformed and enlarged it by adopting a pro-environment and antinuclear platform that had considerable appeal. First elected to the Riksdag (parliament) in 1958, he lost his seat in 1964 but regained it in 1967. He served on several standing committees of the Riksdag and was a deputy member of the Nordic Council. In becoming prime minister he overturned (if briefly) a Socialist control of government that had lasted since 1932.

Fallen Timbers, Battle of (Aug. 20, 1794), decisive victory of the U.S. general Anthony Wayne over the Northwest Indian Confederation, ending two decades of border warfare and securing white settlement of the former Indian territory mainly in Ohio. Wayne's expedition of more than 1,000 soldiers represented the third U.S. attempt (*see* Saint Clair's Defeat) to eradicate the resistance posed by the Northwest Confederation, comprising the Miami, Potawatomi, Shawnee, Delaware, Ottawa, Chippewa, Iroquois, and other tribes.

Bolstered by promises of British support, more than 2,000 warriors gathered in mid-June 1794 near Fort Miami on the Maumee River in Ohio, confidently awaiting a confrontation with the advancing U.S. Army. Using ruse and strategy, Wayne directed his well-trained troops against the Indians, who were gathered behind a protective tangle of fallen trees. The army's assault was successful, and the Indians broke in less than two hours and fled. More than by defeat, the Indians' morale was shattered by failure to receive help from the British, who preferred not to risk hostilities with a neutral nation during a time of war against Revolutionary France.

The fruits of the Battle of Fallen Timbers were claimed at the Treaty of Fort Greenville (Aug. 3, 1795), when the Miami chief Little Turtle, representing the confederation, ceded to the United States most of Ohio and parts of Indiana, Illinois, and Michigan. The treaty thus gave a great impetus to westward migration and settlement of those areas. Within the next 25 years additional Indian lands north and west of the treaty line were also ceded to the United States. In addition, the treaty ended British influence in the area, facilitating the evacuation of border forts that had been provided for in the Jay Treaty (1794); thus the danger of any British-Indian alliance against the United States was finally eliminated.

The battle site, about 12 miles (19 km) southwest of Toledo, is now an Ohio state park.

Fallersleben, August Heinrich Hoffmann von: *see* Hoffmann von Fallersleben, August Heinrich.

Fallières, (Clément-) Armand (b. Nov. 6, 1841, Mézin, Fr.—d. June 22, 1931, Loupillon, near Mézin), French statesman and eighth president of the French Third Republic.

He began his public career as town councillor at Nérac (1871), and in 1876 that constituency sent him to the Chamber of Deputies. Fallières sat with the left and signed the May 18, 1877, protest against the dissolution decreed by President Patrice Mac-Mahon. He returned to the new Chamber; held a minor office in Jules Ferry's Cabinet (1880–81); became minister of the interior under Charles Duclerc (1882–83); and, then, on Jan. 29, 1883, became premier. Fallières's government lasted only 21 days: he resigned after the Senate rejected

Fallières, *c.* 1906
H. Roger-Viollet

his proposed compromise on the expulsion of the pretenders to the French throne. Fallières then held a succession of ministerial posts. In June 1890 he was elected to the Senate and became its president from March 1899 to January 1906, when he became president of the republic. He held the presidency from 1906 until 1913, when he was succeeded by Raymond Poincaré.

falling star: *see* meteor.

fallopian tube, also called OVIDUCT, or UTERINE TUBE, either of a pair of long narrow ducts located in the human female abdominal cavity that transport the male sperm cells to the egg, provide a suitable environment for fertilization, and transport the egg from the ovary, where it is produced, to the central channel (lumen) of the uterus.

Each fallopian tube is 10–13 cm (4–5 inches) long and 0.5–1.2 cm (0.2–0.6 inch) in diameter. The channel of the tube is lined with a layer of mucous membrane that has many folds and papillae—small cone-shaped projections of tissue. Over the mucous membrane are three layers of muscle tissue; the innermost layer has spirally arranged fibres, the middle layer has circular fibres, and the outermost sheath has longitudinal fibres that end in many fingerlike branches (fimbriae) near the ovaries, forming a funnel-shaped depository called the infundibulum. The infundibulum catches and channels the released eggs; it is the wide distal (outermost) portion of each fallopian tube. The endings of the fimbriae extend over the ovary; they contract close to the ovary's surface during ovulation in order to guide the free egg. Leading from the infundibulum is the long central portion of the fallopian tube called the ampulla. The isthmus is a small region, only about 2 cm (0.8 inch) long, that connects the ampulla and infundibulum to the uterus. The final region of the fallopian tube, known as the intramural, or uterine, part, is located in the top portion (fundus) of the uterus; it is a narrow tube continuous with the isthmus, and it leads through the thick uterine wall to the uterine cavity, where fertilized eggs normally attach and develop. The channel of the intramural duct is the narrowest part of the fallopian tube.

The mucous membrane lining the fallopian tube gives off secretions that help to transport the sperm and the egg and to keep them alive. The major constituents of the fluid are calcium, sodium, chloride, glucose (a sugar), proteins, bicarbonates, and lactic acid. The bicarbonates and lactic acid are vital to the sperm's use of oxygen, and they also help the egg to develop once it is fertilized. Glucose is a nutrient for the egg and sperm, whereas the rest of the chemicals provide an appropriate environment for fertilization to occur.

Besides the cells that secrete fluids, the mucous membrane contains cells that have fine hairlike structures called cilia; the cilia help to move the egg and sperm through the fallopian tubes. Sperm deposited in the female reproductive tract usually reach the infundibulum within a few hours. The egg, whether fertilized or not, takes three to four days to reach the uterine cavity. The swaying motions of the cilia and the rhythmic muscular contractions (peristaltic waves) of the fallopian tube's wall work together while moving the egg or sperm.

Fallopius, Gabriel, Italian GABRIELLO FALLOPIO, or FALLOPIA (b. 1523, Modena [Italy]—d. Oct. 9, 1562, Padua), the most illustrious of 16th-century Italian anatomists, who contributed greatly to early knowledge of the ear and of the reproductive organs.

Fallopius served as canon of the cathedral of Modena and then turned to the study of medicine at the University of Ferrara, where he became a teacher of anatomy. He then held positions at the University of Pisa (1548–51) and at Padua (1551–62). His exhaustive observations, made during dissection of human cadavers and outlined in *Observationes anatomicae* (1561), earned him the respect and admiration of his colleagues, including the great Renaissance anatomist Andreas Vesalius.

Fallopius discovered the tubes that connect the ovaries to the uterus (now known as fallopian tubes) and several major nerves of the head and face. He described the semicircu-

Fallopius, engraving
BBC Hulton Picture Library

lar canals of the inner ear (responsible for maintaining body equilibrium) and named the vagina, placenta, clitoris, palate, and cochlea (the snail-shaped organ of hearing in the inner ear). A friend and supporter of Vesalius, he joined him in a vigorous assault on the principles of the classic Greek anatomist Galen, which resulted in a shift of attitude essential to the development of Renaissance medicine.

Fallot, tetralogy of, also called FALLOT'S TETRALOGY, or BLUE BABY SYNDROME, congenital heart disease characterized by cyanosis (bluish discoloration of the skin) usually after the neonatal period, hypoxic spells (which include difficult or laboured respiration, sudden onset of cyanosis, alterations in consciousness), digital clubbing, and heart murmur.

Tetralogy of Fallot (named for Étienne-Louis-Arthur Fallot, who first described it) is the result of a combination of cardiac defects including a defect in the intraventricular septum (the partition that separates the lower chambers of the heart), pulmonary stenosis (narrowing of the opening to the pulmonary artery), dilation and displacement of the aorta to override the ventricular septum, and right ventricular hypertrophy (thickening of the muscle of the right ventricle). This condition causes the deoxygenated venous blood to be shunted from the right to the left side of the heart into arterial circulation.

Total correction of the condition is possible with surgical repair of the septal defect, removal of the obstruction to the right ventricular outflow, and opening of the right ventricle. This procedure—which has a high rate of success—produces marked improvement, but dysrhythmia may still occur unexpectedly.

fallout, deposition of radioactive materials on the Earth from the atmosphere. The terms rain out and snow out are sometimes used to specify such deposition during precipitant weather.

Radioactivity in the atmosphere may arise from (1) natural causes, (2) nuclear or thermonuclear bomb explosions, and (3) induced radioactivities and fission products from atomic reactor operations.

Most of the natural radioactivity in the atmosphere is a result of cosmic rays and the gaseous diffusion of radon from natural uranium and thorium found in the Earth's crust. The local concentrations of these gases in the atmosphere depend to a great extent on the distribution of uranium and thorium in the Earth, as well as on meteorological conditions. Cosmic rays produce, among other isotopes, radioactive forms of carbon and hydrogen.

The explosion of nuclear bombs that release radioactivity leads to three separate types of fallout: local, tropospheric, and stratospheric. The local fallout is due to the deposition of the larger radioactive particles near the site of the explosion. This fallout is quite intense but relatively short-lived. Tropospheric fallout occurs when the finer particles enter the troposphere (the lower part of the Earth's atmosphere) and are deposited at a later time and over a larger area, depending on the local meteorological conditions. In general, tropospheric fallout occurs in the month following the explosion and takes place in the general latitude of the explosion site. Stratospheric fallout, made up of extremely fine particles in the stratosphere (above the troposphere), may continue years after the explosion, and the distribution is nearly worldwide. Generally only large nuclear weapons produce significant stratospheric fallout.

Many different radioisotopes are formed during a nuclear explosion, but only the long-lived isotopes are deposited as stratospheric fallout. Examples are cesium-137 and strontium-90, which have 27- and 28-year half-lives. The latter presents the greater hazard to animal life since it is chemically similar to calcium and may replace the calcium in certain foods and ultimately become concentrated in the body. The radioactive material in the stratosphere eventually mixes with the troposphere, where it then deposits out onto the Earth through electrical attraction or gravity or by attachment to larger particles such as water droplets.

Falloux, Frédéric-Alfred-Pierre, comte de (count of) (b. May 11, 1811, Angers, Fr.—d. Jan. 6, 1886, Angers), French political figure and monarchist who served in various political roles but is best remembered as the sponsor of the important educational legislation known as the *loi Falloux.*

As a young man, Falloux traveled throughout Europe and identified himself with liberal Catholic causes. In 1846 he was elected to the Chamber of Deputies, where he joined Pierre-Antoine Berryer, a leading monarchist, in urging a constitutional restoration of the Bourbons.

Falloux was President Louis-Napoléon Bonaparte's first minister of education and in that post was responsible for the passage of the *loi Falloux,* which, under the guise of freedom of education, restored a great deal of the traditional influence of the Roman Catholic church. He turned against Louis-Napoléon when the latter became emperor as Napoleon III. In bad health, he retired from active political life, although he continued to lend his support to monarchist and liberal Catholic causes.

In 1840 Falloux wrote a biography of Louis XVI and followed with *Histoire de saint Pie V,* 2 vol. (1844), *Madame Swetchine* (1860), and *Mémoires d'un royaliste* (1888), 3 vol. (1925–26). He was elected to the Académie Française in 1856.

Falloux played a key role in the nearly successful restoration of Henri Dieudonné, comte de Chambord, to the French throne in 1871–73. He finally broke with the pretender when the comte refused to accept the tricolour, the traditional symbol of all French regimes after 1789.

fallow deer (*Dama dama*), medium-sized deer, family Cervidae (order Artiodactyla), commonly kept on estates and in parks and zoos. The fallow deer was probably native to the Mediterranean region and western Asia but has been introduced in many areas and now occurs wild in Europe and elsewhere. It often inhabits open woods; the females and

Fallow deer (*Dama dama*)
F. Siedel—Bruce Coleman Inc.

young live in groups while the males remain apart except in the autumn breeding season.

The fallow deer stands about 90 cm (3 feet) at the shoulder. It is typically yellowish brown with white spots in summer and uniformly grayish brown in winter. The male has broad, flattened antlers, usually about 60 cm (about 2 feet) long, with a number of projecting tines.

A related species, the Persian fallow deer (*D. mesopotamica*), is larger and more brightly coloured, and its antlers are not as broadly flattened.

Falls Church, independent city, northeast Virginia, U.S., just west of Washington, D.C. Its history centres around the Falls Church (Episcopal; 1767–69), which was built on the site of an earlier church erected in 1734 and named for its nearness to Great Falls of the Potomac. The church served as a recruiting station during the American Revolution and as a hospital for wounded Union troops during the Civil War. Primarily residential, the city is also the trade centre for nearby truck gardens and poultry farms. Memorial Fountain honours four army chaplains who gave their life jackets to soldiers aboard the troopship *Dorchester* when it was torpedoed off Greenland in 1943. Falls Church was incorporated as a town in 1875 and as a city in 1948, becoming independent then of Fairfax County. Pop. (1984 est.) 9,541.

Falmouth, town ("parish"), Carrick district, county of Cornwall, England, on the western shore of the Carrick Roads. Falmouth occupies a peninsular site and faces water on two sides. The old part of the town overlooks the inner harbour in Carrick Roads, whereas the newer residential area, with hotels, faces Falmouth Bay in the English Channel.

Falmouth has long been important as a port. The complex of drowned river valleys that form Carrick Roads creates a sheltered refuge, accessible at all times and guarded by the Tudor fortresses of Pendennis (west) and Saint Mawes (east). The use of the port as a shipbuilding centre has been assisted by increased wharfage and dry-dock facilities. With its sandy beaches, equable climate, and spacious harbour, Falmouth is a favoured holiday resort and yachting centre. The Trelissick estate and Elizabethan farmhouse on the estuary of the River Fal were taken over by the National Trust in 1956. The Royal Cornwall Yacht Club has its headquarters in the town. Pop. (1981) 18,553.

Consult the INDEX *first*

Falmouth, town ("township"), Barnstable county, southeastern Massachusetts, U.S., on the southwestern point of Cape Cod. It includes the villages of Falmouth, East Falmouth, Falmouth Heights, Hatchville, Menauhant, North Falmouth, Quissett, Silver Beach, Teaticket, Waquoit, West Falmouth, and Woods Hole. The site, called Succanessett by the Indians, was settled in 1661 by Quakers led by Isaac Robinson. It was incorporated in 1694 and named for Falmouth, Eng. The town was bombarded from the sea by the British during the American Revolution and again during the War of 1812. Shipbuilding, whaling, fishing, agriculture, and the manufacture of salt and glass were important during its early development. The birthplace of Katharine Lee Bates (author of the national hymn "America the Beautiful"), the Congregational Church with its Paul Revere bell, and the Old Quaker Meetinghouse are preserved in the town, which is a busy tourist centre. The Ashumet Holly Reservation, maintained by the Audubon Society, is nearby. Pop. (1984 est.) 25,007.

FALN, abbreviation of FUERZAS ARMADAS DE LIBERACIÓN NACIONAL (Spanish: "Armed Forces of National Liberation"), militant nationalist organization formed about 1974 to agitate for Puerto Rican independence from the United States. It has engaged in bombings and other terrorist acts.

The antecedents of the FALN trace back to the 1930s, when the violent Nationalist Party under Pedro Albizu Campos provoked riots, assassinations, and other acts of protest and bloodshed. In Washington, D.C., on Nov. 1, 1950, Puerto Rican nationalists tried but failed to assassinate President Harry S. Truman; and another group, on March 1, 1954, sprayed gunfire into the chambers of the U.S. House of Representatives, wounding five congress-

men. In 1971 bombs were set off in San Juan and other Puerto Rican cities, and in 1973 a Puerto Rican group calling itself Furia (Fury) placed incendiary devices in New York City stores.

The name of FALN first surfaced on Oct. 26, 1974, when five big bombs exploded in Manhattan—in the Wall street area, in Rockefeller Center, and on Park Avenue—causing considerable property damage but no injuries. The FALN claimed responsibility for this series of acts as it did later for bombings in Puerto Rico itself. In the course of 1975, the FALN boasted of a series of bombings, beginning on January 24 with a Wall Street bombing killing three persons and injuring 40 and climaxing on October 27 with nine nearly simultaneous explosions in New York City, Washington, and Chicago, producing only property damage. Bombings continued sporadically thereafter.

In April 1980 a group of 11 FALN terrorists were arrested in Evanston, Ill. on such charges as robbery, conspiracy, and weapons violations and were later convicted in both state and federal courts and sentenced to prison terms as long as 50 years.

false arborvitae, also called HIBA ARBORVITAE (*Thujopsis dolabrata*), ornamental and timber evergreen tree or shrub of the cypress family (Cupressaceae), native to Japan. It is closely related to the arborvitae (*q.v.*) but has larger leaves, marked on the underside with depressed white bands. The trees are often 35 metres (115 feet) tall.

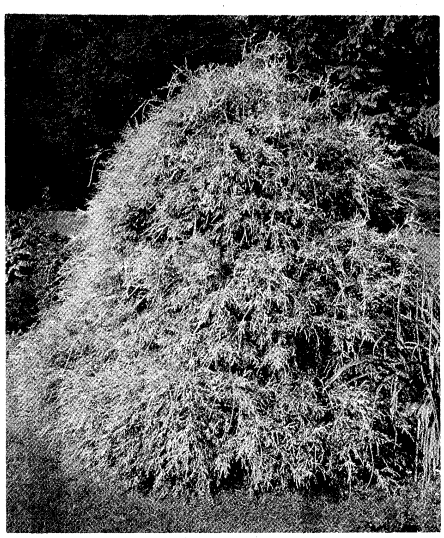
False arborvitae wood is yellowish white, soft, elastic, and very durable; it has been used for boatbuilding. Many shrubby and dwarf varieties have been developed for ornamental use.

false bass (music): *see* fauxbourdon.

False Bay, Afrikaans VALSBAAI, bay on the south side of Cape Peninsula, South Africa, 13 mi (21 km) southeast of Cape Town. Cape Hangklip (east) and Cape Point (west) are about 20 mi apart. Its name refers to the fact that early sailors confused the bay with Table Bay to the north. It is well sheltered, though experiencing southeasterly winds in summer; and its waters are approximately 10° F (5.5° C) warmer than those of Table Bay because of the influence of the Indian Ocean. It is well supplied with fish.

false blister beetle: *see* oedemerid beetle.

false cypress (*Chamaecyparis* species), also called WHITE CEDAR, any of six species of ornamental and timber evergreen conifers constituting the genus *Chamaecyparis* (family Cupressaceae), native to North America and eastern Asia.



Nootka cypress (*Chamaecyparis nootkatensis*)
Franklin Photo Agency

The trees differ from the true cypresses in having smaller, rounded cones with fewer seeds. A young tree is pyramidal in shape, with scalelike leaves densely arranged on the branchlets. Leaf colour differs in horticultural varieties. A single tree may possess both male and female reproductive structures; the female is small and inconspicuous, the male usually yellow or red.

The wood of the Formosan cypress (*C. formosensis*), a tree more than 58 metres (190 feet) tall, is used locally for construction; it is not fragrant like the wood of other cypresses.

The Sarawa cypress (*C. pisifera*) of Japan, 27 to 36 m (90 to 120 ft) tall, has been in cultivation for centuries. It has sharp-pointed leaves, small cones, and fragrant white wood used for boxes and doors. Many horticultural varieties have been developed, most of which retain juvenile foliage at maturity.

The white cypress (*C. thyoides*) of North America, 21 to 27 m (70 to 90 ft) tall, an economically important timber tree, also has many cultivated varieties. Its reddish-brown, fragrant wood is used for mine timbers, fence posts, and other supporting structures.

The hinoki cypress (*C. obtusa*), a bright-green tree 25 to 35 m (80 to 115 ft) high, with reddish-brown bark, is one of Japan's most valuable timber trees. Its wood is used for construction, furniture, and interior work. Many varieties are cultivated for decoration and are used for bonsai and dwarfing.

The Nootka cypress, yellow cypress, or Alaska cedar (*C. nootkatensis*), also called yellow cedar, canoe cedar, Sitka cypress, and Alaska cypress, is a valuable timber tree of northwestern North America. Its pale-yellow, hard wood is used for boats, furniture, and paneling. Some varieties are cultivated as ornamental shrubs, although forest trees may be more than 35 m (115 ft) tall.

The largest species of false cypress, the Lawson cypress, Port Orford cedar, or ginger pine (*C. lawsoniana*), may be more than 60 m (200 ft) tall and 6 m (about 20 ft) in diameter. It is a very hardy tree; over 200 forms are cultivated as ornamentals in North America and Great Britain. Many of these are dwarfs. The oily, spicy, lightweight wood of the Lawson cypress is one of the most important North American lumbers.

False Decretals, a 9th-century collection of ecclesiastical legislation containing some forged documents. The principal aim of the forgers was to free the church from interference by the state and to maintain the independence of the bishops against the encroachments of the archbishops, who were attempting to extend their power.

A party had been formed in the Carolingian Empire to combat the subjection of the church to the state. Within this party was a group that became convinced that the use of legitimate means would never accomplish this purpose and determined to try to achieve it by illegitimate means. They conceived that positive legislation of their demands could be projected into the past by attributing it to popes and kings long dead. Thus, they produced a number of falsifications of church law, of which the best known was the False Decretals.

The False Decretals—also called the Decretals of Pseudo-Isidore because their compilers passed as St. Isidore of Seville, a Spanish encyclopaedist and historian, and sometimes the Collection of Isidore Mercator because they usually begin with the words *Isidorus Mercator, servus Christi lectori salutem* ("Isidore the merchant, a servant of Christ, salutes the reader")—purports to be a collection of decrees of councils and decretals of popes (written replies on questions of ecclesiastical discipline) from the first seven centuries. The collection contains (1) the letters of the popes preceding the Council of Nicaea (325) from Clement I to Miltiades, all of which are forgeries; (2) a collection of the decrees of councils, most of which are genuine, though the forged Donation of Constantine (*q.v.*) is included; (3) a large collection of letters of the popes from Sylvester I (died 335) to Gregory II (died 731), among which there are more than 40 falsifications.

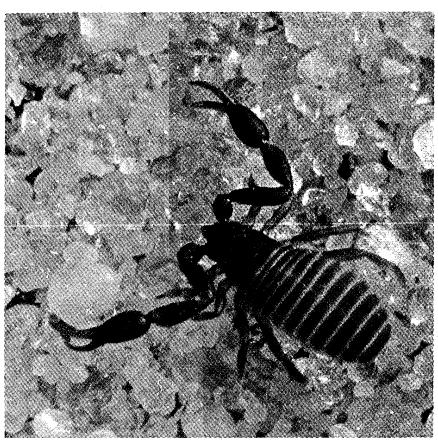
As a collection, the False Decretals seems to have been used first at the Council of Soissons in 853. They were known at the end of the 9th century in Italy but had little influence there until the end of the 10th century. For the next few centuries, they were generally accepted by canonists, theologians, and councils as authentic. Beginning in the 12th century, their authenticity was doubted by some critics, but it was not until the 17th century that David Blondel, a Reformed theologian, clearly refuted their defenders. Since that time, research has concentrated on the origin, extent, and purpose of the falsification.

It is untrue to say that the False Decretals revolutionized canon law, but the forgers did have a considerable influence. They seem to have helped eliminate *chorepiscopi* (bishops in full orders, who, at this time, were auxiliaries of diocesan bishops or of administrators of dioceses), limit the power of archbishops, revive dormant privileges of the clergy, and revive the right of appeal of local bishops to the pope.

False Dmitry: *see* Dmitry (False).

false pregnancy, also called PSEUDOCYESIS, or PSEUDOPREGNANCY, disorder that may mimic many of the effects of pregnancy, including enlargement of the uterus; cessation of menstruation; morning sickness; and even labour pains at term. The cause may be physical—the growth of a tumour or hydatidiform mole in the uterus—or emotional.

false scorpion, also called PSEUDOSCORPION, any of the 1,700 species of the order Pseudoscorpiones (sometimes Chelonethida) of the arthropod class Arachnida. They resemble true scorpions but are tailless and only 1 to 7.5 millimetres (0.04 to 0.3 inch) long. The chelicerae (first pair of appendages) bear silk-gland openings, and the pedipalps (second pair of appendages) are venomous pincers. In courtship the male may show protrusible structures ("ram's horns") on the belly.

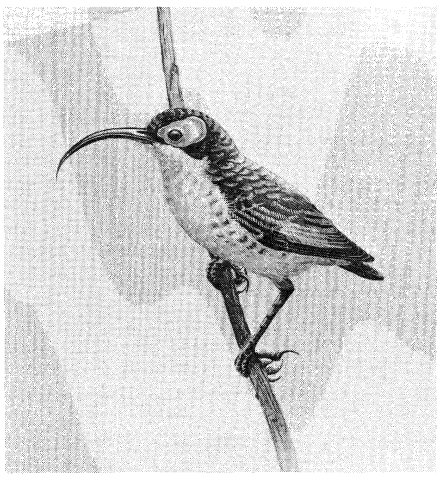


False scorpion (*Dactylochelifer*)
J.A.L. Cooke

False scorpions occur worldwide except in cold regions. Most live under bark or stones; some are found in books and old chests. They molt (shed skin), brood their young, and hibernate in silken nests.

The book scorpion (*Chelifer cancroides*), 4 millimetres (0.2 inch) long, occurs in houses and libraries. It feeds on book lice, carpet-beetle larvae, clothes moths, and bedbugs.

false sunbird, either of two species of Madagascar birds of the family Philepittidae (order Passeriformes). Both are 10 centimetres (4 inches) long, with a short tail and a long, downcurved bill. Originally thought to belong with true sunbirds in the family Nectariniidae,



Wattled false sunbird (*Neodrepanis coruscans*)
Painting by H. Douglas Pratt

they were shown in 1951 to be anatomically like the asities, from which they differ in external appearance. In the wattled false sunbird (*Neodrepanis coruscans*), the male is glossy blue above and yellow below, with a large eye wattle; this is lacking in the female, which has dark-green upperparts. This species moves slowly and quietly along branches, searching for insects; sometimes (like a true sunbird) it takes nectar from trumpetlike flowers. The other species, *N. hypoxantha,* is more brightly coloured and has a thinner bill.

false tiger beetle: *see* oedemerid beetle.

false vampire bat, any of certain bats of the Old World genera *Megaderma, Cardioderma,* and *Macroderma* (family Megadermatidae) and the New World genera *Vampyrum* and *Chrotopterus* (family Phyllostomatidae), conspicuous because of their large size, and originally thought to feed on blood, as do the true vampire bats. The false vampires are now known to be carnivorous, preying mainly on small vertebrates such as other bats, lizards, and mice.

These large, grayish or brownish bats range in size from 6.5 centimetres (about 2½ inches) for *Megaderma* species up to 14 cm for the Australian false vampire or ghost bat (*Macroderma gigas*), the largest bat in the suborder Microchiroptera. The tropical American false vampire (*Vampyrum spectrum*), measuring about 13.5 cm, is the largest New World bat. False vampires are tailless (except *Chrotopterus*, which has a tiny tail), and each species has a conspicuous nose leaf (a flap of skin and connective tissue around the nostrils) and large rounded ears. In the megadermatids the ears are joined at the base, which may help stabilize them during flight, and the eyes are relatively large.

False vampires roost in caves and hollow trees; *Vampyrum* species often roost in pairs with some of their offspring. The African false vampire (*Cardioderma cor*), which eats mostly large invertebrates, forages by hanging in wait, listening for its prey. The capture is made with a short, rapid flight. The Australian false vampire is considered an endangered species.

Falsen, Christian Magnus (b. Sept. 14, 1782, Christiania, Nor.—d. Jan. 13, 1830, Christiania), nationalist political leader, generally regarded as the author of the Norwegian constitution.

Falsen was among those who assembled at the Norwegian city of Eidsvold (now Eidsvoll) on April 10, 1814, to attempt to undo the results of the Treaty of Kiel (Jan. 14, 1814), by which Denmark ceded Norway to Sweden. Those assembled set about to frame a declaration of independence and a constitution and to determine what action to take against Sweden. Falsen led a majority Independent Party that wanted complete independence and was prepared to resist Sweden militarily. There was also a small Union Party that wanted a personal union with Sweden—a dual monarchy.

With an associate, Falsen had drafted a quite liberal constitution before the assembly met. That document served as a guide for the constitution committee, of which he was chairman. Although the more radical clauses were deleted in the final draft (the present Norwegian constitution), he became known as the "father of the constitution." (He also was the author of the declaration of independence.) In the summer of 1814 his party put up a futile military resistance to the Swedes. The Swedes, however, rather than insist on annexation, accepted a personal union with Norway (1814–1905) and also agreed to the maintenance of the Norwegian constitution with modifications. Falsen took a seat in the Storting (parliament) and began to favour a more conservative political position. After the Storting in 1824 rejected an amendment by him that would have greatly restricted the franchise, his career ended in a wave of vilification.

falsetto, the upper register of the human voice, the opposite of chest voice. Though sometimes considered synonymous with head voice, the Italian term *falsetto* means "false soprano" and therefore has been used traditionally to describe only the adult male's head voice, whereby the vocal cords vibrate in a length shorter than usual and somewhat apart with a permanent oval orifice between the edges. In choirs of men and boys, especially in England, there is a long uninterrupted tradition of adult male altos singing falsetto.

Articles are alphabetized word by word, not letter by letter

falsework, also called CENTRING, temporary construction to support arches and similar structures while the mortar or concrete is setting or the steel is being joined. As soon as the work is set, the centring is carefully removed; this process is called striking the centring. The same method is used in building brick sewers. The name centring originated from the primary use in centred arches, but the same term is applied to the use of scaffold boards to support concrete floors while they are hardening.

falsobordone, method of harmonizing psalm tunes, closely related to fauxbourdon (*q.v.*).

Falstaff, Sir John, perhaps the greatest and most famous comic character in all English literature, whose characterization was totally the creation of William Shakespeare. In the two plays of *Henry IV,* he is that "reverend vice ... that father ruffian, that vanity of years" (and, in his own imagination, that "kind Jack Falstaff, true Jack Falstaff, valiant Jack Falstaff"), who is a father substitute of license and good fellowship for Prince Hal and who comments on the political action of the plays with inglorious, reckless, egotistical good sense.

Shakespeare had originally called this character Sir John Oldcastle in the first version of *1 Henry IV,* following his source play, the anonymous *Famous Victories of Henry the Fifth,* in which Oldcastle had been presented as a friend of Prince Hal. He changed the name to Sir John Falstaff before the play was registered, however, doubtless because descendants of the historical Sir John Oldcastle (an English Lollard leader at the turn of the 14th century), who were then prominent at court, protested. He chose the name Falstaff partly because it contained echoes of the name Sir John Fastolf, which he had earlier given to the character of a cowardly knight in *1 Henry VI.* The historical Sir John Fastolf, however, was a career soldier who had made his name and fortune in the second phase of the Hundred Years' War, and although he had something of a reputation as a coward, Shakespeare's presentation of his character was libelous.

The character of Sir John Falstaff, whose death is movingly reported in *Henry V,* later appeared in Shakespeare's *The Merry Wives of Windsor,* a play that, according to tradition, was written at the express command of Queen Elizabeth I, who had wished to see Falstaff in love.

Falster, island (area 198 sq mi [514 sq km]), Storstrøms *amtskommune* (county), Denmark, in the Baltic Sea, connected to southern Sjælland (Zealand) and Lolland islands by the Storstrømsbroen (bridge). Its southern tip, Gedser Odde, is Denmark's most southerly point. Closely associated with Sjælland and Lolland socially and agriculturally, it is flat, with forests in the centre and on the east coast. The fertile soil supports sugar beets and grain. Nykøbing Falster and Stubbekøbing are the main population centres. Pop. (1981 est.) 49,556.

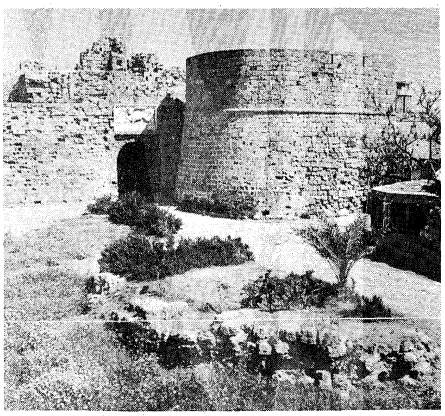
Falun, town, capital of the *län* (county) of Kopparberg and major town of the traditional *landskap* (province) of Dalarna, central Sweden, on Faluån, the river that links Runn and Varpan lakes. The town developed around an old copper mine and became the headquarters of the Stora Kopparberg Mining Company, probably the oldest industrial corporation in the world, dating from 1347. The town's greatest period of prosperity occurred in the 17th century, when the mine's revenue provided a major part of the national income of Sweden. Falun was chartered as a town in 1624 and again in 1641; but the mine's cave-in in 1687 ended the town's greatness, and in 1761 it was devastated by two major fires. During the first half of the 19th century it declined still further until the coming of railroads brought new growth.

Besides the mine, which is now worked primarily for by-products, there are engineering works, brickyards, and chemical plants. With a mining school, teachers' college, and hospitals, Falun is also Dalarna's cultural and medical centre, as well as its garrison town. Mining relics are housed in the former administrative office building. The provincial museum contains ancient and modern costumes and textiles from the area. Notable buildings include the late medieval Stora Kopparberg Church (1450–71) and the Renaissance style Kristine Church (1642–60; restored 1904–05). Pop. (1984 est.) mun., 51,192.

Fama (Latin), Greek PHEME, in Greco-Roman mythology, the personification of popular rumour. Pheme was more a poetic personification than a deified abstraction, although there was an altar in her honour at Athens. The Greek poet Hesiod portrayed her as an evildoer, easily stirred up but impossible to quell. The Athenian orator Aeschines distinguished Popular Rumour (Pheme) from Slander (Sykophantia) and Malice (Diabole). In Roman literature she was imaginatively conceived: Virgil described her (*Aeneid,* Book IV) as a swift, birdlike monster with as many eyes, lips, tongues, and ears as feathers, travelling on

the ground but with her head in the clouds. According to Ovid in the *Metamorphoses,* she inhabited a reverberating mountaintop palace of brass.

Famagusta, Greek AMMÓKHOSTOS, Turkish MAĞUSA, a major port in the Turkish Cypriot administered area of Cyprus. The administrative centre of Famagusta district of the Republic of Cyprus before the Turkish intervention in 1974, it lies on the east coast in a



Othello's Tower, a medieval fortification in Famagusta, Cyprus
J. Baker—Shostal/EB Inc.

bay between Capes Greco and Eloea, east of Nicosia, and possesses the deepest harbour in Cyprus. Famagusta is a Frankish corruption of its Greek name, which means "buried in the sand," descriptive of the silted mouth of the Pedieos River north of the town. It was founded as Arsinoe by the Macedonian Egyptian king Ptolemy II (308–246 BC). An influx of Christian refugees fleeing the downfall of Acre (1291) in Palestine transformed it from a tiny village into one of the richest cities in Christendom. In 1372 it was seized by Genoa and in 1489 by Venice, and in 1571 it fell to the Turks. Ravaged by war and earthquakes, the old walled town is now only partially inhabited, but it contains some of the finest examples of medieval military architecture extant and the 14th-century Gothic Cathedral of St. Nicholas, now a mosque. Under British administration (1878–1960) the modern section, called Varosha, was developed in large part as a tourist resort. After the Turkish intervention, Varosha was sealed off to civilians and tourism ceased. In 1975 portable items, including automobiles, were confiscated from Varosha and sent to Turkey or redistributed locally. Settlers from mainland Turkey were relocated in Famagusta, parts of Varosha (after 1976), and in the surrounding citrus growing areas. Ferry service, begun in 1978, between Mersin, Turkey, and Latakia, Syria, includes Famagusta in its run.

Famagusta district is bounded by the districts of Kyrenia and Nicosia on the west, by the Dhekalia British Sovereign Base Area and Larnaca district on the southwest, and by the Mediterranean Sea on the north, east, and south. It covers an area of 766 sq mi (1,984 sq km) and, except for its southeastern tip (part of the Republic of Cyprus), is in the Turkish Cypriot administered area. The Kyrenia Mountains extend along the province's northern coastline and form the relatively long and narrow, hilly Karpas Peninsula to the east. The highest peak in the province is Olympos, which rises to an elevation of 2,427 ft (740 m). The southern part of the district comprises the eastern Mesaoria Plain that spans to Famagusta Bay in the east. The district has an abundance of wild flowers, bushes, and shrubs. The Pedieos and Yialias rivers, which drain eastward into Famagusta Bay, become dry courses in the summer. The region was under the Lusignans in the 13th century AD. The Genoese occupied it for about 100 years in the 14th–15th centuries. Under the Turks it was a subdistrict of Cyprus. It became a district in the Republic of Cyprus in 1960.

Agriculture is the principal occupation of the people, and products include wheat, barley, vegetables, and fruits. Dairy farming and fishing are practiced. Industries produce beverages, milled flour, leather goods, bricks, pottery, and canned fruit and vegetables. Famagusta, the administrative headquarters of the Turkish Cypriot part of the district, is linked by roads with Ayia Napa, Boghaz, and Nicosia. Pop. (1973) city, 38,960; district, 123,856.

Famennian Stage, uppermost division of marine rocks of the Devonian Period (the Devonian began about 395,000,000 years ago and lasted about 50,000,000 years). The Famennian serves as a worldwide standard for the marine Upper Devonian and was named for exposures studied in the region of Famennes, Belg. It is characterized by strata in several subdivisions, or zones, that include ammonoid cephalopods. The presence of these fossiliferous zones permits far-ranging stratigraphic correlations to be made.

Rocks of the Famennian Stage have a worldwide distribution. Important sections are exposed in Great Britain, where the Ostracod Slates provide a link with similar deposits in Germany. Cephalopod-bearing limestones also occur in Britain. Shales characterize the Famennian of Belgium, whereas the well-developed Famennian of Germany consists of shales, sandstones, and limestones. Goniatite cephalopods dominate the lower Famennian fauna. Limestones and dolomites characterize the Famennian of the U.S.S.R.; in the Moscow basin region, rocks of Famennian age grade upward, without a distinct separation, into Lower Carboniferous strata. Limestones, characterized by the brachiopod genus *Sinospirifer,* dominate the Famennian of southwestern China. Sandstones and shales dominate the Famennian of eastern North America.

familial periodic paralysis, any of the forms of a rare disorder that is characterized by relatively short-term, recurrent attacks of muscle weakness; usually (but not invariably) the disorder is inherited, and, although sex-linkage has not been established, it occurs three times more often in males than in females. The disorder is most often associated with abnormally high or abnormally low serum potassium concentration; these two forms are known as hyperkalemic or hypokalemic periodic paralysis, respectively, and they have some clinical features in common.

Hypokalemic paralysis is the more severe form. It generally begins late in childhood or in adolescence. Onset of paralysis occurs most frequently at night during sleep. An attack of this type may last longer than 24 hours. A form of hypokalemic paralysis that is associated with hyperthyroidism has been noted among adult males of Japanese and Chinese extraction. It is clinically similar to hypokalemia, but carries a greater risk of cardiac involvement. Treatment of the hyperthyroidism prevents further attacks.

Hyperkalemic paralysis begins in infancy and is characterized by more frequent but milder attacks that last minutes or hours; it may also be accompanied by mild myotonia (muscle spasm), of the tongue, for example.

Normokalemia is another form of familial periodic paralysis. In this form of the disorder the potassium level remains stable. Symptoms are generally more severe than those typical of hyperkalemia. Neither normokalemia nor hypokalemia are associated with myotonia.

In familial periodic paralysis, attacks may take from several minutes (generally characteristic of hyperkalemia) to several hours to develop; they range in severity from general weakness to total paralysis. Typically weakness in the legs is the first sign of onset, followed by weakness in the arms. Usually only trunk and limb muscles are affected, and the affected person is able to speak and breathe. The heart muscle is only rarely involved. The attacks may come at intervals of days, months, or years. In later years a degeneration of the muscle fibres may occur. Factors that seem to precipitate attacks include relaxation after periods of exertion or strenuous exercise. Mild exercise, however, may sometimes alleviate a mild attack.

In a few other diseases, such as diabetes, Addison's disease, and kidney insufficiency, there may be brief episodes of paralysis similar to that in familial paralysis.

Treatment of hypokalemic periodic paralysis includes the administration of potassium chloride. In hyperkalemic paralysis, glucose and insulin are often administered. Both of the better known forms of the disorder seem to respond to small doses of acetazolamide, a diuretic. *See also* paralysis.

familiar, in Western demonology, small animal or imp kept as a witch's attendant, given her by the devil or inherited from another

A witch and her familiars, illustration from a discourse on witchcraft, 1621; in the British Library (MS. Add. 32496, f. 53)
By courtesy of the trustees of the British Library

witch. The familiar was a low-ranking demon that assumed any animal shape, such as a toad, dog, insect, or black cat. Sometimes the familiar was described as a grotesque creature of fantasy, an amalgam of several creatures.

The familiar was believed to subsist by sucking blood from a witch's fingers or other protuberances on her body such as a mole or a wart. During the European witchcraft trials of the 15th–17th century a suspected witch was searched for the "teats" by which she fed her familiar, and these, like the devil's brand marks, were considered sure signs of her guilt.

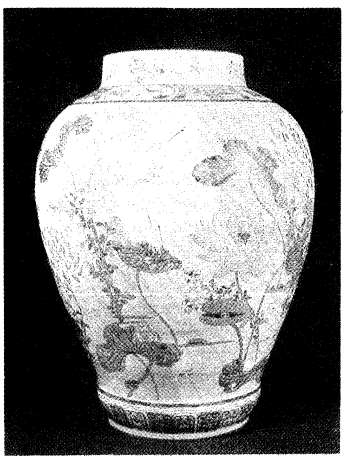
Familist, member of FAMILY OF LOVE, religious sect of Dutch origin, followers of Hendrik Niclaes, a 16th-century Dutch merchant. Niclaes' main activity was in Emden, East Friesland (1540–60). In his *Evangelium regni,* issued in England as *A Joyfyl Message of the Kingdom,* he invited all "lovers of truth, of

what nation and religion soever they be, Christian, Jews, Mahomites, or Turks, and heathen," to join in a great fellowship of peace, the Family of Love, giving up all contention over dogma and seeking to be incorporated into the body of Christ.

Niclaes gained many followers, among them the great publisher Christophe Plantin, who surreptitiously printed a number of Niclaes' works. Niclaes apparently made two visits to England, where his sect had the largest following. Elizabeth I issued a proclamation against the Family of Love in 1580, and James I believed it to have been the source of Puritanism. The sect did not survive after the Restoration of the English monarchy in 1660, but according to George Fox, a British preacher and the founder of the Society of Friends (or Quakers), some remaining Familists later became associated with the Quakers.

Famille, Pacte de, English FAMILY COMPACT, any of three defensive alliances (1733, 1743, and 1761) between France and Spain, so called because both nations were ruled by members of the Bourbon family. The Pactes de Famille generally had the effect of involving Spain in European and colonial wars on the side of the French Bourbons (*e.g.,* the Seven Years' War, 1756–63). Spain also followed French policy in the U.S. War of Independence (1775–83). After the outbreak of the French Revolution, Charles IV of Spain sought to intervene to save Louis XVI and, after his execution, engaged Spain in the war of 1793–95, ending in the humiliating Peace of Basel. After the restoration of the French Bourbons in 1814–15, the French intervened in 1823 to restore the authority of Ferdinand VII of Spain.

famille rose (French: "rose family"), group of Chinese porcelain wares, especially developed during the reign of Yung-cheng (1722–35) in the Ch'ing dynasty, characterized by decoration painted in opaque overglaze colours of the rose family, chiefly shades of pink and

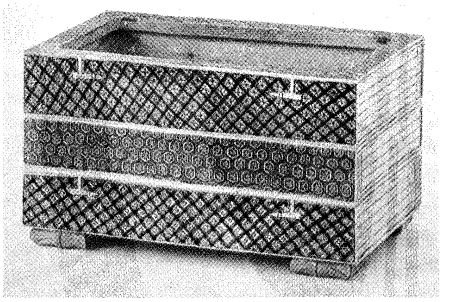


Famille rose porcelain vase of *yang ts'ai* ware, Ch'ing dynasty, Yung-cheng reign (1722–35); in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

carmine. These colours are known to the Chinese as *yang ts'ai* ("foreign colours") because they were first introduced from Europe (*c.* 1685). By the time of the reign of Yung-cheng they were favoured over the translucent famille verte overglaze colours previously used.

famille verte (French: "green family"), group of Chinese porcelain wares made during the K'ang-hsi period (1661–1722) of the Ch'ing dynasty and characterized by decoration painted in a colour range that includes yellow, blue, red, purple, and green, the latter sometimes used for the ground. The verte palette



Famille verte porcelain jardiniere, Ch'ing dynasty, K'ang-hsi reign (1661–1722); in the Museum of Fine Arts, Boston

By courtesy of the Museum of Fine Arts, Boston, Hoyt Collection

used with a yellow ground is famille jaune; used with a rich greenish-black ground, it is famille noire.

family: *see under* descriptive word (*e.g.,* extended family; joint family; nuclear family), except as below.

family, a group of persons united by the ties of marriage, blood, or adoption, constituting a single household, and interacting with each other in their respective social positions of husband and wife, mother and father, son and daughter, brother and sister. The family group is often confused with the household because it constitutes a single household, but boarders and roomers sharing a common residence may be included in a household. The family is also sometimes confused with a kindred because of the unity of blood lines, but a kindred may be divided into several households. Frequently the family is not differentiated from the marriage pair, but the essence of the family group is the parent-child relationship, which may be absent from many marriage pairs. In its institutional aspects the family is also frequently confused with the institution of marriage, the complex of customs regulating the sexual relations between the cohabiting pair of adults within the family group. Marriage defines the procedures for establishing and terminating the husband-wife relation, as well as the reciprocal obligations and the accepted restrictions upon its personnel.

A brief treatment of family follows. For full treatment, *see* MACROPAEDIA: Family and Kinship; Family Law.

A family, in the simplest terms, is the union of a man and a woman (almost always from different lineages and not related by blood) along with their offspring, usually living in a private and separate dwelling. This type of living arrangement, more specifically known as the nuclear family, is believed to be the oldest of the various types of families in existence. Sometimes the nuclear family is extended to include not only the parents and the unmarried children living at home but also children that have married, their spouses, and their offspring; such an arrangement is called an extended family.

Socioeconomic aspects of marriage. The family performs various valuable functions for its members. Perhaps most important of all, it provides for emotional and psychological security, particularly through the warmth, love, and companionship that living together generates between spouses and in turn between them and their children. The family also provides a valuable social and political function by institutionalizing procreation and by providing guidelines for the regulation of sexual conduct. The family additionally provides such other socially beneficial functions as the rearing and socialization of children, along with such humanitarian activities as caring for its members when they are sick or disabled. On the economic side, the family provides food, shelter, clothing, and physical security for its members, many of whom may be too young or too old to provide for the basic necessities of life themselves. Finally, on the social side, the family may serve to promote order and stability within society as a whole.

Historically, in most cultures, the family has been patriarchal, or male-dominated. Perhaps the most striking example of the male-dominated family is the description of the family given in the Old Testament, where the male heads of the clans were allowed to have several wives as well as concubines. As a general rule, the women of the Old Testament had a rather low status. In Roman times the family was still patriarchal, but polygamy was not practiced, and in general the status of women was somewhat improved over that suggested in the Old Testament, although they still could not manage their own affairs. The Roman family was an extended one. The family as it existed in medieval Europe was male-dominated and extended.

The Industrial Revolution and the accompanying urbanization spawned—and continues to spawn—many changes in family structure. Industrialization and urbanization prompted a sharp change in life and occupational styles. Many people, particularly unmarried youths, left the farms and went to urban centres to become industrial workers. This process led to the dissolution of many extended families.

The modern family that has emerged since the Industrial Revolution is rather different from that which existed earlier. For instance, patriarchal rule has slowly given way to a greater equality between the sexes. Similarly, stereotyping of male and female roles within the family is breaking down. No longer is caring for the home and children the exclusive duty of the female, nor earning a living and pursuing a public life the exclusive domain of the male. The structure of the family is also changing in that some couples choose not to marry legally and instead elect to have their children out of wedlock; many of these informal relationships tend to be of short duration, and this has led to a rapid increase in the number of one-parent households.

The modern family is today more of a consuming as opposed to a producing unit, and the members of the family work away from home rather than at home. Public authorities, primarily governmental ones, have assumed many of the functions that the family used to provide, such as caring for the aged and the sick, educating the young, and providing for recreation. Technological advancements have made it possible for couples to decide if and when they want to have children.

Family law. Family law varies from culture to culture, but in its broadest application it defines the legal relationships among family members as well as the relationships between families and society at large. Some of the important questions dealt with in family law include the terms and parameters of marriage, the status of children, and the succession of property from one generation to the next. In nearly every case, family law represents a delicate balance between the interests of society and the protection of individual rights.

The general rule in marriages until modern times was the legal transfer of dependency, that of the bride, from father to groom. Not only did the groom assume guardianship, he usually assumed control over all of his wife's affairs. Often, the woman lost any legal identity through marriage, as was the case in English common law. There have been exceptions to this practice. Muslim women, for instance, had considerable control over their own personal property. The concept of dowries, an amount of money or property given to the husband with the bride in compensation for her dependency, has been practiced in many countries.

Modern marriage is best-described as a voluntary union between a man and a woman (although there are still vestiges of the arranged marriage that once flourished in eastern Europe and Asia). The emancipation of women in the 19th and 20th centuries changed marriage dramatically, particularly in connection with property and economic status. By the mid-20th century, most Western countries had enacted legislation establishing equality between spouses. Similarly changed is the concept of economic maintenance, which traditionally fell on the shoulders of the husband. Though many laws still lean toward this view, there is increasing recognition of a wife's potential to contribute to support, especially as more women join the work force.

Dissolution of marriages is one of the areas in which laws must try to balance private and public interest, since realistically it is the couple itself that can best decide whether its marriage is viable. In many old systems—*e.g.*, Roman, Muslim, Jewish, Chinese, and Japanese—some form of unilateral divorce was possible, requiring only one party to give notice of the intention, usually the male. Most modern systems recognize a mutual request for divorce, though many require an attempt to reconcile before granting divorce. Extreme circumstances, in which blatant neglect, abuse, misbehaviour, or incapacity can be demonstrated, find resolution in civil court. Many systems favour special family courts that can deal more fairly with the sensitive issues.

The issue of children poses special problems for family law. In nearly every culture, the welfare of children was formerly left to the parents entirely, and this usually meant the father. Most societies have come to recognize the general benefit of protecting children's rights and of prescribing certain standards of rearing. Thus, more than in any other area, family law intervenes in private lives with regard to children. Compulsory education is an example of the law superseding parental authority. In the case of single-parent homes, the law will frequently provide some form of support. Legislation on child labour and child abuse also asserts society's responsibility for a child's best interests.

The succession of family interests upon the death of its members can be considered a part of family law. Most legal systems have some means of dealing with division of property left by a deceased family member. The will, or testament, specifies the decedent's wishes as to such distribution, but a surviving spouse or offspring may contest what appear to be unreasonable or inequitable provisions. There are also laws that recognize family claims in the event that property is left intestate (*i.e.*, with no will to determine its distribution).

Family Compact (French–Spanish alliance): *see* Famille, Pacte de.

family court, special court designed to deal with legal problems arising out of family relations. The family court is usually a consolidation of several types of courts dealing with narrower family problems, such as children's courts and orphans' courts.

The family court operates according to looser procedures than do ordinary civil or criminal courts. Special intake procedures also distinguish the family court, which screens potential cases to eliminate those not really requiring judicial attention.

Family courts were first established in the United States in 1910, when they were called domestic relations courts. The idea itself is much older. In the 19th century, the Court for Divorce and Matrimonial Causes was established in England to relieve the ecclesiastical courts of the burden of such cases.

Family courts are created by special statutes defining the types of cases that they are to handle, such as cases involving guardianship, child neglect, juvenile delinquency, paternity, support, or family offenses (*i.e.*, disorderly conduct or minor assaults between spouses).

Most family courts do not handle divorce, separation, or annulment cases, although the civil courts occasionally refer such cases to the family court to determine child custody or modification of alimony payments.

Family of Love (16th-century sect): *see* Familist.

family practice, also called FAMILY MEDICINE, or GENERAL PRACTICE, field of medicine that stresses comprehensive primary health care, regardless of the age or sex of the patient, with special emphasis on the family unit.

Family practice as it is presently defined has only been officially recognized since 1969, but it developed from older models of general medical practice in which all of a patient's health care needs were met by a single physician. At the beginning of the 20th century, almost all physicians in the world were general practitioners, but the increasing volume of medical knowledge and reforms in medical education—such as those triggered in the United States by the Flexner Report of 1910—gave impetus to growing specialization in medical practice. Whereas more than 80 percent of American physicians were in general practice at the turn of the century, fewer than 20 percent had general practices by the mid-1970s; a similar shift to more specialized practice occurred in other developed countries, though usually to a lesser extent. Such countries as Great Britain reinforced the traditional ideas of general medical practice by making the general practitioner the entry point to the health care system; however, even in these countries, medical education and social status tended to favour specialists over generalists. Few training programs were designed to meet the needs of the family practitioner.

By the 1960s, worldwide concern had developed over the shortage of general practitioners, and several major reports by governmental bodies and medical planners emphasized the need for more family physicians to serve as the first contact with the health care system and to provide continuous care of patients. A World Health Organization (WHO) report in 1963 stressed the need for medical education that focused on the patient as a whole throughout life, rather than on specific organ systems, disease entities, or age groups. These studies led to the development of residency training programs that are specifically designed to prepare individuals for general, or family, practice. As a specialty, family practice incorporates portions of other medical specialties, including internal medicine, pediatrics, obstetrics and gynecology, surgery, and psychiatry; the family physician must undergo a series of comprehensive tests of medical skill and knowledge to demonstrate his familiarity with the rapidly changing body of medical knowledge in these areas. Recertification is required every six years.

family sagas (literature): *see* Icelanders' sagas.

famine, extreme and protracted shortage of food, causing widespread and persistent hunger, emaciation of the affected population, and a substantial increase in the death rate. Famines can be classified according to who is affected and where the affected population is located. General famine affects all classes or groups within the country or region of food shortage, although often not all the groups of people suffer to the same degree. Regional famine is concentrated in only part of a country, but all groups within the region of shortage are usually affected. Class famine describes a condition in which certain population groups suffer the greatest hardship in a country short of food, regardless of the geographic concentration of the famine.

The causes of famine are numerous, but they are usually divided into natural and human categories. Natural or physical causes destroy crops and food supplies and include drought, heavy rain and flooding, unseasonable cold weather, typhoons, vermin depredations, plant disease, and insect infestations. Drought is the most common natural cause and the prime contributor to famine in arid and semiarid regions. Drought may occur outside the region affected. Sometimes drought in the headwaters of a major river used for irrigation can cause famine in an irrigated region downstream. The earliest recorded famines date back to the 4th millennium BC and occurred in ancient Egypt and the Middle East. These early famines have been called physical famines because of the natural environment's general hostility to intensive sedentary agriculture.

Since 1700 Asia has been the principal, but not the only, famine region of the world. Many of Asia's famines have been characterized as food shortages due to overpopulation. These have occurred in drought- and flood-prone areas with agricultural production at or barely above the subsistence level. India and China are notable among countries where overpopulation famine has occurred. Recorded famine in India dates to the 14th century and continues in the 20th. Famine in Deccan, India (1702–04), was reportedly responsible for the deaths of about 2,000,000 persons. In 1967 a severe famine was recorded in Bihar, and excessive mortality was avoided only by major international relief efforts. An estimated 9,000,000 to 13,000,000 persons died during a famine in northern China in 1876–79. Famine also continued to plague China into the 20th century: more than 3,000,000 persons starved to death in 1928–29.

Overpopulation has not been the sole contributor to modern famine. The potato blight of Ireland (1846–47) resulted in the deaths of up to 1,000,000 people. A drought-induced famine caused some 1,500,000 deaths in Ethiopia (1971–73). In the mid-1980s, severe food shortages threatened the health and lives of some 150,000,000 inhabitants of drought-stricken sub-Saharan Africa.

Human causes of famine are primarily political and cultural in nature and, unlike most natural causes, are within the bounds of human control. The severe and prolonged food shortages of Roman times have been characterized as transportation famines because of Rome's inability or often unwillingness to transport food to regions of shortage. Grain was a form of wealth for the Roman emperors, and the hoarding of grain while regions of the empire suffered from famine was a common practice. Rome itself was affected by famine in 436 BC, and thousands of persons threw themselves into the Tiber River to escape the pain of starvation.

Famines in medieval Europe have been characterized as cultural food shortages. Natural causes played a role in famines of the Middle Ages, but it was the feudal social system, cultural practices, and overpopulation that extended food shortages into malnutrition, widespread disease (*e.g.*, the Black Death), and famine. During the Middle Ages the British Isles were afflicted by at least 95 famines, and France suffered the effects of 75 or more. In 1235 some 20,000 London residents died from famine, and many persons resorted to eating tree bark for survival.

Warfare, however, has been the most common human cause of famine. In addition to destroying crops and food supplies, warfare also disrupts the distribution of food through the use of siege and blockade tactics. The famines that plagued eastern Europe between 1500 and 1700 have been characterized as political, because the political aspirations of eastern European countries interfered in and often

controlled the production and distribution of basic foodstuffs. In addition to warfare, natural causes continued to play a part in famine during this period. Famines in Hungary (1505 and 1586) drove some parents to eat their children. Russia was not spared from the effects of famine during this period; in 1600 some 500,000 people died of starvation in Russia. The deliberate destruction of crops and food supplies was a common tactic of war in the 19th century, employed by both attacking and defending armies. The "scorched-earth" policy adopted by the Russians in 1812 not only deprived Napoleon's armies of needed food but did the same to the Russian people.

One known instance of famine in the New World occurred about 1051 and forced the Toltecs to migrate from a stricken region in what is now Central Mexico. Some scholars hold that the more diverse New World food sources and, in the case of the Incas, an extensive food-storage system, mitigated the effects of famine. The New World populations were also generally less sedentary than the Old World and could simply migrate elsewhere, as the Toltecs and the Indians of Mesa Verde (now in Colorado, U.S.) apparently did.

Although famine is still prevalent throughout the world, the ability of countries to import food and the efforts of international relief organizations have lessened the effects of modern famine. European nations, the United States, and other developed countries have not reported any instances of famine during the 20th century. Other countries, such as the Soviet Union, have recently avoided high rates of mortality by their ability to import food and to distribute it quickly and efficiently. The potential for future famines continues, especially in Latin America, Central Africa, and Southeast Asia.

Fãn (people): *see* Fang.

fan, in the decorative arts, rigid or folding hand-held device used throughout the world

Major historical famines
The tabulation below is relatively complete for the last 200 years but should be regarded as illustrative only for earlier centuries.

date	area	comment
*c.*3500 BC	Egypt	Earliest written reference to famine.
436 BC	Rome	Thousands of starving people threw themselves into the Tiber.
AD 310	Britain	40,000 deaths.
917–18	India, Kashmir	Great mortality. Water in Jhelum River covered by bodies. "The land became densely covered with bones in all directions, until it was like one great burial-ground, causing terror to all beings."
1064–72	Egypt	Failure of Nile flood for seven years. Cannibalism.
1069	England	Norman invasion. Cannibalism.
1235	England	20,000 deaths in London; people ate bark of trees, grass.
1315–17	Central and western Europe	Caused by excessive rain spring and summer of 1315. Deaths from starvation and disease may have been 10% over wide area.
1333–37	China	Great famine; reported 4,000,000 dead in one region only; perhaps source of Europe's Black Death.
1347–48	Italy	Famine, followed by plague (Black Death).
1557	Russia	Widespread, but especially upper Volga. "Very severe: a great many starved in cities, villages and along the roads." Caused by rains and severe cold.
1594–98	India	Great mortality, cannibalism, and bodies not disposed of. Plague.
1600	Russia	500,000 dead. Also plague.
1630	India, Deccan	During the time of Shāh Jahān, builder of the Tāj Mahal, who undertook relief efforts to assist. War. Parents sold children. 30,000 reported to have died in one city, Surat. Drought followed by floods.
1650–52	Russia	Excessive rain and floods. "People ate sawdust." Many died despite tsar's permitting free grain imports. High grain prices prevented purchase of seed.
1677	India, Hyderābād	Great mortality. Caused by excessive rain. "All persons were destroyed by famine excepting two or three in each village."
1693	France	Awful famine—described by Voltaire.
1769	France	Five percent of population said to have died.
1769–70	India, Bengal	Caused by drought. Estimates of deaths range from 3,000,000 (a tenth of population) to 10,000,000 (a third of population).
1770	Eastern Europe	Famine and pestilence caused 168,000 deaths in Bohemia and 20,000 in Russia and Poland.
1790–92	India, Bombay, Hyderābād, Orissa, Madras, Gujarāt	The Doji Bara or skull famine, so-called because the dead were too numerous to be buried. Cannibalism.
1803–04	Western India	Caused by drought, locusts, war, and migration of starving people. Thousands died.
1837–38	Northwest India	Drought. 800,000 died.
1845–49	Ireland	Great potato famines. A million died from starvation and disease; even more emigrated.
1866	India, Bengal and Orissa	Poor distribution of rainfall. 1,500,000 deaths.
1868–70	India, Rājputānā, Northwest and Central Provinces, Punjab, Bombay	Drought. Famine followed by fever. Deaths estimated at a fourth to a third of total population of Rājputānā. In one district 90% of cattle died. Shortage of water for cooking and drinking.
1874–75	Asia Minor	150,000 deaths.
1876–78	India	Drought. Over 36,000,000 affected; deaths estimated at 5,000,000.
1876–79	North China	Drought for three years. Children sold. Cannibalism. Estimated deaths—9,000,000–13,000,000.
1892–94	China	Drought. Deaths estimated at 1,000,000.
1896–97	India	Drought. Widespread disease. Estimates of death range up to 5,000,000. Relief efforts successful in several areas.
1899–1900	India	Drought. Extensive relief efforts, but 1,250,000 starved. Another estimate, including effects of disease, 3,250,000.
1920–21	North China	Drought. Estimated 20,000,000 affected; 500,000 deaths.
1921–22	U.S.S.R., especially Ukraine and Volga region	Drought. U.S. assistance requested by Maksim Gorky. Despite relief efforts 20,000,000–24,000,000 affected; estimates of death, 1,250,000 to 5,000,000.
1928–29	China, Shensi, Honan, and Kansu	Comparable in extent and severity to great famine of 1877–78, though because of railroads deaths were probably less. In Shensi alone an estimated 3,000,000 died.
1932–34	U.S.S.R., especially Ukraine	Caused by collectivization, forced procurements, destruction of livestock by peasants. Estimated 5,000,000 died.
1941–43	Greece	War. Losses because of increased mortality and reduced births estimated at 450,000.
1941–42	Warsaw Ghetto	War. Starvation, directly or indirectly, estimated to have taken 43,000 lives.
1941–44	Leningrad	War. City besieged for almost three years. More than 1,000,000 died directly or indirectly from starvation.
1943	Ruanda–Urundi	35,000 to 50,000 deaths.
1943–44	India, Province of Bengal	Price of rice driven enormously high by speculation. In spite of several poor harvests rice deficiency was small, but most people could not buy rice due to its exorbitant price. 1,500,000 died.
1947	U.S.S.R.	Reported by Khrushchev in 1963. Referring to Stalin and Molotov: "Their method was like this: they sold grain abroad, while in some regions people were swollen with hunger and even dying for lack of bread." (*Pravda*, Dec. 10, 1963.)
1960–61	Congo, Rep. of the (Kasai)	Caused by civil war. Refugees had no access to protein, resulting in epidemic of kwashiorkor.
1965	India, Bihar	Drought. Because of tremendous success of relief operations, only thousands died, not millions.
1967–69	Nigeria, Biafra	Civil war. Government troops blockaded Biafra, a territory fighting to become independent, cutting off its food supplies. More than 1,500,000 died.
1968–74	The Sahel (Senegal, Mauritania, Mali, Upper Volta, Nigeria, Niger, and Chad)	Drought. Thirty foreign nations sent in food, but aid was extremely badly handled due to corruption of local officials, poor roads, and lack of advance planning. 500,000 people died; 5,000,000 cattle died.
1973	Ethiopia	Drought. 100,000 people died. Because Emperor Haile Selassie did not want to spoil tourist trade, he did not publicize the famine and did not ask for foreign aid.
1974	Bangladesh	Floods covered nearly half of the country, destroying stored grain and growing crops. The government did not make available to the hungry people large quantities of rice that were available, and merchants exported it to India.
1974	Somalia	Drought destroyed people and their animals. In 1975 the U.S.S.R. airlifted 120,000 starving nomads and resettled them on collective farms in the southern part of Somalia and on its coast.
1975–79	Kampuchea	1,000,000 deaths from starvation. Caused by genocidal policies of Khmer Rouge regime: massive deportations of urban population by forced march into the countryside, without food or shelter; total disruption of the economic structure of the country.
1983–85	Black Africa (The Sahel; eastern and southern Africa)	Prolonged drought beginning in the late 1970s; 22,000,000 people endangered in as many as 22 countries, according to UN agencies, though numbers and degree of malnourishment or starvation fluctuated. Cattle and crops afflicted as well.

since ancient times; it has been used for cooling, air circulation, or ceremony and as a sartorial accessory.

The rigid fan has a handle or stick with a rigid leaf, or mount. The folding fan is composed of sticks (the outer two called guards) held together at the handle end by a rivet or pin. On the sticks is mounted a leaf that is pleated so that the fan may be opened or closed. A variant of the folding fan is the *brisé* (French, "broken") fan, in which the sticks are wider and bladelike and connected at the top by a ribbon or thread, so that they will overlap when the fan is opened to form the equivalent of a leaf.

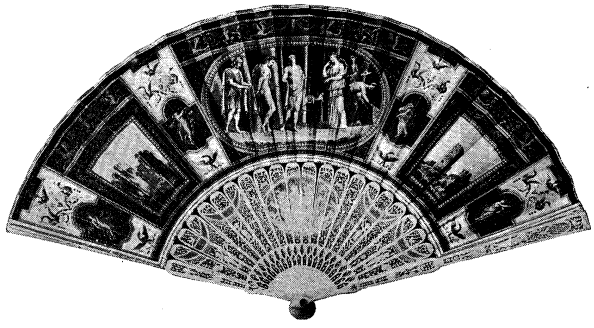
Pictorial evidence suggests that the early fans were all of rigid type and, though shapes varied considerably, were derived from the leaf form. Feather fans in which feathers were fixed radially at one end of the handle are illustrated in Pharaonic Egyptian reliefs. Rigid fans also played an important part in Assyrian, Indian, and ancient Chinese ceremonies. The *flabellum*, a metal disk mounted on a long handle, was used in medieval church ceremony; it was held by the deacon and used *pro muscis fugandis*, "to drive away flies."

Another variant of the rigid fan is the banner fan, which resembles a small flag in that the leaf, often of rectangular shape, is attached to one side of the handle. Known in India and elsewhere, this form was also in favour in Italy during the Renaissance and may well have been introduced to Europe from the Orient.

The fan has played an important part in Chinese and Japanese life. Fans were carried by men as well as women, and there were many classes of fans, each reserved for some special purpose. Thus, in Japan the fans of courtiers differed from those of the warrior caste, while the fans prescribed for the formal tea ceremony were unlike those used on the stage. With so much significance attached to the fan in the Far East, a great deal of attention was paid to its decoration, and the exquisite taste displayed in the embellishment of high-quality Chinese and Japanese fans has never really been equalled. In Europe the painting of fan leaves was, until the 19th century, the work of artisans—clever decorators at best. In China, on the other hand, many of the great painters devoted their talents to the decoration of fans, and the resulting works of art were not always mounted for actual use.

The rigid fan was apparently the more common type in China up to the end of the Sung dynasty, but during the Ming dynasty (1368–1644) the folding fan seems to have come into fashion. The folding fan was invented in the Far East (by the Japanese in the 7th century AD, it is sometimes claimed), and it is possible that a few examples of such Eastern folding fans reached Europe during the Middle Ages. The Portuguese traders who opened up the sea route to China in the 15th century, however, were probably the first to bring Oriental fans to Europe in any quantity, and thereafter the importation of these curios increased. By the end of the 17th century enormous consignments of Chinese and, to a lesser extent, Japanese fans were reaching Europe. These were mostly of rather poor quality by Oriental standards, for they were made for the less discriminating European market; but the intricacy and skill with which even they were fashioned caught the imagination of Europeans, who bought them eagerly.

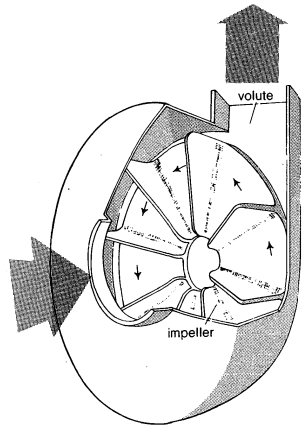
In the West the amount and style of decoration varied with European fashion and ranged from small-scale reproductions of 17th-century wall paintings to simple pleated fans with guards of mother-of-pearl. The fans ranged in size from a radius of about 8 inches during the first three decades of the 19th century to more than 20 inches in the Victorian period. After about 1900 use of the fan began to die out.



French hand-painted folding fan with carved ivory sticks, 18th century, in the Bayerisches Nationalmuseum, Munich

By courtesy of the Bayerisches Nationalmuseum, Munich

fan, device for producing a current of air or other gases or vapours. Fans are used for circulating air in rooms and buildings; for cooling motors and transmissions; for cooling and drying people, materials, or products; for exhausting dust and noxious fumes; for conveying light materials; for forced draft in steam boilers; and in heating, ventilating, and air-conditioning systems.



Cutaway view of centrifugal fan

A fan consists of a series of radial blades attached to a central rotating hub. The rotating assembly of blades and hub is known as an impeller, a rotor, or a runner; and it may or may not be enclosed in a housing. Fans may be driven by an electric motor, an internal-combustion engine, a steam turbine, a gas turbine, or other motive power.

Enclosed fans may be classified as centrifugal or axial-flow. In centrifugal fans air is led through an inlet pipe to the centre, or eye, of the impeller, which forces it radially outward into the volute, or spiral, casing from which it flows to a discharge pipe.

In an axial-flow fan, with the runner and guide vanes in a cylindrical housing, air passes through the runner essentially without changing its distance from the axis of rotation. There is no centrifugal effect. Guide, or stator, vanes serve to smooth the airflow and improve efficiency.

In general, an axial-flow fan is suitable for a relatively large rate of flow with a relatively small pressure gain, and a centrifugal fan for a small rate of flow and a large pressure gain. Actually, the pressure developed in a fan is small compared with the pressure developed in a compressor. The capacities of fans range from 100 to 500,000 cubic feet per minute (3 to 14,000 cubic metres per minute).

Fan Chung-yen, Pinyin FAN ZHONGYAN (b. 989, Wu, Kiangsu Province, China—d. 1052, China), Chinese scholar-reformer who as minister to the Sung emperor Jen Tsung (reigned 1022/23–1063/64) anticipated many of the reforms of the great innovator Wang An-shih (1021–86). In his 10-point program, Fan attempted to abolish nepotism and corruption, reclaim unused land, equalize landholdings, create a strong local militia system, reduce the labour services required of the people, and reform the civil service examination system. He objected to the nature of the examination, which tested stylistic elegance rather than economic or administrative ability. He proposed that the examination stress problems of history and politics. To train men to understand these areas, he proposed the establishment of a national school system. The Emperor adopted the proposal in 1044 and ordered the establishment of a school in every district.

An ardent foe of Buddhism, Fan was widely respected as a great Confucian scholar. He helped create an interest in the *I Ching* ("Classic of Changes") and the *Chung Yung* ("Doctrine of the Mean"), two Confucian Classics previously neglected. He helped foster the Neo-Confucian emphasis on filial piety and helped to make the clan an important institution officially supported by the state.

fan shell: *see* scallop.

Fan Si Pan, also spelled PHANG XI PANG, also called HOANG LIEN SON, highest peak (10,308 ft [3,142 m]) in Vietnam, lying in Hoang Lien Son *tinh* (province) and forming part of the Fan Si Pan-Sa Phin range, which extends northwest–southeast for nearly 19 mi (30 km) between the Red River (Song Hong) and the Black River (Song Da). Along most of the range there is a much steeper slope on the west than on the east. The village of Chapa, 24 mi southwest of Lao Cai, was a noted summer resort under the French and the base for climbing the mountain.

Fan-Tan, bank gambling game, of considerable antiquity in China, which became popular in the western United States in the second half of the 19th century. A square is laid out in the centre of a table, its sides marked 1, 2, 3, 4. The banker empties onto the table a double handful of small coins, beans, or other small objects, which he covers with a metal bowl. The players bet on what will be the remainder when the pile is divided by four. They set their stakes on the side of the square bearing the number bet. When all have staked,the bowl is lifted and the banker removes the objects four at a time with a small stick until four or fewer are left. This is the winning number; if four coins remain, the number 4 wins, and so on. The banker takes 25 percent from each winner's stake and pays the winner five times his stake thus reduced, that is, 2.75 to one. The true odds are three to one. Fan-Tan should not be confused with the sequential card game Fan Tan.

Fan-Tan, also called SEVENS, or PLAY AND PAY, card game that may be played by any number of players up to eight. The full pack of 52 cards is dealt out, one card at a time. Thus, some hands may contain one more

card than others. All players ante to a pool; in some games, those players who are dealt fewer cards than others are required to ante an extra counter.

Only one card is played at a turn. Beginning with the player to the left of the dealer, each player in turn must play a card if able; players who cannot play must pay one counter to the pool.

The first card played must be a 7. The next player may add a card next in rank and of the same suit—*i.e.*, the 8 or the 6—or may play another 7. Thereafter, each must play a card of the same suit and in unbroken sequence with one already on the table or may play a 7. Sequences build up to the king and down to the ace. The first player to play all his cards wins the pool, to which each of the others must add one counter for each of his unplayed cards. The card game Fan-Tan should not be confused with the ancient Chinese bank game of the same name.

Fan Wen-ch'eng, Pinyin FAN WENCHENG (b. 1597, Fu-shun, China—d. Aug. 31, 1666), minister who advised the Manchu forces of Manchuria in their conquest of China and their establishment there of the Ch'ing dynasty (1644–1911/12).

The scion of a famous Chinese family, Fan was taken captive when his native village was overrun by the Manchus. He became a trusted adviser of Nurhachi (1559–1626), founder of the Manchu state in Manchuria, and aided him and his successors in developing a Chinese-style government. In 1636, when the Manchus set up a centralized bureaucratic administration in the Manchurian city of Mukden, Fan became a grand secretary, one of the chief ministerial positions in the new government.

In 1644, when Peking, the capital of the Ming dynasty (1368–1644), fell to a Chinese rebel leader, Li Tzu-ch'eng, Fan induced the Manchus to seize the opportunity to attempt the conquest of China. Through his efforts, they refrained from pillaging, reduced burdensome taxes, and gave a proper ceremonial burial to the last Ming emperor, thus winning the hearts of the people. Fan also restored the civil-service examination system, which had proved effective in recruiting talented Chinese into the government and in providing a means of social mobility for ambitious men. Fan retired in 1654, having been an adviser to four emperors.

Fan Zhongyan (Chinese scholar-reformer): *see* Fan Chung-yen.

Fana, section of the city of Bergen, Hordaland *fylke* (county), southwestern Norway, opposite Store Sotra Island. Raune Fjord and its smaller branches, especially Fana Fjord, cut into Fana's irregular coastline. Most of the settlements in Fana date back to the early European Middle Ages, when the area was an agricultural hinterland of Bergen. By the 20th century, however, Fana had assumed a suburban aspect. Until 1973 it was a *herredskommune* (rural commune). Notable landmarks include a historic church in the town of Fana, a 12th-century stave (wooden-plank, or mast) church in Fantoft, and Troldhaugen, the home of the composer Edvard Grieg.

fana, Arabic FANĀ' ("to pass away," or "to cease to exist"), the complete denial of self and the realization of God that is one of the steps taken by the Muslim Ṣūfī (mystic) toward the achievement of union with God. Fana may be attained by constant meditation and by contemplation on the attributes of God, coupled with the denunciation of human attributes. When the Ṣūfī succeeds in purifying himself entirely of the earthly world and loses himself in the love of God, it is said that he has "annihilated" his individual will and "passed away" from his own existence to live only in God and with God.

Many Ṣūfīs hold that fana alone is a negative state, for even though ridding oneself of earthly desires and recognizing and denouncing human imperfections are necessary for every pious individual, such virtues are insufficient for those who choose the path of Ṣūfism. Through *fanā' 'an al-fanā'* ("passing away from passing away"), however, the Ṣūfī succeeds in annihilating human attributes and loses all awareness of earthly existence; he then, through the grace of God, is revived, and the secrets of the divine attributes are revealed to him. Only after regaining full consciousness does he attain the more sublime state of *baqā'* (subsistence) and finally become ready for the direct vision of God.

Despite comparisons between fana and certain Buddhist and Christian concepts, many Muslim scholars insist that fana, like other Ṣūfī doctrines, is based entirely on Islāmic teachings, referring to the following Qur'ānic verse as the direct source of fana: "All things in creation suffer 'annihilation' and there remains the face of the Lord in its majesty and bounty" (55:26–27).

Fanconi syndrome: *see* de Toni-Fanconi syndrome.

fandango, exuberant Spanish courtship dance and a genre of Spanish folk song. The dance, probably of Moorish origin, was popular in Europe in the 18th century and survives in the 20th century as a folk dance in Spain, Portugal, southern France, and Latin America. Usually danced by couples, it begins slowly, with the rhythm marked by castanets, clapping of hands, snapping of fingers, and the stamping of feet; the speed gradually increases. The music is in $\frac{3}{4}$ or $\frac{6}{8}$ time. Occasionally there is a sudden pause in the music, and the dancers stand rigid until the music resumes. The dance is an expression of passion, and the partners tease, challenge, and pursue each other with steps and gestures. In another version, the fandango is danced by two men as a contest of skill. The first dancer sets the rhythm and steps, the second picks up the step and elaborates.

As song, the fandango consists of *coplas,* improvised satirical, religious, or romantic verses, sung to melodies improvised according to set rules. Fandangos can be sung to accompany the dance or as solos. As a dance and as a genre of song, the fandango exists both within and outside of the flamenco (*q.v.*), or Andalusian Gypsy, tradition. The dance is closely related to the jota.

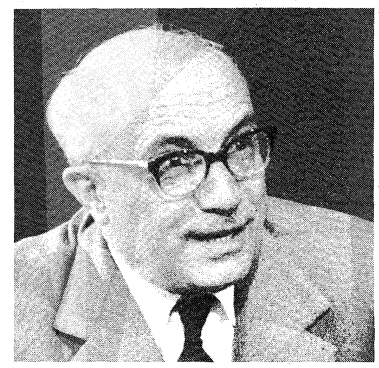
Fanfani, Amintore (b. Feb. 6, 1908, Pieve Santo Stefano, Italy), five-time Italian premier who formed and led the centre-left coalition that dominated Italian politics in the late 1950s and '60s.

A professor of economic history, Fanfani was elected to the Italian Constituent Assembly in 1946. The following year he became minister of labour and social security; in his three years in that post he promoted a plan for urban and rural reconstruction, including plans for workers' housing and the organization of noncommunist labour unions. After having served as minister of agriculture (1951) and of the interior (1953), he formed his own Cabinet on Jan. 12, 1954; it fell with the defeat of its program January 30.

In July 1954 Fanfani was elected secretary-general of the Christian Democrat Party, whose left wing he led. His party's victory in the 1958 general elections allowed him to form another Cabinet, whose policy stressed moderate social reform and substantial spending on education. As both premier and foreign minister, he visited many foreign capitals and gained Italy's election to the United Nations Security Council (Oct. 8, 1958). Attacked by the right wing of the Christian Democrat Party, his government fell on Jan. 26, 1959, and on February 1 he resigned as party head.

Fanfani returned as premier (July 1960–April 1963) after widespread public reaction against increasing neofascist activity, and in 1962 he reshuffled his Cabinet toward the left, with a policy that stressed the nationalization of electricity, regional decentralization, and economic planning.

He was foreign minister in March 1965 and became president of the United Nations General Assembly (Sept. 21, 1965) in preparation for the visit of Pope Paul VI. He was forced to resign as foreign minister in December 1965 after the premature disclosure of possible peace initiatives he had relayed to the United States from the North Vietnamese leader Ho Chi Minh. He resumed the post soon afterward, however, and held it from February 1966 to May 1968. On March 10, 1972, he was appointed a life senator, one of five provided for in the Italian constitution. He was president of the Senate from 1968 to 1973, 1976 to 1982, and from 1985. He campaigned



Fanfani
Publifoto

unsuccessfully for the national presidency in 1971 but did hold the office as caretaker in 1978 after the resignation of Giovanni Leone. He served as premier for a fourth time from November 1982 to August 1983 and for a fifth time during April-May 1987.

fanfare, originally a brief musical formula played on trumpets, horns, or similar "natural" instruments for signal purposes in battles, hunts, and court ceremonies. The term is of obscure derivation.

Although literary sources of great antiquity contain descriptions of military and ceremonial fanfares, the earliest surviving musical examples appear in French hunting treatises of the 14th century; the limitations of the hunting horns of this period kept the form to a rather rudimentary level. By 1600, however, fanfares, as compiled by the Saxon trumpeters Magnus Thomsen and Hendrich Lübeck, court musicians for King Christian IV of Denmark, were exhibiting many characteristics commonly associated with the genre in modern times: incisive rhythms, repeated notes, the use of a single triad (chord built of thirds, as c-e-g).

Imitations of fanfares occur in a great variety of music. The caccia (a 14th-century Italian genre featuring two voices in strict melodic imitation) *Tosto che l'alba* by Ghirardello da Firenze contains a fanfarelike vocal flourish immediately after the phrase *suo corno sonava* ("sounded his horn"). The *Gloria ad modum tubae* (*Gloria in the Manner of a Trumpet*) by the Burgundian Guillaume Dufay (*c.* 1400–74) features two texted canonic voices (*i.e.,* one imitating the other in consistent fashion) above a pair of untexted lower voices that alternate in short, stereotyped fanfare motives. Similar examples are found in musical depictions of military events by such 16th-century composers as Clément Janequin, Girolamo

Frescobaldi, and William Byrd. In the 18th century the French repertoire of *sonneries* (hunting fanfares) inspired numerous instrumental compositions. During the Romantic era fanfares were often used in opera (Ludwig van Beethoven's *Fidelio,* Georges Bizet's *Carmen,* and Richard Wagner's *Tristan und Isolde*). A 20th-century example is the "Fanfare for the Common Man," by the American composer Aaron Copland.

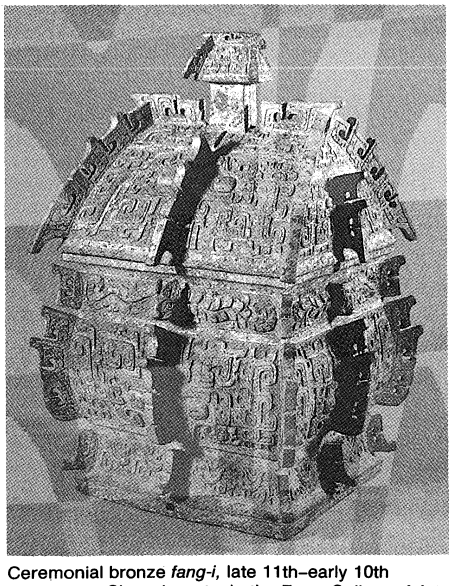
Fang, also spelled FÃN, Bantu-speaking peoples occupying the southernmost districts of Cameroon south of the Sanaga River, mainland Equatorial Guinea, and the forests of the northern half of Gabon south to the Ogooué estuary. They numbered about 2,700,000 in the late 20th century.

The Fang speak languages of the Bantu subgroup of the Niger-Congo language family. They can be divided into three linguistic groups: (1) the Beti to the north, the main tribes being the Yaunde, or Ewondo, and Bene; (2) the Bulu, including the Bulu proper, Fong, Zaman, and Yelinda; and (3) the Fang in the south, including the Fang proper, Ntumu, and Mvae.

According to tradition the Fang migrated into the forest from the savanna plateau on the right bank of the Sanaga at the beginning of the 19th century. They were fine warriors and hunters, with a reputation for cannibalism. Under colonial rule they engaged in ivory trading, turning, after World War I, to large-scale cocoa farming.

The Fang kinship system is strongly patrilineal, with large, patriarchal families and exogamic clans traced through the male line. Among the southern Fang there is little political organization, whereas in the north some Beti groups have clan chiefs. By 1939 the entire population was reportedly Christian. Since 1945, however, there has been a rapid growth of syncretistic sects combining animistic and Christian beliefs with a cargo-cult element. All the native crafts, including wood carving and their once-reputed work in iron and steatite, have disappeared under Western influence. As a result of educational progress and relative economic prosperity, the Fang have become politically influential, especially in Gabon.

fang-i, Pinyin FANGYI, type of Chinese bronze vessel produced during the Shang and early Chou dynasties (from *c.* 18th century BC to *c.* 900 BC). The *fang-i* is a container in the form of a small hut or granary, square or rectangular in section, with sides that slope outward slightly from a low base to a cover in the shape of a hipped roof.



Ceremonial bronze *fang-i,* late 11th–early 10th century BC, Chou dynasty; in the Freer Gallery of Art, Washington, D.C.

By courtesy of the Smithsonian Institution, Freer Gallery of Art, Washington, D.C.

A small nob, also in the form of a hipped roof, is placed at the centre of the cover. The decoration includes motifs characteristic of the Shang and early Chou, especially a series of *t'ao-t'ieh* (*q.v.*), or monster masks, placed within segmented fields, defined by flanges, along the corners and through the flat sides of the vessel.

Fang Lizhi (b. Feb. 12, 1936, Peking, China), Chinese astrophysicist and dissident who was held by the Chinese leadership to be partially responsible for the 1989 student rebellion in Tiananmen Square.

Fang attended Peking University (1952–56) and won a position at the Chinese Academy of Sciences' Institute of Modern Physics Research. In 1957 he was publicly rebuked and expelled from the Chinese Communist Party (CCP) for a paper he wrote decrying the Marxist position on physics and calling for a reform of the educational system. He helped to establish a physics department at Peking's University of Science and Technology (known as Keda), and he continued his research on solid-state and laser physics while teaching electromagnetics and quantum mechanics. In 1966 he was confined for a year and then sent to a communal farm to be "reeducated." During this period he was isolated from the scientific community, and he redirected his field of study to cosmology. Released in 1969 to teach, Fang was forced to publish his work under a pseudonym.

At the start of the post-Mao era, Fang's party membership was restored, and he was allowed to attend conferences outside of China for the first time. He contributed research on a number of subjects in astrophysics and won much acclaim for his work. In 1985 Fang was appointed a vice president of the Ho-fei branch of Keda. He began to work on restructuring the university and reforming educational policy. His outspoken criticisms were somewhat encouraged until students began to participate in demonstrations; Fang was one of those held responsible and was transferred to the Peking Observatory. He was once more expelled from the CCP early in 1987, and (from 1988) his trips abroad were curtailed. Invited by U.S. president George Bush to attend a banquet during a state visit to China in February 1989, Fang and his wife, Li Shuxian (also a physicist), were refused entry by the Chinese police. When two months later student demonstrations in Tiananmen Square received international attention, Fang again was held responsible, and he took refuge in the U.S. embassy. Fang and his wife remained at the embassy until June 1990, when they were allowed to leave the country.

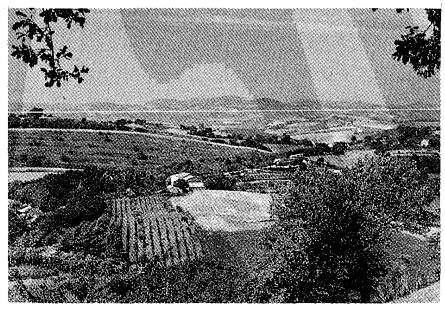
Fangio, Juan Manuel (b. June 24, 1911, Buenos Aires, Arg.), driver who dominated automobile-racing competition in the 1950s, winning the world driving championship in 1951, 1954, 1955, 1956, and 1957. He had won 16 world-championship Grand Prix races, including four consecutive German title races, when he retired from racing in 1958. Fangio won the world title driving for Alfa Romeo, Mercedes-Benz, Ferrari, and Maserati. He was known as a smooth and safe driver. After his retirement from racing, he worked for Mercedes-Benz in Argentina.

Fanning Atoll (Kiribati): *see* Tabuaeran Atoll.

Fanø, island of the North Frisian group, in the North Sea off Esbjerg, southwestern Jutland, Den. Crown property until it was purchased by its inhabitants in 1741, it supported a large fishing fleet in the 18th and 19th centuries. It was popularized as a resort by the Jutland nobility about 1900, and its present economy depends jointly on fishing and tourism. The island has an area of 22 square miles (56 square km), three-quarters of which consists of beaches, dunes, heath, and marshland. Settlements are Nordby and Sønderho. Pop. (1985 est.) 3,161.

Articles are alphabetized word by word, not letter by letter

Fano, town and episcopal see, Pesaro e Urbino *provincia,* Marche *regione,* central Italy. It lies along the Adriatic coast at the mouth of the Metauro River, just southeast of Pesaro. It was founded on the site of the ancient Fanum Fortunae ("Temple of Fortune"), which was said to have been built in the 3rd or 2nd century BC by a colony of veterans who were sent there by Augustus and who built wall fortifications, some of which still remain. One of the five cities of the Maritime Pentapo-



Farmlands near Fano, Italy

L. Bodden—Shostal/EB Inc.

lis controlled by the Byzantine exarchate of Ravenna, the town later flourished under the Malatesta family of Rimini from 1304 until it passed under direct papal control in 1463. Its harbour was restored by Pope Paul V in the early 17th century. It became part of the kingdom of Italy in 1860.

Notable landmarks include the Roman Arch of Augustus; the Palazzo Malatestiano (1413–21), housing the rich civic museum; the Palazzo della Ragione (1299); and the churches of Santa Maria Nuova (with two paintings by Perugino) and San Michele (1475–95).

Fano is on the main Milan-Bari railway and is a popular summer resort. Agriculture, especially the cultivation of vegetables and sugar beets, and fishing are the chief occupations. Pop. (1989 est.) mun., 52,674.

Fanon, Frantz (Omar) (b. 1925, Martinique—d. Dec. 6, 1961, Washington, D.C., U.S.), West Indian psychoanalyst and social philosopher, known for his theory that some neuroses are socially generated and for his writings on behalf of the national liberation of colonial peoples.

After attending schools in Martinique and France, Fanon served in the French army during World War II and afterward completed his studies in medicine and psychiatry at the University of Lyon. In 1953–56 he served as head of the psychiatry department of Blida-Joinville Hospital in Algeria, which was then part of France. He joined the Algerian liberation movement in 1954 and in 1956 became an editor of its newspaper, *El Moudjahid,* published in Tunis. In 1960 he was appointed ambassador to Ghana by the rebel Provisional Government.

Fanon's *Peau noire, masques blancs* (1952; *Black Skin, White Masks*) reflected his personal frustrations with racism. The publication shortly before his death of his book *Les Damnés de la terre* (1961; *The Wretched of the Earth*) established Fanon as a prophetic figure, the author of a social gospel that urged colonized peoples to purge themselves of their degradation in a "collective catharsis" to be

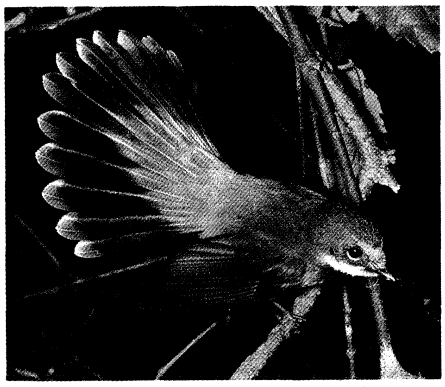
achieved by violence against their European oppressors. He was also the author of *Pour la révolution africaine* (1964; "For the African Revolution").

Fanshawe, Sir Richard, 1ST BARONET (b. June 1608, Ware Park, Hertfordshire, Eng.—d. June, 16, 1666, Madrid), poet, translator, and diplomat whose version of Camões' *Os Lusíadas* is a major achievement of English verse translation.

Educated at Cambridge, he was appointed secretary to the English embassy at Madrid in 1635. At the outbreak of the Civil War he joined the King. In 1648 he became treasurer to the navy, and in 1650 he was dispatched by Charles II to obtain help from Spain. Although this was refused, Fanshawe was created a baronet; he rejoined Charles in Scotland and was taken prisoner at the Battle of Worcester. On Cromwell's death he reentered the King's service in Paris and after the Restoration was appointed ambassador to Portugal and later to Spain.

Fanshawe's *Il Pastor Fido, The faithful Shepherd,* a translation of Battista Guarini's *Il Pastor Fido,* was published in 1647. A second edition "with divers other poems" (1648) included his version of the fourth book of Virgil's *Aeneid,* in Spenserian stanza. His *Selected Parts of Horace* appeared in 1652. The great work of his retirement during the Protectorate was his translation in the original metre of the *Os Lusíadas* of Camões (1655).

fantail, also called FAN-TAILED FLYCATCHER, any of numerous birds of the Old World subfamily Rhipidurinae, family Muscicapidae (*q.v.*). Some authors retain these birds in the subfamily Muscicapinae. The fantails constitute the genus *Rhipidura.* Fantails are native to forest clearings, riverbanks, and beaches



Rufous fantail (*Rhipidura rufifrons*)
E. McNamara—Ardea, London

from southern Asia to New Zealand; some have become tame garden birds. Most of the two dozen species are attired in shades of gray, black, brown, or rufous, often accented with areas of white, especially on the belly, eyebrows, and tail. They are named from their habit of constantly wagging and spreading their long, rounded tails. They build small cup nests, which are so finely bound in cobweb that they seem shellacked.

Examples are the white-browed fantail (*R. aureola*), a brownish resident of Bangladesh and India, 18 centimetres (7 inches) long; and the gray fantail, or cranky fan (*R. fuliginosa*), 16 cm (6¼ in.) long, a common species in Australia, New Zealand, and nearby islands. The best known Australian fantail is the willy-wagtail (*R. leucophrys*), found northward to New Guinea and the Solomon Islands. One of the larger fantails (22 cm [8½ in.]), it has a short, sweet song, sometimes uttered at night.

fantail warbler (bird): *see* cisticola.

fantasia, in music, a composition free in form and inspiration, usually for an instrumental soloist; in 16th- and 17th-century England the term was applied especially to fugal compositions, (*i.e.*, based on melodic imitation) for consorts of string or wind instruments. Earlier 16th-century fantasias for lute or keyboard consisted of short sections based on one or more musical motives. In England the fantasy or fancy for keyboard, lute, or viola had a late flowering at the time of Henry Purcell (1659–95).

In the 17th and early 18th centuries in Germany the organ *Fantasie* reflected this improvisatory character, in direct contrast to the highly structured fugue that usually followed. Freedom of form and execution persisted in the fantasias of Carl Philipp Emanuel Bach (1714–88), Mozart, Beethoven, and Schubert, some of which retained the fugal element as well. Robert Schumann in his *Fantasie,* Opus 17 (1836), and Chopin in his *Fantaisie in F Minor* (1840), maintained the tradition of a single, self-contained movement, at least outwardly. But later works, including Arnold Schoenberg's *Phantasy for Violin and Piano* (1949), frequently recall the sectionalized arrangement that prevailed during the Renaissance and early Baroque periods. The complex contrapuntal organ fantasias of J.S. Bach, on the other hand, inspired similar works by Franz Liszt, Max Reger, and Ferruccio Busoni. Some composers have exploited the fantasia for its programmatic, or descriptive, possibilities, among them John Mundy (died 1630), who wrote a fantasia on the weather, and Peter Ilich Tchaikovsky, who composed his symphonic fantasy *Francesca da Rimini* in 1876. While appealing particularly to the romantic imagination, the fantasia served, from the beginning, also as a vehicle for instrumental elaboration of vocal music (*e.g.*, Franz Schubert's "Wanderer" fantasy, based on one of his own songs).

Fanti, also spelled FANTE, people of the southern coast of Ghana between Accra and Sekondi-Takoradi. They speak a dialect of Akan, a language of the Kwa branch of the Niger-Congo family. Oral tradition states that the Fanti migrated from Techiman (or Tekyiman), in what is now the northwestern Ashanti Region, during the 17th century; they established several autonomous kingdoms that later joined in the Fanti Confederacy.

The Fanti food crops include yams, cassava, cocoyams (taro), and plantain; cash crops include cocoa, palm oil, and timber. Fishing is also important. They occupy compounds consisting of rooms around a walled courtyard. Households may consist of kin groups related through either male or female descent; it is common for a husband and wife to continue living in their own homes after marriage.

The Fanti have a dual lineage system. Matrilineal descent determines membership in clans and their localized segments. Every lineage has a ceremonial stool in which reside important ancestral spirits, whose worship is an important feature of Fanti religion. Patrilineal descent governs the inheritance of spiritual attributes, as well as determining membership in the *asafo,* a military organization allegiance to which takes precedence over that to the matrilineage. The functions of the *asafo* are political (as the medium through which commoners express political sentiment and criticism of the chief), social (formerly as a cooperative labour unit and as guardian of the rights of its members), religious (in funerals and state ceremonies), and military (serving as the primary defensive unit of the state).

The head of each Fanti state is the paramount chief, chosen from the royal lineage. Under him are divisional chiefs and subchiefs. The chiefs and representatives of the *asafo* function as advisers to the paramount chief. The Fanti states never united under a single chief; each remained autonomous, forming alliances in time of war.

Traditional Fanti religion includes belief in a supreme creator god and in lesser deities who derive their power from him. Most Fanti are now Christians.

Fanti, Manfredo (b. Feb. 23, 1808, Carpi, Kingdom of Italy—d. April 5, 1865, Florence), one of the most capable patriot generals during the mid-19th-century wars of Italian independence; he helped the northern Italian house of Sardinia–Piedmont consolidate Italy under its leadership.

Exiled for participating in a republican uprising in Savoy (1831), Fanti distinguished himself for several years fighting for the liberals in France and in Spain. He returned to Milan in 1848 to fight the Austrians, but the Sardinia–Piedmont forces were defeated despite his tactical genius. King Charles Albert of Sardinia reopened the war and was again decisively beaten at Novara (March 1849). Fanti, suspected of being too ardent a revolutionary by his Piedmontese superiors, was removed from command but later cleared.

While fighting Austria again in 1859, Fanti scored brilliant victories at Palestro, Magenta, and San Martino. After the Peace of Villafranca, he organized the army of the Central Italian League, which included Tuscany, Modena, Parma, and Romagna. When central Italy was annexed by Piedmont, Fanti became minister of war (January 1860). After the invasion of Sicily (May 1860) by the revolutionary force of Giuseppe Garibaldi, King Victor Emmanuel II of Sardinia–Piedmont sent Fanti south. He won impressive victories in the papal lands. The King took command as the Italians entered Neapolitan territory, where Fanti scored further successes. In reforming the Italian army, Fanti opposed concessions to Garibaldi and his volunteers—a position that made Fanti unpopular and led to his resignation in June 1861, but in April 1862 he accepted command of an army corps in Florence.

Fanti confederacy, also spelled FANTE, historic group of states in what is now southern Ghana. It originated in the late 17th century when Fanti people from overpopulated Mankessim, northeast of Cape Coast, settled vacant areas nearby. The resulting Fanti kingdoms formed a confederacy headed by a high king (the Brafo) and a high priest. It extended from the River Pra in the west to the Ga region (around Accra) in the east. To the south was the Atlantic coast, dotted with Dutch and British trading forts; to the north was the expanding Ashanti empire. The Fanti, as intermediaries in Ashanti-European trade, debased Ashanti gold before selling it to the British and Dutch and controlled the flow of European firearms to the Ashanti.

After decades of hostility, the Ashanti king Osei Bonsu conquered the Fanti confederacy (1806–24) and gained direct access to the coast. After his death Ashanti power declined, and in 1831 the British administrator of Cape Coast, George Maclean, negotiated a treaty providing for Fanti independence and Ashanti use of trade routes to the coast. Britain thereupon extended an informal protectorate over the south.

Resistance crystallized in the 1860s, after the British and the Dutch agreed to an exchange of forts (1867) without consulting any African rulers. The kings of the Fanti kingdoms, Denkyera, and other southern states met at Mankessim early in 1868 to establish a self-governing state free from European domination. The new Fanti Confederation had an executive council, a judiciary, an army, taxes, and a written constitution. Although short-lived, it was strong enough that the Dutch became discouraged and abandoned the coast. The

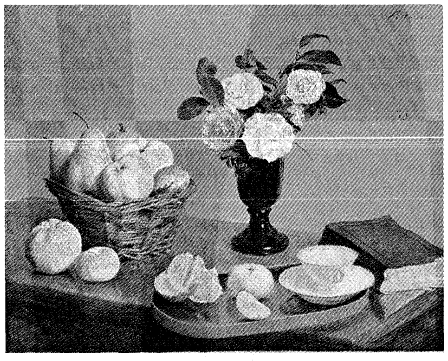
British successfully exploited rivalries among members of the Confederation, and it disbanded in 1873. The next year Britain annexed the whole region south of the Ashanti empire as the Gold Coast crown colony.

Fantin-Latour, Henri, in full IGNACE-HENRI-JEAN-THÉODORE FANTIN-LATOUR (b. Jan. 14, 1836, Grenoble, Fr.—d. Aug. 25, 1904, Buré), French painter, printmaker, and illustrator noted for his still lifes with flowers and his portraits, especially group compositions, of contemporary French celebrities in the arts.

Fantin-Latour's first teacher was his father, a well-known portrait painter. Later, he studied at the school of Lecoq de Boisbaudran and attended the École des Beaux-Arts. He exhibited at the official French Salons, but in 1863 he also showed his work in the rebel Salon des Refusés.

Although academic in manner, Fantin-Latour was independent in style. He had numerous friends among the leading French painters of his day, including J.-A.-D. Ingres, Eugène Delacroix, Camille Corot, Édouard Manet, and Gustave Courbet. His portrait groups, often arranged in rows of heads and figures like 17th-century Dutch guild portraits, are perhaps most interesting for their portrayal of various literary and artistic persons of the time.

Fantin-Latour's flower paintings were particularly appreciated in England, where, through James McNeill Whistler and Sir John Everett Millais, Fantin-Latour found a patron in Edwin Edwards. A wealthy amateur engraver, he supported Fantin-Latour for years by purchasing his still lifes.



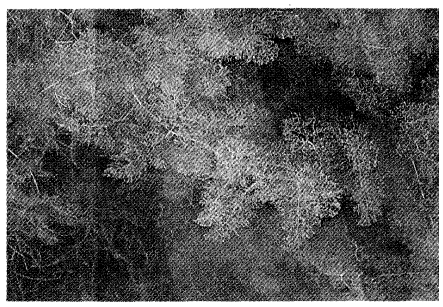
"Still Life," oil on canvas by Henri Fantin-Latour, 1866; in the National Gallery of Art, Washington, D.C.

By courtesy of the National Gallery of Art, Washington, D.C., Chester Dale Collection

The last period of Fantin-Latour's life was primarily devoted to lithography. In the Salon of 1876 he exhibited "L'Anniversaire," honouring Hector Berlioz, and thereafter his lithographs were shown regularly. Most characteristic were his delicate portraits and imaginative drawings illustrative of the music of Richard Wagner, Berlioz, and other composers. He also illustrated Adolphe Jullien's *Wagner* (1886) and *Berlioz* (1888).

fanworm, any of various segmented aquatic worms of the family Sabellidae (class Polychaeta, phylum Annelida). Fanworms have fanlike tentacles extending from two lobes at the front end of the body close to the mouth. The tentacles are used both for respiration and for food gathering. Fanworms live on the sea bottom in tubes that are constructed of mud particles or of sand cemented together by mucus. The tentacle fan protrudes from the tube while the worm is feeding, but it can be withdrawn rapidly into the tube when danger threatens. Fanworms feed on suspended organic debris and plankton, which they trap in mucus on their erect feathery tentacles. The particles of food are transported along ciliated grooves to the mouth. Most fanworms inhabit marine environments, but a few species live in fresh water.

fanwort, also called WATER SHIELD, any of about seven species of aquatic flowering plants constituting the genus *Cabomba,* of the fanwort or water-shield family (Cabombaceae), native to the New World tropics and subtropics. Water shield (*q.v.*) is also the common name for *Brasenia,* the only other genus of the family.



Fanwort (*Cabomba*)
E.R. Degginger—EB Inc.

The narrow, floating leaves of fanwort are about 5 to 20 mm (1/5 to 3/4 inch) long. A slimy leafstalk attaches the centre of the leaf blade to the stem and roots, which are anchored in mud. The submerged leaves, 2 to 5 cm (about 3/4 to 2 inches) wide, are finely divided and fan shaped. The pale-yellow or white flowers are about 5.5 mm to 1 cm (1/5 to 2/5 inch) long. *Cabomba caroliniana,* sometimes called Washington grass, fish grass, or Carolina water shield, is the most common species in North America. It is often cultivated as an aquarium plant.

FAO: *see* Food and Agriculture Organization.

Far Eastern Economic Review, weekly news magazine covering general, political, and business and financial news of East and Southeast Asia. It is the most authoritative and influential news magazine of the Far East. It is published in Hong Kong, where it was established in 1946. The magazine carries feature articles on the major developments in the region and on outside developments that affect it. A network of correspondents supplies weekly reports from the countries in the region. The *Far Eastern Economic Review* is noted for its objectivity and for the accuracy of its reports. Its editorial stance is oriented distinctly toward free trade and market economics and has generally resembled that of the London *Economist* or the *Wall Street Journal*—whose publishers, Dow Jones & Company, acquired ownership of the magazine in 1974.

Far Eastern Republic, also called CHITA REPUBLIC, Russian DALNEVOSTOCHNAYA RESPUBLIKA, or CHITINSKAYA RESPUBLIKA, nominally independent state formed by Soviet Russia in eastern Siberia in 1920 and absorbed into the Soviet Union in 1922. At the time of the Far Eastern Republic's creation, the Bolsheviks controlled Siberia west of Lake Baikal, while Japan held much of the Pacific coast, including Vladivostok. Lenin therefore ordered the creation of the Far Eastern Republic, centring on the city of Chita, to act as a buffer between Soviet and Japanese holdings. Once Soviet power was firmly established in Siberia, the republic was to be absorbed into the Russian Soviet Federated Socialist Republic.

Victories by the local Bolsheviks, pressure from the United States, which was worried about Japanese control of the entire Pacific coast of Asia, and pressure from the increasingly stronger and securer Soviet government forced Japan to evacuate Siberia in 1922. The Far Eastern Republic was then incorporated into the Soviet Union in November 1922.

Far Traveller (Old English poem): *see* Widsith.

Fārābī, al-, in full MUḤAMMAD IBN MUḤAMMAD IBN ṬARKHĀN IBN UZALAGH AL-FĀRĀBĪ, also called ABŪ NAṢR AL-FĀRĀBĪ, Latin name ALPHARABIUS (also spelled Alfarabius), or AVENNASAR (b. *c.* 878, Turkistan—d. *c.* 950, Damascus?), Muslim philosopher, one of the preeminent thinkers of medieval Islām. He was regarded in the Arab world as the greatest philosophical authority after Aristotle.

Very little is known of al-Fārābī's life. He was of Turkic origin and is thought to have been brought to Baghdad as a child by his father, who was probably in the Turkish bodyguard of the Caliph (the titular leader of the Islāmic community). Al-Fārābī was not a member of the court society, and neither did he work in the administration of the central government. In 942 he took up residence at the court of the prince Ṣayf ad-Dawlah, where he remained, mostly in Ḥalab (modern Aleppo), until the time of his death.

Al-Fārābī's philosophical thinking was nourished in the heritage of the Arabic Aristotelian teachings of 10th-century Baghdad. His great service to Islām was to take the Greek heritage, as it had become known to the Arabs, and show how it could be used to answer questions with which Muslims were struggling. To al-Fārābī, philosophy had come to an end in other parts of the world, but had a chance for new life in Islām. Islām as a religion, however, was of itself not sufficient for the needs of a philosopher. He saw human reason as being superior to revelation. Religion provided truth in a symbolic form to nonphilosophers, who were not able to apprehend it in its more pure forms. The major part of al-Fārābī's writings were directed to the problem of the correct ordering of the state. Just as God rules the universe, so should the philosopher, as the most perfect kind of man, rule the state; he thus relates the political upheavals of his time to the divorce of the philosopher from government.

farad, unit of electrical capacitance (ability to hold an electric charge), in the metre–kilogram–second system of physical units, named in honour of the English scientist Michael Faraday. The capacitance of a capacitor is one farad when one coulomb of electricity changes the potential between the plates by one volt. In terms of ordinary electric and electronic equipment, the farad is enormous, and capacitors are generally rated in microfarads (one microfarad equals 10^{-6} farad) or picofarads (10^{-12} farad).

faraday, unit of electricity, used in the study of electrochemical reactions and equal to the amount of electric change that liberates one gram equivalent of any ion from an electrolytic solution. It was named in honour of the 19th-century English scientist Michael Faraday and equals 9.6485309×10^4 coulombs, or 6.0221367×10^{23} electrons (*see also* Avogadro's law).

Faraday, Michael (b. Sept. 22, 1791, Newington, Surrey, Eng.—d. Aug. 25, 1867, Hampton Court, Surrey), English physicist and chemist, whose many experiments contributed greatly to the understanding of electromagnetism.

A brief treatment of the life and works of Michael Faraday follows. For full treatment, *see* MACROPAEDIA: Faraday.

Faraday was early trained as a bookseller and bookbinder. He was appointed at 21 an assistant to Sir Humphry Davy, the noted

English chemist, and accompanied Davy on a continental European tour in 1813–15. In 1821 Faraday discovered the principle of the electric motor and built a primitive model of one. Two years later he was the first to liquefy chlorine, and in 1825 he isolated benzene. Convinced of the interrelation of electricity and magnetism, he discovered the phenomenon of electromagnetic induction—the production of electric current by a change in magnetic intensity. In 1833 he became professor of chemistry at the Royal Institution.

Among his other accomplishments, Faraday produced the first dynamo, stated the basic laws of electrolysis, discovered that a magnetic field will rotate the plane of polarization (vibration) of light, and studied dielectrics (nonconducting materials).

Faraday married Sarah Barnard in 1821. He retired some years before his death to live near Hampton Court in Surrey. His published works include *Chemical Manipulation* (1827); *Experimental Researches in Electricity* (1839–55); *Experimental Researches in Chemistry and Physics* (1859); *A Course of Six Lectures on the Chemical History of a Candle* (1861); and, posthumously, *On the Various Forces in Nature* (1873).

Faraday effect, in physics, the rotation of the plane of polarization (plane of vibration) of a light beam by a magnetic field. Michael Faraday, an English scientist, first observed the effect in 1845 when studying the influence of a magnetic field on light waves that had been plane polarized by passing through a block of glass. (Light waves vibrate in two planes at right angles to one another, and passing ordinary light through certain substances eliminates the vibration in one plane.) He discovered that the plane of vibration is rotated when the light path and the direction of the applied magnetic field are parallel. The Faraday effect occurs in many solids, liquids, and gases and is proportional to the strength of the magnetic field, the thickness of the substance, and Verdet's constant, which depends on the material. The direction of rotation is the same as the direction of current flow in the wire of the electromagnet, and therefore if the same beam of light is reflected back and forth through the medium, its rotation is increased each time.

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

Faraday's law of induction, in physics, a quantitative relationship between a changing magnetic field and the electric field created by the change, developed on the basis of experimental observations made in 1831 by the English scientist Michael Faraday.

The phenomenon called electromagnetic induction was first noticed and investigated by Faraday; the law of induction is its quantitative expression. Faraday discovered that, whenever the magnetic field about an electromagnet was made to grow and collapse by closing and opening the electric circuit of which it was a part, an electric current could be detected in a separate conductor nearby. Moving a permanent magnet into and out of a coil of wire also induced a current in the wire while the magnet was in motion. Moving a conductor near a stationary permanent magnet caused a current to flow in the wire, too, as long as it was moving.

Faraday visualized a magnetic field as composed of many lines of induction, along which a small magnetic compass would point. The aggregate of the lines intersecting a given area is called the magnetic flux. The electrical effects were thus attributed by Faraday to a changing magnetic flux. Some years later the British physicist James Clerk Maxwell proposed that the fundamental effect of changing magnetic flux was the production of an electric field, not only in a conductor (where it could drive an electric charge) but also in space even in the absence of electric charges. Maxwell formulated the mathematical expression relating the change in magnetic flux to the induced electromotive force (*E,* or *emf*). This relationship, known as Faraday's law of induction (to distinguish it from his laws of electrolysis), states that the magnitude of the *emf* induced in a circuit is proportional to the rate of change of the magnetic flux that cuts across the circuit. If the rate of change of magnetic flux is expressed in units of webers per second, the induced *emf* has units of volts.

Faraday's laws of electrolysis, in chemistry, quantitative laws used to express magnitudes of electrolytic effects, first described by the English scientist Michael Faraday in 1833. The laws state that (1) the amount of chemical change produced by current at an electrode–electrolyte boundary is proportional to the quantity of electricity used, and (2) the amounts of chemical changes produced by the same quantity of electricity in different substances are proportional to their equivalent weights. In electrolytic reactions, the equivalent weight of a substance is the gram formula weight associated with a unit gain or loss of electron. The quantity of electricity that will cause a chemical change of one equivalent weight unit has been designated a faraday. It is equivalent to 9.6485309×10^4 coulombs of electricity. Thus, in the electrolysis of fused magnesium chloride, $MgCl_2$, one faraday of electricity will deposit 24.312/2 grams of magnesium at the negative electrode and liberate 35.453 grams of chlorine at the positive electrode.

Faradofay, formerly TAOLANARO, or FORT-DAUPHIN, town, southeastern Madagascar. It was settled in 1528, and Étienne de Flacourt wrote his descriptive *Histoire de la Grande Isle de Madagascar* there in 1661. A port on the Indian Ocean, it handles exports of dried fish, lumber, cattle, sisal, waxes, beans, peanuts (groundnuts), and other foodstuffs. It serves as the outlet for large sisal and castor-oil plantations and for mica and thorianite mines. Its extensive beaches make it a holiday resort. Pop. (1978 est.) 15,000.

Farāh, also spelled FARRAH, or FERAH, town, southwestern Afghanistan, on the Farāh River. Usually identified with the ancient town of Phrada, it was once a centre of agriculture and commerce until destroyed by the Mongols in 1221; it later revived but was sacked in 1837 by the Persians. The building of the Qandahār–Herāt road through Farāh in the 1930s and of a bridge over the river (1958) restored some of the town's former importance. Farāh is situated in an exposed position with open desert to the south, making the summers hot and dusty. The people are mostly of Tadzhik origin.

Following Soviet military intervention beginning in 1979 and the deployment of Soviet troops between Shīndand and Farāh, the area near Farāh was the scene of heavy fighting. After the Soviet army established a military command and airbase at Shīndand in mid-1980, intermittent Afghan guerrilla activities continued. The area around Farāh is a dry region of plains and low mountains, drained by the Farāh and Hārūt rivers. The main occupation is agriculture, based on irrigation waters from the rivers or from underground channels (*kārīz*). Crops include wheat, cotton, tobacco, and barley. The plains support goats and sheep, whose wool is used for rug and carpet weaving. Pop. (1984 est.) town, 20,605.

Farah, Nuruddin (b. 1945, Baidoa, Italian Somaliland [now in Somalia]), Somali writer, the first novelist and the first English-language author of his country.

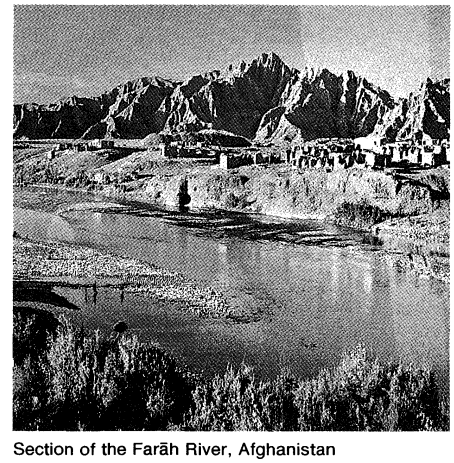
Farah was educated in Ethiopia and at the colonial-era Institutio Magistrale in Mogadishu, learning English as well as Italian. After working for the Ministry of Education, he studied literature and philosophy at Panjab University in Chandīgarh, India. There he wrote his first published novel, *From a Crooked Rib* (1970). The book's story deals with the determination of one woman to maintain her dignity in a society that believes "God created Woman from a crooked rib; and anyone who trieth to straighten it, breaketh it."

In his next novel, *A Naked Needle* (1976), Farad used a flimsy tale of interracial and cross-cultural love to reveal a lurid picture of post-revolutionary Somali life in the mid-1970s. He next wrote a trilogy—*Sweet and Sour Milk* (1979), *Sardines* (1981), and *Close Sesame* (1983)—about life under a particularly African dictatorship, in which ideological slogans barely disguise an almost surreal society and human ties have been severed by dread and terror. Although his novels were sometimes criticized for their facile generalizations, Farah revealed a rich imagination and remarkable ease and exactness with the English language that made him the most significant Somali writer in any European language. The political nature of his fiction forced him into exile, and he taught in Europe, North America, and elsewhere in Africa.

Fa'rah, Tall (Iraq): *see* Shuruppak.

Far'ah, Tall al-, ancient site in southwestern Palestine, located on the Wādī Ghazzah near Tall al-'Ajjul, in modern Israel. The site was excavated between 1928 and 1930 by British archaeologists in Egypt under the direction of Sir Flinders Petrie, who identified the site as Beth-pelet. Other scholars, however, are probably correct in their belief that the site is instead ancient Sharuhen, an important Egyptian (Hyksos) fortress during the late 17th and early 16th centuries BC. According to the Egyptian account, after the collapse of Hyksos rule in Egypt, Sharuhen managed to resist a siege by anti-Hyksos Egyptians for three years. The excavations revealed city levels and tombs dating from about 1900 BC to about 1200 BC. Nearby were a number of sites dating from the Chalcolithic Period (4th millennium BC) that yielded valuable prehistoric pottery and stone objects.

Farāh River, Dari Persian in full DARYĀ-YE FARĀH RŪD, river in western Afghanistan, rising on the southern slopes of the Band-e Bāyan Range, flowing southwest past the town of Farāh, and emptying into the Helmand (Sīstān) swamps on the Iranian border after a course of 350 miles (560 km). The river fluctuates greatly with the seasons, sometimes



Section of the Farāh River, Afghanistan
R. Everts—ZFA/EB Inc.

flooding in the spring and becoming impassable. Its waters are used for irrigation along much of its length.

Faraj, in full AL-MALIK AN-NĀṢIR ZAYN AD-DĪN ABŪ AS-SA'ĀDĀT FARAJ (b. 1389, Cairo—d. 1412, Damascus), 26th Mamlūk ruler of Egypt and Syria; his reign was marked by a loss of internal control of the Mamlūk kingdom, whose rulers were descendants of slaves. Faraj was the victim of forces—including foreign invasion and domestic feuds—that he did not create and could not control.

Faraj's father, Barqūq, died in 1399. While he was a child, two guardians, representing the rival Turkish and Circassian factions, acted for him. As the result of feuds between their factions, Faraj was deposed on Sept. 20, 1405, and his brother al-Malik al-Manṣūr replaced him; but Faraj was reinstated the following November.

During Barqūq's rule, a defensive alliance between the Ottomans and the Mamlūks had been formed against Timur (commonly Tamerlane, the renowned Turkic conqueror). Faraj's guardians allowed this alliance to weaken, a shortsighted policy that proved disastrous for Ottomans and Mamlūks alike as Timur dealt individually with his enemies. Following the fall of Damascus and Aleppo in Syria to the Timurid armies in 1400, Faraj remained subservient to Timur for the next five years.

The invasion of Syria was a serious disability to Faraj because of the loss of revenue. As a consequence the coinage was debased, and new fiscal taxation levies were imposed. Faraj was never able to reconquer Syria, although he led several expeditions against the Syrian Mamlūks, who were his nominal vassals. During one of these expeditions, Faraj was defeated, captured, and imprisoned in Damascus, where he was killed in 1412.

Faranah, town, central Guinea, western Africa. The town is located on the Niger River and was founded in the 1890s as a French outpost in the campaign against Samory Touré, the Malinke warrior-leader. It is connected by road with Dabola and Kissidougou and is a trading centre for rice, cattle, and palm oil and kernels. It has a hospital and a Roman Catholic mission (1948). The surrounding region is inhabited by the Dialonke people. To the southwest of Faranah is a coffee- and oil palm-producing area of the Guinea Highlands, which contains the source of the Niger (there called the Dioliba) River. Pop. (1983) 39,384.

farandole, lively and popular chain dance of Provence and Catalonia. It was mentioned as early as the 14th century and, according to tradition, was taken to Marseille from Greece by Phoenician sailors. Performed on feast days, the farandole is danced by men and women holding hands in a chain. The dancers, following the steps introduced by the chain leader, wind through the streets to the accompaniment of pipes and tabors. The music is in $\frac{6}{8}$ time. The farandole is one of a group of Mediterranean, Balkan, and Middle Eastern chain dances that includes the Romanian hora and the Greek *syrtos,* and it is related to the medieval carole. The dance of the French Revolution, the carmagnole, was a variety of farandole.

Farazdaq, al- (Arabic: "The Lump of Dough"), byname of TAMMĀM IBN GHĀLIB ABŪ FIRĀS (b. *c.* 641, Yamāmah region, Arabia—d. *c.* 728 or 730), Arab poet famous for his satires in a period when poetry was still a political instrument. With his rival Jarīr, he represents the transitional period between Bedouin traditional culture and the new Muslim society that was being forged.

Living in Basra, al-Farazdaq composed satires on the Banū Nashal and Banū Fuqaim tribes, and when al-Farazdeq Ziyād ibn Abīhi, a member of the latter tribe, became governor of Iraq in 669, he was forced to flee to Medina, where he remained for several years. On the death of Ziyād, he returned to Basra and gained the support of Ziyād's son, 'Ubayd Allāh. When al-Ḥajjāj became governor (694), al-Farazdaq was again out of favour, in spite of the laudatory poems he dedicated to al-Ḥajjāj and members of his family; this was probably a result of the enmity of Jarīr, who had the ear of the governor. Al-Farazdaq became official poet to the caliph al-Walīd (reigned 705–715), to whom he dedicated a number of panegyrics. He also enjoyed the favour of the caliph Sulaymān (715–717) but was eclipsed when 'Umar II became caliph in 717. He got a chance to recover patronage under Yazīd II (720–724), when an insurrection occurred and he wrote poems excoriating the rebel leader.

Al-Farazdaq was an eccentric of the first order, and his exploits, as well as his verses and his feud with Jarīr, provided subjects for discussion to generations of cultivated persons.

His *Dīwān,* the collection of his poetry, contains several thousand verses, including laudatory and satirical poems and laments. His poems are representative of the nomad poetry at its height. Most of them are characterized by a happy sincerity, but some of his satires are notably obscene.

Farben, IG (German cartel): *see* IG Farben.

farce, a comic dramatic piece that uses highly improbable situations, stereotyped characters, extravagant exaggeration, and violent horseplay. Farce is generally regarded as intellectually and aesthetically inferior to comedy in its crude characterizations and implausible plots, but it has been sustained by its popularity in performance and has persisted throughout the Western world to the present.

Antecedents of farce are found in ancient Greek and Roman theatre, both in the comedies of Aristophanes and Plautus and in the popular native Italian *fabula Atellana,* entertainments in which the actors played stock character types—such as glutton, greybeard, and clown—who were caught in exaggerated situations.

It was in 15th-century France that the term farce was first used to describe the elements of clowning, acrobatics, caricature, and indecency found together within a single form of entertainment. Such pieces were initially bits of impromptu buffoonery inserted by actors into the texts of religious plays—hence the use of the Old French word *farce,* "stuffing." Such works were afterward written independently, the most amusing of the extant texts being *Maistre Pierre Pathelin* (*c.* 1470). French farce spread quickly throughout Europe, notable examples being the interludes of John Heywood in 16th-century England. Shakespeare and Molière eventually came to use elements of farce in their comedies.

Farce continued throughout the 18th and 19th centuries, in France Eugène Labiche's *An Italian Straw Hat* (1851) and Georges Feydeau's *A Flea in Her Ear* (1907) being notable successes. Farce also surfaced in music hall, vaudeville, and boulevard entertainments.

Farce survived in the 20th century in such plays as *Charley's Aunt* (1892) by Brandon Thomas and found new expression in film comedies with Charlie Chaplin, the Keystone Kops, and the Marx Brothers. The farces presented at the Aldwych Theatre, London, between the world wars were enormously popular, and numerous successful television comedy shows attest to the durability of the form.

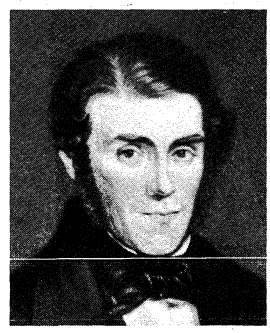
farcy (disease): *see* glanders.

Fard, Wallace D., also called WALLI FARRAD, FARRAD MOHAMMED, F. MOHAMMED ALI, or WALLACE FARD MUHAMMAD (b. *c.* 1877, Mecca—d. 1934?), Mecca-born founder of the Nation of Islām (sometimes called Black Muslim) movement in the United States.

Fard immigrated to the United States sometime before 1930. In that year, he established in Detroit the Temple of Islām as well as the University of Islām, which was the temple's school, and the Fruit of Islām, a corps of male guards. Fard preached that blacks (who were not to be called Negroes) must prepare for an inevitable race war and that Christianity was the religion of slaveowners. Accordingly, he gave his followers Arabic names to replace those that had originated in slavery. Fard offered blacks a credo of moral and cultural superiority to their white oppressors. In 1934 he disappeared without a trace. Members of the movement believe Fard to be the incarnation of Allāh, and his birthday, February 26, is observed as Saviour's Day.

Fardd, Eben, original name EBENEZER THOMAS (b. August 1802, Llanarmon, Caernarvonshire, Wales—d. Feb. 17, 1863), Welsh-language poet, the last of the 19th-century bards to contribute works of genuine poetic distinction to the eisteddfods (poetic competitions).

Fardd's best-known poems include *Dinystr Jerusalem* ("Destruction of Jerusalem"), an ode that won the prize at the Welshpool eisteddfod (1824); *Job,* which won at Liverpool (1840); and *Maes Bosworth* ("Bosworth Field"), which won at Llangollen (1858). In addition to his eisteddfodic compositions, he wrote many hymns, a collection of which was published in 1862. His complete works appeared under the title *Gweithiau Barddonol Eben Fardd* (1875; "Poetic Works of Eben Fardd"). From 1827 he conducted a school at Clynnog, Caernarvonshire.



Fardd, detail of an engraving by Samuel Bellin, 1851, after a painting by Evan Williams

By courtesy of the National Library of Wales, Aberystwyth

Fareham, district (borough), county of Hampshire, England, at the head of a creek opening into the northwestern corner of Portsmouth harbour. It has an area of 29 square miles (74 square km). The district embraces the market town of Fareham and several outlying historic localities. These include Portchester, which was the site of extensive Saxon occupation, a Roman fortress, and a castle built in 1160–72 by Henry II; and Titchfield, with its part-Saxon church and the remains of a 13th-century abbey.

Fareham was known as Fernham in Domesday Book, in which it is mentioned as subject to reduced assessment because of its exposed position and its liability to Danish attacks. It formed part of the original endowment of the see of Winchester. In medieval times it was a free port with considerable trade in wine and wool. A fair was established under grant of Henry III, and in the 18th century it was principally known for the sale of toys; the fair was abolished in 1871.

Fareham's modern trade is in grain, timber, and coal, and its principal industries are boatbuilding and light engineering. Pop. (1986 est.) 95,700.

Fareham, Louise-Renée de Kéroualle, countess of: *see* Portsmouth, Louise-Renée de Kéroualle, duchess of.

Farel, Guillaume (b. 1489, Gap, Dauphiné, Fr.—d. Sept. 13, 1565, Neuchâtel), Reformer and preacher primarily responsible for introducing the Reformation to French-speaking Switzerland, where his efforts led to John Calvin's establishment of the Reformed Church in Geneva.

As a student at the University of Paris, Farel was the pupil and friend of the scholar Jacques Lefèvre d'Étaples, who helped him obtain a professorship to teach grammar and philosophy at the Collège Cardinal Lemoine in Paris. Farel soon became regent of the college. He converted to the beliefs of the Protestant Reformation sometime before 1521, the year he was appointed a diocesan preacher by the Reformist bishop of Meaux, Guillaume Briçonnet.

The reform movement's slowness clashed with Farel's impatient temperament, and he returned to Paris in 1523. Persecution of Reformers there soon forced him to flee to Basel, Switz., but a dispute with the humanist Desiderius Erasmus brought about his banishment. For two years Farel preached in Montbéliard, Strasbourg, Basel, and Bern, finally settling in Aigle, Valais, where he preached from 1526 to 1529. In 1530 he moved to Neuchâtel and then to Geneva (1532), which declared its support for the Reformation in 1536. He had become the leading French Reformer, and he persuaded John Calvin, who was passing through Geneva in October 1536, to remain there and become his assistant. In 1538, by which time Calvin had gained equal stature to that of Farel, both men were expelled from Geneva. Farel went to Neuchâtel and after some further wandering returned to Neuchâtel in 1543, making it the centre of his activities for the rest of his life.

He became increasingly influenced by Calvin. An evangelical with a vigorous preaching style, Farel was held in considerable respect by his contemporaries, including Theodore Beza, the French Reformer and successor to Calvin at Geneva, who said Farel's word was like thunder. Even the independent-minded Calvin had shuddered and obeyed when Farel declared his life of study accursed by God.

Although none of Farel's sermons are extant, several of his French books remain, including an elementary dogmatics, a liturgy, a polemic against the Libertine party, and an anti-Catholic attack on the use of images and relics.

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

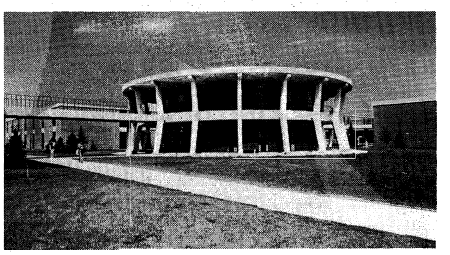
Farès, Nabile (b. 1941, Collo, Alg.), Kabylian novelist and poet known for his abstruse, poetic, and dreamlike style. Rebellion against the established religious traditions and the newly formed conventions of Algeria since independence is central to his work.

In his first novel, *Yahia, pas de chance* (1970; "Yahia, No Chance"), Farès introduced a quest that was to haunt his later works; the search for the self takes him back to his childhood, and further still, to the pre-Islāmic voices of inspiration tied to the earth. Farès' successive novels—*Un Passager de l'Occident* (1971; "A Passenger from the West") and the trilogy "La Découverte du nouveau monde" ("The Discovery of the New World"), including *Le Champs des oliviers* (1972; "The Olive-tree Groves"), *Mémoire de l'absent* (1974; "Memory of the Absent"), and *L'Exil et le désarroi* (1976; "Exile and Disorder")—carry forward the diffuse style and themes of lost innocence and delirium. The past is traced to the mixed origins engendered by Berber, Muslim, and French influences: the semimythical queen Kahena, the Bedouin invader, and the European colonizer are traced and identified as the source of the *métissage*—the cultural intermingling, or mixed identity. Farès's work demands the death of the identity and the explosion of the New City (the sign of Algeria since independence), in order that a truly new world may be forged.

In his novels, Farès sought to create a style that would match the explosive quality of his theme. Thus, form and prose burst into poetic and dramatic shape and, at the extreme, act through pure accumulation or conjunction of rapid-fire language, often having the effect of concrete poetry. Indeed, so violent is the explosion of words, whole passages are at times reduced to fragmented letters barely able to be pieced together.

Farès wrote two volumes of poetry, *Le Chant d'Akli* (1971; "The Song of Akli") and *Chants d'histoire et de vie pour des roses de sable: Texte bilingue pour un peuple sahrawi* (1978). The latter, written in Spanish and French, is a celebration of the struggle of the Saharoui people against the partition of the territory of the Spanish Sahara.

Fargo, seat (1873) of Cass County and the largest city of North Dakota, U.S., on the Red River of the North, opposite Moorhead, Minn. Founded in 1871 by the Northern Pacific Railway, it served as an outfitting post for settlers, with its rail, steamboat, and stagecoach facilities. It was named for William George Fargo (of Wells, Fargo & Company), a pioneer in the shipment of goods by express. The development of wheat growing in the area consolidated Fargo's role as a transportation, marketing, and distribution centre. North Dakota State University (established in Fargo as an agricultural college in 1890) is a noted centre of agricultural research. Local industries include the manufacture of farm implements, autos and accessories, and fertilizer. The meat-packing plants and stockyards in suburban West Fargo rank among the nation's largest. The city is also a regional financial and medical centre. The Cass County Historical Society Museum and the Forsberg House in Fargo have collections of pioneer relics. Bonanzaville, U.S.A., near West Fargo, is a reconstruction of the area's 19th-century farming boom. Inc. city, 1875. Pop. (1982 est.) 62,596.



Engineering Department office, North Dakota State University, Fargo, N.D.
Milt and Joan Mann from CameraMann

Fargo, William George (b. May 20, 1818, Pompey, N.Y., U.S.—d. Aug. 3, 1881, Buffalo, N.Y.), pioneer American businessman, one of the founders of Wells, Fargo & Company.

Fargo began his long association with Henry Wells (*q.v.*) when he served as an agent for Livingston, Wells, and Pomeroy's Express in 1843. The following year, together with Wells and Daniel Dunning, he founded Wells and Company, the first express company to operate west of Buffalo, N.Y. When that company was merged with Livingston, Wells, and Pomeroy's Express and Butterfield, Wasson, and Company in 1850, Fargo became secretary and Wells president of the new American Express Company (*q.v.*).

In 1852 the two men founded Wells, Fargo & Company (*q.v.*) to serve the growing West. When Wells retired in 1868, Fargo became president of the American Express Company, a post he held until his death.

Fargo served two terms (1862–66) as mayor of Buffalo but was defeated as a candidate for the New York Senate (1871).

Fargue, Léon-Paul (b. March 4, 1876, Paris—d. Nov. 25, 1947, Paris), French poet and essayist whose work spanned numerous literary movements.

Before he reached 20 years of age, Fargue had already published his important poem *Tancrède* in the magazine *Pan* (1895; published in book form in 1911) and had become a member of the Symbolist circle connected with *Le Mercure de France*. His first collection of verse, *Poèmes*, was published in 1912 and reissued in 1918. Later works include *Pour la musique* (1919; "For Music"), *Espaces* (1929; "Spaces"), and *Sous la lampe* (1929; "Under the Lamp").

After 1930 Fargue devoted himself almost exclusively to journalism, writing newspaper columns and longer, lyrical essays about Parisian life. It is for these and the prose-poem memoirs collected in *Le Piéton de Paris* (1939; "The Parisian Pedestrian") that he is chiefly remembered.

Fargue's works have been linked with the Dadaists (for their juxtaposition of images), the Cubists (for their dislocation and deformation of words), and the Surrealists (for their fascination with dreams). Fargue helped found the *Nouvelle Revue Française* in 1912, contributed to the first issue of the Surrealist magazine *Litterature* in 1919, codirected the experimental journal *Commerce* in the 1920s, and was a friend of many writers, artists, and composers, including Pablo Picasso and Igor Stravinsky.

Farhād (Parthian kings): *see under* Phraates.

Fārī'ah, Tall al-, ancient site in northern Palestine, located near the head of the Wādī al-Fārī'ah northeast of Nābulus in Israeli-occupied Jordan. Excavations at the site, sponsored since 1946 by the Dominican École Biblique de St. Étienne in Jerusalem, have revealed that occupation began during the Chalcolithic Age (*c.* 4000–*c.* 3000 BC), although no actual structures have been found antedating the beginning of the Early Bronze Age (*c.* 3200–*c.* 2300). Though the site was massively fortified, it appears to have been deserted from about 2950 to about 1900. Thereafter, it gradually regained its importance, and the succeeding building stages seem to confirm the identification of the site with Tirzah, one of the capitals of northern Israel during the 9th century. The site was destroyed by the Assyrians in 722 and was finally abandoned about 600 BC.

Faribault, city, seat of Rice County, southeastern Minnesota, U.S., at the confluence of the Cannon and Straight rivers, in a mixed-farming and lake area, 53 mi (85 km) south of St. Paul. Established in 1826 as a fur-trading post by Alexander Faribault (whose house [1853] still stands), it was the centre for the Indian missions of Henry B. Whipple, first Episcopal bishop of Minnesota, who organized Seabury Divinity School (1858), Shattuck School (1867; now a military academy), and St. Mary's Hall, a school for girls. State schools for the deaf (1863), blind (1874), and mentally retarded (1879) and the Ephphatha Church for the deaf and blind are in the city. Large nurseries specialize in peonies and chrysanthemums, and a variety of goods are manufactured, notably woolens. Blue cheese is cured in caves along the Straight River. Inc. 1872. Pop. (1982 est.) 16,536.

Farīd Khān: *see* Shēr Shāh of Sūr.

Farīd od-Dīn Abū-Ḥamīd Moḥammad: *see* ʿAṭṭār, Farīd od-Dīn (Moḥammad ebn Ebrāhīm).

Farīdābād, town, southeastern Haryāna state, northwestern India, connected by road with Delhi (north) and Mathura (southeast). It is a local market for wheat, sugarcane, and cotton. Founded in 1607 by Shaikh Farīd, Emperor Jahāngīr's treasurer, to protect the Delhi–Āgra high road, it was constituted a municipality in 1867. A project for Pakistani refugee resettlement and light industrial development was initiated in the town in 1950.

The area about Farīdābād comprises part of the southern Punjab Plains. Agriculture and industry are both economically important; jowar (sorghum) and bajra (pearl millet) are grown. Pop. (1981) town, 330,864.

Farīdkot, town, southwestern Punjab state, northwestern India, 70 miles (116 km) southwest of Ludhiāna town. It was founded by Bhallan of the Burai Jāṭ (a warrior community of northern India) during the 16th-century reign of the Mughal emperor Akbar. It later came under British rule. Seized in 1803 by Ranjit Singh, the Sikh ruler of the historic Punjab, it was subsequently restored to the British by the Treaty of Amritsar in 1809. Situated in a cotton-producing area, the town's industries include cotton ginning and baling, powerloom weaving, steel rolling, and metal founding; agricultural implements, machine tools, bicycles, and sewing machines are manufactured. Pop. (1981) town, 42,423.

Articles are alphabetized word by word, not letter by letter

Farīdpur, city, central Bangladesh, on the west bank of the Marā (Dead) Padma stream, a tributary of the Padma. It serves as a rail terminus for the branch line connecting Goalundo Ghāt with Calcutta and is linked by road with Kushtia, Meherpur, Khulna, Barisāl, and Jessore. The city takes its name from the Muslim saint Farīd-ud-Dīn Masʿūd, whose shrine is located there. Constituted a municipality in 1869, it has a thermal power station, jute mills, and five government colleges affiliated with the University of Dhākā. Pop. (1981 prelim.) city, 66,911.

Farigoule, Louis-Henri-Jean: *see* Romains, Jules.

Farim, town, north central Guinea-Bissau, West Africa, on the Rio Cacheu. It is a market centre for the agricultural products of the interior; peanut (groundnut) cultivation, concentrated around the town, is mainly for export, and cattle are raised for domestic consumption in the northern savannas of the region. There are phosphate deposits near the town. Farim is connected by road to Bissau, the national capital, and it marks the limit of navigation of the Rio Cacheu. Pop. (1979) mun., 26,242.

Farina, Giuseppe, byname NINO (b. 1906, Turin, Italy—d. June 30, 1966, near Chambéry, Fr.), Italian automobile racing driver who was the first to win the world driving championship according to the modern point system.

Farina, the holder of a doctorate in engineering, was the Italian driving champion in 1937, 1938, and 1939. He won the world title in 1950 while driving for Alfa Romeo. He was killed in a road accident.

Farinacci, Prospero, Latin FARINACCIUS (b. Oct. 30, 1544, Rome—d. Oct. 30, 1618, Rome), Italian jurist whose *Praxis et Theorica Criminalis* (1616) was the strongest influence on penology in Roman-law countries until the reforms of the criminologist-economist Cesare Beccaria (1738–94). The *Praxis* is most noteworthy as the definitive work on the jurisprudence of torture.

After studying at Padua and earning a reputation as an advocate, Farinacci entered papal service under Clement VIII and was procurator general to Paul V. A staunch churchman, Farinacci upheld the inviolability of the confessional seal against all theories of state necessity.

Farinacci, Roberto (b. Oct. 16, 1892, Isernia, Italy—d. April 28, 1945, Vimercate), radical Italian politician and Fascist *ras,* or local party boss, who helped Benito Mussolini rise to power in 1922 and who became an important figure in the Fascist regime.

After dropping out of school to work for the railroad in Cremona (1909), Farinacci became an ardent Socialist. When World War I broke out, he advocated Italian intervention, and after the war he became attracted to Mussolini. Farinacci founded the Fascist daily *Cremona nuova* and was the main party organizer in Cremona. Under Farinacci, the Fascist *squadre d'azione* (armed squads) engaged in brutal repression and violence, often incurring Mussolini's disfavour, especially by forcibly taking over Cremona (July 1922).

Farinacci, continually critical of Mussolini for being too cautious and moderate, had many followers and probably hastened the Fascist ascendancy. Appointed secretary general of the party (February 1925), Farinacci insisted upon defying Mussolini and was allowed to resign in March 1926.

Farinacci practiced law until he was recalled to power in 1935. He became Mussolini's main contact with the Germans and urged Italy's entry into World War II, which proved disastrous. When Mussolini was overthrown (July 1943), Farinacci, protected by the Germans, escaped arrest. He returned to Cremona but tried to flee Italy when the Allies advanced northward. Recognized by Italian partisans, he was tried and executed by a firing squad.

Farinati, Paolo, Farinati also spelled FARINATO (b. *c.* 1524, Verona [Italy]—d. *c.* 1606), Italian painter, engraver, and architect, one of the leading 16th-century painters at Verona.

Farinati's father, Giovanni Battista, was also a painter and may have been his first master; later he probably worked under Nicolò Giolfino. Farinati was active almost entirely in Verona. According to Carlo Ridolfi, a Madonna painted by Farinati attracted the attention of Philip II of Spain when passing through Villafranca on Jan. 17, 1549. The first certain date is 1553, for by March of that year his St. Martin altarpiece for the cathedral at Mantua (still there) is recorded as finished; further dated pictures occur at intervals, the last in 1603 ("Miracle of the Loaves and Fishes" in San Giorgio in Braida, Verona). Most of his vast output of paintings was for churches in Verona and its environs, where much of it has survived. He was strongly influenced by his younger contemporary Paolo Veronese and also by Parmigianino, among others. He also executed a few engravings, some architectural projects (which apparently included work on the Castello San Felice at Verona), and very many drawings. It is by his drawings that he is most widely known and represented.

Farinati's last years were divided between domestic squabbles with his sons and furtherance of his belief that he was related to the noble Florentine family of Farinati degli Uberti.

Farinelli, original name CARLO BROSCHI (b. Jan. 24, 1705, Andria, Kingdom of Naples [Italy]—d. July 15, 1782, Bologna), celebrated Italian castrato singer of the 18th century and one of the greatest singers in the history of opera. He adopted the surname of his benefactors, the brothers Farina.

He studied in Naples under Nicola Porpora, one of the leading 18th-century opera composers and the outstanding voice teacher of the century. At 16 he made his debut at Rome in Porpora's *Eomene.* Later he sang in Porpora's *Angelico e Medoro,* with a text by the famed librettist Pietro Metastasio, with whom Farinelli formed a close friendship. Farinelli's reputation spread throughout Italy and to Vienna and London, and he was admired for his pure, powerful voice, his technical proficiency, his skill in florid embellishment, and his musical expression. In Venice he was associated with the noted opera composer Johann Adolf Hasse. In 1734 he joined Porpora in London, appearing in his operas and, with the castrato Senesino, in Hasse's opera *Artaserse.*

In 1737 Farinelli went to Spain, where his singing alleviated the deep-seated melancholia of Philip V; nightly for 10 years he sang the same four songs to Philip. He stayed in Spain until 1759, achieving distinction as an impresario and also taking an active part in public affairs. Though dismissed from his post at court by Charles III for political differences, he had accumulated great wealth and spent the rest of his life peacefully in Italy.

Farini, Luigi Carlo (b. Oct. 22, 1812, Russi, Kingdom of Italy—d. Aug. 1, 1866, Quarto, Italy), Italian, physician, historian, and statesman of the Risorgimento who did much to bring central Italy into union with the north.

After participating in the revolutionary uprisings of 1831, Farini received his medical degree at Bologna and went into practice. Exiled from the Papal States and from Tuscany, he drafted the manifesto of the Rimini movement (1845), which aimed at forcing the papacy to institute reforms. When this movement failed, Farini became the private physician of Prince Jérôme Bonaparte and traveled about Europe.

Under an amnesty granted by the new pope, Pius IX, Farini returned to Italy. He practiced medicine and held several government posts in Rome before leaving in protest of papal policy.

From 1849 to 1865 Farini was a deputy in the Piedmontese legislature at Turin, where he contributed to several journals. In 1850 he wrote the violently antirevolutionary *Storia della stato romano dal 1815 al 1850* ("History of the Roman State from 1815 to 1850"). Throughout this period he supported the liberal monarchist Count Camillo Cavour, and together they served in the Cabinet of Massimo d'Azeglio—Farini as minister of public instruction (October 1851–May 1852). A coalition (*connubio*) of Liberals of the Right Centre and Left Centre parties was arranged by the two men (Feb. 5, 1852) and led directly to Cavour's ascendancy to the premiership.

In 1859 Farini was appointed Piedmontese dictator of Modena (in central Italy) following the outbreak of war with Austria. He established a league of central states (Modena, Tuscany, Romagna, and Parma) for mutual protection. Under Farini's leadership, the league voted to be annexed to Piedmont. Farini gained the approval of Piedmont's ally, Napoleon III of France (August 1860), by assuring him that Rome would not be annexed.

Cavour sent Farini to govern Naples, which had been won for Victor Emmanuel II of Sardinia–Piedmont by Giuseppe Garibaldi. In ill health, Farini ruled badly. On poor terms with the Garibaldians, he resigned and returned to Turin, resuming his post of minister of interior. He became premier of the Kingdom of Italy in December 1862 but resigned four months later because of continuing ill health.

Farjeon, Eleanor (b. Feb. 13, 1881, London—d. June 5, 1965, Hampstead, London), English writer for children whose magical but unsentimental tales, which often mock the be-

haviour of adults, earned her a revered place in many British nurseries.

The daughter of a British novelist and granddaughter of a U.S. actor, Eleanor Farjeon grew up in the bohemian literary and dramatic circles of London. Attending opera and theatre at 4 and writing on her father's typewriter at 7, Farjeon came to public attention at 16 as the librettist of an opera, with music by her brother Harry, which was produced by the Royal Academy of Music.

Her success with *Nursery Rhymes of London Town* (1916), simple tunes originally for adults but adapted and sung in junior schools throughout England, spurred her writing. In addition to such favourites as *Martin Pippin in the Apple Orchard* (1921) and *The Little Bookroom* (1955), which won the Carnegie Medal and the first Hans Christian Anderson Award, Farjeon's prolific writings include children's educational books, among them *Kings and Queens* (1932; with Herbert Farjeon); adult books; and memoirs, notably *A Nursery in the Nineties* (1935; rev. ed. 1960).

Farley, James A(loysius) (b. May 30, 1888, Grassy Point, N.Y., U.S.—d. June 9, 1976, New York City), U.S. politician who engineered electoral triumphs for Franklin D. Roosevelt. Farley served as postmaster general until breaking with Roosevelt in 1940 to make his own bid for the presidency.

After moving to New York City in 1905, Farley studied bookkeeping and worked for the Universal Gypsum Company. He moved back to Stony Point, near his native town, where he served as township clerk for three terms (1912–19). His marked political abilities, especially in the business of person-to-person campaigning, caused him to rise in the party ranks, and in 1918, in reward for campaign services that year, he was appointed by Gov. Alfred E. Smith to the post of warden of the port of New York, a job that was abolished the next year.

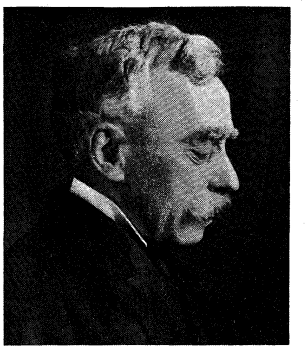
During the 1920s, Farley served as chairman of the Rockland County Democratic Committee. He served one term in the legislature (1923–24) before being appointed (again by Smith, whose reelection Farley had masterminded) to the state athletic commission. In 1926 he resigned his position at Universal Gypsum to establish his own business firm.

Farley's career truly came to life in 1928, when he became secretary of the New York State Democratic Committee and organized Franklin Roosevelt's successful gubernatorial campaign. He ran Roosevelt's reelection campaign in 1930, the year he also became chairman of the state committee. Convinced that Roosevelt could win the party's presidential nomination in 1932, Farley travelled the country in his behalf. At the convention, he arranged the deal whereby John N. Garner of Texas received the vice-presidential nomination in return for support of Roosevelt by the Texas and California delegations.

As the newly appointed chairman of the Democratic National Committee, Farley directed the 1932 campaign and was rewarded with a Cabinet appointment as postmaster general. In charge of patronage for the triumphant Democrats, Farley made some enemies; but his buoyant good humour kept him a popular figure. He repeated his masterful campaign direction in 1936, but a rift between Farley and Roosevelt gradually developed. In 1940 Farley resigned from the Cabinet and, because of his opposition to Roosevelt's third-term bid, allowed his own name to go before the convention that year. In 1944, as chairman of the New York State Democratic Committee, he again opposed Roosevelt's reelection bid. Farley then dropped out of politics in order to devote his energies to private enterprise, retiring in 1973.

Farlovian Stage, division of the Old Red Sandstone of the Devonian Period of western Europe (the Devonian Period began about 395,000,000 years ago and lasted about 50,000,000 years); the Farlovian Stage follows the Breconian and was named for exposures studied near the town of Farlow, in the English Midlands. Farlovian rocks consist of gray and yellow sandstones and shales that contain the primitive Upper Devonian fishlike vertebrates *Bothriolepis* and *Holoptychius.* Farlovian rocks were produced by strongly flowing rivers.

Farlow, William Gilson (b. Dec. 17, 1844, Boston—d. June 3, 1919, Cambridge, Mass.), mycologist and plant pathologist who pioneered investigations in plant pathology; his course in this subject was the first taught in the United States.



Farlow

By courtesy of the Harshberger Collection, University of Pennsylvania, and the Hunt Institute, Pittsburgh

After receiving the M.D. degree from Harvard University (1870), Farlow studied in Europe until 1874, when he became professor of cryptogamic botany (the study of flowerless and seedless plants) at Harvard, a post he held until his death. Farlow's publications were mainly on taxonomic and bibliographic phases of mycology, (the study of fungi), but he also wrote articles on algae, lichens, and ferns. His extensive library and collections of fungi, algae, lichens, and mosses became the nucleus of Harvard University's Farlow Research Library and herbarium.

farm machinery, mechanical devices, including tractors and implements, used in farming to save labour. Farm machines include a great variety of devices with a wide range of complexity: from simple hand-held implements used since prehistoric times to the complex harvesters of modern mechanized agriculture.

The operations of farming for which machines are used are diverse. For crop production they include handling of residues from previous crops; primary and secondary tillage of the soil; fertilizer distribution and application; seeding, planting, and transplanting; cultivation; pest control; harvesting; transportation; storage; premarketing processing; drainage; irrigation and erosion control; and water conservation. Livestock production, which not so long ago depended primarily on the pitchfork and scoop shovel, now uses many complicated and highly sophisticated machines for handling water, feed, bedding, and manure, as well as for the many special operations involved in producing milk and eggs.

In the early 19th century, animals were the chief source of power in farming. Later in the century, steam power gained in importance. During World War I gasoline- (petrol-) powered tractors became common, and diesel engines later became prevalent. In the developed countries, the number of farm workers has steadily declined in the 20th century, while farm production has increased because of the use of machinery.

Farman, Henri (b. 1874, Paris—d. July 18, 1958, Paris), French aviator and aircraft constructor who developed ailerons for lateral control, an innovation that subsequently came into general use on all planes.

Born to British parents, he was first a painter and later a racing motorist. With his brother Maurice he modified a Voisin pusher biplane and in January 1908 won a £2,000 prize that had been offered for a circular flight of one kilometre. In 1909 he set world endurance and speed records. In 1912 the brothers merged their interests in the Farman works at Boulogne-sur-Seine, making many planes of their characteristic pusher biplane type for military and training purposes. The 1914 model was extensively used for artillery observation and reconnaissance in World War I. The Farman "Goliath" was the first long-distance passenger airliner, beginning regular Paris–London flights on Feb. 8, 1919. Farman became a French citizen in 1937.

Farman, Maurice (b. March 21, 1877, Paris—d. Feb. 25, 1964, Paris), French aircraft designer and manufacturer who contributed greatly to early aviation.

A champion bicyclist, he also distinguished himself as an automobile racing driver. With his brother Henri, Maurice made the first circular flight of more than one kilometre in 1908, completing a 1.6-kilometre (one-mile) flight near Paris. The following year he built his first airplane. His early craft were modifications of the Voisin biplane. The most successful was the Longhorn, first built in 1912. By the beginning of World War I, it was one of the standard trainers in France and Great Britain.

Maurice Farman, 1909

H. Roger-Viollet

In 1911 Maurice made pioneering experiments in aerial radiotelephony. The following year the Farman brothers pooled their manufacturing resources, although they still designed their planes individually. Their company prospered during World War I, and in 1917 they introduced the "Goliath," the first long-distance passenger plane, which from 1919 made regular flights between Paris and London, greatly stimulating commercial aviation in France and the rest of Europe.

Farmer–Labor Party, in U.S. history (1918–44), a minor political party of Minnesotan small farmers and urban workers, which supported Robert M. La Follette in the 1924 presidential election and Franklin D. Roosevelt in 1932 and 1936. An outgrowth of the Nonpartisan League (*q.v.*), the Farmer–Labor Party began nominating candidates for the Minnesota legislature in 1918. Several state senators and representatives were elected from the party, which became a federation in 1923.

Its candidate, Floyd B. Olson, was elected governor in 1930, reelected in 1932 and 1934. The party merged with the Democrats to form the Democratic-Farmer-Labor Party in 1944.

An offshoot, the National Farmer–Labor Party, nominated P.P. Christensen in the 1920 presidential election. Lacking adequate finances and organization, the party won few votes and expired in 1923.

Farmer's Almanac, also called OLD FARMER'S ALMANAC, annual journal containing weather prognostications, planting schedules, astronomical tables, astrological lore, recipes, anecdotes, and sundry pleasantries of rural interest, first published by Robert B. Thomas in 1792 for the year 1793. The almanac issued long-range weather forecasts, based on esoteric interpretations of natural phenomena, long before the United States Weather Bureau or any other weather service existed, and generations of farmers planted and harvested according to its advice. The word old was added to the name in 1830 to distinguish the journal from imposters. The almanac has been in continuous publication for longer than any other American journal.

Farmer's Law, Latin LEGES RUSTICAE, Byzantine legal code drawn up in the 8th century AD, probably during the reign of Emperor Leo III the Isaurian (717–741), which focused largely on matters concerning the peasantry and the villages in which they lived. It protected the farmer's property and established penalties for misdemeanors committed by the villagers. It was designed for a growing class of free peasantry, supplemented by the influx of Slavic peoples into the empire, that became a dominant social class in later centuries.

Its provisions concerned property damage, various kinds of theft, and taxation. The village was regarded as a fiscal unit, and payment of a communal tax was required of all members of the community. The land and crops of delinquent farmers could be appropriated by anyone willing to pay the tax.

The significance of the Farmer's Law lay in its axiom that the landowner was also a taxpayer; its influence was widespread, having an impact on legal developments among the south and east Slavs, particularly in Serbia.

farmer's lung, also called THRESHER'S LUNG, or HARVESTER'S LUNG, pulmonary disorder causing sudden onset of breathlessness; fever; a rapid heartbeat; cough, especially in the morning; copious production of phlegm; and a general sense of feeling ill. The disease results from the development of hypersensitivity to inhaled dust from moldy hay or other fodder. Acute attacks may last a few days to several weeks. In its chronic form, farmer's lung may persist for years and lead to respiratory failure from chronic bronchitis or pulmonary fibrosis. Avoidance of offending dusts is the most effective treatment.

Farmer's lung is the prototype of a number of diseases that are categorized as hypersensitivity pneumonitis; these include pigeon breeder's lung (also called bird fancier's, or bird breeder's, lung), mushroom worker's lung, cheese-washer's lung, and coffee worker's lung.

Farmers' Nonpartisan League: *see* Nonpartisan League.

farming: *see under* descriptive word (*e.g.,* tenant farming; subsistence farming).

For international statistics on farming and farms worldwide, *see* BRITANNICA WORLD DATA ANNUAL.

Farmington, town (township), Hartford county, central Connecticut, U.S., on the Farmington River. Early settlement centred on the plantation of Tunxis (Tunxes), which was renamed for Farmington, Eng., and incorporated in 1645. After the American Revolution, the town underwent an industrial boom that lasted until the early 19th century. Its products during the peak years of 1802 and 1803 included linen, hats, buttons, and muskets. The boroughs of Unionville and Farmington were consolidated with the town in 1947. Farmington now is mainly residential. It is the home of Miss Porter's School (1843), a private school for girls, and Tunxis Community College (1970). Of historical interest are the Farmington Museum (1660), Congregational Church (1770), and the Hill-Stead Museum (1901). Pop. (1987 est.) 17,955.

Farmington, town, seat (1838) of Franklin county, west-central Maine, U.S., on the Sandy River, 38 miles (61 km) northwest of Augusta. Settled in 1781, it was incorporated in 1794 and was named for its location in a good farming region. It developed as an agricultural trade centre, particularly of vegetables and corn (maize), and has canneries and light manufacturing. The University of Maine at Farmington originated as a normal school (founded in 1812). The Nordica Homestead Museum houses memorabilia of the operatic career of Lillian Nordica (1859–1914), a native of Farmington. Titcomb Memorial Ski Slope is 2 miles (3 km) west. Pop. (1984 est.) 6,980.

Farmington, city, San Juan county, northwestern New Mexico, U.S., at the confluence of the San Juan, Animas, and La Plata rivers. Settled in 1876, when Indian lands were opened to homesteaders, it was incorporated in 1901 and became a small farming community and distribution point for the nearby Ute Mountain and Navaho Indian reservations. Growth was stimulated by the discovery of coal, oil, and natural gas in the 1950s. The construction of Navajo Dam and petroleum-processing plants influenced light-industrial development. A branch of New Mexico State University is in the city. Aztec Ruins National Monument is 14 miles (23 km) northeast, and the Salmon (Pueblo) Ruins are 12 miles (19 km) east. Pop. (1987 est.) 39,583.

Farmington River, river, southern Liberia, western Africa. It is Liberia's only river of commercial importance. It rises in the Bong Range and flows south-southwest for 75 miles (120 km) to the Atlantic coast at Marshall, where the Gbage and Junk rivers join its estuary. The river is navigable for 10 miles (16 km) below Harbel, the Firestone Plantations Company port from which rubber is shipped to Monrovia (30 miles [48 km] west-northwest of the river's mouth) for export.

Farnaby, Giles (b. *c.* 1560, Truro, Cornwall, Eng.—d. 1640, London), English composer of virginal music and madrigals who ranks with the greatest keyboard composers of his day.

Farnaby was said to have come from the family of the schoolmaster and scholar Thomas Farnaby of Truro. He graduated as a bachelor of music from the University of Oxford in 1592. A cousin, Nicholas, was a maker of the small spinet of the day, the virginal, and Giles may have begun his musical activity in that way. His marked disregard for the prevailing conventions of written counterpoint seems to suggest the approach of a virginal player rather than that of a church-trained organist. Of the 52 pieces by him in the Fitzwilliam Virginal Book, an early 17th-century collection, the most individual are such short and intimate ones as "His Dream" and "His Rest." His larger sets of variations exploit a vein of virtuosity scarcely inferior to that of his eminent contemporary John Bull. Farnaby also composed a set of fresh but unimportant canzonets (1598) and a number of psalm settings.

His son Richard is represented by four pieces in the same collection.

Farne Islands, group of islets and reefs, lying 1.5 to 6 miles (2.5 to 10 km) off the North Sea coast of the county of Northumberland, England. The islands are composed of resistant dolerite rocks, and the largest, House (16 acres [6.5 hectares]), has precipitous cliffs reaching up to 80 feet (24 m) in height. The group is preserved as a bird sanctuary by the National Trust. The lighthouse on Long Stone was the home of Grace Darling, Victorian heroine of sea-rescue fame; the modern lighthouse is on Inner Farne.

Farnese FAMILY, an Italian family that ruled the Parma duchies from 1545 to 1731. Originating in upper Lazio, the family soon became noted through its statesmen and its soldiers, especially in the 14th and 15th centuries.

The first of its most celebrated members was Alessandro (1468–1549), the future Pope Paul III (*see* Paul III *under* Paul [Papacy]). His vast culture, as well as the love affair of his sister Giulia with Pope Alexander VI, assured his rapid rise at the Roman court. A cardinal from the age of 25, he was elected pope on Oct. 13, 1534, after a compromise reached by the French and the imperial parties. In the prevailing spirit of nepotism, Paul III, at the consistory of Aug. 19, 1545, detached Parma and Piacenza from the papal dominions and erected them into duchies.

Pier Luigi (1503–47), the first duke, was Paul's son by a woman whose name is unknown. He instituted a supreme council of justice and a ducal chamber, ordered a census of the population, reduced the Valtarese to submission, and curbed the power of the feudal lords. Pier Luigi's second son and successor, Ottavio (1542–86), made Parma his capital instead of Piacenza and continued his father's work of internal consolidation and the struggle against the feudal lords. He harshly repressed a conspiracy in 1582 and subdued the Valtarese again. Pier Luigi's eldest son, Alessandro (1520–89), had been created cardinal at 14. A patron of scholars and artists, it was he who completed the magnificent Farnese palaces in Rome and at Caprarola.

The third duke, Alessandro (1545–92), Ottavio's son, was the most distinguished male member of the Farnese family (*see* Farnese, Alessandro, duca di Parma e Piacenza). Educated at the court of Madrid, where he had been sent as a hostage according to a clause in the treaty of Ghent, he followed a career of arms and, after his father's death, continued in command of the Spanish forces in Flanders because Philip II would not agree to his return to Parma, of which he was duke only in name.

Alessandro was succeeded in 1592 by his son Ranuccio I (1569–1622), who had been regent since 1586. In 1612 Ranuccio ferociously repressed a conspiracy of the nobles, which was provoked by a further diminution of the privileges of the local feudatories but was abetted by the Gonzaga dukes of Mantua and perhaps also by the house of Savoy.

Ranuccio's son and successor Odoardo I (1612–46), ambitious and impulsive, engaged in inconclusive campaigns and diplomacy during the Thirty Years' War. His eldest son, Ranuccio II (1630–94), who succeeded him in 1646, inherited a heavy financial and diplomatic burden. In 1649 Pope Innocent X accused the Farnese of the murder of an ecclesiastic and seized the fief; Ranuccio declared war but was utterly defeated at Bologna (August 13). Although the duchy survived, it remained on the whole precarious, one of the reasons being the continual passage of troops during the War of the Grand Alliance.

Francesco (1678–1727), son of Ranuccio II and his successor in 1694, attempted to save the fortunes of the state and of the dynasty, now in utter decadence, by his economic and diplomatic initiative, but his only important success was the marriage of his niece Elisabetta (*see* Isabella) to Philip V of Spain in 1714, which enabled him to pursue a plan for an anti-Austrian league in Italy.

The last Farnese of the male line was Antonio (1679–1731), duke from 1727. Parma and Piacenza passed to Don Carlos (the future Charles III of Spain), Philip V's eldest son by Isabella.

Farnese, Alessandro: *see* Paul III *under* Paul (Papacy).

Farnese, Alessandro, DUCA (duke) DI PARMA E PIACENZA (b. Aug. 27, 1545, Rome—d. Dec. 3, 1592, Arras, Fr.), regent of the Netherlands (1578–92) for Philip II, the Habsburg king of Spain. He was primarily

Alessandro Farnese, duke of Parma, oil painting by Frans Pourbus the Elder; in the Galleria Nazionale, Parma, Italy

By courtesy of the Soprintendenza alle Gallerie di Parma, Italy

responsible for maintaining Spanish control there and for perpetuating Roman Catholicism in the southern provinces (now Belgium). In 1586 he succeeded his father as duke of Parma and Piacenza, but he never returned to Italy to rule.

Heritage and early career. The family of condottieri (chiefs of bands of mercenaries) into which Alessandro Farnese was born obtained its high position in the 15th century in the service of the popes, as well as through a custom of contracting politically useful marriages. A Farnese even became pope in 1534, assuming the name of Paul III; he set up the papal states of Parma and Piacenza as a duchy in order to award them to his illegitimate son Pier Luigi. A son of Pier Luigi, Ottavio (duke of Parma from 1547 to 1586), married Margaret of Austria, the illegitimate daughter of the Habsburg emperor Charles V; and from this union twins were born on Aug. 27, 1545, only one of whom, Alessandro, survived.

The lineage of his mother and the quarrels of his father with the Emperor determined Alessandro's destiny. When still a child, he was sent to the court of Philip II of Spain, another member of the Habsburg family, as a guarantee of Duke Ottavio's loyalty to the Habsburgs. Philip was then in Brussels, in the Netherlands, and Alessandro stayed there from 1556 to 1559, becoming acquainted with men who would be the principal actors in the dramatic religious and political conflict soon to tear the Netherlands asunder. In 1559 he went to Madrid, where he became a friend of the royal family. He next returned to the Netherlands, in 1565, where his mother, Margaret of Parma, had been regent for six years. In the same year, at the age of 20, he married the Portuguese infanta Maria after protracted matrimonial negotiations. He did not meet his betrothed until two days before his marriage, and the household that established itself at Parma in 1566 was not particularly happy, since the chief interests of the young husband remained hunting, riding, and warfare. Farnese's correspondence of this period is filled with complaints of his enforced idleness.

The opportunity for action that he had so long awaited arrived unexpectedly in 1571, when, appointed as a lieutenant to Don John of Austria, he fought brilliantly against the Turks in the Battle of Lepanto. The following year, however, Farnese returned, not without resentment, to Parma. Religious disturbances in the Netherlands soon freed him from inactivity when, in 1577, Don John, by then the Spanish governor general, charged with suppressing the revolt, appealed for his support. In 1578 Farnese fought energetically in the Battle of Gembloux, in which the rebellious Dutch forces were routed, and punished a number of towns with a harshness that contrasts with his subsequent attitude.

Promotion to governor general. Don John died Oct. 1, 1578, and a few days later Philip II appointed Farnese as governor general of the Netherlands. For the first time the sovereign had made a fortunate choice. Farnese had intellectual flexibility, which in the Netherlands contrasted favourably with the severity and sectarianism of earlier Spanish governors. He was a great soldier, with a fundamental knowledge of his profession. A sociable man, gifted with considerable natural attraction, he rejected all fanaticism. In many ways he resembled his foe William of Orange, who had also, for the first time, encountered an adversary of his own stature.

Thus, Farnese began, at the age of 34, a brilliant career, which ended only with his death. He immediately showed the full measure of his astuteness by undertaking a diplomatic reconciliation with the Dutch states that had Catholic majorities, while continuing military operations against the Union of Utrecht, the alliance of rebellious provinces, mostly Protestant, led by William of Orange. Although seriously ill, Farnese conducted the difficult siege of Maastricht and captured the town on June 29, 1579, thus delivering a heavy blow to the prestige of his adversary. His negotiations with the southern, largely Catholic, provinces, in the meantime, were concluded by the Treaty of Arras in May 1579. One of the main achievements of his administration was accomplished in this treaty, which restored peace in the southern provinces. The agreement was reached at the cost of certain Spanish concessions, which included the removal of foreign troops and Farnese's own departure within six months. An expert politician, Farnese succeeded, however, in keeping himself in the Netherlands as commander and regent, going so far as to enter into conflict with his mother, whom the King had initially appointed to the position in order to attain his purpose.

The removal of foreign troops and the organization of a "national" force left Farnese with only 15,000 poorly trained soldiers, the majority of whom were of the same nationality as their opponents. It was a pitiful band that he led to the sieges of the next two years. Unable to attempt long sieges, Farnese negotiated as quickly as possible and granted honourable surrenders. He captured the city of Tournai in November 1581 and permanently established his government there. He succeeded in forcing another surrender the following year, but his army was at the end of its strength and could no longer undertake extensive operations against the Union of Utrecht, which continued under the leadership of William.

Farnese, using all of his talents of persuasion, then succeeded in obtaining from the King, and from the Spanish-controlled provinces, the recall of Spanish troops and the dispatch of Italian units into the Netherlands. Finally, with sufficient reinforcements, he switched to the offensive at the end of 1582. Heading an army of 60,000 men, with full powers to act, he devised and carried out an excellent strategy.

Toward the middle of 1583, by conquering the towns of Diest and Westerlo, he endangered communications between Antwerp and Brussels. He subdued several coastal towns and tentatively planned to encircle the United Provinces by capturing the county of Zutphen. In the first half of 1584 he conquered three more strategic positions, thus cutting off Antwerp from the sea. Ypres and Bruges surrendered in turn.

Without further delay, Farnese launched the siege of Antwerp. In order to isolate the city, Farnese built fortlets and a pontoon bridge across the lower Scheldt River and succeeded in frustrating all attempts of the beleaguered forces to leave the city. The city surrendered at the end of 13 months, on Aug. 17, 1585, concluding one of the most celebrated sieges of military history.

The capture of Antwerp was the climax of Farnese's career: the construction of a solid line of defense against the United Provinces consolidated the union of the Catholic Netherlands, which later became Belgium. The assassination of William of Orange at Delft on July 10, 1584, moreover, relieved Farnese of a redoubtable adversary. On the death of his father in 1586, Alessandro became duke of Parma.

Last years. Farnese undoubtedly would have pressed the war northward if Philip II had not compelled him to participate in his scheme for the conquest of England. He was instructed to concentrate his forces on the Channel coast preparatory to invading England, but the defeat of the Invincible Armada in 1588 ended that dream. In Spain part of the responsibility for the disaster was laid on Farnese, and his popularity underwent a serious decline.

At this point Farnese fell ill and was tended at Spa, while his lieutenants were left to face the Dutch army, reconstituted by Maurice of Nassau, as well as they could. Exhausted by illness, he died at Arras at the age of 47, just in time to avoid learning of his intended disgrace at the hands of Philip II.

Of all the regents for the Netherlands during the reign of Charles V, none could rival Alessandro Farnese, either as strategist or as diplomat. His great achievement was the restoration of Spanish rule in the southern provinces and the secure perpetuation of Catholicism there. (J.-L.Ch.)

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Farnese, Palazzo, Rome, important example of High Renaissance architecture designed by Antonio da Sangallo and built between 1517 and 1589. In 1546, when Sangallo died, leaving the building of the palace unfinished, Michelangelo was appointed by Pope Paul III, who was a member of the Farnese family, to complete the work.

Michelangelo is responsible for the balcony, the large coat of arms, the windows of the upper story, and the cornice of the main facade, as well as for the upper story of the cortile, or main courtyard, which is more Mannerist than High Renaissance in style. The interior is decorated with frescoes by Annibale Carracci. The palace now houses the French embassy.

Farnese, Teatro, Italian Baroque theatre at Parma, Italy, the prototype of the modern playhouse and the first surviving theatre with a permanent proscenium arch. Construction on the Teatro Farnese was begun in 1618 by Giovanni Battista Aleotti for Ranuccio I Farnese, and it officially opened in 1628. At one end of the large, rectangular wooden structure was a stage area designed for deep-perspective

scenery and spectacular effects. The stage area, divided in half by two half walls, had provision for three sets of side wings and a back shutter in the front and four sets of wings or shutters in the rear. A proscenium arch, placed at the front of the stage, was decorated with paintings and statues set into niches. A large U-shaped open area (pit, or parterre) was used for dancing, royal processions, and other courtly entertainments; it could even be flooded for water spectacles. Rows of benches ringed this area in a stadium fashion. Above the benches were two rows of arches topped by a small gallery with statues. The Farnese was renovated in the early 1700s by Filippo Juvarra and rebuilt following its destruction during World War II.

Farnsworth, Philo Taylor (b. Aug. 19, 1906, Beaver, Utah, U.S.—d. March 11, 1971, Salt Lake City, Utah), U.S. pioneer in the development of television.

While in high school, Farnsworth conceived the basic requirements for television, and after two years at Brigham Young University, Provo, Utah, he began research into the process of picture transmission. In 1926 he co-founded Crocker Research Laboratories, which was reorganized as Farnsworth Television, Inc. (1929) and later as Farnsworth Radio and Television Corporation (1938).

In 1927 Farnsworth successfully transmitted an image (a dollar sign) composed of 60 horizontal lines and submitted his first television patent. He subsequently invented numerous devices, including equipment for converting an optical image into an electrical signal, amplifier tubes, cathode-ray tubes, electrical scanners, electron multipliers, and photoelectric materials. He also contributed to the development of radar systems, vacuum tubes, and the generation of electrical energy by atomic fusion.

Faro, southernmost city of Portugal, capital and *concelho* (municipality) of Faro district, lying on the Atlantic coast near the Cabo (cape) de Santa Maria. Held by the Moors from early in the 8th century until 1249, when it was recaptured by Afonso III, the city was the last Moorish stronghold in Portugal. It was sacked by the English in 1596 and was almost totally destroyed in the earthquakes of 1722 and 1755. Notable remaining buildings include the Renaissance cathedral (restored in the 18th century); the convent of Nossa Senhora da Anunciação (1513) is in ruins. The former bishop's palace library was pillaged by the Earl of Essex in 1596 and formed the nucleus of the Bodleian Library in Oxford.

Agriculture is the primary economic activity and Faro exports fish, wine, sumac (for tanning), and fruit. The publishing industry dates from 1489 when Jewish printers were operating presses in Lisbon and Faro for the country's earliest incunabula in Hebrew. Eucalyptus trees, originally imported from Australia, are an important source of pulp for the paper industry. During the 1970s the Portuguese government designated a reserve near Faro to conserve both the environment and the traditional architecture. Faro is located on the coastal railroad and highway, with connections to another railroad and highway that extend north to Setúbal.

Faro district (area, 1,915 sq mi [4,960 sq km]) is coextensive with the historical province of Algarve. Mineral resources include tin, lead, antimony, and auriferous quartz but are little exploited. The district is popular with tourists because of its mild climate, fine beaches, and Moorish-looking towns. Henry the Navigator chose the district as a base, and the first expeditions in the Age of Discovery (15th century) sailed from ports near Faro city. Pop. (1981) city, 28,622; *concelho*, 45,692; district, 328,605.

Faro, one of the oldest of all gambling games played with cards, supposedly named from the picture of a pharaoh on French playing cards imported into Great Britain. It was specifically forbidden by English law as early as 1739. A favourite of highborn gamblers throughout Europe in the late 18th and early

Faro game in Bisbee, Ariz., 1903
From John Scarne, *Scarne's Complete Guide to Gambling* (1961)

19th centuries, Faro was the game at which the young count Rostov, in Tolstoy's *War and Peace*, lost a fortune. Faro was introduced to the United States in New Orleans. A writer in 1894 termed it "unquestionably entitled to be called the national American card game." The Faro bank, a house where Faro was played, was marked traditionally by a picture of a tiger as an advertisement, and playing Faro was known as bucking the tiger. Common in U.S. gaming rooms, especially in the West, until 1915, the game had all but vanished by 1925, except in a few Nevada casinos.

In the game the 13 cards of the spade suit, representing the ranks of all suits, are enamelled on a layout on which the bets are placed against the house. A bet may be placed on any rank to win or (by coppering the bet—that is, placing a copper counter on the chips) to lose; or, by the manner in which the chips are placed on the layout, a bet may cover several ranks. A shuffled pack of playing cards is placed face up in a dealing box. The top card, called soda, is removed from the box and not used. The next card taken from the box loses (the house pays the coppered bets placed and takes in bets placed on the card to win). The card left showing in the box wins, and the house pays the amount of any bet placed on that rank to win. The two cards constitute a turn. The dealer then removes the exposed card from the box, puts aside another card (which loses), and leaves exposed another card (which wins). The game continues in this fashion through the pack. The last card in the box (called in hock) does not count.

When cards of the same rank appear in the same turn and so both win and lose, the house takes half of each bet on that rank, whether to win or to lose. This is called a split. A casekeeper keeps on display a running record of which cards have been played and which are still to come for reference of all players.

Stuss is a variant of the game in which the cards are dealt from a pack held face down in the dealer's hand, not from a dealing box. When a split occurs the house takes all the bets on that rank instead of only half of them.

Faroe Islands (Atlantic Ocean): *see* Faeroe Islands.

Faroese Language: *see* Faeroese language.

Farouk I, also spelled FARUK, Arabic FĀRŪQ AL-AWWAL (b. Feb. 11, 1920, Cairo—d. March 18, 1965, Rome), king of Egypt from 1936 to 1952, whose administration was hampered by internal rivalries and whose alienation of the military led to his own downfall and to the formation of a republic.

Farouk, the son and successor of King Fu'ād I, was educated in Egypt and England before he ascended the throne in 1936. As king he continued his father's rivalry with the popular-based Wafd party, with which he clashed over many issues, including administrative functions, appointments, and even the form used for his coronation. For the most part, he was able to keep the Wafd out of power.

After the outbreak of World War II, Farouk tried to maintain neutrality, despite the presence of British troops in Egypt, but in 1942 the British forced him to name as prime minister the Wafd leader Muṣṭafā an-Naḥḥās Pasha, who was sympathetic to their interests. In October 1944 an-Naḥḥās negotiated the Alexandria Protocol, a step toward the creation of a league of Arab states. Farouk wanted to place himself at the head of this movement, and he dismissed an-Naḥḥās, who had lost the support of the British.

Egyptian nationalism suffered from a shattering defeat at the hands of the newly created state of Israel (1948) and from the failure to terminate British military occupation of Egypt. The military defeat especially enraged many Egyptian army officers, who saw Farouk's corruption and incompetence as being largely the cause of it. His activities became intolerable in 1952, when he sponsored unpopular candidates for president of the Officers Club and minister of defense. The Free Officers, led by Gamal Abdel Nasser, overthrew Farouk's regime in July 1952 and forced him to abdicate. He was succeeded by his infant son, Fu'ād II, but less than a year later Egypt became a republic.

Farquhar, George (b. 1678, Londonderry, County Derry, Ire.—d. April 29, 1707, London), Irish playwright of real comic power writing for the English stage at the beginning of the 18th century. He stood out from his contemporaries for originality of dialogue and a stage sense that doubtless stemmed from experience as an actor.

The son of a clergyman, Farquhar entered Trinity College, Dublin, as a sizar (one who received a college allowance in return for performing menial duties), but he preferred to spend his energies as an unsuccessful actor at the Smock Alley Theatre in Dublin. During a performance of John Dryden's *Indian Emperour,* he failed to distinguish between a tipped foil and a deadly rapier, gravely wounding a fellow actor. After this incident he abandoned acting and, encouraged by a leading actor, Robert Wilks, with whom he had acted in Dublin, Farquhar decided to go to London to write comedy. His early plays were, in the main, spirited variations on a theme: young men have their fling for four acts and reform, unconvincingly, in the fifth. The plays have freshness, however, as well as wit and a lively human sympathy—Farquhar enjoys his fools rather than despises them.

Farquhar, engraving by R. Clamp for *Burney's Theatrical Portraits*
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

His first play, *Love and a Bottle,* was well received at London's Drury Lane Theatre in 1699 and was followed in the same year by *The Constant Couple.* A sequel to the latter, *Sir Harry Wildair,* appeared in 1701. Between 1702 and 1704 he wrote *The Inconstant* (adapted from John Fletcher's *Wild-Goose Chase*), *The Twin-Rivals,* and *The Stage-Coach,* a farce translated from French. Nothing else appeared until 1706, and he may have spent some time soldiering. In 1703 he had married a Yorkshire woman whom he mistakenly believed to have a fortune.

Farquhar's real contribution to the English drama came in 1706 with *The Recruiting Officer* and, in the following year, with *The Beaux Stratagem.* In these plays he introduced a verbal vigour and love of character that are more usually associated with Elizabethan dramatists. He completed writing *The Beaux Stratagem* on his deathbed, dying a few days after its successful production at the Haymarket Theatre.

Farrad Mohammed: *see* Fard, Wallace D.

Farragut, David (Glasgow) (b. July 5, 1801, near Knoxville, Tenn., U.S.—d. Aug. 14, 1870, Portsmouth, N.H.), U.S. admiral who achieved fame for his outstanding Union naval victories during the American Civil War (1861–65).

Farragut was befriended as a youth in New Orleans by Captain (later Commodore) David

Farragut, daguerreotype

By courtesy of the Library of Congress, Washington, D.C.

Porter (of the U.S. Navy), who adopted him. Farragut served under Porter aboard the frigate *Essex* in the War of 1812; this vessel captured so many British whaling vessels that Farragut, then age 12, was put in charge of one of the prize ships. By the age of 20 he was already an accomplished ship's officer. In 1823 he served under Porter in a squadron that suppressed pirates in the Caribbean. He was given his first independent command, of the *Ferret,* in 1824.

In December 1861, after many years of routine service, Farragut was assigned to command the Union blockading squadron in the western Gulf of Mexico with orders to enter the Mississippi River and capture New Orleans, through which the South was receiving much of its war supplies. Although the War Department had recommended that he first reduce the two forts that lay some distance downstream of the city by mortar fire, he successfully carried out his own, bolder, plan of running past them with guns blazing in the dark (April 24, 1862). His naval force then destroyed most of the Confederate river squadron that was stationed just upstream of the forts. Troops from Union transports could then land almost under Farragut's protecting batteries, resulting in the surrender of both forts and city.

The following year, when General Ulysses S. Grant was advancing toward Vicksburg, Miss., Farragut greatly aided him by passing the heavy defensive works at Port Hudson below the Red River and stopping Confederate traffic below that tributary. Vicksburg fell in July 1863, and the entire Mississippi River was soon in Federal control.

Farragut next turned his attention to Mobile Bay, Ala., which was defended by several forts, the largest of which was Fort Morgan. A line of mines ("torpedoes") on one side of the bay's channel obliged any attacking ships to pass close to Fort Morgan on the other side of the channel, and the Confederate ironclad *Tennessee* was also stationed in the bay. Farragut's force entered the bay in two columns (Aug. 5, 1864), with armoured monitors leading and a fleet of wooden frigates following. When the lead monitor *Tecumseh* was demolished by a mine, the leading wooden ship *Brooklyn* stopped in alarm, and the whole line of ships drifted in confusion under the very guns of Fort Morgan. As disaster seemed imminent, Farragut shouted his famous words, "Damn the torpedoes, full speed ahead!" to the hesitating *Brooklyn.* He swung his own ship, the *Hartford,* clear and headed across the mines, which failed to explode. The rest of the fleet followed and anchored above the forts. Then the *Tennessee* emerged from the shelter of the fort and, after a hard fight during which it was repeatedly rammed, surrendered. The forts were now isolated and surrendered one by one with Fort Morgan the last to do so. This battle was the capstone of Farragut's career. But his poor health precluded further active service. Having become a rear admiral in 1862 and a vice admiral in 1864, he was made a full admiral in 1866. He went the next year to Europe and paid ceremonial visits to the seaports of the great powers.

Farrah (town, Afghanistan): *see* Farāh.

Farrar, Frederic William (b. Aug. 7, 1831, Bombay—d. March 22, 1903, Canterbury, Kent, Eng.), popular English religious writer and author of a sentimental novel of school life, *Eric; or, Little by Little* (1858), which went into 36 editions in his lifetime.

In 1856 Farrar became a fellow of Trinity College, Cambridge, and later accepted an assistant mastership at Harrow School. *Eric* was followed by *Julian Home* (1859) and *St. Winifred's* (1862). Farrar was also an expert philologist; his *Essay on the Origin of Language* (1860) earned him a fellowship of the Royal Society. His *Life of Christ* (1874) ran through 30 editions in as many years. In 1876 Farrar became canon of Westminster cathedral and in 1883 archdeacon. He was dean of Canterbury from 1895 until his death.

Farrar, Geraldine (b. Feb. 28, 1882, Melrose, Mass., U.S.—d. March 11, 1967, Ridgefield, Conn.), American soprano, known for her beauty and dramatic talent and the intimate timbre of her voice.

At 5 years of age Farrar began studying music in Boston, and by the time she was 14 she was giving recitals. She then studied with Emma Thursby in New York City and Francesco Graziani in Berlin. In 1901 she made a sensational debut at the Royal Opera in Berlin in Charles François Gounod's *Faust* and remained with that company for three years, during which she studied with Lilli Lehmann.

After three years with the Monte Carlo Opera, Farrar made her first appearance at the Metropolitan Opera in New York City as Juliette in Gounod's *Roméo et Juliette.* For the next 15 years she was a leading member of that company, appearing in hundreds of performances and almost 30 roles—the most popular being Madam Butterfly, Carmen, Thaïs, Gilda, Zerlina, Cherubino, Manon, Mignon, and Tosca. Her farewell performance came in 1922 in the title role of Ruggero Leoncavallo's *Zaza.* Thereafter she appeared in recitals, and during one season she was a commentator for the radio broadcasts of the Metropolitan Opera. She also appeared in a number of silent films, including *Carmen,* and wrote an autobiography, *Such Sweet Compulsion* (1938).

Farrell, James T(homas) (b. Feb. 27, 1904, Chicago—d. Aug. 22, 1979, New York City), American novelist and short-story writer known for his realistic portraits of the lower middle-class Irish in Chicago, drawn from his own experiences.

Farrell attended the University of Chicago from 1925 to 1929. He began to write seriously in about 1925, shaping his writing to reveal his conviction that destinies are shaped by environment. In 1932 he moved to New York City. That year the first volume of his well-known *Studs Lonigan* trilogy, *Young Lonigan,* was published. It was followed by *The Young Manhood of Studs Lonigan* in 1934 and *Judgment Day* in 1935. The series traces the self-destruction of a young man who has been spiritually crippled by the morally squalid urban environment he grows up in. Danny O'Neill, a character introduced in *Studs Lonigan,* is the subject of a later series (1936–53), in which he reflects Farrell's acquired faith in humanitarian values and man's power to cope with circumstances. *The Face of Time* (1953) is considered to be another of Farrell's best works.

Farrell's relentless and rather humourless Naturalism led some critics to suggest that his works are only shocking and highly detailed case histories; his fiction is nevertheless durable in its deep understanding of the lower middle-class mentalities it describes.

After 1958 Farrell worked on what was to be a 25-volume cycle, *A Universe of Time,* of which he completed 10 volumes. His complete works include 25 novels and 17 collections of short stories. Among his works of nonfiction are *A Note on Literary Criticism* (1936), a discussion on Marxist literature; and *Reflections at Fifty* (1954), personal essays.

Farrell, Suzanne (b. Aug. 16, 1945, Cincinnati, Ohio, U.S.), American dancer especially known for her performances with the New York City Ballet.

Farrell began dancing in her native Cincinnati and continued her training on a grant from the Ford Foundation at the School of American Ballet in New York City. She joined the corps of the New York City Ballet at the age of 16 and was promoted to soloist in 1963. Two years later George Balanchine created for her the role of Dulcinea in *Don Quixote.*

In 1969 Farrell joined Maurice Bejart's Ballet of the 20th Century. Balanchine, who was dismayed to have lost one of his best dancers, persuaded Farrell to return in 1975. Thereafter, Balanchine used Farrell extensively and created new works for her, among them *Union Jack* (1976) and *Vienna Waltzes* (1977).

Farrer, William James (b. April 3, 1845, near Kendal, Westmorland, Eng.—d. April 16, 1906, N.S.W., Australia), British-born Australian agricultural researcher who developed several varieties of drought- and rust-resistant wheat that made possible a great expansion of Australia's wheat belt.

Farrer settled in Australia in 1870 and worked as a tutor near Canberra. In 1875 he was licensed as a surveyor and worked in the land department of New South Wales for 11 years, after which he retired to his home at Lambrigg, near Canberra, where he began experimental wheat breeding. He worked alone for several years but kept in touch with other wheat breeders throughout the world and with the New South Wales agricultural department, which appointed him wheat experimentalist in 1898. He developed several varieties (called cultivars) of wheat, including Federation, which was made available to Australian farmers in 1902–03 and soon became the country's most popular variety. Later developments in wheat breeding owed much to his methods.

farrier: *see* blacksmith.

Farrukh Beg (fl. 16th–17th centuries, India), outstanding Mughal painter, praised by the Indian Mughal emperor Jahāngīr as "unrivaled in the age."

A Kalmyk of Central Asia, Farrukh Beg first worked at Kābul under Mīrzā Muḥammad Ḥakīm, the half brother of the Mughal emperor Akbar. After Ḥakīm died Farrukh Beg joined Akbar's service (1585). His earliest paintings are strongly Persian in character, and he continued to be a conservative painter, not modifying his style to any considerable extent in the new environment. Several features of his later paintings—the large plants, colour scheme, and treatment of drapery—have suggested that he might have spent some years in the Deccan. His presence in Delhi in 1609 is attested to by a note in Jahāngīr's memoirs recording a gift to the artist of 2,000 rupees.

Farrukhābād-Fatehgarh, municipality, central Uttar Pradesh state, northern India, just west of the Ganges River. The two towns form a joint municipality. Farrukhābād was founded in 1714 by Muḥammad Khān Bangash, an independent local Mughal governor. Near it are the ruined tombs of former rulers. Located at major road and rail junctions, it is a manufacturing centre and agricultural market.

Fatehgarh was founded about 1714, when a ruler of Farrukhābād built a fort on the site. A massacre occurred there during the 1857 Indian Mutiny.

The area in which Farrukhābād-Fatehgarh is situated occupies part of the alluvial plain of the Ganges and is irrigated by the Lower Ganges Canal. The main crops grown in the area include potatoes, tobacco, and watermelons; these are also the principal exports, together with perfume, saltpetre, and cotton prints.

There are a number of ancient historic sites in the area. The town of Kampil, northwest of Farrukhābād-Fatehgarh, is mentioned in epics of the 2nd century BC and earlier; it has numerous ancient temples. Sankisa (ancient Sāṃkāśya), to the west, was a famous Buddhist pilgrimage centre and has several mounds that are the remains of Buddhist stupas. Pop. (1981) town, 145,793; metropolitan area, 160,796.

Fārs, also spelled FARS, also called FARSISTAN, geographical region, south-central Iran. The ancient region, known as Pārs, or Persis (*q.v.*), was the heart of the Achaemenid Empire (559–330 BC), which was founded by Cyrus the Great and had its capital at Pasargadae. Darius I the Great moved the capital to nearby Persepolis in the late 6th or early 5th century BC. Alexander the Great defeated the Achaemenid army at Arbela in 331 and burned Persepolis. Persis (Fārs) became part of the Seleucid kingdom in 312 after Alexander's death. The Parthian empire (247 BC–AD 224) of the Arsacids (corresponding roughly to the modern region of Khorāsān in Iran) replaced the rule of the Seleucids in Persis during 170–138 BC. The Sāsānid Empire (AD 224–651) had its capital at Istkhr. It was not until the 18th century, under the Zand dynasty (1750–79) of southern Iran, that Fārs again became the heart of an empire, this time with its capital at Shīrāz. In the 20th century the role of Fārs in Iran declined considerably with the building of the Trans-Iranian railway outside the region and the discovery of oil in the Khūzestān region.

The terrain of Fārs is composed mostly of ridges that are prolongations of the Zagros Mountains; the ridges run southeast–northwest and are intersected by plains. Climatically, it divides into two regions: the *garmsīr* and the *sardsīr*. The sparsely settled *garmsīr* (hot climate) region lies at elevations up to 2,500 feet (750 m). It is humid on the coastal plain bordering the Persian Gulf; this area supports the cultivation of fruit, cereals (rice, corn [maize]), vegetables, and tobacco. The plains and plateaus of the *sardsīr* (cold climate) region are other centres of cultivation, being watered by the Kūr and other rivers and springs. These plains form closed basins (with salty lakes) that merge into the interior deserts. Most ranges in the *sardsīr* and the transitional zone (elevation, 2,500–4,500 feet [750–1,400 m]) originally had oak forests, which have largely been cut; summer pastures lie in the higher elevations.

The most important ethnic groups in Fārs are the Qashqā'ī (Kashgai) of Turkic origin and speech, the Khamseh of Arab and Turkic stock, and the Lak, who speak an East Caucasian language. Agriculture and the herding of sheep are important occupations, while carpet weaving still continues. The discovery of oil and natural-gas fields in the region stimulated industrial development. Government-run industries include cold storage, petrochemicals, a telephone-equipment manufacturing plant, and milk pasteurization. Other industries produce processed foods, pharmaceuticals, cement, textiles, sugar, and nonalcoholic beverages. There is a meat-processing complex at Shīrāz, the chief city of Fārs. Other urban centres are Kāzerūn, Lār, Jahrom, and Dārāb in the *garmsīr* and Neyrīz, Fasā, Ābādeh, Ardakān, and Fīrūzābād in the *sardsīr* or the transitional zone. Shīrāz and Ābādeh are on the main road from Bushire to Tehrān. Shīrāz also has an airport. Pop. (1984 est.) 2,814,740.

Fārs, Khalīj-e (Asia): *see* Persian Gulf.

Fārsī language: *see* Persian language.

farsightedness: *see* hyperopia.

farthingale, underskirt expanded by a series of circular hoops that increase in diameter from the waist down to the hem and are sewn into the underskirt to make it rigid. The fashion spread from Spain to the rest of Europe from 1545 onward. The frame could be made of whalebone, wood, or wire. The shape was first domed, coned, or bell-like; later it became more like a tub or drum. The fashion persisted in most European courts until 1620, with variations such as the French farthingale—which descended from a round padded bolster—and the Italian, or wheel, farthingale—which tilted upward at the back.

All these skirts made possible the wider display of patterned silk, taffeta, fustian, or wool with decoration of embroidery, buttons, or jewels. They allowed freedom of movement in dancing but in exaggerated forms were a nuisance in small houses or carriages. Citizens' wives and countrywomen followed the court fashion in modified form.

The original Spanish farthingale was dark in colour, but elsewhere the fashion became extravagant and gaudy. The frame reappeared in the hooped and panniered dresses of the 18th century and the crinoline and bustle of Victorian times.

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farthingale chair, armless chair with a wide seat covered in high-quality fabric and fitted with a cushion; the backrest is an upholstered panel, and the legs are straight and rectangular in section. It was introduced as a chair for ladies in the late 16th century and was named in England, probably in the 19th century, for its ability to accommodate the exceptionally wide-hooped skirts known as farthingales.

Farthingale chair, oak with Turkey work upholstery, English, *c.* 1645; in the Victoria and Albert Museum, London

By courtesy of the Victoria and Albert Museum, London

An earlier English name was "imbrauderer's chair," or "upholsterer's chair." The farthingale chair was one of the earliest comfortable upholstered seats and was used in many parts of Europe.

Fartlek (Swedish: "Speed Play"), approach to distance-running training involving variations of pace from walking to sprinting aimed at eliminating boredom and enhancing the psychological aspects of conditioning. It was popularized by the Swedish Olympic coach Gosta Holmer after World War II and is used particularly by cross-country and long-distance track runners, usually in combination with other training methods. This type of training can be tailored to each individual's needs. Pace and terrain are continuously altered, with workouts ranging from about 20 minutes to several hours in length. The runner may employ such variations as short sprints, walking, running up inclines, running at a pace, or backward running.

Fārūq al-Awwal (king of Egypt): *see* Farouk I.

Fās (Morocco): *see* Fès.

Fasano: *see* John XVIII (or XIX) *under* John (papacy and antipapacy).

fasces, in ancient Rome, insignia of official authority. It was carried by the lictors, or attendants, and was characterized by an ax head projecting from a bundle of elm or birch rods tied together with a red strap; it symbolized penal power. The Roman emperors originally had 12 fasces, but after Domitian (reigned AD 81–96), they had 24; dictators, 24; consuls, 12; praetors, 6; legates, 5; priests, one. Lowering of the fasces was a form of salute to a higher official. Removal of the ax within the city signified recognition of the people's sovereignty.

Benito Mussolini's Fascist Party of Italy was named for the fasces, which the members adopted in 1919 as their emblem.

Fasching, the Roman Catholic Shrovetide carnival as celebrated in German-speaking countries. There are many regional differences concerning the name, duration, and activities of the carnival. It is known as *Fasching* in Bavaria and Austria, *Fosnat* in Franconia, *Fasnet* in Swabia, *Fastnacht* in Mainz and its environs, and *Karneval* in Cologne and the Rhineland. The beginning of the pre-Lenten season is generally considered to be Epiphany (January 6), but in Cologne, where the festivities are the most elaborate, the official beginning is marked on the 11th hour of the 11th day of the 11th month of the year. Merrymaking may get underway on the Thursday before Lent, but the truly rambunctious revelry associated with Fasching usually reaches its high point during the three days preced-

ing Ash Wednesday, culminating on Shrove Tuesday. The names of these final days also vary regionally.

Although the exact historical origins of Fasching are unclear, the observance of its rites is mentioned in Wolfram von Eschenbach's *Parzival* (early 13th century). It was a festival that originated in the cities—most notably Mainz and Speyer—and was already established in Cologne by 1234. Traditionally, it was not only a feast before Lent, but also a time during which the rules and order of daily life were subverted. This gave rise to such customs as handing over the keys of the city to a council of fools or ceremoniously letting women rule. It also inspired noisy costumed parades and masked balls; satirical and often impertinent plays, speeches, and newspaper columns; and generally excessive behaviour—all of which are still common elements of contemporary Fasching celebrations. After the Reformation, Protestant areas of Europe took exception to such Catholic excesses and carnival practices began to die out in them. *See also* carnival; Shrove Tuesday; Mardi Gras; Fastnachtsspiel.

fascio siciliano, plural FASCI SICILIANI, any of the organizations of workers and peasants founded in Sicily in the early 1890s, reflecting the growing social awareness of the lower classes.

The *fasci* were primitive trade unions and mutual-benefit societies aimed at helping workers get better contracts and helping villagers to protect their lands from enclosure. Conservative resistance to their demands led to an outbreak of violence. In early 1893, when the peasants of Caltavuturo occupied land that they claimed was theirs, a number were killed by local authorities. Disturbances continued throughout the year. Members of the *fasci* attacked and burned public buildings. The police and the upper classes responded with force in an attempt to suppress them.

In 1894 Prime Minister Francesco Crispi sent troops to Sicily to restore order. Martial law was declared, and the arrest of many *fasci* leaders followed. In March 1896 those arrested during the disturbances were granted amnesty.

fascioliasis, infection of man and grass-grazing animals, caused by the small parasitic fluke worm *Fasciola hepatica*, which lives in the bile ducts and causes liver inflammation. Although fascioliasis most commonly affects sheep, producing liver rot, it may occasionally be acquired by man by the ingestion of the encysted form of the fluke attached to such aquatic plants as watercress. In man early clinical manifestations usually include upper abdominal pain, fever, diarrhea, jaundice, and urticaria. The most effective chemotherapeutic agent is emetine hydrochloride.

fasciolopsiasis, infection of humans and swine by the trematode *Fasciolopsis buski*, a parasitic worm. The adult worms, some 3 centimetres (1.18 inch) long, attach themselves to the tissues of the small intestine of the host by means of ventral suckers; the sites of attachment may later ulcerate and form abscesses. In the early stage of the infection, there is usually abdominal pain, as well as diarrhea and nausea alternating with constipation. If heavy infestations are untreated, general body weakness and fluid retention may have serious consequences, especially in children. Hexylresorcinol and tetrachlorethylene are effective therapeutic drugs. In China, India, Thailand, and other parts of the Far East, infection in humans is usually contracted following ingestion of uncooked aquatic plants containing cysts of the worm larvae. An effective preventive measure is simply the immersion of aquatic foods in boiling water.

fascism, a political movement that governed Italy during the years 1922–43, Germany during 1933–45, Spain during 1939–75, and a few other countries at various times; more generally, the term is applied to any nationalist totalitarian movement or government. The Italian word *fascismo* is derived from the Latin *fasces,* a bundle of elm or birch rods containing an ax, that was an insignia of authority in ancient Rome. Benito Mussolini adopted the symbol as the emblem of the Italian Fascist movement in 1919.

A brief treatment of fascism follows. For full treatment, *see* MACROPAEDIA: Socioeconomic Doctrines and Reform Movements, Modern.

In all its forms, fascism displays certain key features. The absolute primacy of the state is the chief of these, and from it follow others: the submission of the individual will to the unified will of the people as expressed by the state and entire obedience to a usually charismatic leader, who embodies the state. In addition, martial virtues, combat, and conquest are celebrated, while liberal democracy, rationalism, and bourgeois values are denigrated. An element of mysticism commonly pervades fascist expressions of the sanctity of the state or the race and declarations of its destiny, as in Mussolini's prophecy of a "rebirth" of the Roman Empire.

Italian Fascism grew out of the widespread disillusionment with ineffectual government, uninspired leadership, and chaotic economic conditions that beset Italy after World War I. Such conditions created a political atmosphere conducive to the glorification of authoritarian and, especially, military virtues. The poet Gabriele d'Annunzio was one of a number of intellectuals who exalted adventure, conflict, and war during that period. In 1919 d'Annunzio even led a takeover of the city of Fiume (now Rijeka, Yugos.), which he ruled for 16 months. In the same year Mussolini founded the Fascist movement in Milan, calling his followers the "Fasci de Combattimento." The first milestone in the party's rise to power occurred on Oct. 28, 1922, when Mussolini and his black-shirted followers staged a march on Rome, demanding that he be appointed prime minister and threatening to take over the government by force if he were not. The King capitulated and the next day invited Mussolini to form a government. Armed Fascist gangs soon began to terrorize the headquarters of leftist parties and to assault and even murder their members. Mussolini outlawed all political parties but the Fascist Party the following January and thenceforth ruled Italy as a totalitarian state.

In Germany Adolf Hitler's National Socialist (Nazi) movement grew out of an even more bitter aftermath of World War I and was nourished by a stronger strain of antiliberal nationalism. Hitler's program differed from Mussolini's in many respects, notably in its far more detailed program for attaining national and racial power and security, but they were fundamentally similar expressions of a particular political outlook.

In Spain the Falange Española came to power after a civil war against a radical republican regime. The Spanish Fascists held on to power mainly by remaining neutral in World War II and thus avoiding the defeat that unseated fascism in Germany and Italy.

In Japan the presence of the emperor as the embodiment of the national will and identity and of a strong militarist tradition provided the necessary ingredients for the development of a fascist movement in the 1930s, when many Japanese intellectuals began to call for the rejection of westernizing influences and a return to the ancient virtues of Japanese religion, ethics, and the samurai tradition. Like Germany, Japan came to conceive of its role in the world not only as a paragon of its particular virtues but also a validator of those virtues by conquest of less enlightened peoples.

Fāshir, al-, town, capital of Dārfūr ash-Shamālīyah *mudīrīyah* (province) and Darfur Region, northwestern Sudan, 119 mi (192 km) northeast of Nyala. A historic caravan centre, it is located at an elevation of about 2,400 ft (700 m). The town serves as an agricultural marketing centre for the cereals and fruits grown in the vicinity of Jabal (mountain) Marrah, 75 mi southwest of al-Fāshir. It is linked by road with al-Junaynah and Umm Kaddādah. In the late 18th century Sultan ʿAbd ar-Raḥmān ar-Rashed of the Fur Sultanate of Dārfūr established his capital at Al-Fāshir, and the town grew up around the sultan's palace. Pop. (1973) 51,932.

Fashoda Incident (Sept. 18, 1898), the climax, at Fashoda (Kodok), Egyptian Sudan, of a series of territorial disputes in Africa between Great Britain and France.

The disputes arose from the common desire of each country to link up its disparate colonial possessions in Africa. Great Britain's aim was to link Uganda to Egypt by building a Cape-to-Cairo railway, while France, by pushing eastward from the west coast, hoped to extend its dominion across Central Africa and the Sudan.

In order to fulfill France's expansionist aspirations, the French foreign minister, Gabriel Hanotaux, promoted an expedition of 150 men eastward from Gabon in 1896, under the command of Jean-Baptiste Marchand. Equally determined to reconquer the Sudan, a British force under Sir Herbert (later Lord) Kitchener was ordered simultaneously to advance southward from Egypt (where the British had been entrenched since 1882) up the Nile. Marchand reached Fashoda on July 10, 1898, and occupied the fort; Kitchener, having had first to take Omdurman and Khartoum, did not reach Fashoda until September 18. In the tense confrontation that ensued, neither Marchand nor Kitchener was ready to give up his claims to the fort; but, because both wished to avoid a military engagement, they agreed that Egyptian, British, and French flags should fly over the fort.

The new French foreign minister, Théophile Delcassé, mindful of the incident's international implications and anxious to gain British support against Germany, chose to ignore the outraged public's reaction. On November 4 he instructed Marchand to withdraw from Fashoda but continued to press French claims to a string of smaller posts that would have kept open a French corridor to the White Nile. Although the British prime minister and foreign secretary, Lord Salisbury, rejected this proposal also, the French and British governments eventually agreed (March 21, 1899) that the watershed of the Nile and the Congo should mark the frontier between their respective spheres of influence.

Subsequently the French consolidated all their gains west of the watershed, while the British position in Egypt was confirmed. The solution of the crisis led to the Anglo-French Entente of 1904.

Fāsī, al- (traveller and writer): *see* Leo Africanus.

Fāsī, al-, in full YŪSUF IBN MUḤAMMAD IBN YŪSUF AL-FĀSĪ (b. 1530/31?, Ksar el-Kebir, Mor.—d. Aug. 14, 1604, Fès), Muslim teacher and mystic who was prominent in the intellectual life of northwest Africa.

The details of his life are obscure. After his family emigrated from Spain, he settled in the capital of Fès in 1580. His reputation as a teacher and scholar soon attracted many students. Noted for his piety, he founded a *zāwiyah* (lodge), which became popular among travellers. His traditions of scholarship were continued after his death by his son and by his

son's progeny. The members of the Fāsīyyūn family were the intellectual leaders of 17th-century Morocco.

Fasi, Rabbi Isaac: *see* Alfasi, Isaac ben Jacob.

Fasilides, also spelled FASILIDAS, FASILADAS, or BASILIDE (d. 1667), Ethiopian emperor from 1632 to 1667, who ended a period of contact between his country and Europe, initiating a policy of isolation that lasted for more than two centuries.

Fasilides succeeded to the throne on the abdication of Susenyos (1632), who had permitted an increase of Spanish and Roman Catholic influence in Ethiopia. Fasilides reestablished a close alliance between the Ethiopian Coptic Christian Church and the ruling house, expelled Catholic missionaries, and enlisted the aid of the Muslim rulers of the coastal states to bar all Europeans from the country. He also created a new capital at Gonder, in order to protect the throne from the danger of invasions by the Galla peoples of the south.

Faṣlī era (Persian *faṣlī*: "harvest"), chronological system devised by the Mughal emperor Akbar for land-revenue purposes in North India, for which the Muslim lunar calendar was inconvenient. The word comes from the Arabic term for "division," which in India was applied to the seasons and hence the harvest.

The era dated from Akbar's accession year, the Muslim year AH 963 (AD 1555–56). This was also the Hindu Saṃvat era year 1612. Akbar arbitrarily took 649 years from the Saṃvat year in order to make the Faṣlī year 963. Thereafter, the Faṣlī era proceeded according to the Saṃvat calendar. (To transpose Faṣlī into Gregorian, or New Style, calendar dates add 592/593 years.) The system was introduced into the Deccan by Shāh Jahān in the 1630s and was adopted two years later than in the north.

Fassbinder, Rainer Werner (b. May 31, 1946, Bad Wörishofen, Ger.—d. June 10, 1982, Munich), motion-picture and theatre director, writer, and actor, who was an important force in postwar West German cinema. His socially and politically conscious films often reckon with themes of oppression and despair.

Fassbinder left school at age 16, and became involved with an avant-garde Munich theatre. In 1967 he and others formed the Antitheater, producing original works and unusual theatrical versions of such writers as Goethe and Sophocles. Many of the actors and actresses in the Antitheater company later starred in his films.

Fassbinder, a prolific artist, made his first full-length motion picture in 1969; he completed 41 feature-length films and many theatre pieces. His films, largely criticisms of middle-class values and manners, include *Katzelmacher* (1969; the word is Bavarian slang for foreign worker), about a working-class Greek who shocks the German bourgeoisie; *Die bitteren Tränen der Petra von Kant* (1972; *The Bitter Tears of Petra von Kant*), an account of power struggles in human relationships; and *In einem Jahr mit 13 Monden* (1979; *In a Year of 13 Moons*), a political allegory concerning a transsexual who regrets having had a sex-change operation. Fassinder's great trilogy—*Die Ehe der Maria Braun* (1979; *The Marriage of Maria Braun*), an ironic portrait of a marriage that reflects German history from World War II to the "economic miracle" of the 1950s; *Lola* (1981), Fassbinder's version of the Blue Angel legend; and *Veronika Voss* (1982), based on the life of the German actress Sybille Schmitz—was enthusiastically received. He also adapted Alfred Döblin's novel *Berlin Alexanderplatz* for television in 1980. Though initially Fassbinder's success was critical rather than popular, both his later films and his death at the age of 36 prompted widespread interest in his early work.

fast-food restaurant, commercial establishment, usually owned and managed under a franchise agreement, that specializes in cooking a limited number of pre-packaged or pre-portioned foods for immediate sale over the counter or through a drive-in facility.

The principle of so-called fast food is at least as old as the hot dog stand or the ice cream drive-in. Neither is franchise ownership a late-20th-century phenomenon, U.S. soft drink manufacturers, for instance, having for decades sold their syrups and vending machines to retailers under franchise-type agreements, regulating the preparation and sale of the product. During the late 1950s, however, a change occurred in national eating habits that gave rise to a new combination of these marketing techniques. By this time the members of the so-called Baby Boom generation were becoming working teenagers, spending greater and greater amounts of their disposable income on eating out and on operating automobiles; a sharp trend toward smaller families made itself felt simultaneously, affording women increased social mobility and wider opportunity for work outside the home. Entrepreneurs reasoned that the risk and the cost involved in meeting the resultant demand for convenience foods could be offset by the organization of restaurant "chains," each outlet of which would be operated by an individual owner under the terms of a franchise; the aspiring manager who agreed to sell and advertise according to specific standards and to submit to regular inspection by the parent company could in turn buy a chain store, figuring any ensuing profit or loss to his own account.

The earliest of the successful fast-food chains featured a severely limited menu. However, by the 1970s, competition and the continued demand for fast food had prompted the addition of breakfast items, frozen and filled desserts, and various sandwiches to the original hamburger-and-soft-drink fare. Some chains, however, achieved marked success in specialization, notably those that sold fried chicken, seafood, or roast beef sandwiches and those that served cafeteria-style meals featuring inexpensive cuts of steak.

fasti (probably from Latin *fas*, "divine law"), in ancient Rome, sacred calendar of the *dies fasti,* or days of the month on which it was permitted to transact legal affairs; it also denoted registers of various types. The *fasti* were first exhibited in the Forum, in 304 BC, and thereafter such lists became common. They usually contained not only the months and days of the year, together with the different festivals, but also a variety of other information, such as the dates of military victories and temple dedications. The *fasti* were carved in stone or marble, although they are also extant in manuscript form.

Fasti also denoted registers in the form of historical records; for example, lists of consuls (*fasti consulares*) were accompanied by records of triumphs (*fasti triumphales*). A notable example survives in the fragments of the Capitoline *fasti,* which were set up on the triumphal arch of the emperor Augustus (reigned 27 BC–AD 14). Although the *fasti* preserve important evidence for Roman chronology, it is not certain that the original records from which the later ones were copied were kept in reliable chronological order.

fasting, abstinence from food or drink or both for ritualistic, mystical, ascetic, or other religious or ethical purposes. The abstention may be complete or partial, lengthy or of short duration. Fasting has been practiced from antiquity worldwide by the founders and followers of many religions, by culturally designated individuals (*e.g.,* hunters or candidates for initiation rites), and by individuals or groups for whom the fast constitutes a symbolic protest against violations of social, ethical, or political principles.

In the religions of ancient peoples and civilizations, fasting was a practice to prepare persons, especially priests and priestesses, to approach the deities. In the Hellenistic mystery religions (*e.g.,* the healing cult of the god Asclepius), the gods often revealed their divine teachings in dreams and visions only after a fast that required the total devotion of the devotees. Among the pre-Columbian peoples of Peru, fasting often was one of the requirements for penance after confession of sins before a priest. In many cultures the practice was considered a means to assuage an angered deity or to aid in resurrecting a deity who was believed to have died (*e.g.,* a god of vegetation).

In so-called primitive religions (*i.e.,* those of pretechnological peoples), fasting is often engaged in before and during a vision quest (*e.g.,* among the American Indian tribes of the plains area and the northwestern section of the United States). Among the Tungus of Siberia, shamans (religious personages with healing and psychic transformation powers) often receive their initial visions not with a quest but rather after an unexplained illness; after the initial vision, however, they fast and train themselves to see further visions and to control spirits. Priestly societies among the Pueblo Indians of the southwestern section of the United States fast during retreats before major ceremonies connected with seasonal changes.

Fasting for special purposes or before or during special sacred times is a characteristic of the major religions of the world. In Jainism, for example, fasting according to certain prescribed rules and practicing certain types of meditation lead to trances that enable a person to dissociate himself from the world and reach a transcendent state. Buddhist monks fast on certain days and confess their sins in quiet whispers. In China, before the sacrifice during the night of the winter solstice, when the heavenly Yang (positive energy) principle was believed to begin its new cycle, a fixed period of fasting and abstinence was observed. In India, Hindu *sādhus* (holy men) are admired for their frequent personal fasts for various reasons.

Among the Western religions, only Zoroastrianism prohibits fasting, because of its belief that such a form of asceticism will not aid in strengthening the faithful in their struggle against evil. The other Western religions—Judaism, Christianity, and Islām—emphasize fasting during certain periods. Judaism, which developed many dietary laws and customs, observes several annual fast days, primarily on days of penitence (such as Yom Kippur, the Day of Atonement) or mourning. Christianity, especially Roman Catholicism and Eastern Christianity, has observed a 40-day fast period during Lent, a spring period of penitence, and during Advent, a penitential period before Christmas. Among Roman Catholics the observance has been modified since the second Vatican Council (1962–65) to allow greater individual choice, with mandatory fasting only on Ash Wednesday and Good Friday. Protestant churches generally leave the question of fasting to the consciences of individual church members. The month of Ramaḍān in Islām is observed as a period of penitence and total fasting from dawn to dusk.

In addition to its religious functions, fasting may also serve social and political ends, particularly as a gesture of protest or solidarity. The example par excellence is given by Mahatma Gandhi, who, in the early part of the 20th century, conducted a fast in prison to

atone for the violent excesses of those of his followers who did not practice his teaching of *ahiṃsā* (nonviolence) against British rule in India. Gandhi later often fasted in pursuit of similar objectives, including the removal of disabilities imposed by the government upon the untouchables. Fasting has frequently been practiced to protest against war and what are considered social evils and injustices, as in the fasts of the U.S. black comedian Dick Gregory from the 1960s in protest against the violation of civil rights of American Indians and against U.S. military activity in Southeast Asia. In 1981, 10 Irish nationalists died in a Belfast prison during a hunger strike conducted to urge recognition of themselves and their associates as political prisoners.

Fastnachtsspiel, carnival or Shrovetide play that emerged in the 15th century as the first truly secular drama of pre-Reformation Germany. Usually performed on platform stages in the open air by amateur actors, students, and artisans, the *Fastnachtsspiele* consisted of a mixture of popular and religious elements—broad farce and abbreviated morality plays—that reflected the tastes of a predominantly bourgeois audience. The plays often contained satirical attacks on greedy clergymen and other traditional dislikes of the German burghers, an element that relates them, though distantly, to the Feast of Fools and the French *sotie.* In addition to features borrowed from liturgical drama and bits of comedy that were no doubt brought in by the wandering minstrels, the *Fastnachtsspiele,* according to many scholars, contain themes and influences from German literature of the pre-Christian era.

Hans Rosenplüt of Nürnberg and his younger contemporary the barber Hans Folz of Worms, who also settled in Nürnberg, were the most notable purveyors of *Fastnachtsspiele* in the mid-15th century, their plays being formless, uninhibited comedy. In the 16th century the plays reached a level of greater respectability when Hans Sachs wrote many *Fastnachtsspiele* among his 208 plays. He is also said to have directed and acted in them.

Fastnet Cup, trophy for sailing yachts, awarded to the winner of a race sailed from Cowes, Isle of Wight, Eng., around the Isles of Scilly to the Fastnet Rock off the southwest coast of Ireland, and back to Plymouth, Devon, a distance of about 605 miles (975 kilometres). First held in 1925, the race was sailed annually until 1931 and thereafter every other year (except for a lapse during World War II), in alternation with the Bermuda Race. Since 1957 the Fastnet Cup Race has been part of the Admiral's Cup (*q.v.*) competition. For winners, *see* Sporting Record: *Yachting.*

Fastolf, Sir John (b. *c.* 1378, Caister, Norfolk, Eng.—d. Nov. 5, 1459, Caister), English career soldier who fought and made his fortune in the second phase of the Hundred Years' War between England and France (1337–1453). His name is immortalized through Shakespeare's character Sir John Falstaff, but the courageous Fastolf bears little resemblance to the cowardly, dissolute, clowning Falstaff of *Henry IV,* parts I and II, and *The Merry Wives of Windsor.*

Fastolf served with distinction against the French at Agincourt (1415) and Verneuil (1424) and in the "Battle of the Herrings" at Rouvay in 1429, where he used barrels of herrings to shield his troops. Although accused of cowardice in the defeat of his forces at Patay in June 1429, he was later cleared of the charge. About 1440 he retired from military service. The papers left by his Norfolk neighbour and friend John Paston picture Fastolf as an irascible, acquisitive old man who was utterly ruthless in his business dealings. Childless, he intended to leave his possessions for pious works, but the Pastons got most of them. The Bishop of Winchester, however, managed to salvage a portion for his new Magdalen College in Oxford University.

fat, any substance of plant or animal origin that is nonvolatile, insoluble in water, and oily or greasy to the touch. Fats are usually solid at ordinary temperatures, such as 25° C (77° F), but they begin to liquefy at moderately elevated temperatures. Chemically, fats are identical to animal and vegetable oils, consisting primarily of glycerides, which are esters formed by the reaction of three molecules of fatty acids with one molecule of glycerol (*see* oil).

Together with oils, fats comprise one of the three principal classes of foodstuffs, the others being proteins and carbohydrates. Nearly all cells contain these basic substances. Fat is sometimes called nature's storehouse of energy because on a weight basis it contains more than twice as much energy as does carbohydrate or protein. It is probably as storehouses or depots of concentrated energy that fats appear in plant reproductive organs, such as pollen grains and seeds. It is this fat that man recovers from plants for use as food or in industry. The fat content of the nonreproductive tissue of plants is usually so low that recovery is impracticable. Yet much of man's dietary fat comes from natural foodstuffs without being separated from the other plant materials with which it occurs. The proportion of fat in these foodstuffs varies from 0.1 percent in white potatoes to 70 percent in some nut kernels.

More than 90 percent of the fat recovered in the world is obtained from about 20 species of plants and animals. Most of this separated fat is used eventually as human food. Consequently, fat technology deals largely with the separation and processing of fats into forms acceptable to the various dietary customs in the countries in which they are to be used. (For further information on the subject, see MACROPAEDIA: Food Processing.

Uses of fats. Man has used many natural fats for both food and nonfood purposes since prehistoric times. The Egyptians, for example, used olive oil as a lubricant in moving heavy building materials. They also made axle greases from fat and lime, mixed with other materials, as early as 1400 BC. Homer mentions oil as an aid to weaving and Pliny talks about hard and soft soaps. Candles and lamps using oil or tallow have been used for thousands of years.

The commercial uses of fats have increased in number as the understanding of the chemical nature of fats has expanded. C.W. Scheele, a Swedish chemist, discovered in 1779 that glycerol could be obtained from olive oil by heating it with litharge (lead monoxide), but it was not until about 1815 that the French chemist Michel-Eugène Chevreul (1786–1889) demonstrated the chemical nature of fats and oils. A few years later the separation of liquid acids from solid acids was accomplished. Margarine was invented by the French chemist Hippolyte Mège-Mouriès, who in 1869 won a prize offered by Napoleon III for a satisfactory butter substitute. The modern hydrogenation process had its origin in research in the late 19th century that led to the establishment of the vegetable-oil-shortening industry and a variety of industrial applications.

After World War I, organic chemists gained extensive knowledge first of fatty-acid compositions and then of glyceride compositions. Growth of the chemical industry stimulated a simultaneous expansion of the use of fats as raw materials and as intermediates for scores of new chemicals. The modern application of many organic chemical reactions to fats and fatty acids formed the foundation of a new and rapidly growing fatty-chemicals industry.

Functions in plants and animals. The universal distribution of fats in plant and animal tissues suggests physiological roles that go beyond their function as a fuel supply for the cells. In animals the most evident function of fats is that of a food reserve to supply energy (through subsequent enzymatic oxidation—that is, combination with oxygen catalyzed by enzymes). The storage of fat in vegetable seeds can be explained similarly on the basis that it is a food reserve for the embryo. It is not so easy, however, to account for the presence of large quantities of fat in such fruits as olives, avocados, and palms; much of this fat is probably lost or destroyed before the seed germinates. Fats fulfill other valuable functions in plants and animals. Subcutaneous deposits of fat insulate animals against cold because of the low rate of heat transfer in fat, a property especially important for animals living in cold waters or climates, *e.g.,* whales, walruses, and bears.

Fats that have been separated from tissues always contain small quantities of closely associated nonglyceride lipids such as phospholipids, sterols, vitamins A, D, and E, and various carotenoid pigments. Many of these substances are vital emulsifying agents or growth factors. Others function as agents that prevent deterioration of fats in plant tissues and seeds caused by destructive combination with oxygen. These minor constituents probably are present in the fats as a result of their physical solubility, and thus fats serve as carriers for these substances in animal diets.

Many animals require some fat containing one or more of the essential fatty acids (linoleic, arachidonic, and to a limited extent linolenic) to prevent the physical symptoms of essential-fatty-acid deficiency manifested by skin lesions, scaliness, poor hair growth, and low growth rates. These essential fatty acids must be supplied in the diet since they cannot be synthesized in the body.

The prostaglandins, discovered by the Nobel laureate U.S. von Euler of Sweden, are hormone-like compounds derived from arachidonic acid. These biologically active fatty acids, which are present in very minute quantities in animal tissues, apparently are involved in contraction of smooth muscles, enzyme activity in lipid metabolism, function of the central nervous system, regulation of pulse rate and blood pressure, function of steroid hormones, fat mobilization in adipose tissue, and a number of other vital functions.

Synthesis and metabolism in living organisms. Formation of fats in seeds and fruits occurs late in the ripening process. Sugars and starches predominate in fruits, seeds, and sap in the unripe condition. These apparently are converted by enzymes during the maturing process to fatty acids and glycerol, which then form glycerides. Studies with radioactive-tracer techniques confirm the synthesis of fats from carbohydrates in both plants and animals. In fact, it has been shown by the use of labelled acetic acid, or acetate, ions that any food source from which acetate ions may form as an intermediate metabolite can be converted to fatty acids in at least some animal tissues. It has been further demonstrated that acetate can be converted to cholesterol in animal tissue. It is noteworthy that, almost without exception, natural fats contain only fatty acids with an even number of carbon atoms. These acids apparently are built up of two-carbon units. Although the preponderance of fatty acids with 18 carbon atoms has suggested the hypothesis that fats are derived from three molecules of glucose (a carbohydrate with six carbon atoms), later discoveries through tracer studies have indicated the buildup from the two-carbon acetate units. Since acetate can be formed from fats, proteins, or carbohydrates by reaction with oxygen, it is thus possible for fats to be synthesized indirectly from any of these sources. The formation of multiple link-

ages between carbon atoms (double bonds) in the fats synthesized from acetate is accomplished (probably in the liver) by addition or removal of hydrogen atoms through the action of enzymes.

Utilization of stored fat by plant embryos has not been entirely explained, but it is known that in germinating embryos the glycerides are hydrolyzed—that is, decomposed to glycerol and fatty acids—by lipolytic (fat-splitting) enzymes. These may pass through oxidative processes to form intermediate metabolic products that can be oxidized further to carbon dioxide and water or can be converted to carbohydrates, which may then pass through the many steps of carbohydrate metabolism.

In animal digestive tracts, the fats in foods are emulsified with digestive secretions containing lipase, an enzyme that hydrolyzes at least part of the glycerides. The glycerol, partial glycerol esters, fatty acids, and some glycerides are then absorbed through the intestine and are at least partially recombined to form glycerides and phospholipids. The fat, in the form of microscopic droplets, is transported in the blood to points of use or storage. The fat of an individual animal may vary somewhat according to the composition of fats in the food.

Fats used by or stored in animal tissues come from two sources—enzymatic synthesis and diet. The fat synthesized from carbohydrates intermediates followed by enzymatic resynthesis to form the fat characteristic of the animal, but some dietary fatty acids are absorbed directly and recombined in the body fat.

The manner in which fat reserves are circulated to the organs where metabolism occurs is incompletely understood. Radioactive-tracer studies provide some insight into this complicated process. It has long been established that when mobilization of reserve fat takes place the stream is directed primarily to the liver, where fatty acids may be partially desaturated; *i.e.,* hydrogen is removed from the fatty-acid chains to produce unsaturated or double bonds between carbon atoms. This apparently facilitates subsequent oxidation in other tissues. Fatty acids also may be oxidized directly in the various tissues as well as in the liver. Fatty-acid metabolism is presumed to be by oxidation in successive two- and four-carbon stages. Intermediate products could be acetoacetate and acetate groups. If the mechanism is faulty, acetone is formed and excreted (acetonuria). The final products of normal metabolism are carbon dioxide and water.

Chemical composition of fats. Although natural fats consist primarily of glycerides, they contain many other lipids in minor quantities. Corn oil, for example, may contain glycerides plus phospholipids, glycolipids, phosphoinositides (phospholipids containing inositol), many isomers of sitosterol and stigmasterol (plant steroids), several tocopherols (vitamin E), vitamin A, waxes, unsaturated hydrocarbons such as squalene, and dozens of carotenoids and chlorophyll compounds, as well as many products of decomposition, hydrolysis, oxidation, and polymerization of any of the natural constituents.

Table 1: Common fatty acids

common name	systematic name	formula	carbon atoms	double bonds	melting point (°C)
caprylic	octanoic	$C_7H_{15}COOH$	8	0	16.5
capric	decanoic	$C_9H_{19}COOH$	10	0	31.5
lauric	dodecanoic	$C_{11}H_{23}COOH$	12	0	44
myristic	tetradecanoic	$C_{13}H_{27}COOH$	14	0	58
palmitic	hexadecanoic	$C_{15}H_{31}COOH$	16	0	63
stearic	octadecanoic	$C_{17}H_{35}COOH$	18	0	72
arachidic	eicosanoic	$C_{19}H_{39}COOH$	20	0	77
oleic	*cis*-9-octadecenoic	$C_{17}H_{33}COOH$	18	1	13.4
linoleic	*cis*-9, *cis*-12-octadecadienoic	$C_{17}H_{31}COOH$	18	2	−5
linolenic	*cis*-9, *cis*-12, *cis*-15-octadecatrienoic	$C_{17}H_{29}COOH$	18	3	−11.3
eleostearic	*cis*-9, *cis*-11, *cis*-13-octadecatrienoic	$C_{17}H_{29}COOH$	18	3	49
ricinoleic	12-hydroxy-*cis*-9-octadecenoic	$C_{17}H_{33}OCOOH$	18	1+OH	16
arachidonic	5,8,11,14-eicosatetraenoic	$C_{19}H_{31}COOH$	20	4	−49.5
erucic	*cis*-13-docosenoic	$C_{21}H_{41}COOH$	22	1	33.5

Fatty acids contribute from 94 to 96 percent of the total weight of various fats and oils. Because of their preponderant weight in the glyceride molecules and also because they comprise the reactive portion of the molecules, the fatty acids influence greatly both the physical and chemical character of glycerides. Fats vary widely in complexity; some contain only a few component acids, and at the other extreme more than 100 different fatty acids have been identified in butterfat, although many are present in only trace quantities. Most of the oils and fats are based on about a dozen fatty acids (*see* Table 1). In considering the composition of a glyceride it is particularly important to distinguish between the saturated acids (acids containing only single bonds between carbon atoms, such as palmitic or stearic), with relatively high melting temperatures, and the unsaturated acids (acids with one or more pairs of carbon atoms joined by double bonds, such as oleic or linoleic), which are low melting and chemically much more reactive.

In the series of saturated acids, the melting point increases progressively from below room temperature for the acids of lower molecular weight to high melting solids for the longer chain acids. Unsaturated acids may contain up to six double bonds, and as unsaturation increases the melting points become lower. Glycerides based predominantly on unsaturated acids, such as soybean oil, are liquids; and glycerides containing a high proportion of saturated acids, such as beef tallow, are solids. The carbon atoms in fatty acids are arranged in straight chains, and the first site of unsaturation (double bond) in most of the unsaturated acids appears between the ninth and tenth carbon atoms, starting the counting from the terminal carboxyl group (*see* Table 2). The specificity of location of unsaturation in fatty acids obtainable from both plant and animal sources suggests that all are formed by a common enzymatic dehydrogenation mechanism.

Since the glycerides, which make up 90 to 99 percent of most individual fats or oils of commerce, are esters formed by three fatty-acid molecules combining with one molecule of glycerol, they may differ not only in the fatty acids that they contain but also in the arrangement of the fatty-acid radicals on the glycerol portion. Simple triglycerides are those in which each molecule of glycerol is combined with three molecules of one acid; *e.g.,* tripalmitin, $C_3H_5(OCOC_{15}H_{31})_3$, the glyceryl ester of palmitic acid, $C_{15}H_{31}COOH$. Only a few of the glycerides occurring in nature are of the simple type; most are mixed triglycerides; *i.e.,* one molecule of glycerol is combined with two or three different fatty acids. Thus stearodipalmitin, $C_3H_5(OCOC_{15}H_{31})_2(OCOC_{17}H_{35})$, contains two palmitic acid radicals and one stearic acid radical. Similarly, oleopalmitostearin, $C_3H_5(OCOC_{15}H_{31})(OCOC_{17}H_{33})(OCOC_{17}H_{35})$, contains one radical each of oleic, palmitic, and stearic acids. Each mixed triglyceride containing three different acid radicals may exist in three different isomeric forms, because any of the three can be linked with the centre carbon of the glycerol molecule. A mixed triglyceride containing two radicals of the same acid and one radical of another acid has only two isomeric forms.

Monoglycerides and diglycerides are partial esters of glycerol and have one or two fatty-acid radicals, respectively. They are seldom found in natural fats except as the products of partial hydrolysis of triglycerides. They are easily prepared synthetically, however, and have important applications mainly because of their ability to aid in the formation and stabilization of emulsions. As constituents of shortening in baked products they increase product volumes, improve tenderness, and retard staling. They also have technical importance as intermediates in the manufacture of coatings and resins.

Physical and chemical properties. Fats (and oils) may be divided into animal and vegetable fats according to source. Further, they may be classified according to their degree of unsaturation as measured by their ability to absorb iodine at the double bonds. This degree of unsaturation determines to a large extent the ultimate use of the fat.

Table 2: Saturation and unsaturation in fatty acids

lauric acid	$CH_3{-}CH_2{-}CH_2{-}CH_2{-}CH_2{-}CH_2{-}CH_2{-}CH_2{-}CH_2{-}CH_2{-}CH_2{-}COOH$	a saturated fatty acid with 12 carbon atoms
oleic acid	$CH_3(CH_2)_7CH=CH(CH_2)_7COOH$	an unsaturated fatty acid with one double bond and 18 carbon atoms
linoleic acid	$CH_3(CH_2)_4CH=CHCH_2CH=CH(CH_2)_7COOH$	an unsaturated fatty acid with two double bonds and 18 carbon atoms
linolenic acid	$CH_3CH_2CH=CHCH_2CH=CHCH_2CH=CH(CH_2)_7COOH$	an unsaturated fatty acid with three double bonds and 18 carbon atoms
arachidonic acid	$CH_3(CH_2)_4CH=CHCH_2CH=CHCH_2CH=CHCH_2CH=CH(CH_2)_3COOH$	an unsaturated fatty acid with four double bonds and 20 carbon atoms

Liquid fats (*i.e.*, vegetable and marine oils) have the highest degree of unsaturation, while solid fats (vegetable and animal fats) are highly saturated. Solid vegetable fats melting between 20° and 35° C (68° and 95° F) are found mainly in the kernels and seeds of tropical fruits. They have relatively low iodine values and consist of glycerides containing high percentages of such saturated acids as lauric, myristic, and palmitic. Fats from fruits of many members of the palm family, notably coconut and babassu oils, contain large amounts of combined lauric acid. Most animal fats are solid at ordinary temperatures; milk fats are usually characterized by the presence of short-chain carboxylic acids (butyric, caproic, and caprylic); and marine oils contain a large number of very long chain highly unsaturated acids containing up to six double bonds and up to 24 or even 26 carbon atoms.

Fats are practically insoluble in water and, with the exception of castor oil, are insoluble in cold alcohol and only sparingly soluble in hot alcohol. They are soluble in ether, carbon disulfide, chloroform, carbon tetrachloride, petroleum benzin, and benzene. Fats have no distinct melting points or solidifying points because they are such complex mixtures of glycerides, each of which has a different melting point. Glycerides, further, have several polymorphic forms with different melting or transition points.

Fats can be heated to between 200° and 250° C (392° and 482° F) without undergoing significant changes provided contact with air or oxygen is avoided. Above 300° C (572° F) fats may decompose, with the formation of acrolein (the decomposition product of glycerol), which imparts the characteristic pungent odour of burning fat. Hydrocarbons also may be formed at high temperatures.

Fats are hydrolyzed readily. This property is used extensively in the manufacture of soaps and in the preparation of fatty acids for industrial applications. Fats are hydrolyzed by treatment with water alone under high pressure (corresponding to a temperature of about 220° C [428° F]) or with water at lower pressures in the presence of caustic alkalies, alkaline-earth metal hydroxides, or basic metallic oxides that act as catalysts. Free fatty acids and glycerol are formed. If sufficient alkali is present to combine with the fatty acids, the corresponding salts (known popularly as soaps) of these acids are formed, such as the sodium salts (hard soap) or the potassium salts (soft soaps).

fat cell (anatomy): *see* adipose cell.

Fata Morgana, mirage associated with the legendary enchantress Morgan le Fay (*q.v.*) of Arthurian romance.

Fatah, also called AL-FATAH, also spelled FAT'H, or AL-FAT'H, inverted acronym of ḤARAKĀT AL-TAḤRĪR AL-WAṬANI AL-FILASṬĪNI ("Palestine National Liberation Movement"), political and military organization of Arab Palestinians, founded in the late 1950s by Yāsir ʿArafāt and Abū Jihad (Khalil al-Wazir) with the aim of liberating Palestine from Israeli control by waging low-intensity warfare against the latter. The new organization obtained Syrian support and thus became based in Damascus.

By 1963 Fatah had developed a commando-type organizational structure. On Dec. 31, 1964, it carried out its first military operation, the blowing up of an Israeli water-pump installation; Fatah's first military communiqué was issued the following day. By 1968 it had emerged as a major Palestinian force, being the major target of the Israeli attack on the Jordanian village of Karameh in March in which 150 guerrillas and 29 Israelis were killed before Jordanian tanks drove off the Israeli troops. The strong showing of Fatah at Karameh—especially after the Arab humiliation in the Six-Day War of 1967—boosted Fatah politically and psychologically. By the end of the 1960s it was the largest and richest of all the Palestinian organizations and had taken over effective control of the Palestine Liberation Organization (*q.v.*), or PLO.

Following the civil war in Jordan on Sept. 16–27, 1969, the Jordanian army forced the PLO and Fatah fighters out of Jordan and into Lebanon, and in July 1971 Jordanian authorities killed a respected Fatah leader, Abū ʿAlī Iyyād. The result was the emergence of an extremist, militant corps of Fatah called Black September (Ailulal Aswad, or September al-Aswad), first proclaimed in November 1971 and drawing its first international notoriety in September 1972 from the murder of 11 Israeli athletes at the Olympic Games in Munich. Both Black September and the regular forces of Fatah were thereafter involved in a number of terrorist activities, primarily against Israel.

In 1982 the Israeli invasion of Lebanon, where Fatah had been headquartered, presented a further crisis. The PLO and Fatah were ousted from areas not controlled by Syria. Rival, battling factions developed within Fatah during 1983, and a divisive leadership struggle developed. By the 1990s, however, ʿArafāt had reclaimed his leadership of Fatah, which remained the largest PLO member.

fatback (fish): *see* menhaden.

Fate, Greek MOIRA, plural MOIRAI, Latin PARCA, plural PARCAE, in Greek and Roman mythology, any of three goddesses who determined human destinies, and in particular the span of a person's life and his allotment of misery and suffering. Homer speaks of Fate (*moira*) in the singular as an impersonal power and sometimes makes its functions interchangeable with those of the Olympian gods. From the time of the poet Hesiod (8th century BC) on, however, the Fates were personified as three very old women who spin the threads of human destiny. Their names were Clotho (Spinner), Lachesis (Allotter), and Atropos (Inflexible). Much later, some fanciful writers assigned different tasks to the three goddesses: Clotho spun the "thread" of human fate, Lachesis dispensed it, and Atropos cut the thread (thus determining the individual's moment of death). The Romans identified their obscure native deities known as the Parcae with the Greek Moirai and thus adopted the Greek conception of the Fates (Latin: *fata*).

Fate of the Sons of Usnech, The (Irish literature): *see* Deirdre.

Fateh Ali Tipu (sultan of Mysore): *see* Tippu Sultan.

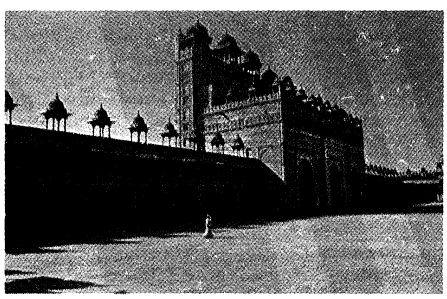
Fateh Singh, Sant (b. Oct. 27, 1911, Punjab, India—d. Oct. 30, 1972, Amritsar, Punjab), Sikh religious leader who became the foremost campaigner for Sikh rights in post-independence India.

Fateh Singh spent most of his early career in social and educational activities around Sri Gangānagar in Rājasthān, western India. In the 1940s he, Tara Singh, and other Sikh leaders joined the Quit India movement, a confederation of Indians determined to force Great Britain to give up India. India gained its independence in 1947, and by 1955 Fateh Singh and Tara Singh were advocating the establishment of Punjabi Suba, a Punjabi-speaking autonomous state in India in which Sikh religious, cultural, and linguistic integrity could be preserved intact.

In the early 1960s Fateh Singh entered a power struggle with Tara Singh over the leadership of the Sikh movement for the autonomy of the Punjab. The conflict between the two Sikh leaders ended in 1962 in victory for Fateh Singh when he founded his own political party (the Akālī Party) as a rival to Tara Singh's Akālī Party. Fateh Singh eventually became the leader of the entire Sikh community, and in 1966, partly owing to his agitation, a separate Punjabi-speaking state (Punjab) was established in India.

Fatehpur, town, southern Uttar Pradesh state, northern India. It lies southeast of Kānpur, on a major road and rail line to Allahābād. Fatehpur was founded by Pashtuns (Pathāns) in the 15th century; it came under the control of several dynasties until it was ceded to the British East India Company by the Nawab of Oudh (1801). An agricultural trade centre with some industry, it contains a mosque and tombs of historic interest. Along the road west of the town stand four great masonry pillars erected in the 19th century. Crops grown in the surrounding area include grains, cotton, sugarcane, and oilseeds. Pop. (1981) 84,831.

Fatehpur Sīkri, town, southwestern Uttar Pradesh state, northern India. The town lies about 23 miles (37 km) west of Āgra. It was founded in 1569 by the great Mughal emperor Akbar as his capital. In that year Akbar had visited the Muslim hermit Chishtī, who was residing in the village of Sīkri. Chishtī correctly foretold that Akbar's wish for an heir would be gratified with the birth of a son, who was born in Sīkri that very year (he would later rule as the emperor Jahāngīr). The grateful Akbar decided that the site of Sīkri was auspicious, and he decided to make it his capital. He personally directed the building of the Jāmiʿ



Buland Darwāza (Victory Gate) of the Jāmiʿ Masjid (Great Mosque) at Fatehpur Sīkri, Uttar Pradesh, India

Shostal Assoc.—EB Inc.

Masjid (Great Mosque; 1571), with an ornate tomb for Chishtī. The mosque's southern entrance, the colossal gateway Buland Darwāza (Victory Gate), is one of India's greatest architectural works. This monumental gateway is constructed out of red sandstone and is attractively carved. Fatehpur Sīkri contains other early Mughal structures, exhibiting both Muslim and Hindu architectural influences. They include the palace of Akbar's wife (Jodhā Bāī), a private audience hall, and houses. The Mughal capital was moved to Delhi in 1586 because of Fatehpur Sīkri's inadequate water supply. Fatehpur Sīkri is now maintained as a historic site. Pop. (1981) 17,908.

Fatḥ ʿAlī Shāh (b. 1771—d. Oct. 20, 1834, Isfahan, Iran), shah of Persia (1797–1834) whose reign coincided with rivalry among France, Great Britain, and Russia over eastern affairs.

Strong enough to subdue a rebellion in Khorāsān, he could not defeat the European powers. He became involved in a war with Russia in 1804 concerning the sovereignty of Georgia, whose ruler had transferred his allegiance from Persia to Russia. He purchased peace by abandoning his claim in 1813, after several years of war. He also lost Dagestan and Baku to Russia. In 1826 he took advantage of the recent death of Tsar Alexander I to renew the war but was compelled by the peace of 1828 to make an additional cession of territory, Persian Armenia.

Father of the Church, any of the great bishops and other eminent Christian teachers of the early centuries whose writings remained as a court of appeal for their successors, especially in reference to controverted points of faith or practice. *See* patristic literature.

fathom, old English measure of length, now standardized at six feet (1.83 metres), which has long been used as a nautical unit of depth. The longest of many units derived from an anatomical measurement, the fathom originated as the distance from the middle fingertip of one hand to the middle fingertip of the other hand of a large man holding his arms fully extended. The name comes from the Danish *faedn,* "outstretched arms."

Fathometer: trade name for a type of sonic depth finder (*q.v.*).

fatigue, specific form of human inadequacy in which the individual experiences an aversion to exertion and feels unable to carry on. Such feelings may be generated by muscular effort; exhaustion of the energy supply to the muscles of the body, however, is not an invariable precursor. Feelings of fatigue may also stem from pain, anxiety, fear, or boredom. In the latter cases, muscle function commonly is unimpaired.

The once-held belief that work was the cause of fatigue led to efforts to use the work output of factory workers, for example, as direct measures of fatigue. Early studies by industrial psychologists and engineers failed to show a close connection between how an individual worker said he felt and the amount of work he accomplished; production-oriented investigators were even led to attribute no significance at all to inner feelings of fatigue, and their attention shifted from the inner condition of the worker to external phenomena not related to the worker at all. In the process it was forgotten that work output is a product of, rather than a description of, the worker.

For other researchers who retained an interest in the worker himself, study was typically directed to observable body processes rather than to the overall internal state of the worker as manifested in how he said he felt. Such studies disclosed, among other things, that oxygen and glucose were consumed during work and that waste products such as carbon dioxide and uric acid were produced. Hence, for some investigators fatigue came to mean a bodily state in which waste products were present in high concentration.

All such studies clearly revealed specific results of exertion and disclosed evidence for the burning of food materials (metabolites); taken by themselves, the data provided a picture of the human organism as an energy-converting system and showed a definite relation of this process to energetic (work) performance. Such studies are a part of basic physiological research and apply most closely to what may be expected of people under heavy exertion in the workaday world and in sports and athletics.

Feelings and other signs of fatigue can arise suddenly and disappear suddenly, and the onset, duration, and termination of fatigue symptoms may appear to bear little relation to exertion or work. When fatigue arises in nonexertional situations, there is a temptation simply to say that the fatigue is "psychological" or "motivational." Relatively little research has been devoted to fatigue as descriptive of the person himself and of the full range of demands he has to meet, although many of these demands lie outside the simple energy requirements of more-or-less arduous work.

Man is able to—and may—respond to any situation in more than one way and at more than one level of behavioral complexity. The most readily observable ways are grossly physical and chemical; but these, in turn, underlie other levels of response such as primitive sensory activity (becoming aware of stimuli), and still higher levels such as perceiving (*e.g.,* evaluating the nature and objectives of work activity). At the highest level of activity the relationship often is spoken of as existing between the whole person and the environment.

Since most investigative attention in industrial or other production situations has been directed toward what man can do in terms of his being only a machine that converts food energy into useful work, an understanding of the fine details of the relation between fatigue and physiological body processes has preceded experimental efforts to specify the role of personal attitudes (such as the individual's own evaluation of his abilities). Such self-evaluations (*e.g.,* a worker's judgment that he cannot continue activity) rather than any exhaustion of the energy available within the body result in the termination of activity. Often when such changes in performance are attributed to motivation, or to any of a number of factors called psychological, one's allegiance to ancient views of the nature of man may tempt him to think of mental factors disjoined and unrelated to any physical, energistic description of the organism. Yet, a fully useful definition of fatigue would require that all relevant factors be considered. Indeed, modern efforts to achieve a unified, integrated definition of fatigue rest on studies in which higher-order mental processes (such as thinking, perceiving, and emoting) are investigated to find whether they seem to stem from physical body processes.

Fatigue as it is applied to the whole person involves an individual's feelings of discomfort and aversion, his inner awareness of making mistakes, and any changes in observable signs of effort required to carry on the performance involved. These aspects are found to be related in various ways to measurable variations in work output. Investigators who typically focus primarily on work output are apt to be concerned with the applied, practical view of the person as a productive worker; interest is more likely to be concentrated upon the worker himself by those scientists who wish to study fatigue even if their findings are not directly productive of work output. The worker himself is interested in how he feels and what makes him feel as he does.

At any rate, in accounting for fatigue, it is useful to make distinctions between what pertains to the individual as a whole and what pertains only to some part or organ of the individual. That the total behaviour is spoken of as personalistic, or psychological, is not simply because self-awareness (inner feeling of fatigue) is involved but because, at this level, resources are directed toward ends that go beyond the limited function of any one body part. This situation is illustrated by a simple example in muscular activity. When muscle activity is described in itself (at a given subpersonalistic level), it is simply called muscle contraction. Muscle contraction occurring as an integrated part of more complex personalistic behaviour may be called reaching; this action is an integral part of grasping a pencil, which is part of the more personalistic act of writing to one's friends.

While fatigue is one consequence of grossly observable activity, it can occur in the absence of manifest muscular exertion. It can develop, for example, as a rather immediate response to a socially exercised demand (such as that of a nagging supervisor), of which the person suddenly becomes aware but may not like. The feeling of fatigue produced in the absence of productive work seems to be essentially the same as that produced by goal-directed labour. Some components nevertheless are different, such as aching muscles in the one case and not in the other, but the factors that give fatigue its identity and differentiate it from other states of inadequacy are present in both. In each case conditions exist that can even result in one's total inability to carry on, whether his muscles contain high concentrations of waste products or not.

Muscular exertion does, however, produce biochemical changes in the body that are quite complex and that differ in various tissues and organs such as the heart or the brain. The consequence almost invariably is to produce secondary effects, perhaps muscular stiffness, and these in turn give rise to higher level effects such as one's sensory awareness of pain and discomfort. At a more personalistic level, the individual may develop a change in attitude with regard to the task or activity in progress; *e.g.,* he may begin to feel aversion for the work. The whole process, in effect, yields the individual's self-generated assessment of his own ability to carry on. If he continues his exertions under his personal assessment that such activity will produce more pain or will become more nearly intolerable or even impossible, the anticipated consequences include less efficient work performance. As the worker becomes preoccupied with his discomfort and with his waning production, the effect typically is to produce still more inefficient work. Thus fatigue defined as muscular inability to carry on and fatigue defined as a kind of felt aversion for exertion and as feelings of inability to carry on are all produced.

Performance may be observed to deteriorate (among factory workers, for example) even when there are no signs of the feeling state and of the aversive, pessimistic self-assessment defined here as personalistic fatigue. Indeed, often enough one may be "fatigued" without knowing it, indicating the predominance of relatively subpersonalistic factors at work. Such factors can be lumped under the term impairment, mentioned originally as one of the major forms of human inadequacy. While transient impairment and personalistic fatigue generally have not been distinguished from each other by many psychologists, in numerous studies impairment, rather than the feeling of fatigue, has been the point of interest.

Impairment of this sort reflects alterations in the chemical processes that occur within the cells of the body. That the alterations are reversible is illustrated in alcohol intoxication and oxygen lack (hypoxia). When such transient impairment incapacitates the individual for energetic activities without greatly affecting his brain processes, he is likely to feel tired and weak. Thus, it can be said that transient physiological impairment and personalistic fatigue are closely related, one being a basis for the other. When brain processes are so sharply affected as to reduce perceptual or attitudinal awareness, impairment may produce marked behavioral consequences without associated feelings of fatigue. In such cases, feelings of weakness and tiredness may not be reported by the individual since his abilities for self-evaluation have been dulled.

The failure of people to have feelings of fatigue as a consequence of physiological impairment is characteristic of some forms of hypoxia, which can be brought on in several ways. One of these is by a fairly abrupt reduction in atmospheric oxygen pressure, as would occur in one's being deposited atop a mountain by helicopter. Feelings of fatigue are much more likely to set in when oxygen reduction is gradual and associated with exertion (as in mountain climbing). Along with lack of oxygen, other factors of the climber's task play their roles, and the climber's own awareness of the negative factors that are developing produces the full syndrome of fatigue, including both the inability to carry on and the aversive attitude.

In contrast to this, oxygen lack can be produced much more quickly in a decompression chamber in a laboratory, without any associated muscular exertion. It is possible to reach

levels of hypoxia that abruptly reduce the subject's efficiency in exercising self-assessment, and personalistic fatigue in such cases fails to develop.

fatigue, in engineering, manifestation of progressive fracture in a solid under cyclic loading as in the case of a metal strip that ruptures after repeated bending back and forth. Fatigue fracture begins with one or several cracks on the surface that spread inward in the course of repeated application of forces until complete rupture suddenly occurs when the small unaffected portion is too weak to sustain the load. Structural and machine parts subject to vibrations and other cyclic loading must be designed to avoid fatigue fracture.

fātiḥah, also called FĀTIḤAT AL-KITĀB, the "opening" or first chapter (*sūrah*) of the Muslim book of divine revelation, the Qur'ān; in tone and usage it has often been likened to the Christian Lord's Prayer. In contrast to the other *sūrah*s, which are usually narratives or exhortations delivered by God, the seven verses of the *fātiḥah* form a short devotional prayer addressed to God, and in oral recitation are ended with the word *amīn* ("amen"). The *fātiḥah* has acquired broad ceremonial usage in Islām: it introduces each ritual bowing (*rak'ah*) in the five daily prayers (*ṣalāt*); it is recited at all Muslim sanctuaries; validates important resolutions; appears frequently on amulets, and is recited for the dead.

In North Africa, *fātiḥah* (or *fatḥah*) designates a prayer performed silently with arms outstretched, palms turned upward. The first *sūrah* is not necessarily recited but was probably once part of the ceremony.

Fátima, village and sanctuary, Vila Nova de Ourém municipality, Santarém district, central Portugal; it is located on the tableland of Cova da Iria, 18 mi (29 km) southeast of Leiria. Named for a 12th-century Moorish princess, Fátima has since 1917 been one of the greatest Marian shrines in the world, visited by thousands of pilgrims annually. On

Basílica at the Shrine of Our Lady of Fátima, Portugal
C.I.R.I.—EDISTUDIO

May 13, 1917, and each subsequent month until October, three young peasant children, Lucia dos Santos and her cousins Francisco and Jacinta Marto, reportedly saw a lady who identified herself as the Lady of the Rosary. On October 13, a crowd (generally estimated at about 70,000) gathered at Fátima witnessed a "miraculous solar phenomenon" immediately after the lady had appeared to the children. After initial opposition, the Bishop of Leiria on Oct. 13, 1930, accepted the children's visions as the appearance of the Virgin Mary; in the same year papal indulgences were granted to pilgrims. The content of the devotion includes frequent recitation of the rosary and devotion to the Immaculate Heart of the Blessed Virgin Mary.

The first national pilgrimage to Fátima took place in 1927, and the basilica was begun in 1928 and consecrated in 1953. With a tower, 213 ft (65 m) high, surmounted by a large bronze crown and a crystal cross, it is flanked by hospitals and retreat houses and faces a vast square in which is the little Chapel of the Apparitions. Numerous cures have been reported, though publicity has not been sought. On the 50th anniversary of the first vision, May 13, 1967, a crowd of pilgrims, estimated to number 1,000,000, gathered at Fátima to hear Pope Paul VI say mass and pray for peace. Pop. (1981) village, 525; village and adjacent *freguesia* (parish), 7,298.

Fāṭimah, also spelled FATIMA, also called AZ-ZAHRĀ' (Arabic: Shining One) (b. *c.* 605, Mecca, Arabia—d. 633, Medina), daughter of Muḥammad (the founder of Islām) who in later centuries became the object of deep veneration by many Muslims, especially the Shī'ī. Muḥammad had other sons and daughters, but they either died young or failed to produce a long line of descendants. Fāṭimah, however, stood at the head of a genealogy that steadily enlarged through the generations.

To the Shī'ī she is particularly important because she was married to 'Alī, whom the Shī'ī considered to be the legitimate heir of the authority of the Prophet Muḥammad and the first of their *imām*s. The sons of Fāṭimah and 'Alī, Ḥasan and Ḥusayn, are thus viewed by the Shī'ī as the rightful inheritors of the tradition of Muḥammad, a further ramification of Fāṭimah's significance among Shī'ī believers. Accordingly, many Islāmic traditions give Fāṭimah's life majesty that it did not possess in historical reality.

Fāṭimah accompanied Muḥammad when he emigrated from Mecca to Medina in 622. Soon after her arrival in Medina she married 'Alī, the son of one of the Prophet's uncles. Their first years were ones of material want. 'Alī was often harsh with her, and Fāṭimah brought her case before Muḥammad himself; the Prophet took great satisfaction in being able to reconcile husband and wife. When in 632 Muḥammad was facing his last illness, Fāṭimah was there to nurse him. In general she was timid and avoided involvement in political affairs. Yet after Muḥammad's death she had a sharp clash with Abū Bakr, who succeeded Muḥammad as leader of the Islāmic community, over property that she claimed Muḥammad had left her. Abū Bakr refused to sanction her claim, and for six months she and 'Alī refused to recognize his authority. It is not clear whether or not she had become reconciled to Abū Bakr by the time she died.

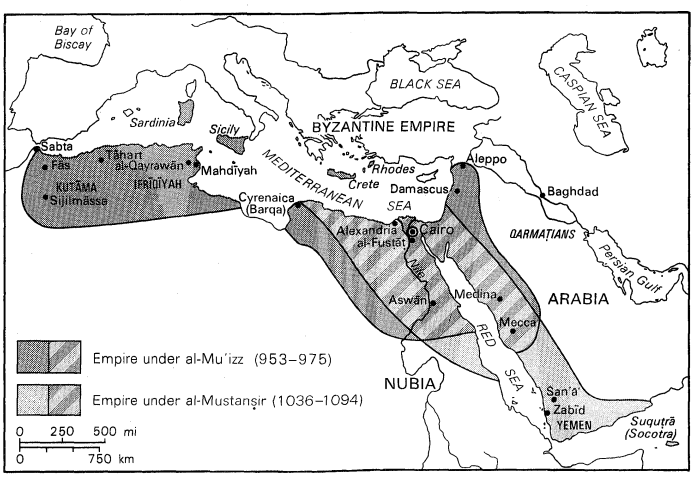
Fāṭimid DYNASTY, political and religious dynasty that dominated an empire in North Africa and subsequently in the Middle East from AD 909 to 1171 and tried unsuccessfully to oust the 'Abbāsid caliphs as leaders of the Islāmic world. It took its name from Fāṭima, the daughter of the Prophet Muḥammad, from whom the Fāṭimids claimed descent.

Before the Fāṭimids, there had been other rulers in North Africa and Egypt who had succeeded in making themselves virtually independent of the 'Abbāsid caliphs in Baghdad; but they had been Muslims of the Sunnī branch of Islām, willing to recognize the token suzerainty of the caliph as head of the Islāmic community. The Fāṭimids, however, were the heads of a rival religious movement—the Ismā'īlī sect of the Shī'ī branch—and dedicated to the overthrow of the existing religious and political order in all Islām. Unlike their predecessors, they refused to offer even nominal recognition to the 'Abbāsid caliphs, whom they rejected as usurpers. They themselves—as Ismā'īlī *imām*s (spiritual leaders), descendants of the Prophet through his daughter Fāṭima and his kinsman 'Alī—were, in the eyes of their followers, the rightful caliphs, both by descent and by divine choice the custodians of the true faith and the legitimate heads of the universal Islāmic state and community. Their purpose was not to establish another regional sovereignty but to supersede the 'Abbāsids and to found a new caliphate in their place.

Period of expansion. During the 9th century, Ismā'īlī missionaries became established in many parts of the Islāmic empire, preaching a doctrine of revolution against the Sunnī order and the 'Abbāsid state. After a number of unsuccessful risings, the Ismā'īlīs were able to establish a firm base in the Yemen; from there they sent emissaries to North Africa, where they achieved their greatest success. By 909 they were strong enough for their *imām*, who had been in hiding, to emerge and proclaim himself caliph, with the messianic title of al-Mahdī (the Divinely Guided One). This marked the beginning of a new state and dynasty.

For the first half-century the Fāṭimid caliphs ruled only in North Africa and Sicily, where they had to deal with many problems. Most of their subjects were Sunnīs of the Mālikī school; others—a substantial minority—were the Khawārij, or Khārijites. Neither group was well disposed toward the Ismā'īlī doctrines of the new rulers, and they offered stubborn resistance to them. Even among the Ismā'īlīs themselves, a conflict soon arose between the state and the revolution—that is, between the caliph al-Mahdī (reigned 909–934) and the missionaries who had brought him to power. There also were political problems with Berber tribes and neighbouring Muslim rulers, as well as a war against the Byzantines in Sicily and Italy that the Fāṭimid rulers had inherited from their North African predecessors.

Conquest of Egypt. While coping with these difficulties, the Fāṭimids never lost sight of their ultimate aim, expansion to the East,



The Fāṭimid Empire
Adapted from Abbas Hamdani, *The Fatimids* (1962); Pakistan Publishing House

where the centre of ʿAbbāsid strength lay. The first step was the conquest of Egypt. The first caliph, al-Mahdī, established his capital at Mahdīyah (founded 920) on the east coast of Tunisia. His successors al-Qāʾim (reigned 934–946), al-Manṣūr (reigned 946–953), and al-Muʿizz (reigned 953–975) ruled from there. In 913–915, 919–921, and 925 unsuccessful expeditions were sent against Egypt. Finally, in 969, under the caliph al-Muʿizz, the first stage in the advance to the East was completed. Fāṭimid troops conquered the Nile Valley and advanced across Sinai into Palestine and southern Syria. Near al-Fusṭāṭ, the old administrative centre of Muslim Egypt, the Fāṭimids built Cairo, which became the capital of their empire, and in it a new cathedral mosque and seminary, called al-Azhar, after Fāṭima az-Zahrā (the Resplendent), the ancestress of the dynasty.

For more than a century the Fāṭimid rulers in Cairo pursued their aim of establishing the universal Ismāʿīlī imamate. At times they were compelled by other problems—war on the frontiers, trouble in the Mediterranean, unrest at home or in the provinces—to reach some agreement with their Sunnī rivals; but such arrangements were always temporary.

The Fāṭimid caliphate was a regime at once imperial and revolutionary. At home, the caliph was a sovereign, governing a vast empire and seeking to expand it by normal military and political means. Its heart was Egypt; its provinces at its peak included North Africa, Sicily, the Red Sea coast of Africa, Syria, Palestine, the Yemen, and the Hejaz, with the two holy cities of Mecca and Medina. Control of these was of immense value to a Muslim ruler, conferring great religious prestige and enabling him to exploit the annual pilgrimage to his advantage.

The caliph was not only an emperor; he was also an *imam*—the spiritual head of the Ismāʿīlīs wherever they were and, according to Ismāʿīlī doctrine, the embodiment of God's infallible guidance to mankind. As such he was the archenemy of the Sunnī ʿAbbāsid order and the hope and refuge of those who wished to overthrow it. In all the lands still under ʿAbbāsid suzerainty, he commanded a great network of missionaries and agents, and he used them to gain converts for the Ismāʿīlī faith and workers for the Fāṭimid cause; their task was also to preach and, where possible, to practice subversion against the Sunnī order and the regimes that supported it. The mission was elaborately and secretly organized under the supreme direction of the chief missionary in Cairo. In the Fāṭimid state the mission became in effect a third branch of the government, together with the traditional military and bureaucratic establishments; it thus approximated to something otherwise lacking in the medieval Islāmic world—an institutionalized state church.

The primary tasks of the mission were the formulation and dissemination of Ismāʿīlī doctrine. Ismāʿīlī theology supplied the arguments by which the Fāṭimids denied the ʿAbbāsid claim to the caliphate and asserted their own, and was thus a powerful weapon in their armoury. First in Tunisia and then in Egypt, a series of distinguished theologians wrote what became the classical formulations of Ismāʿīlī doctrine. The Fāṭimids also founded great libraries and colleges, whose functions were to train missionaries to go out into the field, and to provide further instruction for the converts sent to Cairo for this purpose.

The work of the mission was only a part—albeit an important one—of the Fāṭimid grand strategy against the Sunnī Empire; in this strategy, the universal aims of the Ismāʿīlī faith and the imperial purposes of the Fāṭimid state met and merged. Linked with these actions was a great commercial expansion and an economic policy aimed at developing the Red Sea trade between Asia and the Near East, to the detriment of the alternative route through the Persian Gulf, which was controlled by the Sunnī powers. In the course of this effort, the Fāṭimids extended their rule down both shores of the Red Sea, established their supremacy in Yemen, and sent missionaries to eastern Arabia, to Central Asia, and to India.

Beginning of Fāṭimid decline. The height of Fāṭimid expansion to the East was reached in 1057–59, when a dissident general in Iraq changed sides and proclaimed the Fāṭimid caliph in Mosul and then, for a year, in Baghdad itself. The Fāṭimids were unable to provide support, however, and the general was driven out of Baghdad by the Seljuq Turks. This proved to be a turning point and the beginning of the decline of both Fāṭimid power and Ismāʿīlī influence.

Several reasons may be adduced for the failure of the Fāṭimid bid for Islāmic leadership. One was their adoption and retention of a religious doctrine that was ultimately unacceptable to the Sunnī majority. Fāṭimid Ismāʿīlism, as a theology, was remote from the central consensus of Islām, and with the Sunnī revival of the 11th and 12th centuries its rejection became certain. The coming of the crusaders indirectly sealed its fate, for in the great 12th-century contest between Islām and Christendom there was no room for dissention on the Muslim side.

In their ventures abroad, the Fāṭimids achieved many successes, the most notable being the conquest of Egypt itself. They suffered repeated setbacks, however, in Palestine and Syria where, in addition to local opponents, they also had to face major attacks from outside—by the Byzantines, the Turks, and then the European crusaders. It was in Syria that the great Fāṭimid advance to the East was delayed and halted; and it was in Syria that a new power arose that in time destroyed them.

These troubles abroad no doubt fed, and were fed by, the growing discontents in Egypt. At first the caliphs retained full personal control of affairs, presiding over an essentially civilian government. The army's importance increased, however, and factional differences arose among the Berber, Turkish, Sudanese, and Nubian troops. Fights between the different groups first became a factor during the reign of al-Ḥākim (reigned 996–1021), in whose time, partly because of his own highly eccentric behaviour, the personal authority and religious prestige of the caliph began to decline. His successors became little more than puppets in the hands of their viziers and their generals. During the long reign of al-Mustanṣir (reigned 1036–94) factional strife brought Egypt into a vicious circle of anarchy and tyranny, made worse by recurring famine and plague. The provinces, in east and west, were lost to local dynasts or invaders.

In 1073, an able soldier, Badr al-Jamālī, went to Cairo at the invitation of the caliph and seized power; in one night his officers rounded up the leading generals and officials and put them to death. He assumed the titles of commander of the armies, director of the missionaries, and vizier, symbolizing his control of the military, religious, and bureaucratic establishments; it is by the military title that he is usually known. Badr al-Jamālī restored order and, for a while, even brought some measure of prosperity. Egypt came under the rule of a military regime, headed by the commander of armies and maintained by his troops. The office became permanent; Badr was succeeded by his son and then by a series of military autocrats who kept the Fāṭimid caliphs in tutelage. The later commanders were not even Ismāʿīlīs.

The end of the Fāṭimid state. Badr and his successors saved the Fāṭimid state from collapse and postponed its end for nearly a century. Responding to the Seljuq challenge from the East, he pursued an active policy in Syria, Arabia, and elsewhere, using both religious and worldly weapons. In Syria, however, the armies of the Fāṭimids suffered repeated defeats; in Arabia their following was reduced to insignificance. Badr's son and successor al-Afḍal in effect renounced the claims of the Egyptian Fāṭimid dynasty to the universal caliphate.

On the death of al-Mustanṣir in 1094 it was al-Afḍal who chose the new caliph. Al-Mustanṣir had nominated his elder son, Nizār, who had been accepted by the Ismāʿīlī leaders; the younger son, Aḥmad, was a youth without allies, who would be entirely dependent on his sponsor. It was no doubt with this in mind that al-Afḍal married his sister to Aḥmad and, on al-Mustanṣir's death, proclaimed his brother-in-law as caliph with the regnal name al-Mustaʿlī (reigned 1094–1101); in doing so, al-Afḍal split the sect from top to bottom.

Even in Egypt there was some opposition; in Persia, Iraq, and Central Asia the Ismāʿīlī mission, led by Ḥasan-e Ṣabbāḥ, refused to recognize the new caliph and broke off relations with the Fāṭimid authorities in Cairo. Ḥasan-e Ṣabbāḥ's new Ismāʿīlī movement, known after its Syrian branch as the Assassins, proclaimed Nizār and his descendants as rightful *imāms* and condemned the caliphs in Cairo as usurpers. Even those Ismāʿīlīs, chiefly in the Yemen, who had accepted al-Mustaʿlī broke away in 1130 when al-Mustaʿlī's son al-Āmir (reigned 1101–30) was murdered by the Assassins and was succeeded by his cousin al-Ḥāfiẓ (reigned 1130–49). Claiming that al-Āmir had left an infant son who was now the hidden *imām*, the Yemenites refused to recognize al-Ḥāfiẓ or his successors in Cairo.

The end of the dynasty came in 1171. The last four caliphs were no more than a local Egyptian dynasty, without power, influence, or hope. In 1171, the last caliph died. Saladin, the nominal vizier, had become the real master of Egypt, and the Fāṭimid caliphate, already dead as a religious and political force, was formally abolished.

Articles are alphabetized word by word, not letter by letter

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fatness: *see* obesity.

fatsia, also called JAPANESE ARALIA (*Fatsia japonica*), evergreen shrub or small tree, in the ginseng family (Araliaceae), native to Japan but widely grown indoors for its striking foliage and easy care. In nature it can attain

Fatsia japonica
W.H. Hodge

a height to 6 metres (20 feet); the glossy, dark-green leaves, roughly star-shaped, with 7 to 11 lobes, may be nearly 45 centimetres (1½ feet) across. Compact-growing and variegated leaved varieties are available. Occasionally, under good indoor conditions, it may produce white flower clusters followed by shiny black fruit.

Fatsia has been crossed with an English ivy (*Hedera helix*) to produce the tree ivy, or aralia

ivy (× *Fatshedera lizei*), an intergeneric cross, a most uncommon botanical occurrence.

fatty acid, important component of lipids (constituents of living cells) in plants, animals, and microorganisms. Generally, a fatty acid consists of a straight chain of an even number of carbon atoms, with hydrogen atoms along the length of the chain and at one end of the chain and a carboxyl group (—COOH) at the other end. It is this carboxyl group that makes it an acid (carboxylic acid). If the carbon-to-carbon bonds are all single, the acid is saturated; if any of the bonds is double or triple, the acid is unsaturated and is more reactive. A few fatty acids have branched chains; others contain ring structures (*e.g.,* prostaglandins). Fatty acids are not found in a free state in nature; commonly they exist in combination with the alcohol glycerol in the form of triglyceride (*q.v.*).

The most widely distributed fatty acid is oleic acid, which is abundant in some vegetable oils (*e.g.,* olive, palm, peanut, and sunflower seed) and which makes up about 46 percent of human fat.

Many animals cannot synthesize one or more of the fatty acids and must ingest them in foods. Two such derived fatty acids are linoleic and linolenic acids; these, and sometimes arachidonic acid, which can be synthesized from linolenic, are required by all mammals and are called essential fatty acids.

Soaps are the sodium and potassium salts of fatty acids.

fatty liver, abnormal accumulation of fat in the liver cells, usually as a result of chronic malnutrition. The particular substances the lack of which brings on fatty liver are choline and methionine. Choline is a vitamin essential for the metabolism of fat in the liver (by oxidation the liver breaks fats down into forms that can be used by tissues outside the liver), and methionine is an amino acid—a nitrogenous compound, one of the components of protein—that is used by the body in the manufacture of choline.

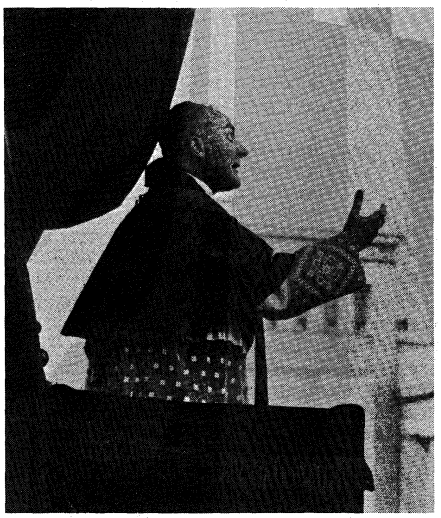
Persons who have fatty livers characteristically either lack choline and methionine in their diets or are unable to assimilate these substances. Children with kwashiorkor, a protein-deficiency disease, have fatty livers, as alcoholics frequently do. In the case of alcoholism, it is thought that, in addition to the faulty diet, the stimulatory effect of alcohol on the production of fat in the liver may play a role. Fatty liver may also be caused by anything that interferes with the functioning of the liver, including infections, chemical poisons, and a deficient supply of oxygen to the liver. Treatment of fatty liver is directed toward the underlying cause.

faujasite, hydrated sodium and calcium aluminosilicate mineral, a rare member of the zeolite family, somewhat resembling chabazite in chemical composition, crystal structure, and distribution. Isolated specimens have been found in sedimentary rocks in Germany and Switzerland; they take the form of colourless or pale-yellow octahedra with rounded edges, with isometric symmetry. The channels and cavities within the aluminosilicate molecular framework are larger than those in any other natural zeolite, allowing the dehydrated mineral to be penetrated by organic molecules as large as toluene and cyclohexane. The chemical formula of faujasite is as follows: $(Na_2,Ca)_{3.5}Al_7Si_{17}O_{48} \cdot 32H_2O$.

Faulhaber, Michael von (b. March 5, 1869, Heidenfeld, Prussia—d. June 12, 1952, Munich), German cardinal and archbishop of Munich who became a prominent opponent of the Nazis.

Educated at Rome, Faulhaber was ordained in 1892. He taught at the German universities of Würzburg (1899–1903) and Strassburg (1903–11), subsequently serving as bishop of Speyer (1911–17) and archbishop of Munich and Freising (1917–52). He was created a cardinal in 1921.

Repelled by Nazi totalitarianism, neopaganism, and racism, Faulhaber contributed to the

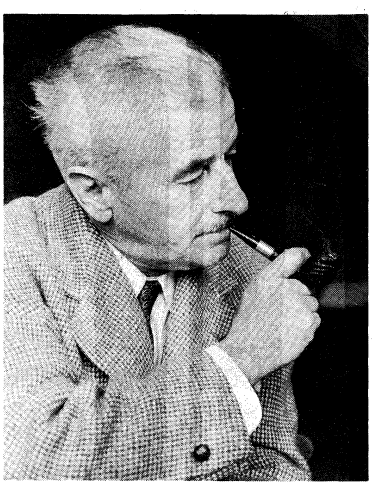


Faulhaber
Bavaria-Verlag

failure of Hitler's Munich Putsch (1923), an attempt to oppose the Weimar Republic with a national revolution. During the Nazi regime he delivered his famous sermons entitled *Judaism, Christianity, and Germany* (translated in 1934), which emphasized the Jewish background of Christianity and pointed out that the teachings of the New Testament logically followed those of the Old. He further emphasized that the German tribes had become civilized only after Christianization and asserted that Christian values were fundamental to German culture. Throughout his sermons until the collapse (1945) of the Third Reich, Faulhaber vigorously criticized Nazism, despite governmental opposition. Attempts on his life were made in 1934 and in 1938. He worked with American occupation forces after the war, and he received the West German Republic's highest award, the Grand Cross of the Order of Merit.

Among his other published works is *Die Sittenlehre des Evangeliums* (1936; "The Moral Teachings of the Gospels").

Faulkner, William (Cuthbert), original surname (until 1924) FALKNER (b. Sept. 25, 1897, New Albany, Miss., U.S.—d. July 6, 1962, near Oxford, Miss.), American novelist best known for the series known as the Yoknapatawpha cycle, developed as a fable of the real American South in history and, beyond



Faulkner
Robert Capa—Magnum

that, of human destinies everywhere. He won the Nobel Prize for Literature in 1949.

Youth and first writings. Faulkner was the oldest of four brothers born in a county seat in northern Mississippi. His parents were Murry C. and Maud Butler Falkner; it was the novelist himself who later added a "u" to the name. Soon the Falkners moved to Ripley, in the adjoining county, and then 50 miles southwestward to Oxford, where the novelist was to spend most of his life. In Oxford his father owned and lost a livery stable and a hardware store before he became business manager of the state university. The family was proud of its Southern heritage and revered the memory of the boys' hot-tempered great-grandfather, Col. William C. Falkner, who had served with distinction during the Civil War. Later, besides building a railroad from Ripley into Tennessee, he had written a romantic novel, *The White Rose of Memphis* (1881), popular enough to be reprinted 36 times.

Billy, or "Memmie"—as he was called by the family and also by a devoted servant, Caroline Barr, who told him stories remembered from slavery days—was an imaginative boy, always leading his brothers into scrapes. His imagination was fed by haphazard reading. There was no public library in Oxford then, but the house was stocked with books, including Dickens and many other English classics. He was not interested in formal studies and dropped out of high school after his second year. At the time, he was in love with a neighbour girl, Estelle Oldham. Dreaming of marriage, he went to work in his grandfather's bank. Meanwhile, another neighbour, Philip Stone, soon to enter the family law office, took charge of his reading and provided him with books unknown in Oxford, many of which were in the Symbolist or Modernist tradition: Charles Baudelaire, Paul Verlaine, and Stéphane Mallarmé (Faulkner taught himself to read French). He also read Oscar Wilde, James Joyce, T.S. Eliot, and Conrad Aiken.

Estelle married another man and went to live in the Orient. Faulkner enlisted in the Royal Air Force of Canada and was sent to Toronto as a cadet pilot in 1918, but the war ended before he had finished his basic training. Home again in Oxford, he was admitted to the University of Mississippi—"by special dispensation for returned troops," he said in a letter—but he stayed there only long enough to join a fraternity and contribute poems to the literary magazine. During the years that followed, he engaged in a series of occupations to earn enough for "paper, tobacco, food, and a little whiskey" while he was learning to write. Thus, in the fall of 1921, he worked as a clerk in a New York City bookstore. For the next three years he was postmaster of the university station, just outside of Oxford—"the damndest postmaster the World has ever seen," Phil Stone wrote of him. It was Stone who put up most of the money for the publication of his first book, a cycle of pastoral poems, *The Marble Faun* (1924).

The first half of 1925 he spent in New Orleans; perhaps it was the only time when Faulkner moved in a talkative literary circle, though he did little of the talking. It was also the time when he wrote his first novel, *Soldier's Pay,* about the return to Georgia of a fatally wounded aviator. The novelist and short-story writer Sherwood Anderson was then the great man of the New Orleans circle, and he recommended the novel to his own publisher. In July Faulkner sailed for Italy on a slow freighter; soon he made his way to Paris, partly on foot. He was living there alone, on the Left Bank, when he heard that the novel had been accepted for publication the following spring. The advance against royalties of $200 paid for most of his passage to

New York and his railroad ticket to Oxford, where he arrived before Christmas. In Oxford (and, during the summers, in Pascagoula, on the Gulf coast of Mississippi) he continued for some years to support himself by odd jobs: by working as house painter, carpenter, golf professional, deckhand on a shrimp trawler, and, by his own account, rum smuggler on a speedboat that dodged through the Louisiana bayous. Meanwhile he was writing furiously, mostly at night.

His second novel, *Mosquitoes* (1927), was a heavily satirical picture of the New Orleans literary circle. It was also, in effect, a rejection of the circle and its like. He was to do his future work in something close to isolation. Besides novels and poems, he was producing stories, each of which was handed over to Phil Stone, typed by his secretary, and sent off to several magazines. The stories always came back, and, at one time, Stone reported that a drawer of his filing case was nearly full of rejected manuscripts. A third novel, *Flags in the Dust,* finished in the autumn of 1927, was refused by the publisher of the other two. Faulkner became persuaded that his work would never again appear between hard covers. "Now I can write," he said to himself before starting *The Sound and the Fury.* A translation of the remark might be, "Now I can forget the public and live in my imagination."

Flags in the Dust was given a new title, *Sartoris,* and was finally accepted by another publisher, after changes in the manuscript by an unknown hand; it appeared in January 1929. Disproportioned and sometimes emotionally overwrought, it is the last of his apprentice works, but also the first to deal with his imagined community of Yoknapatawpha County and to state many of the themes he would later develop at length. *The Sound and the Fury,* accepted by still another publisher, appeared in October of the same year. Describing as it does the decay and fall of the aristocratic Compson family—and, implicitly, of a social order—from four different points of view, it is extraordinary for its technical and psychological range and is the first of his masterworks.

Estelle Oldham came back from China after the failure of her first marriage, and she and Faulkner were married in June 1929. During the spring of that eventful year he had written a draft of *Sanctuary*—"the most horrific tale I could imagine"—and had sent it to his new publisher, Harrison Smith. "Good God, I can't publish this. We'd both be in jail," Smith reported, but without returning the typescript. During the late autumn, Faulkner wrote *As I Lay Dying* while he worked as night fireman at the university power station. Reviews of *The Sound and the Fury,* more impressive than its sale, were persuading editors to take a second look at his short stories. "A Rose for Emily" was the first to appear in a national magazine (April 1930), and it was soon followed by others. Faulkner took the risk of buying a big, dilapidated house—which he called Rowanoak—built shortly before the Civil War.

Mature works. He was now well along in what later came to be known as his major phase. The sheer number of his books was becoming impressive. In the years from 1930 to 1942 he published two collections of stories, a second and last book of poems (*A Green Bough,* 1933) and nine novels—all this besides working on movies in Hollywood and making repairs on Rowanoak with his own hammer and saw. The novels are *As I Lay Dying* (1930), about a poor-white family and its journey through fire and flood to bury the mother in Jefferson, the county seat of Faulkner's Yoknapatawpha County; *Sanctuary* (1931), his one popular success—the publisher had changed his mind about it, and Faulkner had rewritten it in proof, without softening the horror; *Light in August* (1932), with its portrait of Joe Christmas, who may or may not be a mulatto and can live in neither the white world nor the black world; *Pylon* (1935), about barnstorming aviators, published in the same year that his youngest brother, Dean, was killed while piloting a plane that Faulkner had bought two years earlier, when he had been working for the movies, a death that ironically echoed that of the protagonist in *Sartoris; Absalom, Absalom!* (1936), a fable of the old South that is one of his best books but was the most scathingly reviewed, so that his readers began to drop away; *The Unvanquished* (1938), about the Sartoris clan in and after the Civil War; *The Wild Palms* (1939), two separate stories counterpointed in alternate chapters; *The Hamlet* (1940), first volume of a trilogy about the rise of the unscrupulous Snopes family; and *Go Down, Moses* (1942), about the Mississippi wilderness and the white and the black descendants of a planter who lived on the edge of it. Except for *Pylon,* all these novels contribute to the Yoknapatawpha cycle.

That cycle was not something planned in advance, as Émile Zola's *Les Rougon-Macquart* series had been. Faulkner started with his own countryside, his own kinfolk, his own memory of stories told him by Caroline Barr—Mammy Callie—or overheard on Saturday afternoons in the Oxford town square; but the stories grew in his imagination, where he sublimated, as he liked to say, "the actual into the apocryphal." Sometimes his version of an incident or his judgment of a character changed from novel to novel, but he was not disturbed by such inconsistencies: "I know these people better now," he used to explain. In the end the novels are even more remarkable for their unity than for their diversity. They all have in common three qualities that, before their time, were somewhat exceptional in American fiction: a sense of place, with events partly determined by their background in nature; a sense of history—that is, of the living past; and a sense of community. Often, Faulkner's narrator is the imagined voice of the community.

Unified as they are in their essential subject, the novels are extremely diverse in their approach to it. Each of them adopts a new method or a number of methods to solve a particular problem that the author had set himself. Sometimes the novel had started with a mental picture—Faulkner says, for instance, that *Light in August* started with the picture of a pregnant woman walking barefoot on a dusty road, and the problem was to explain how she got there and what happened next; the author himself did not know when he was writing the first chapter. The case was different with *As I Lay Dying,* where the whole story existed in Faulkner's mind before he set the first word of it on paper (writing very rapidly, he says, on the back of an upturned wheelbarrow). Three other books—*The Unvanquished, The Hamlet,* and *Go Down, Moses*—first existed as magazine stories, and the problem was to bring the stories together into a novel. Each of the three provides a completely different solution. Among the methods that Faulkner adopted were some he had learned from his reading of Symbolist or Modernist authors—for example, the interior monologue as developed by Joyce and others—but he also acquired and applied the principle that every author should invent his own methods and, if possible, push them further in each new book. Thus, his interior monologues were sometimes those of idiots or of persons on the edge of insanity. A technique he made peculiarly his own was that of delayed meaning, so that he circled around the subject of a novel as if it were a city hidden in the jungle. In matters of style, he set the modern against the traditional, the simple against the involuted or sometimes the needlessly obscure, and mingled Shakespearean grandiloquence with Southern humour.

His widespread influence, however, was still in the future. During the early 1940s, Faulkner seemed close to being forgotten—not in France, where his novels had been ably translated; not by his fellow American novelists, some of whom admired his work intensely; but by the American public at large. Although *The Hamlet* and *Go Down, Moses* contain some of his best writing—including a superb story, "The Bear"—they had gone almost unnoticed. In 1945 his novels were effectively out of print, except for a few copies of *Mosquitoes* in his first publisher's warehouse. Faulkner himself, unable to live by writing fiction, had accepted a long-term contract to write movie scripts in Hollywood at a modest salary.

His second rise to fame, steeper than the first, began with the publication in 1946 of *The Portable Faulkner.* It presented his Yoknapatawpha legend as a whole, with extracts from most of his books arranged in historical order. Some of the novelists who admired his work seized the opportunity to write illuminating essays about it. The public began to take notice, and Random House, his final publisher, put the books back into print, one after another. In 1948 Faulkner published a new novel, *Intruder in the Dust,* about a white boy who saves a proud Negro from being lynched. It was the first of his books since *Sanctuary* to have even a modest popular success. *Collected Stories,* published early in 1950, won the National Book Award. At the end of the same year Faulkner was awarded the Nobel Prize and accepted it in an address famous for his prediction that man would survive in a world on the brink of self-destruction. Academic critics had gone to work on his books, which were providing the raw material, sometimes transformed beyond recognition, of a thriving industry.

Though a private man, Faulkner had become a public figure. He travelled abroad for the State Department: to Peru and Brazil in 1954; to Japan (where he had enthusiastic readers), the Philippines, and western Europe in 1955; to Greece in 1957; and to Venezuela in 1961. He was happier as writer in residence at the University of Virginia (1957 and 1958), because his only daughter and his grandchildren were living nearby. Meanwhile, he had taken a stand on at least one public question, that of the Negroes in Mississippi. Faulkner profoundly sympathized with the Negroes, but he had a strong residue of Southern nationalism and believed that the South should integrate for itself, without Northern interference. His opinions irritated many blacks and whites and drew fire from both liberals and conservatives.

Faulkner drank heavily at intervals, but most of the time he kept producing, as is shown by the record of his publications. In 1951 a sequel to *Sanctuary* was published; it was a three-act play, *Requiem for a Nun,* with a narrative prologue to each act that gave it the effect of a novel. In 1954 Faulkner's longest novel, *A Fable,* on which he had been working for nearly 10 years, was published; its hero is Christ reincarnated as a French corporal during World War I. In other novels of his last period, Faulkner was rounding out the Yoknapatawpha story, which continued to grow in his imagination; the country became a kindlier place as he looked back on it. Some of the demonic fire had gone out of his writing, which now expressed a more tolerant view of human nature. *The Town* (1957) and *The Mansion* (1959) concluded the Snopes trilogy. *The Reivers,* Faulkner's last book, is a nostalgic comedy of boyhood that appeared, to great acclaim, only a month before he died in a hospital near Oxford. His death followed that of Hemingway by a year and marked the

passing of a generation that had invented new shapes for American fiction. (Ma.C.)

MAJOR WORKS. *Novels. Soldier's Pay* (1926); *Mosquitoes* (1927); *Sartoris* (1929); *The Sound and the Fury* (1929); *As I Lay Dying* (1930); *Sanctuary* (1931); *Light in August* (1932); *Pylon* (1935); *Absalom, Absalom!* (1936); *The Unvanquished* (1938); *The Wild Palms* (1939); *The Hamlet* (1940); *Go Down, Moses* (1942); *Intruder in the Dust* (1948); *Requiem for a Nun* (1951), part novel, part play; *A Fable* (1954); *The Town* (1957); *The Mansion* (1959); *The Reivers* (1962).

Short stories. These 13 (1931); *Dr. Martino and Other Stories* (1934); *Knight's Gambit* (1949); *Collected Stories* (1950); *Big Woods* (1955).

Poems. The Marble Faun (1924); *A Green Bough* (1933).

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By far the largest collection of Faulkner manuscripts, including many preliminary drafts, is on deposit at the Alderman Library of the University of Virginia. After most of the collection was displayed at Princeton, Meriwether described it in an admirable book-length catalog, *The Literary Career of William Faulkner* (1961). Carl Peterson, *Each in Its Ordered Place: A Faulkner Collector's Notebook* (1975), is a comprehensive listing of the writings with a chronologically arranged checklist of background and critical material.

There is no collected edition of Faulkner in English (there is one in Spanish), but his books are faithfully kept in print. Malcolm Cowley (ed.), *The Portable Faulkner* (1946, rev. 1967), is a selection based on the Yoknapatawpha County cycle.

The authorized record of his life, abundantly detailed, is by Joseph L. Blotner, *William Faulkner: A Biography,* 2 vol. (1972). There is firsthand information about the man and his background in John Faulkner, *My Brother Bill* (1963); in a book by another brother, Murray C. Falkner, *The Falkners of Mississippi* (1967); and in John B. Cullen and Floyd C. Watkins, *Old Times in the Faulkner Country* (1961). Almost all the interviews with Faulkner, including those in Japan, are collected in James B. Meriwether and Michael Millgate (eds.), *Lion in the Garden* (1968). Malcolm Cowley, *The Faulkner-Cowley File* (1966), contains 26 of Faulkner's letters.

Many critical studies of Faulkner's work have elaborated the symbolic elements to the neglect of the sense and the structure. A better balanced treatment of all the novels is Michael Millgate, *The Achievement of William Faulkner* (1966). Cleanth Brooks, *William Faulkner: The Yoknapatawpha Country* (1963), is unsurpassed for the novels and stories in the Yoknapatawpha cycle. His *William Faulkner: Toward Yoknapatawpha and Beyond* (1978) completes a study of the writer's career. Other critical books that contribute to a full picture are William Van O'Connor, *The Tangled Fire of William Faulkner* (1954); Olga W. Vickery, *The Novels of William Faulkner: A Critical Interpretation* (1959); H.H. Waggoner, *William Faulkner: From Jefferson to the World* (1959); Warren Beck, *Man in Motion: Faulkner's Trilogy* (1961), about the Snopes novels; and John Langley, Jr., *The Tragic Mask: A Study of Faulkner's Heroes* (1963). Shorter critical essays are collected in Frederic J. Hoffman and Olga W. Vickery (eds.), *William Faulkner: Three Decades of Criticism* (1960), which also contains a selective bibliography by Vickery; Linda W. Wagner (ed.), *Four Decades of Criticism* (1973); and in Robert Penn Warren (ed.), *Faulkner: A Collection of Critical Essays* (1966), which is notable for Warren's introduction; Lyall Harris Powers, *Faulkner's Yoknapatawpha Comedy* (1980), deals with the thematic unity of the novels.

fault, in geology, fracture in the rocks of the Earth's crust, where compressional or tensional forces cause the rocks on the opposite sides of the fracture, or fault, to be displaced relative to each other. Faults range in length from a few centimetres to many hundred kilometres, and displacement likewise may range from less than a centimetre to several hundred kilometres along the fracture surface (the fault plane). In some instances, the movement is distributed over a fault zone composed of countless individual faults that occupy a belt hundreds of metres wide. The distribution of faults is uneven; some large areas have almost none, others are cut by innumerable faults of varying size.

Faults may be vertical, horizontal, or inclined at any angle. Although the angle of inclination of a specific fault plane tends to be relatively uniform, it may differ considerably from place to place along the fault line. When rocks slip past each other in faulting, the upper block along the fault plane is called the hanging wall, or headwall; the block below is called the footwall.

Faulting may smoothly polish the walls of the fault plane, marking them with scratches called slickensides, or it may crush them to a fine-grained, claylike substance known as fault gouge; when the crushed rock is relatively coarse-grained it is called fault breccia. Occasionally the beds adjacent to the fault plane fold or bend as they resist slippage because of friction. Areas of deep soil cover often show no surface indications of the faulting below.

The displacement of the blocks on the opposite sides of the fault plane usually is measured in relation to sedimentary strata or to markers, such as veins and dikes. (Absolute movement relative to a plane such as sea level is generally unknown.) The movement along a fault may be rotational, the blocks rotating relative to one another. The apparent movement of a fault may be quite different from the actual movement, where erosion has removed the evidence.

Movement may occur as a continuous creep or as a series of spasmodic jumps of a few metres during a few seconds. Such jumps are separated by intervals during which stress builds up until it overcomes the frictional forces along the fault plane. Most, if not all, earthquakes are caused by rapid movement along faults.

Faults are classified according to their angle of inclination and their relative and apparent movement. Normal, or gravity, faults are produced by vertical compression as the Earth's crust lengthens, or spreads. The hanging wall slides down relative to the footwall at an angle of inclination generally greater than 45°. Such faults are common throughout the world. In Utah and Nevada, where they bound one or both sides of many of the mountain ranges, the mountains have been formed by the sliding downward of the hanging walls many thousands of metres, where they have become the valley floors.

Thrust faults result from horizontal compressional forces caused by a shortening, or contraction, of the Earth's crust. With the easiest path of relief upward, the hanging wall moves up and over the footwall, usually at a dip of less than 45°; similar faults of greater than 45° are called reverse faults, and thrust faults with a very low angle of dip and a very large total displacement are often called overthrusts. Large thrust faults are characteristic of the Appalachian region in the Ridge and Valley province of Virginia and Tennessee.

Strike-slip (also called transcurrent, wrench, or lateral) faults are similarly caused by horizontal compression but with the easiest relief in a horizontal direction almost parallel to the compressional force. The fault plane is essentially vertical, and the movement is lateral along it. These faults are widespread and are responsible for the repeated offsetting of mid-oceanic ridges. A well-known terrestrial example of this type is the San Andreas Fault, which, during the San Francisco earthquake of 1906, had a maximum movement of 6 metres (20 feet). The total movement along this fault during the last few millions of years appears to have been several tens of kilometres.

Fauna, in ancient Roman religion, a goddess of the fertility of woodlands, fields, and flocks; she was the counterpart—variously considered the wife, sister, or daughter—of Faunus (*q.v.*).

faunal region, also called ZOOGEOGRAPHIC REGION, any of six or seven areas of the world defined by animal geographers on the basis of their distinctive animal life. These regions differ only slightly from the floristic regions (*q.v.*) of botanists.

Each region more or less coincides with a major continental land mass, separated from other regions by oceans, mountain ranges, or deserts. They are: Palaearctic, Ethiopian (Africa south of the Sahara), Oriental, Australian, Nearctic, Neotropical, and Antarctic. The Palaearctic (roughly, Europe, northern Africa, and northern Asia) and the Nearctic (North America and Greenland) are often combined as the Holarctic region inasmuch as considerable interchange of fauna has occurred between them via the land bridge that formerly existed between Siberia and Alaska.

Some zoogeographers consider the Neotropical (South America and Central America to central Mexico), the Australian, and the Antarctic regions as so different from the others that they elevate them to higher units called realms, equal to the remaining regions combined. Such a scheme presents the following realms: Neogea (Neotropical); Notogea (Australian); Metagea (Holarctic, Oriental, and Ethiopian); and Antarctica.

faunal succession, law of, observation that assemblages of fossil plants and animals follow or succeed each other in time in a predictable manner. Sequences of successive strata and their corresponding enclosed faunas have been matched together to form a composite section detailing the history of the Earth, especially from the inception of the Cambrian Period, which began about 570,000,000 years ago. Faunal succession occurs because evolution generally progresses from simple to complex in a nonrepetitive and orderly manner. Because members of faunas can be distinguished from one another through time and because of the wide geographic distribution of organisms on the Earth, strata from different areas can be correlated with each other and dated. Faunal succession is the fundamental tool of stratigraphy and comprises the basis for the geological time scale. Climate and conditions throughout the Earth's history can be studied using the successive groups of plants and animals because they reflect their environment.

faunizone, stratigraphic unit that is distinguished by the presence of a particular fauna of some time or environmental significance. It differs from a biozone because it is based on a fossil assemblage rather than a particular genus or species (*compare* biozone). The corresponding unit of geological time is called a faunichron.

Faunus, ancient Italian rural deity whose attributes in classical Roman times were identified with those of the Greek god Pan. Faunus was originally worshipped throughout the countryside as a bestower of fruitfulness on fields and flocks. He eventually became primarily a woodland deity, the sounds of the forest being regarded as his voice. The name of his female counterpart, Fauna, who shared many of his attributes, came to be applied generically to the animal life characteristic of a particular region or period.

A grandson of Saturn, Faunus was typically represented as half man, half goat, a derivation from the Greek Satyr, in the company of similar creatures, known as Fauns. Like Pan, Faunus was associated with merriment, and his twice-yearly festivals were marked by revelry and abandon. At the Lupercalia (*q.v.*),

a celebration of fertility held partly in his honour each February in Rome well into the Christian Era, youths clothed as goats ran through the streets wielding strips of goatskin.

Faure, Edgar(-Jean), pseudonym EDGAR SANDAY (b. Aug. 18, 1908, Béziers, Fr.—d. March 30, 1988, Paris), French lawyer and politician, premier (1952, 1955–56), and a prominent Gaullist during the Fifth Republic.

The son of a military doctor, Faure studied Russian at the Paris School of Eastern Languages, later graduating from the Paris faculty of law and practicing in the capital. Entering politics, he joined the Radical Party. During World War II he took part in the resistance movement, joining General Charles de Gaulle's French Committee of National Liberation in Algiers (1943–44).

Elected a deputy to the National Assembly in 1946, he rose to become premier for six weeks in 1952 and for a year in 1955. Then came the collapse of the Fourth Republic and de Gaulle's rise to power in 1958. Although at first excluded by de Gaulle, from 1962 Faure was given delicate and important missions abroad and in 1966 was made minister of agriculture. Appointed minister of education after the student rebellion in May–June 1968, he transformed the university system within a year.

De Gaulle's resignation in 1969 meant a second downfall for Faure, whose reforms were not approved by President Georges Pompidou. In 1973, however, he became president of the National Assembly and held the post until 1978. He was elected a member of the European Parliament from 1979 to1981.

In 1978 Faure was elected to the Académie Française. Besides various political and social works, he wrote detective novels under the pseudonym Edgar Sanday.

Faure, (François-) Félix (b. Jan. 30, 1841, Paris—d. Feb. 16, 1899, Paris), sixth president of the French Third Republic, whose presidency (Jan. 15, 1895 to Feb. 16, 1899) was marked by diplomatic conflicts with England, rapprochement with Russia, and the continuing problem of the Dreyfus Affair.

Félix Faure, engraving after a photograph

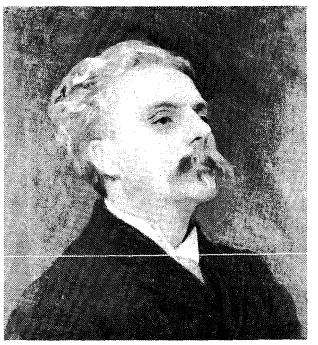
By courtesy of the Bibliotheque Nationale, Paris

After a successful career as an industrialist in Le Havre, Faure was elected its deputy mayor. In 1881 he was elected to the Chamber of Deputies from the Seine-Inférieure (modern Seine-Maritime) *département.* He took a seat with the republican followers of Léon Gambetta.

After terms as minister of colonies (1883–85) and two as minister of marine (to 1895), Faure became president of France. His victory was unexpected; it came as a rebuff to the political left and its candidate, Henri Brisson. As president he approved the French conquest of Madagascar and exchanged visits with Tsar Nicholas II of Russia in 1896 and 1897. The Fashoda conflict, an unsuccessful confrontation with Great Britain in the Sudan (1898), helped to undermine Faure's popularity, but the real dominating issue during his presidency was the Dreyfus Affair. Faure was opposed to reopening the case of Alfred Dreyfus, an army captain falsely accused of treason, and Faure's position encouraged agitation from both the left and the right. He died suddenly, and his funeral was the scene of a confrontation between pro- and anti-Dreyfus groups.

Fauré, Gabriel (-Urbain) (b. May 12, 1845, Pamiers, Ariège, Fr.—d. Nov. 4, 1924, Paris), composer whose refined and gentle music influenced the course of modern French music.

Fauré's musical abilities became apparent at an early age. When the Swiss composer and



Gabriel Fauré, portrait by J.S. Sargent; in a private collection

Giraudon–Art Resource/EB Inc.

teacher Louis Niedermeyer heard the boy, he immediately accepted him as a pupil. Fauré studied piano with Camille Saint-Saëns, who introduced him to the music of Franz Liszt and Richard Wagner. While still a student, Fauré published his first composition, a work for piano, *Trois romances sans paroles.* In 1896 he was appointed church organist at the church of La Madeleine in Paris and professor of composition at the Paris Conservatoire. In 1905 he succeeded Théodore Dubois as director of the Conservatoire, and he remained in office until ill health and deafness forced him to resign in 1920. Among his pupils were Maurice Ravel, George Enesco, Jean Roger-Ducasse, Florent Schmitt, and Nadia Boulanger.

Fauré excelled not only as a songwriter of great refinement and sensitivity but also as a composer in every branch of chamber music. He wrote more than 100 songs, including "Après un rêve" (*c.* 1865) and "Les Roses d'Ispahan" (1884), and song cycles that included *La Bonne Chanson* (1891–92) and *L'Horizon chimérique* (1922). He enriched the literature of the piano with a number of highly original and exquisitely wrought works, of which his 13 nocturnes, 13 barcaroles, and 5 impromptus are perhaps the most representative and best known. Fauré's *Ballade* (1881) for piano and orchestra (originally solo piano), two sonatas for violin and piano, and *Berceuse* for violin and piano (1880) are among other popular works that use the piano. *Élégie* for cello and piano, later arranged for orchestra, and two sonatas for cello and piano, as well as much chamber music, are frequently performed and recorded.

Fauré was not instinctively attracted to the theatre, but he wrote incidental music for several plays, including Maurice Maeterlinck's *Pelléas et Mélisande* (1898), as well as two lyric dramas, *Prométhée* (1900) and *Pénélope* (1913). Among his few works written for the orchestra alone is *Masques et bergamasques* (1919). The *Messe de requiem* for solo voices, chorus, orchestra, and organ (1887) did not gain immediate popularity, but it has since become one of Fauré's most frequently performed works.

Although he had deep respect for the traditional forms of music, Fauré delighted in infusing those forms with a mélange of harmonic daring and a freshness of invention. This quiet and unspectacular revolution prepared the way for more sensational innovations by the modern French school. One of the most striking features of his style was his fondness for daring harmonic progressions and sudden modulations, invariably carried out with supreme elegance and a deceptive air of simplicity.

Fauresmith industry, a sub-Saharan African stone-tool industry dating from the early part of the upper Pleistocene, about 75,000 to 100,000 years ago. The Fauresmith industry is largely contemporaneous with the Sangoan industry (*q.v.*), also of sub-Saharan Africa. The two tool industries apparently corresponded to different habitats, however, Fauresmith having been used in open steppe areas and Sangoan in forested regions. These differences suggest that the two tool traditions may have been in use by two distinct cultural groups, a plains-dwelling people and forest-dwelling people.

The Fauresmith industry, named for the town of Fauresmith, Orange Free State, South Africa, is characterized by small hand axes and cleavers and by numerous flake tools, including triangular projectile points of classic Levalloisian technique (*see* Levalloisian stone-flaking technique). The Fauresmith industry is associated with Saldanha man, attributed to *Homo sapiens rhodesiensis.*

Fauriel, Claude(-Charles) (b. Oct. 21, 1772, Saint-Étienne, Fr.—d. July 15, 1844, Paris), French scholar and writer whose major contribution was to the development of the study of comparative literature and to the revival of interest in literary-historical studies.

He was educated at the Oratorian colleges of Tournon and Lyons, but, during the French Revolution, his political sympathies were with the Republicans. Fauriel served in the army and in 1799 became private secretary to the minister of police, Joseph Fouché. He resigned after three years when he felt that Napoleon was becoming too ambitious. At about this time, his first literary efforts—articles in the *Décade Philosophique*—were noticed and approved by Madame de Staël. Another friend, François Guizot, helped him to gain the chair of foreign literature at the Sorbonne after the July Revolution in 1830. In 1836 he was elected to the Académie des Inscriptions et Belles-Lettres.

Fauriel's *Chants populaires de la Grèce moderne,* 2 vol. (1824–25; "Popular Songs of Modern Greece") served the dual causes of poetry and Greek independence and brought his name before a wide public. His other works include *Histoire de la Gaule méridionale sous la domination des conquérants germains,* 4 vol. (1836; "History of Southern Gaul Under the Rule of the German Conquerors"); a translation of a Provençal poem on the Albigensian Crusade—*Histoire de la croisade contre les hérétiques albigeois* (1837; "History of the Crusade Against the Albigensian Heretics"); and two posthumously published works, *Histoire de la poésie provençale,* 3 vol. (1846; *History of Provençal Poetry*) and *Dante et les origines de la langue et de la littérature italiennes,* 2 vol. (1854; "Dante and the Origins of the Italian Language and Literature"). Fauriel's memoirs were found among the papers of Madame de Condorcet, with whom he had a liaison, and were published by L. Lalanne under the title *Les Derniers Jours du consulat* (1886; "The Last Days of the Consulate").

Faust, also called FAUSTUS, or DOCTOR FAUSTUS, hero of one of the most durable legends in Western folklore and literature, the story of a German necromancer or astrologer who sold his soul to the devil in exchange for knowledge and power. There was a historical Faust, indeed perhaps two, one of whom

more than once alluded to the devil as his *Schwager,* or crony. One or both died *c.* 1540, leaving a tangled legend of sorcery and alchemy, astrology and soothsaying, studies

Faust, detail from the title page of the 1616 edition of *The Tragicall History of D. Faustus,* by Christopher Marlowe

By courtesy of the trustees of the British Library; photograph, R.B. Fleming

theological and diabolical, necromancy and, indeed, sodomy. Contemporary references indicate that he was widely travelled and fairly well known, but all observers testify to his evil reputation. Contemporary Humanist scholars scoffed at his magical feats as petty and fraudulent, but he was taken seriously by the Lutheran clergy, among them Martin Luther and Philippe Melanchthon. Ironically, the relatively obscure Faust came to be preserved in legend as the representative magician of the age that produced such occultists and seers as Paracelsus, Nostradamus, and Agrippa von Nettesheim.

Faust owes his posthumous fame to the anonymous author of the first *Faustbuch* (1587), a collection of tales about the ancient magi—who were wise men skilled in the occult sciences—that were retold in the Middle Ages about such other reputed wizards as Merlin, Albertus Magnus, and Roger Bacon. In the *Faustbuch* the tales were attributed to Faust; they were narrated crudely and were further debased with clodhopping humour at the expense of Faust's dupes. The intense conviction of the author's descriptions of Hell and of the fearful state of mind of his merciless hero, as well as his creation of the savage, embittered, remorseful fiend Mephistopheles were so realistic that they inspired unquestioning belief. Some of these passages were used verbatim by Thomas Mann in his novel *Doktor Faustus* (1947; *Doctor Faustus,* 1950).

The *Faustbuch* was speedily translated and read throughout Europe. An English prose translation of 1592 inspired *The Tragicall History of D. Faustus* (1604) by Christopher Marlowe, who, for the first time, invested the Faust legend with tragic dignity. It invoked more effectively than the original the summoning from the underworld of Helen of Troy to seal Faust's damnation. Marlowe retained much of the coarse humour and clownish episodes of the *Faustbuch.* German versions of Marlowe's play increased them. This association of tragedy and coarse buffoonery remained an inherent part of the Faust dramas and puppet plays that were popular for two centuries. Yet for all the antics of Casper the clown, the puppet plays retained some tense and moving scenes. Faust's end was often floodlit with poetry, and his eternal damnation was never in doubt.

The publication of magic manuals bearing Faust's name became a lucrative trade; the books included careful instructions on how to avoid the bilateral pact with the devil or, if need be, how to break it. The classic of these, *Magia Naturalis et Innaturalis,* was in the grand-ducal library in Weimar, Ger., and was known to Goethe.

The German writer Gotthold Lessing undertook the salvation of Faust in an unfinished play (1784). Lessing, an enlightened rationalist, saw Faust's pursuit of knowledge as noble, and arranged the hero's reconciliation with God. This was the approach adopted by the outstanding chronicler of the Faust legend, J. W. von Goethe. His *Faust* (Part I, 1808; Part II, 1832, after the poet's death) makes of the Faust myth a profoundly serious but highly ironic commentary on the diverse potentialities of Western man's cultural heritage.

The poem contains an array of epic, lyric, dramatic, operatic, and balletic elements, ranging through metres and styles to present an immensely varied commentary in terms of theology, mythology, philosophy, political economy, science, aesthetics, music, and literature. In the end Goethe saves Faust by bringing about his purification and redemption.

Hector Berlioz was moved to create a dramatic cantata, *The Damnation of Faust,* upon the French version of Goethe's dramatic poem by Gerard de Nerval. This work, first performed in 1846, is also staged as an opera. Charles Gounod based his opera *Faust* on Part I of the Goethe work, to a libretto by Jules Barbier and Michel Carré. It was first performed in Paris in 1859.

In the 19th and 20th centuries other writers sought to emulate Goethe in assaying Faust's salvation, but with none of his stunning success. And others retold the story without Goethe's happy ending. Among them were Adelbert von Chamisso, *Faust, Ein Versuch* (1804); Christian Grabbe, *Don Juan und Faust* (1829); Nikolaus Lenau, *Faust: Ein Gedicht* (1836); Woldemar Nürnberger, *Josephus Faust* (1847); Heinrich Heine, *Doktor Faust: Ein Tanzpoem* (1851); and Paul Valéry, *Mon Faust* (1946). Lenau and Valéry, in particular, stressed the dangers of seeking absolute knowledge, with its correlative of absolute power. For them the incorruptibility proclaimed by Goethe confronts an annihilating instinct common to mankind and to the original *Faustbuch.* They fear that the Faustian spirit of insatiable scientific inquiry has been given modern expression.

Consult the INDEX *first*

Faustina, Annia Galeria, byname ANNIA GALERIA FAUSTINA THE YOUNGER (b. *c.* 125—d. 176), cousin and wife of the Roman emperor Marcus Aurelius (ruled 161–180) and his companion on several of his military campaigns.

Annia Galeria Faustina, marble bust; in the Uffizi, Florence

Alinari—Art Resource/EB Inc.

The daughter of the emperor Antoninus Pius (ruled 138–160) and Annia Galeria Faustina the Elder, Faustina married Marcus in 145; and the following year, when he became co-ruler in a limited capacity with Antoninus Pius, she was granted the title augusta by the Senate. Because she accompanied her husband from 170 to 174 on his wars against the Danubian tribes, Faustina became known as *mater castrorum* ("mother of the camps"). She went with Marcus when he travelled east (175–176) to confront the rebel general Avidius Cassius, but she died suddenly during the journey. Divine honours were bestowed upon her, and a school for the education of the daughters of the poor was established in her memory.

Faustus OF RIEZ, SAINT (b. *c.* 400, Roman Britain—d. *c.* 490; feast day in Southern France, September 28), bishop of Riez, Fr., who was one of the chief exponents and defenders of Semi-Pelagianism (*q.v.*).

In the early 5th century Faustus went to southern Gaul, where he joined the newly founded monastic community on the Îles de Lérins (off the southeast coast of present France), of which he became the third abbot *c.* 433. After his election as bishop of Riez (*c.* 458) he played a leading role in the ecclesiastical life of 5th-century Gaul.

Faustus' *De gratia* gave the final form to Semi-Pelagianism. He taught that God cannot interfere with man's freedom either before or after his conversion to Christianity, and that all faith is rooted in grace because human freedom itself is a form of grace. His doctrine was rejected, however, by the second Council of Orange (France) in 529. His controversial orthodoxy prevents his veneration by the universal church.

Fauvism, French FAUVISME, style of painting that flourished in France from 1898 to 1908; it used pure, brilliant colour, applied straight from the paint tubes in an aggressive, direct manner to create a sense of an explosion on the canvas. The Fauves painted directly from nature as the Impressionists had before

"Paysage aux arbres rouges" ("Landscape with Red Trees"), Fauve painting by Maurice de Vlaminck, oil, 1906; in the Musée National d'Art Moderne, Paris

By courtesy of the Musee National d'Art Moderne, Paris

them, but their works were invested with a strong expressive reaction to the subjects they painted. First formally exhibited in Paris in 1905, Fauvist paintings shocked visitors to the annual Salon d'Automne; one of these visitors was the critic Louis Vauxcelles, who, because of the violence of their works, dubbed the painters "Les Fauves" (Wild Beasts).

The leader of the group was Henri Matisse, who had arrived at the Fauve style after careful, critical study of the masters of Postimpressionism Paul Gauguin, Vincent van Gogh, and Georges Seurat. Matisse's methodical studies led him to reject traditional renderings of three-dimensional space and to seek instead a new picture space defined by movement of

colour. Matisse exhibited his famous "Woman with the Hat" (Walter A. Haas Collection, San Francisco) at the 1905 exhibition; brisk strokes of colour—blues, greens, and reds—form an energetic, expressive view of the woman. As always in Matisse's Fauve style, his painting is ruled by his intuitive sense of formal order.

Other members of the group included two painters from Chatou, Fr., André Derain and Maurice de Vlaminck, who, together with Matisse, formed the nucleus of the Fauves. Derain's Fauve paintings translate every tone of a landscape into pure colour, applied with short, forceful brushstrokes. The agitated swirls of intense colour in Vlaminck's works are indebted to the expressive power of van Gogh. Three young painters from Le Havre were also attracted to Fauvism by the strong personality of Matisse. Othon Friesz found the emotional connotations of the bright Fauve colours a relief from the mediocre Impressionism he practiced; his companion Raoul Dufy developed a rather carefree ornamental version of the bold style that suited his own personal aesthetic nature; and Georges Braque created a definite sense of rhythm and structure out of small spots of colour, foreshadowing his development of Cubism. Albert Marquet, Matisse's fellow student at the École des Beaux-Arts in the 1890s, also participated in Fauvism, as did the Dutchman Kees van Dongen, who applied the style to depictions of the fashionable society of Paris. Other painters associated with the Fauves were Georges Rouault, Henri Manguin, Charles Camoin, and Jean Puy.

Fauvism was for most of these artists a transitional, learning stage. By 1908 a revived interest in Paul Cézanne's vision of the order and structure of nature had led them to reject the turbulent emotionalism of Fauvism in favour of the logic of Cubism. Matisse alone pursued the course he had pioneered, achieving a sophisticated balance between his own emotions and the world he painted.

fauxbourdon (French), English FALSE BASS, also called FABURDEN, musical texture prevalent during the late Middle Ages and early Renaissance, produced by three voices proceeding primarily in parallel motion in intervals corresponding to the first inversion of the triad. Only two of the three parts were notated, a plainchant melody together with the lowest voice a sixth below (as e below c′); occasional octaves (as c–c′) occurred as well. The middle part was realized by the singer at the interval of a fourth below the plainchant melody (as g below c′). The result was a particularly "sweet" sound in contrast to the mixture of passing dissonants and open sonorities favoured in earlier music.

Guillaume Dufay (*c.* 1400–74) is said to have been the first to introduce fauxbourdon into written music. Other early 15th-century Burgundian and Netherlandish composers, too, embraced this essentially homophonic technique, especially for psalm and hymn settings requiring distinct textual articulation and clear enunciation. In more elaborate compositions the fauxbourdon texture appeared at times greatly varied and ornamented, as in several settings of the *Magnificat* by Gilles Binchois (died 1460). Fauxbourdon was, therefore, an important element in the transition from the medieval emphasis on perfect consonants to the euphony that characterized the a cappella polyphony of the Humanist era.

At least one school of musical scholarship holds that fauxbourdon represents a continental adaptation of an English method of extemporaneous singing in which upper and lower voices were added to a chant melody to form $\frac{6}{3}$ chords. If so, it would seem that by the mid-15th century the designation fauxbourdon, anglicized to faburden, was being applied to the original practice. At any rate, English composers did favour successions of $\frac{6}{3}$ chords in any number of written compositions with the crucial melody in the middle or at the top and the rest often richly enhanced. This style of composition, too, is often called English descant, faburden, or fauxbourdon. In addition, English composers employed fauxbourdon in its continental form as well. It is now generally believed that English descant originally involved singing in two parts with an upper voice extemporaneously added to a plainchant, frequently in contrary motion, as opposed to the parallel motion typical of fauxbourdon.

In 16th-century Italy and Spain, simple chord settings of psalms, usually in four parts, were frequently labelled *falsobordone*. But unlike the earlier fauxbourdon, *falsobordone* was based on chords in root position. Even though inversions do not necessarily alter the harmonic implications of chords, root positions do convey a greater sense of harmonic stability, since the fundamental tone, the chord root, appears in the bass, acoustically its natural habitat.

Finally, in the 16th century, English keyboard music, too, was sometimes based on a cantus firmus, or underlying melody, called "faburden of the chant," consisting not of the original plainchant but of its transposition to a lower pitch, as in the second voice of a fauxbourdon. "O Lux on the faburden" by John Redford (died 1547) is a well-known example based on such a derivative melody.

Faval Island (Azores): *see* Faial Island.

Favara, town, Agrigento province, south central Sicily, Italy, just east of Agrigento city. The name of the town is believed to be of Arabic origin. It is the site of a late 13th-century castle, built by the Chiaramonte family, Sicilian nobles from the 11th–15th centuries. In a sulphur-mining and marble-quarrying district, its chief industry is the production of tanning extracts. Pop. (1981 prelim.) mun., 32,793.

Favart, Charles-Simon (b. Nov. 13, 1710, Paris—d. May 12, 1792, Belleville, Fr.), French dramatist and theatre director who was one of the creators of the *opéra comique.*

After his father's death, Favart simultaneously carried on his business as a pastry cook and wrote librettos for light operas. He became stage manager of the Opéra-Comique in 1743 and director of the company in 1758. His insistence that individual characters be costumed in a manner historically appropriate to their personalities and station, rather than in contemporary style, was an innovation that other directors were quick to imitate.

Favart's best play, *Les Trois Sultanes* (1761), is a comedy based on a love triangle. In it, song and dance play a less important part

Favart, engraving by Claude-Antoine Littret de Montigny after a portrait by Jean-Étienne Liotard
H. Roger-Viollet

than in his other works, the best of which is *La Chercheuse d'esprit* (1741). Favart had a special talent for pastoral plays, one of which, *Bastien et Bastienne* (1753), was later given a musical setting by Mozart.

Faversham, parish (town), Swale district, county of Kent, England. Faversham grew first as a port on the River Swale near Watling Street. It was assessed in 1086 as a royal demesne, and a market was held there. King Stephen (ruled 1135–54) founded a Cluniac (later Benedictine) monastery in 1147.

Faversham was associated with the medieval Cinque Ports (*q.v.*) from that group's earliest days. In 1302 the town's barons were granted all the liberties of the ports. The governing charter was granted in 1545.

Faversham has both continental and coastal shipping. Oyster fisheries are also located there. Pop. (1981 prelim.) 16,098.

favism, a hereditary disorder involving an allergic-like reaction to the broad bean (*Vicia fava*). Susceptible persons may develop a blood disorder (hemolytic anemia) by eating the beans, or even by walking through a field where the plants are in flower.

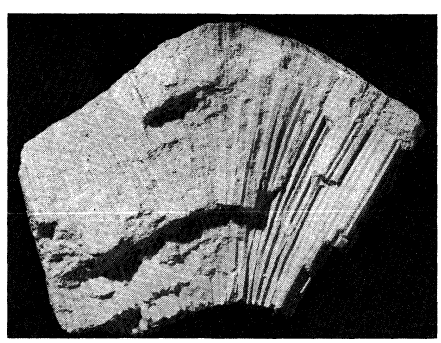
The known distribution of the disease is largely limited to people of Mediterranean origins (Spaniards, Italians, Greeks, Armenians, and Jews). Susceptibility to favism is inherited as a sex-linked trait and appears to be closely related to glucose-6-phosphate dehydrogenase deficiency (*q.v.*).

Favorinus (fl. 2nd century), Skeptical philosopher and rhetorician of the Roman Empire who was highly esteemed for his learning and eloquence.

He was a congenital eunuch and is known to have lived in Rome, Athens, Corinth, and Ephesus. He was the teacher of Herodes Atticus, Gellius, and Fronto and was a friend of Plutarch. While in Rome, he held high office under Emperor Hadrian but, later, falling into disfavour, was exiled to Chios until the end of Hadrian's reign, at which time he returned to Rome and recovered his status.

Favorinus wrote philosophical discourses, declamations, a Miscellaneous History, and memoirs. His serene discourse *On Exile* was printed from a Vatican Greek papyrus in 1931. Only fragments remain of his other works.

Favosites, extinct genus of corals found as fossils in marine rocks from the Ordovician



Favosites
By courtesy of the trustees of the British Museum (Natural History); photograph, Imitor

to the Permian periods (between 500,000,000 and 225,000,000 years old). *Favosites* is easily recognized by its distinctive form; the genus is colonial, and the individual structures that house each coral animal are closely packed together as long, narrow tubes. In cross section, the structure has a distinctive honeycomb appearance.

Favre, Claude: *see* Vaugelas, Claude Favre, seigneur de.

Favre, (Gabriel-Claude-) Jules (b. March 21, 1809, Lyon—d. Jan. 19, 1880, Versailles, Fr.), a resolute French opponent of Napoleon III and a negotiator of the Treaty of Frankfurt ending the Franco-German War.

From the time of the Revolution of 1830, he declared himself a republican. Elected to

Jules Favre, lithograph by J.-B.-A. Lafosse after a photograph by Pierre Petit

By courtesy of the Bibliotheque Nationale, Paris

the legislative assembly of 1849 by the Rhône *département*, he tried with Victor Hugo and others to organize an armed resistance in the streets of Paris to the coup d'etat of Dec. 2, 1851, after which he temporarily withdrew from politics.

In 1858 he distinguished himself by his defense of Felice Orsini, the would-be assassin of Napoleon III. Elected deputy for Paris in 1857, Favre was one of "the five" who gave the signal for the republican opposition to the empire. In 1863 he became the head of his party and began denouncing the Mexican expedition and the occupation of Rome. These speeches, eloquent and inclusive, won him a seat in the Académie Française in 1867.

On Sept. 4, 1870, in the Government of National Defense, Favre became vice president under Gen. L.-J. Trochu and also minister of foreign affairs, with the onerous task of negotiating peace with victorious Germany. His statement on Sept. 6, 1870, that he "would not yield to Germany an inch of territory nor a single stone of the fortresses" was a piece of oratory that Bismarck countered, at the Ferrières meeting on September 19, by his declaration that the cession of Alsace-Lorraine was the indispensable condition of peace. Favre also arranged for the armistice of Jan. 28, 1871, without knowing the situation of the armies and without consulting the government at Bordeaux.

Elected deputy to the National Assembly in six different constituencies on Feb. 8, 1871, when his part in the armistice negotiation was not yet known, Favre was sent by Thiers to conclude the final peace with the Germans. He withdrew from the ministry, discredited, on Aug. 2, 1871, and thereafter lived in semi-retirement.

Favre, Pierre: *see* Faber, Peter.

fawātiḥ (Arabic: "prefatory ones"), also called ḤAWĀMĪM (the letters *ḥā* and *mīm*), or ḤURŪF AL-MUQAṬṬAʿAH (Arabic: the "detached letters"), letters of the alphabet appearing at the beginning of 29 of the *sūrāhs* (chapters) of the Muslim sacred scripture, the Qur'ān. The 14 letters thus designated occur singly and in various combinations of two to five. As the letters always stand separately (*muqaṭṭaʿah*), they do not form words and are read by their alphabetic names, as *hā mīm, alif lām mīm, tā sīn mīm.*

The original meaning and function of the *fawātiḥ*, which are associated principally with *sūrāhs* dating from the late Meccan period (before AD 622), has not been preserved. Scholars have given several theories for the *fawātiḥ:* the letters might be assigned mystical numerical values; or they could indicate abbreviations for the individual words of a sentence. Most popularly, since the *sūrahs* preceded by the same combination of letters are grouped together in the Qur'ān, a third theory might imply that these clusters were originally part of private Meccan manuscripts before they were assembled by Muḥammad's secretary, Zayd ibn Thābit, into an authoritative recension; the *fawātiḥ* could then be construed as the initials of the Meccan owners.

Fawcett, Dame Millicent Garrett (b. June 11, 1847, Aldeburgh, Suffolk, Eng.—d. Aug. 5, 1929, London), leader for 50 years of the movement for woman suffrage in England. From the beginning of her career she had to struggle against almost unanimous male opposition to political rights for women; from 1905 she also had to overcome public hostility to the militant suffragists led by Emmeline Pankhurst and her daughter Christabel, with whose violent methods Fawcett was not in sympathy. She was also a founder of Newnham College, Cambridge (planned from 1869, established 1871), one of the first English university colleges for women.

Millicent Garrett was the seventh of the 10 children of Newson Garrett, a radical shipowner, who for years supported the efforts of his eldest daughter, the pioneer woman

Dame Millicent Garrett Fawcett

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

physician and medical educator Elizabeth Garrett (Mrs. J.G.S.) Anderson, to be admitted to the practice of medicine. On April 23, 1867, Millicent was married to Henry Fawcett, radical politician and professor of political economy at Cambridge. She helped him to overcome the handicap of his blindness, while he supported her work for women's rights, beginning with her first speech on the subject of woman suffrage (1868).

In 1897 she became president of the National Union of Women's Suffrage Societies. Finally, in 1918, the Representation of the People Act, which enfranchised about 6,000,000 women, was passed. (Ten years afterward, British women received the vote on a basis of full equality with men.) In 1919 she retired from active leadership of the suffrage union, which had been renamed the National Union for Equal Citizenship.

In July 1901, during the South African War, she was sent by the government to investigate the British concentration camps for Boer civilians. Her report vindicated (whitewashed, in the opinion of some) the administration of the camps. Throughout World War I she dedicated her organization to "sustaining the vital forces of the nation." After the war she was made a Dame of the British Empire.

Fawcett's writings include *Political Economy for Beginners* (1870; 9th ed., 1904), a text still in use at her death; *Janet Doncaster* (1875), a novel; *The Women's Victory—and After* (1920); and *What I Remember* (1924).

fawjdār, in India, under the Mughals, an executive head of a district (*sarkār*). He was responsible for law and order, held police powers and criminal jurisdiction, and commanded irregular levies for the maintenance of peace.

The name was also used for the *āmil*, or chief officer of a sub-district, or *pargana*. Under the British the term was used for the head of the district police.

Fawkes, Guy (b. 1570, York, Yorkshire, Eng.—d. Jan. 31, 1606, London), British soldier and best remembered participant in the conspiracy known as the Gunpowder Plot. Its object was to blow up the Parliament building, while James I and his chief ministers met within, in reprisal for increasing oppression of Roman Catholics in England.

Fawkes, a member of a prominent Yorkshire family, was a convert to Roman Catholicism. His adventurous spirit as well as his religious zeal led him to leave Protestant England (1593) and enlist in the Spanish Army in the Netherlands. There he won a reputation for great courage and cool determination. Meanwhile, the instigator of the plot, Robert Catesby, and his small band of Catholics agreed that they needed the help of a military man who would not be readily recognizable, as they were. They dispatched a man to the Netherlands in April 1604 to enlist Fawkes, who, without knowing the precise details of the plot, returned to England and joined them.

The plotters rented a cellar extending under Parliament, and Fawkes planted at least 20 barrels of gunpowder there and camouflaged them with coals and faggots. But the plot was discovered, and Fawkes was arrested (Nov. 4, 1605). Only after being tortured on the rack did he reveal the names of his accomplices. Tried and found guilty before a special commission (Jan. 27, 1606), he was executed opposite the Parliament building.

England's celebration of Guy Fawkes day (November 5) includes fireworks, masked children begging "a penny for the guy," and the burning of "guys," little effigies of the conspirator.

Faxa Bay, Icelandic FAXAFLÓI, inlet of the North Atlantic Ocean on the southwestern coast of Iceland. It indents the coast for 30 mi (50 km) and extends for 50 mi between the Snaefellsnes (north) and Reykjanes (south) peninsulas. The bay is the largest in Iceland, and its banks form excellent fishing grounds. The main ports along the bay are Akranes and Reykjavík, Iceland's capital, where almost one-third of the Icelandic fish catch (apart from herring) is brought ashore. A U.S. air base is at Keflavík on the southern shore.

Faxa Bay includes two eastern arms: Hvalfjördhur (Hval Fjord) and Borgarfjördhur (Borgar Fjord). Hvalfjördhur provides safe shelter for shipping and was used as an anchorage for Allied naval convoys during World War II. It is now a whaling base.

Faxian (Chinese monk): *see* Fa-hsien.

Fay, Sidney Bradshaw (b. April 13, 1876, Washington, D.C.—d. Aug. 29, 1967, Lexington, Mass., U.S.), U.S. historian known primarily for his classical reexamination of the causes of World War I.

After receiving his Ph.D. (1900) from Harvard University, he studied at the Sorbonne and the University of Berlin, returning to teach history at Dartmouth (Hanover, N.H.) and Smith (Northampton, Mass.) colleges and at Harvard and Yale universities until his retirement in 1946.

Fay was the first U.S. historian to challenge the widely held notion that Germany alone was responsible for initiating World War I. His *Origins of the World War,* 2 vol. (1928) resulted from his exhaustive study of previously uninvestigated archives and documents. He proposed the thesis of collective responsibility for the outbreak of war, placing blame on Serbia's independent role in the assassination of

Archduke Francis Ferdinand (June 28, 1914), on Austrian demands, on German support to Austria-Hungary, on Russian mobilization, and on French and English compliance with Russia. Fay's book was thus extremely influential in modifying attitudes toward Germany after the war.

Fay is also considered one of the most eminent American authorities on German history, particularly the rise of the Prussian state. His other major works are *The Hohenzollern Household and Administration in the Sixteenth Century* (1916) and *The Rise of Brandenburg-Prussia to 1786* (1937). He also translated Friedrich Meinecke's *Die deutsche Katastrophe* (*The German Catastrophe*) in 1950.

Faya, formerly LARGEAU, oasis town, major town of the Borkou region, northern Chad, north central Africa. It lies in the Sahara at the northern tip of the Bodele depression, 490 mi (790 km) northeast of the capital, N'Djamena. Originally called Faya, it was renamed Largeau after the capture in 1913 of Borkou by the French army officer Col. Étienne Largeau. The original name was restored in the 1970s. Date palm production in Faya was the focus of a 1970s development project. The town has an airport and a small electric power plant. Pop. (1973 est.) 7,328.

Fayal Island (Azores): *see* Faial Island.

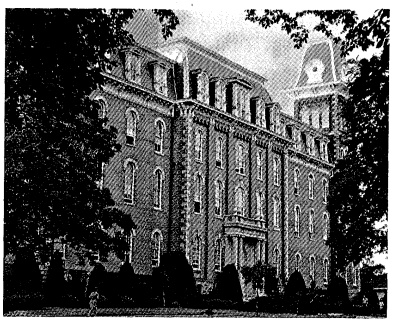
fayalite, silicate mineral that is a member of the forsterite–fayalite series (*q.v.*) of olivines.

fayḍ (Arabic: "emanation"), in Islāmic philosophy, the emanation of created things from God. The word is not used in the Qur'ān (Islāmic scripture), which uses terms such as *khalq* ("creation") and *ibdāʿ* ("invention") in describing the process of creation. Early Muslim theologians dealt with this subject only in simple terms as stated in the Qur'ān, namely, that God had ordered the world to be, and it was. Later Muslim philosophers, such as al-Fārābī (10th century) and Avicenna (11th century) under the influence of Neoplatonism conceived of creation as a gradual process. Generally, they proposed that the world came into being as the result of God's superabundance. The creation process takes a gradual course, which begins with the most perfect level and descends to the least perfect—the world of matter. The degree of perfection is measured by the distance from the first emanation, for which all creative things yearn. The soul, for example, is trapped in the body and will always long for its release from its bodily prison to join the world of spirits, which is closer to the first cause and therefore more perfect.

Al-Fārābī and Avicenna held that God emanates not out of necessity but out of a free act of will. This process is spontaneous because it arises from God's natural goodness, and eternal because God is always superabundant. Al-Ghazālī (a Muslim theologian of the 11th century) refuted the *fayḍ* theory on the grounds that it lowers God's role in the creation to mere natural causality. God, he maintained, creates with absolute will and freedom, and theories of necessary overflowing and emanation lead logically to the denial of the absoluteness of the divine active will.

Fayetteville, city, seat of Washington County, northwestern Arkansas, U.S., in the Ozarks on the White River, adjacent to Springdale (north). There was no settlement there when the site, on the Overland Mail Route, was chosen as the county seat in 1828. The community, first named Washington Court House, was renamed after Fayetteville, Tenn., in 1829.

It was incorporated in 1836, and it received



University Hall ("Old Main"), University of Arkansas, Fayetteville
By courtesy of the University of Arkansas News Service

a city charter in 1859 (abolished by the legislature in 1867); it was reincorporated as a town in 1869, and in 1906 it again became a city. It suffered severely during the Civil War. The battles of Pea Ridge (March 7–8, 1862) and Prairie Grove (Dec. 7, 1862) were fought nearby. After the Battle of Fayetteville (April 18, 1863) the place was occupied by the Federal army until the end of the war.

The city is in an agricultural and resort area, with farm-based industries, particularly poultry processing. It acquired a reputation as a centre of education through its early schools, especially Sophia Sawyer's Fayetteville Female Seminary (1839) and Arkansas College (1852; destroyed during the Civil War), the state's first degree-granting college. The University of Arkansas was founded there in 1871 as Arkansas Industrial University. Pop. (1980) 36,604.

Fayetteville, city, seat of Cumberland County, southwestern North Carolina, U.S., on the Cape Fear River at the head of navigation. The two original settlements of Cambelltown (1739) and Cross Creek (1746) united in 1783 and were incorporated and renamed for the Marquis de Lafayette. It was the state capital (1789–93) and the scene (Nov. 21, 1789) of a second state convention to ratify the U.S. Constitution (after its previous rejection at Hillsboro). A fire in 1831 destroyed more than 600 buildings. Gen. William Sherman's troops occupied the town in March 1865. Textiles and wood products are the economic mainstays. Ft. Bragg and Pope Air Force Base, nearby, are also important to the economy. Fayetteville State University was founded in 1867, Methodist College in 1960, Fayetteville Technical Institute in 1961. Pop. (1980) city, 59,507; metropolitan area (SMSA), 247,160.

Faylakah, island of Kuwait, lying in the Persian Gulf near the entrance to Kuwait Bay; it is 15 sq mi (39 sq km) in area. Inhabited since prehistoric times, it is important archaeologically, remains of human habitation from as early as 2500 BC having been found there. A museum has been built near the ruins of a Greek temple. Most of the people live in the village of az-Zawr, on the island's northwestern tip. Fishing and labouring in the archaeological diggings are the principal occupations, but the island has also become a resort. Pop. (1980) 4,845.

Faynzilberg, Ilya Arnoldovich: *see* Ilf, Ilya, and Petrov, Yevgeny.

Fayrfax, Robert (b. April 23, 1464, Deeping Gate, Lincolnshire, Eng.—d. Oct. 24, 1521, St. Albans, Hertfordshire), foremost among the early English Tudor composers, noted principally for his masses and motets written in a style less florid than that of his predecessors. He is distinguished from his English contemporaries by his more frequent use of imitative counterpoint and the freedom with which he varies the number of voices employed during the course of a single composition.

Nothing is known of his career until 1497, when he was granted the first of a series of benefices as reward for his services as singer and composer. He is referred to as one of the gentlemen of the King's Chapel, a position he held until the year of his death. He received his greatest honour in 1520, when he was put in charge of the Chapel Royal musicians when they accompanied Henry VIII to his meeting with Francis I of France at the Field of Cloth of Gold.

Fayrfax was twice awarded the degree of doctor of music, at Cambridge in 1504 and at Oxford (where his degree is the earliest such known) in 1511. The mass *O quam glorifica*, composed for his Cambridge doctorate, is one of five complete extant masses, all for five voices and based on devotional verses. His surviving work also includes excellent examples of secular music, including instrumental arrangements of jigs and hornpipes.

Fayṣal (Arabic personal name): *see under* Faisal, except as below.

Fayṣal I, Fayṣal also spelled FAISAL (b. May 20, 1885, Mecca—d. Sept. 8, 1933, Bern), Arab statesman and king of Iraq (1921–33) who was a leader in advancing Arab nationalism during and after World War I.

Fayṣal was the son of Ḥusayn ibn ʿAlī, *amīr* and grand *sharīf* of Mecca who ruled the Hejaz from 1916 to 1924. When World War I provided an opportunity for rebellion for many Arab leaders who had come to resent Ottoman rule, including certain Syrian Arabs who looked to Ḥusayn for leadership because he was not under direct Ottoman rule, Fayṣal in 1915 travelled to Damascus to reach an understanding with the secret Arab nationalist societies there about the terms under which they would support an Arab revolt led by Ḥusayn. Fayṣal's ability to meet with diverse groups previously unknown to him and to win their recognition of Ḥusayn as an Arab leader indicated the existence of a nascent Arab nationalism.

When in the following year the Arab revolt was declared, Fayṣal played an important part in the military campaigns against the Ottomans. An Arab military force occupied Damascus in September 1918, and Fayṣal was declared king of Syria in accord with his understanding that Arab support for British military ambitions would be rewarded by British support for the creation of an Arab state consisting of most of Syria. When Fayṣal went to Paris in 1919 to participate in the peace

Fayṣal I, 1919
BBC Hulton Picture Library

conference, however, he became clearly aware of French determination to establish a sphere of influence in Lebanon and Syria. Realizing that he would have to make concessions, he negotiated the agreement accepting French military occupation of Lebanon and the Syrian coastal regions as far north as Alexandretta (modern Iskenderun, Tur.). In January 1920 he returned to Damascus, where he was unable to calm the violent resentment aroused by the news of French pretensions. Most Arab leaders did not understand the futility of resisting French military power and the consequent pressures under which he had laboured in Paris. When France soon found reason to invade Fayṣal's kingdom and occupy Damas-

cus (July 1920), Fayṣal himself was forced into exile, eventually going to London at the invitation of the British government.

Meanwhile, Britain had established a sphere of influence in Iraq. To ease resistance to British rule, Britain decided in March 1921 to sponsor Fayṣal as king of an Iraqi government with which Britain would conclude a treaty providing for eventual independence. Fayṣal accepted the plan and was enthusiastically welcomed in Iraq, where he was crowned in August 1921. His ability to command widespread support in Iraq as well as Syria provided a continuing indication of nationalistic feeling among Arabs of the entire Fertile Crescent. Indeed, as a Pan-Arab leader he had no specific political roots in Iraq, deriving his authority by moderating various conflicting elements. He valued British friendship while maintaining his full credentials among fervent Arab nationalists as their leader. From his position of influence, he negotiated with Britain a series of treaties culminating in 1930 with a treaty that enabled Iraq to achieve complete independence and membership in the League of Nations by 1932.

Fayṣal ibn ʿAbd al-ʿAzīz ibn ʿAbd ar-Raḥmān as-Saʿūd, Fayṣal also spelled FAISAL, FEISAL, OR FEISUL (b. *c.* 1906, Riyadh, Arabia—d. March 25, 1975, Riyadh), king of Saudi Arabia from 1964 to 1975, an influential figure of the Arab world, generally a critic

Fayṣal
Lichfield

not only of Israel but also of Soviet influence in the Middle East.

Fayṣal was a son of King Ibn Saʿūd and a brother of King Saʿūd. He was appointed foreign minister and viceroy of Hejaz in 1926 after his father conquered that province, in which lies the holy city of Mecca. In 1934 he led a victorious campaign against Yemen. He represented Saudi Arabia at the United Nations Conference of 1945 and was later ambassador to the UN General Assembly.

After Saʿūd's accession in 1953, Fayṣal became crown prince and foreign minister. In 1958, during an economic crisis, Saʿūd gave him full executive powers. He resigned in 1960 but returned in 1962, and in March 1964 he assumed all powers as viceroy, becoming king in November 1964, after Saʿūd was deposed by religious leaders, senior members of the ruling family, and the Council of Ministers.

Domestically, Fayṣal was much more active than his predecessors in economic and educational programs. Although he supported Yemeni royalist forces in their unsuccessful resistance to republicanism, he joined the Arab states in the Arab–Israeli war of 1967. Though in failing health, he remained active in his office until he was shot to death by his nephew Prince Fayṣal ibn Musad ʿAbd al-ʿAzīz. King Fayṣal was succeeded by his brother Crown Prince Khālid ibn ʿAbd al-ʿAzīz as-Saʿūd.

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Fayum portrait, any of the funerary portraits dating from the Roman period (1st to the 4th century) found in Egyptian tombs throughout Egypt but particularly at the oasis of al-Fayyūm. Depictions of the head and bust of the deceased, the portraits are executed either on wooden tablets (about 17 by 9 inches [about 43 by 23 cm]) and placed under the bandages covering the mummy's face, or on the linen shroud itself. They are painted in tempera or in pigments mixed with liquid beeswax.

Fayyūm, al-, Fayyūm also spelled FAIYUM, or FAYUM, *muḥāfaẓah* (governorate) of Upper Egypt, in a great depression of the Western Desert southwest of Cairo. Extending about 50 miles (80 km) east–west and about 35 miles

Waterwheel irrigation of cotton fields in al-Fayyūm, Egypt
Tor Eigeland—Black Star/EB Inc.

(56 km) north–south, the whole Fayyūm, including ar-Ruwayān Wadi, a smaller, arid depression, is below sea level (maximum depth 150 feet [45 m]). The *muḥāfaẓah* also includes a triangular tract of desert to the west, bounded by al-Jīzah to the north and Banī Suwayf to the south. The name is derived from the Coptic *Phiom* ("the sea"), probably inspired by the ancient Lake Moeris that formed there during the Pleistocene epoch when the Nile, about 60 feet (18 m) higher than today, breached the gravelly ridge that separates al-Fayyūm from the Nile valley proper.

On the southeastern side of the depression is al-Fayyūm, the capital of the *muḥāfaẓah,* formerly Madīnat al-Fayyūm ("City of the Fayyūm"). The present Lake Qārūn in the depression is sustained by a partial diversion of the Nile into the Yūsuf (Ibrāhīmīyah) Canal, which follows the ancient channel of the Nile into the Fayyūm, branching out to provide irrigation water. The brackish lake, occupying 85 square miles (220 square km), has been successfully stocked with saltwater fish, enabling a commercial-fishing industry to develop.

The naturally protected, well-defined geographic entity of al-Fayyūm was favoured by prehistoric hunters, who were probably attracted there by abundant game and equable climate. It was an important province in the 12th dynasty (1938–1756 BC), when the capital of Egypt was situated nearby. There is documentary evidence (3rd century BC) of Jewish settlement there. Ptolemy II (285–246 BC) reduced the level of the lake to its present level, reclaiming much agricultural land. Greek settlers were brought to the area, creating prosperous Hellenistic communities. The ruins of these have yielded thousands of Greek, Demotic, and Coptic papyri. When occupied by the Arabs (*c.* AD 640), it was apparently still a prosperous agricultural region, chiefly producing rice and flax. Vulnerable to Berber desert raiders, it later declined, although it continued for centuries to be a centre of Coptic Christianity.

Al-Fayyūm *muḥāfaẓah* has an area of 705 square miles (1,827 square km). With the linking of al-Fayyūm to the Nile valley by railroad (1874), the governorate's isolation was reduced and the way opened for development of the rich soils deposited by the Nile. Most of the area of al-Fayyūm is now settled and cultivated. Cereals, rice, beans, grapes, olives, figs, dates, honey, cotton, and sugarcane are produced. Pigeons are raised for domestic commercial use. In the early 1970s about 9,900 acres (4,000 hectares) of desert were reclaimed for agricultural use. Attar of roses collected there is used in the perfume industry. Other industrial activities include manufacture of woolen and linen cloth, leather tanning, and tobacco processing. Construction of a chemical plant using solar evaporation to extract sodium chloride, sulfide, chlorate, and magnesium oxide started in 1980 near Lake Qārūn. Coal and iron-ore deposits have been found in the governorate.

The region has many ancient sites, including Shedet (later Crocodilopolis), chief centre for worship of the crocodile-god Sebek, near which al-Fayyūm town now lies. In the time of the Ptolemies, Setje was named Arsinoe after the wife of Ptolemy II Philadelphus. Since pharaonic times al-Fayyūm's irrigation waters, its lifeline, have been controlled by sluices at al-Lāhūn across the Yūsuf Canal. Other modern centres in the great oasis include Sinnūris, Iṭsā, and Ibshawāy. The governorate is linked by a highway across the desert to al-Jīzah (Giza) and by local roads to Banī Suwayf. A branch railway off the Cairo–Aswān line serves the governorate, and narrow-gauge railways radiate from the capital into the countryside. Pop. (1986 est.) 1,527,000.

Fayyūm, al-, Fayyūm also spelled FAIYUM, or FAYUM, formerly MADĪNAT AL-FAYYŪM, capital of al-Fayyūm *muḥāfaẓah* (governorate), Egypt. The town is located in the southeastern part of the governorate, on the site of the ancient centre of the region, called Shedet in pharaonic times and Crocodilopolis, later Arsinoe, in the Ptolemaic and Roman periods. Its ruins to the northwest of the city date to at least the 12th dynasty (1938–1756 BC), and during excavations numerous Demotic, Greek, and Coptic papyrus fragments were found. In medieval times there was a flourishing town on the site, and one mosque dates to the Mamlūk period. The Yūsuf Canal flows through the town; a large waterwheel system with buckets, the only known example in Egypt, raises water to irrigation channels.

Al-Fayyūm is a market and distribution centre for the governorate. It is linked by rail to Banī Suwayf in the Nile valley, and to Cairo by a highway that runs northward across the desert. Narrow-gauge railways radiate from the town to serve the agricultural communities of the governorate, and the Yūsuf Canal also fans out into a series of irrigation channels. Pop. (1986 est.) 227,300.

Fazang (Buddhist philosopher): *see* Fa-tsang.

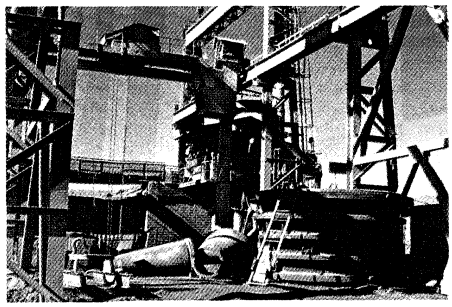
fazenda, large plantation in Brazil, comparable to the slave plantations of the Caribbean and the United States. In the colonial period (16th–18th century) the plantation owners (*fazendeiros*) ruled their estates and the black slaves and freemen who worked them with virtually no interference from the colonial authorities. *Fazendeiros* were usually born in Brazil of Portuguese ancestry. Often, they were absentee landlords who took up residence in some town in the region. *Fazendas* were found throughout Brazil; during the colonial period they were concentrated primarily in the northwestern and central regions, where sugar was produced, shifting during the 19th century to coffee production in the central and southern regions.

Fazzān (Africa): *see* Fezzan.

FBI: *see* Federal Bureau of Investigation.

Fdérik, also spelled F'DERICK, formerly FORT-GOURAUD, IDJIL, or IJILL, mining village, north-central Mauritania, western Africa,

just west of Zouîrât. It is important as the base for the exploitation of extensive iron-ore deposits in the nearby Mount Ijill. The iron



Iron-ore crushing mill at Fdérik, Mauritania
Caracciolo-Banoun—M. Grimoldi

ore is exported through the Atlantic port of Nouadhibou, via a 419-mile (674-kilometre) railway. There are salt works near Fdérik. Pop. (1977) 2,200.

FDIC: *see* Federal Deposit Insurance Corporation.

FDP (German political party): *see* Free Democratic Party.

Feabhail, Loch (Ireland): *see* Foyle, Lough.

fealty (feudal ritual): *see* homage and fealty.

Fear Manach (Northern Ireland): *see* Fermanagh.

Fearing, Kenneth (Flexner) (b. July 28, 1902, Oak Park, Ill., U.S.—d. June 26, 1961, New York, N.Y.), American poet and novelist who used an array of topical phrases and idiom in his satires of urban life.

Fearing worked briefly as a reporter in Chicago. In 1924 he moved to New York City and was a commercial free-lance writer for the rest of his life. In his poetry Fearing depicts a mechanized society devoid of belief, faith, and love; his staccato idiom expresses a viewpoint indigenous to America. His work, acclaimed for its power, vividness, and wit, appeared in *Poetry* magazine and *The New Yorker.* His books include *Stranger at Coney Island* (1948) and *New and Selected Poems* (1956).

During the 1940s Fearing's readership shifted from his poetry to his psycho-thriller fiction. His most successful book, *The Big Clock* (1946; film version, 1948), is a satire about a magazine publisher who commits murder and then sets his top reporter to hunt down a suspect, who is the reporter himself. Fearing's prose lacks the passion but not the wit of his poetry; it is noted for effectiveness and imagination.

feast, also called FESTIVAL, day or period of time set aside to commemorate or ritually celebrate events or time periods (agricultural, religious, or socio-cultural) that give meaning and cohesiveness to an individual and his community. The term derives from the fact that such days or periods generally originated in religious celebrations or ritual commemorations that included sacred communal meals: "feast" is thus the opposite of "fast" (*see* fasting).

A brief treatment of feasts follows. For full treatment, *see* MACROPAEDIA: Rites and Ceremonies, Sacred.

The major religious feasts and festivals, with few exceptions, are annual. The religious year not only represents a span of time but is also a representation of sacred events of the past eternally recurring. Just as the Christian year beginning with Advent is a reenactment of sacred events, the year in other religions also presents a sacred cycle. Among historic religions, the cyclic re-creation of time is most explicit in the Zoroastrian New Year. The unrestrained character of most New Year festivals represents cyclic chaos before creation and is most pronounced in primitive religions, though it survives in the Hindu Holī and similar rites.

Festivals possess an educational and social as well as a religious character. In primitive cults having no written records, seasonal recital of mythology at festival time serves the function of transmitting traditional lore within the tribe. Festivals bind a religious group into a unity that transcends family and local ties. The Muslims of Arabia and Indonesia come into a socio-religious relationship in spite of geographical separation by virtue of their common observance of the festival associated with the fast of Ramaḍān. Continuity between the living and the dead is maintained by communal offerings at festivals, and the cosmic order that underlies social order is maintained by honouring the gods. The unity of "denominations" within religions, such as the Śaivites in Hinduism or the Shīʿites in Islām, is secured by sectarian observances. The solidarity of the ancient Greek or Mesopotamian city was celebrated by festal worship of the local deity, while larger political solidarity was preserved by subordinating local festivals in the context of a great national calendar. In primitive religions the festivals of the village deity perform the same role.

Great feast days recapitulate the history of religion in any given place: the pre-Christian cult of the dead in northern Europe survives in All Saints' Day; the Thai New Year includes older primitive and Hindu aspects incorporated into the later Buddhist celebration, and the Sikh festival of *hola* is an adaptation of the older Hindu Holī.

For a list of feasts, festivals, and holidays worldwide, *see* holiday.

Feast of ———: *see under* substantive word or words (*e.g.*, Holy Trinity, Feast of the).

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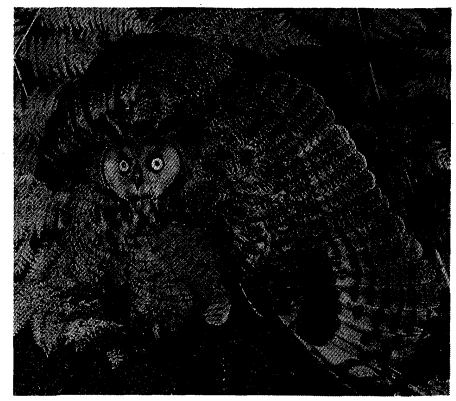
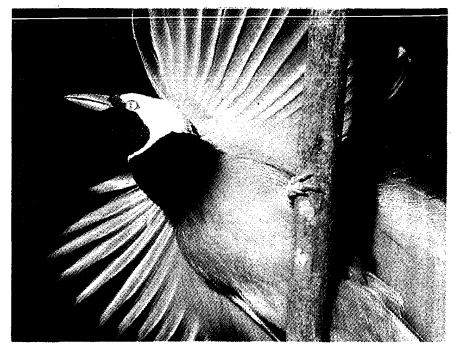
feather, the component structure of the outer covering and flight surfaces of all modern birds. Unique to birds, feathers apparently evolved from the scales of birds' reptilian ancestors. The many different types of feathers are variously specialized for insulation, flight, formation of body contours, display, and sensory reception.

Unlike the hair of most mammals, feathers do not cover the entire skin surface of birds but are arranged in symmetrical tracts (pterylae) with areas of bare skin (apteria) between. The latter may contain the small, soft feathers called down.

The typical feather consists of a central shaft (rachis), with serial paired branches (barbs) forming a flattened, usually curved surface—the vane. The barbs possess further branches—the barbules—and the barbules of adjacent barbs are attached to one another by hooks, stiffening the vane. In many birds, some or all of the feathers lack the barbules or the hooks, and the plumage has a loose, hairlike appearance.

Feathers have been used for ornamentation and as regalia in many societies, both nonliterate and highly developed. Hats and other accoutrements have featured or been constructed entirely of feathers and sometimes entire wings or pairs of wings down to modern times. Numerous governments have protected colourful species of birds to prevent their extinction at the hands of feather hunters. Feathers from domestic fowl slaughtered for meat are a standard by-product of poultry





Feathers of (top) a long-eared owl (*Asio otus*) in an attitude of aggressive display; (centre) a peacock (*Pavo*); (bottom) a male Raggiana bird-of-paradise (*Paradisaea apoda raggiana*) during courtship display
(Top) Jane Burton—Bruce Coleman Ltd., (centre) John H. Gerard, (bottom) Baiyer River Sanctuary, New Guinea; photograph, Tom McHugh from The National Audubon Society Collection/Photo Researchers—EB Inc.

farmers and are used for decoration, padding, and insulation. *See also* plumage.

Feather, Victor (Grayson Hardie), BARON FEATHER OF THE CITY OF BRADFORD (b. April 10, 1908, Gainsborough, Lincolnshire, Eng.—d. July 28, 1976, London), British trade unionist who led the Trades Union Congress (TUC) in its confrontations with governments over industrial-relations legislation from 1969 to 1973.

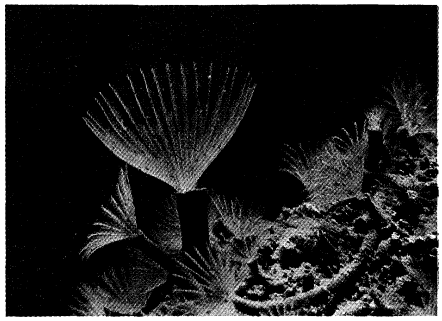
Feather grew up in the industrial town of Bradford in the West Riding of Yorkshire. After working briefly in a textile mill, he became at age 14 an employee of the Bradford Cooperative Society. By age 15 he was a shop steward for the local union and, by age 21, chairman of the branch committee.

He joined the TUC staff in 1937, became assistant secretary (1947–60), assistant general secretary (1960–69), and finally general sec-

retary in 1969. The main issues during his leadership of the TUC were the legislative proposals of the Labour government set out in its 1969 White Paper *In Place of Strife,* which had to be scrapped, and the following Conservative government's Industrial Relations Act of 1971; union opposition to this act brought the government down and cost Edward Heath the leadership of the Conservative Party.

Feather was made a life peer in 1974. On retiring in 1973 he became president of the European Trade Union Confederation, a governor of the British Broadcasting Corporation and the National Institute of Economic and Social Research, and (1974) a member of the Arts Council.

feather-duster worm, any large, segmented marine worm of the family Sabellidae (class Polychaeta, phylum Annelida). The name is also occasionally applied to members of the closely related family Serpulidae. Sabellids live in long tubes constructed of mud or sand cemented by mucus, whereas serpulids



Feather-duster worm (*Sabella crassicornis*)
Jack Dermid

build tubes of calcareous materials. The epithet feather-duster refers to the multicoloured crown of finely divided tentacles that are attached in two groups, one on either side of the worm's head. The worm extends the tentacles for feeding and breathing but quickly retracts them at the first sign of danger.

feather moss, also called PLUME MOSS, or BOREAL FOREST MOSS (*Ptilium,* formerly *Hypnum, crista-castrensis*), widely distributed plant of the order Bryales that forms dense, light-green mats on rocks, rotten wood, or peaty soil, especially in mountain forests of the Northern Hemisphere. The erect stem of a feather moss has a feather-like, or frondlike, appearance. The leaves, with their curving, hooklike tips, are often more than two millimetres (1/10 inch) long.

feather star, any of the 550 living species of crinoid marine invertebrates of the phylum Echinodermata lacking a stalk. The arms, which have feathery fringes, usually number

Feather star (Comantheria grandicalyx)
Douglas Faulkner

five. Feather stars usually attach themselves to a surface or to some floating object and feed on drifting microorganisms, trapping them in the sticky arm grooves.

Feather stars occur chiefly on rocky bottoms in shallow water. They are most abundant from the Indian Ocean to Japan, where *Tropiometra* is the commonest genus. *Antedon* is the best known genus in the Atlantic.

feather-winged beetle, any of the approximately 350 insect species of the widely distributed family Ptiliidae (Trichopterygidae) of the order Coleoptera, characterized by long fringes of hair on the long, narrow hindwings. Most feather-winged beetles are between 0.25 and 1 millimetre (0.01 to 0.04 inch) in length, although some members of the family range up to 2 millimetres.

Feather-winged beetles live in rotting wood, fungi, manure, under bark, or in ant nests. *Nanosella fungi,* one of the smallest insects, lives in the New World Tropics; it is about 0.25 mm long.

featherback (fish): *see* notopterid.

featherbedding, labour union practices that require the employer to pay for the performance of what he considers to be unnecessary work or for work that is not in fact performed or to employ workers who are not needed. The existence of featherbedding in any specific instance is usually disputed and depends on what is considered reasonable. Work rules that require large work crews or that restrict the amount of work a worker can do in a given time period may be considered featherbedding.

Featherbedding provisions in labour contracts may result from the continuation of work rules that were once efficient but that have become obsolete because of changed technology. A union may insist on the continuation of such work rules to ensure the employment security of its members. In some cases unions have obtained passage of building codes and other legislation ostensibly designed to ensure public safety but actually embodying featherbedding practices.

Feathered Serpent, major diety of the ancient Mexican pantheon. *See* Quetzalcóatl.

feathertail, small marsupial mammal, a species of glider (*q.v.*).

featherwork, decorative use of ornamental feathers, especially the feather mosaic needlework of Victorian England. Feathers have been used for adornment since prehistoric times. The Anasazi Indians constructed a turkey-feather and yucca-cord fabric before their introduction to the loom. Highly advanced featherwork in Hawaii, New Zealand, Tahiti, and New Guinea had its counterpart throughout Meso-America and Peru. The brightly coloured feathers of parrots, toucans, jays, tanagers, and trogons were used on headdresses, cloaks, and other ceremonial garments, while more common feathers were used on mats and blankets. The feathers were overlapped and attached somewhat like shingles to a base fabric, stuck directly into wooden arrow shafts, or tied onto ceramic figures. After the Spanish conquest, bits of feathers served as backgrounds for Christian symbols. The pre-Columbian Indians also used feathers in connection with stone or metal jewelry, as did the Chinese, Polynesians, and Eskimos.

Feathers do not appear to have been used much in Europe for ornamental purposes until the close of the 13th century. Under the early Ottoman Empire, men's turbans were decorated with feathers and jewels, and during the reign of Elizabeth I, feathers began to occupy an important place as headdress ornaments for women. Ostrich feathers were particularly liked for this purpose, although those most in demand overall have been the marabou stork feathers, aigrettes of the heron, and feathers of the various species of hummingbirds and birds of paradise. In the 18th century, featherwork was primarily crafted

Poncho shirt decorated with featherwork, Chimú Culture, Peru, AD 1000–1300; in the Art Institute of Chicago
By courtesy of the Art Institute of Chicago, ex. coll. Eduard Gaffron, purchase, Buckingham Fund

by amateurs as wall hangings. White poultry feathers were dyed various colours, although those of the pheasant, pigeon, peacock, guinea fowl, and black rooster were left natural. The 19th-century feather mosaics, often realistic pictures of birds covered with their correspondingly correct feathers, were commonly framed and hung like paintings. Diaper-patterned featherwork of the time was used to cover fire screens, valances, and mirror frames and to fashion muffs, masks, hats, and dress trimmings.

In the 20th century, commercial ostrich farms have provided plumes for feather dusters, boas, and limited millinery uses. Since the 17th century, feathers have been used in the construction of a colourful array of artificial flies for fishing, and some feathers, primarily in Latin America, are crafted into decorative floral bouquets, feather paintings, and greeting cards. Since the past indiscriminate hunting of birds for feathers has almost eliminated some species, restrictions are now enforced by the conservation agencies of many governments.

Febronius, Justinus: *see* Hontheim, Johann Nikolaus von.

February, second month of the Gregorian calendar. *See* month.

February Revolution (March 8–12 [Feb. 24–28, old style], 1917), the first stage of the Russian Revolution of 1917, in which the monarchy was overthrown and replaced by the Provisional Government. This government, intended as an interim stage in the creation of a permanent democratic-parliamentary polity for Russia, was in turn overthrown by the Bolsheviks in October (November, new style) of the same year. The October (November) Revolution, sometimes called the Bolshevik Revolution, established the present Soviet Communist government in Russia. *See* Russian Revolution of 1917.

Fécamp, seaside resort and fishing port of northern France, Seine-Maritime *département,* Haute-Normandie region, northeast of Le Havre. It lies at the opening of the valley of the Valmont River, between high cliffs. In the 11th century Fécamp became famous for its Benedictine abbey, which, before the growth of the fame of Mont-Saint-Michel, was the foremost pilgrimage centre in Normandy. The abbey of the Trinity, which was destroyed by lightning, was rebuilt between the 12th and

13th centuries and was restored in the 15th and 18th centuries. It is an impressive building with a lantern tower 275 feet (84 m) high. There is also a distillery in the town where Benedictine, the liqueur originally produced by local monks, continues to be made. A museum in the distillery is open to the public. The north Atlantic cod fisheries formerly gave the town some prosperity, but this has passed now to Le Havre. The town, popular as a seaside resort since the 1920s, has a casino, sports facilities, and a good beach. Pop. (1982) 21,212.

feces, also spelled FAECES, also called EXCREMENT, solid bodily waste discharged from the large intestine through the anus during defecation (*q.v.*). Feces are normally removed from the body one or two times a day. About 100 to 180 g (3 to 6 ounces) of feces are excreted by a human adult daily.

Normally, feces are made up of 75 percent water and 25 percent solid matter. About 30 percent of the solid matter consists of dead bacteria; about 30 percent consists of indigestible food matter such as cellulose; 10 to 20 percent of choiesteroi and other fats; 10 to 20 percent of such inorganic substances as calcium phosphate and iron phosphate; and 2 to 3 percent is protein. Cell debris shed from the mucous membrane of the intestinal tract also passes in the waste material, as do bile pigments (bilirubin) and dead leukocytes (white blood cells). The brown colour of feces is due to the action of bacteria on bilirubin, which is the end product of the breakdown of hemoglobin (red blood cells). The odor of feces is caused by the chemicals indole, skatole, hydrogen sulfide, and mercaptans, which are produced by bacterial action.

Many diseases and disorders can affect bowel function and produce abnormalities in the feces. The syndrome of constipation is characterized by infrequent evacuations and the production of excessively hard and dry feces, while diarrhea results in overly frequent defecation and excessively soft, watery feces. Bleeding in the stomach or intestines may result in the passage of blood with the stool, which appears dark red, tarry, or black. Abnormal quantities of fat in the feces usually indicate pancreatic or small intestine afflictions. Typhoid, cholera, and amoebic dysentery are among diseases spread by the contamination of food with the feces of infected persons.

Fechner, Gustav Theodor (b. April 19, 1801, Gross Särchen, near Muskau, Lusatia [Germany]—d. Nov. 18, 1887, Leipzig, Ger.), German physicist and philosopher who was a key figure in the founding of psychophysics, the science concerned with quantitative relations between sensations and the stimuli producing them.

Although he was educated in biological science, Fechner turned to mathematics and physics. In 1834 he was appointed professor of physics at the University of Leipzig. His health broke down several years later; his partial blindness and painful sensitivity to light in all likelihood developed as a result of his gazing at the Sun during the study of visual afterimages (1839–40).

Pensioned modestly by the university in 1844, he began delving more deeply into philosophy and conceived of a highly animistic universe with God as its soul. He discussed his idea of a universal consciousness at length in a work containing his plan of psychophysics, *Zend-Avesta: oder über die Dinge des Himmels und des Jenseits* (1851; *Zend-Avesta: On the Things of Heaven and the Hereafter*).

Fechner's *Elemente der Psychophysik,* 2 vol. (1860; *Elements of Psychophysics*), established his lasting importance in psychology. In this work he postulated that mind and body, though appearing to be separate entities, are actually different sides of one reality. He also developed experimental procedures, still useful in experimental psychology, for measuring sensations in relation to the physical magnitude of stimuli. Most important, he devised an equation to express the theory of the just-noticeable difference, advanced earlier by Ernst Heinrich Weber. This theory concerns the sensory ability to discriminate when two stimuli (*e.g.,* two weights) are just noticeably different from each other. Later research has shown, however, that Fechner's equation is applicable within the midrange of stimulus intensity and then holds only approximately true.

From about 1865 he delved into experimental aesthetics and sought to determine by actual measurements which shapes and dimensions are most aesthetically pleasing.

Feckenham, John de, original name JOHN HOWMAN (b. *c.* 1515, Feckenham, Worcestershire, Eng.—d. 1584/85, Wisbech, Cambridgeshire), English priest and the last abbot of Westminster.

Feckenham was a monk at Evesham until that monastery was dissolved in 1540. He then returned for a time to Oxford, where he had formerly been educated, becoming in 1543 chaplain to Bishop Edmund Bonner of London. He shared Bonner's disgrace for opposing Edward VI's advancing Protestantism in 1549 and spent most of the time imprisoned until the accession of Mary. Released, he was made a chaplain to the queen and in 1554 dean of St. Paul's. Two years later Feckenham was put in charge of restoring the Benedictine monastery at Westminster and was consecrated abbot. He was a leading opponent of the religious changes introduced by Elizabeth I after her accession in 1557; and when he and his monks refused the oath of supremacy, they were ejected and the monastery was closed (July 12, 1559). Feckenham was sent to the Tower of London in 1560 and, except for the years 1574–77, passed the remainder of his life in some kind of imprisonment.

Feckenham was an eloquent preacher, and his sermons as dean of St. Paul's attained great popularity. He exercised a moderating influence during the Marian persecution (interceding on occasion for Lady Jane Grey and for Elizabeth), and he was one of the most prominent of the Marian churchmen who survived into Elizabeth I's reign and refused to conform to the new religious settlement.

Fedala (Morocco): *see* Mohammedia.

Fedchenko Glacier, also spelled FEDČENKO, Russian LEDNIK FEDCHENKO, longest valley glacier in the Soviet Union and one of the longest in the world. It is situated in the Pamirs of the Tadzhik Soviet Socialist Republic and is 48 miles (77 km) long, covering about 350 square miles (900 square km). It flows north from the ice field of Revolution Peak (22,880 feet [6,974 m]), receiving ice from 127 tributary glaciers. The average speed of the glacier in its middle course is 26 inches (67 cm) a day. Its meltwater forms the headstream of the Surkhob River and the Amu Darya.

Fedeli, Compagnia dei, one of several Italian companies performing commedia dell'arte (improvised popular comedy) at the beginning of the 17th century. The name means "company of the faithful." The Fedeli was a successor to the pioneering Gelosi company and incorporated some of the Gelosi's actors and performance material.

The Fedeli was directed by Giovambattista Andreini, son of the celebrated commedia actors Francesco and Isabella Andreini. The company included Flaminia, considered to be one of the greatest actresses of her time. The French queen Marie de Médicis was especially fond of the Fedeli, and she arranged for the company to make several tours of France. The Fedeli alternated with French players at the Hôtel de Bourgogne and at court. The company also toured Prague and Vienna.

Feder, Gottfried (b. Jan. 27, 1883, Würzburg, Ger.—d. Sept. 24, 1941, Murnau), German political activist who was the principal economic theoretician of the initial phase of German Nazism.

Feder, a civil engineer, gained notoriety in 1919 for his vaguely socialistic "Manifest zur Brechung der Zinsknechtschaft" ("Manifesto on Breaking the Shackles of Interest"), and his speech before a German Workers' Party meeting at Munich in September of that year provided the immediate inspiration for Adolf Hitler's entry into politics. Feder's socialist and anticapitalist ideas subsequently found expression in Hitler's 25-point program for the National Socialist German Workers' (Nazi) Party in March 1920, as well as in Feder's own book, *Der deutsche Staat auf nationaler und sozialer Grundlage* (1923; "National and Social Bases of the German State"), considered by Hitler to be "the catechism of the [Nazi] movement." Between 1924 and 1936 Feder sat in the German Reichstag and served as chairman of the Nazi Party's economic council (1931), state secretary of the German Ministry of Economics (1933), and state housing commissioner (1934). With the general accommodation of Nazi policy to the existing economic system, however, Feder's role in party affairs drastically diminished, and by 1936 he had been relegated to virtual obscurity.

Federal Art Project: *see* WPA Federal Art Project.

Federal Bureau of Investigation (FBI), largest investigative agency of the United States federal government. Generally speaking, it is responsible for conducting investigations where a federal interest is concerned, except where another agency of the federal government has been specifically delegated that duty by statute or executive fiat. In pursuance of its duties, the bureau gathers facts and reports the results of its investigations to the attorney general of the United States and his assistants in Washington, D.C., and to the United States attorneys' offices in the federal judicial districts of the nation.

The bureau is a part of the Department of Justice, responsible and subordinate to the attorney general of the United States. The bureau, headquartered in Washington, D.C., has field offices in large cities throughout the United States and in Puerto Rico. In addition, the bureau maintains liaison posts in several major foreign cities to facilitate the exchange of information with foreign agencies on matters relating to international crime and criminals.

The head of the bureau, whose title is director, was appointed by the attorney general until 1968; thereafter, by law, he became subject to appointment by the president of the United States with the advice and consent of the Senate.

The bureau has a large staff of employees, including between 6,000 and 7,000 special agents who perform the investigative work. These special agents, the majority of whom have 10 years or more of service with the bureau, are usually required to have either a legal or an accounting education.

History. In 1908 the then attorney general of the United States, Charles J. Bonaparte, established the Bureau of Investigation within the Department of Justice to answer the need for a federal investigative body. In 1924 Attorney General Harlan Fiske Stone (later to become chief justice of the United States) appointed J. Edgar Hoover (1895–1972) as its director and ordered that the bureau be reorganized. Reappointed to that post by successive attorneys general, Hoover was primarily

responsible for the development of the bureau and its professional standards in law enforcement, though his frequent overzealousness and occasional persecutions have been criticized.

Law enforcement in the United States remains principally a responsibility of state and local governments. However, trends toward centralization, the adoption of federal regulatory legislation, the passage of many substantive federal criminal laws, and the need of local law enforcement for supportive services (such as central FBI fingerprint files and laboratory facilities) have increased the responsibilities and duties of the bureau.

Jurisdiction. The Federal Bureau of Investigation has investigative jurisdiction with respect to most federal criminal laws and other matters in which the United States is or may be a party in interest. This responsibility extends to some 180 areas of the criminal law (ranging from aircraft piracy and antiracketeering statutes through kidnapping to white-slave trafficking), and, in addition, the bureau is charged with collecting evidence in most civil cases in which the United States is or may be a party.

The principal exceptions to the bureau's federal criminal investigative jurisdiction lie in such specialized fields as narcotics violations and immigration matters; tax, customs, and currency violations; security frauds; and postal violations, which are the responsibility, respectively, of the Drug Enforcement Administration and the Immigration and Naturalization Service, both in the Department of Justice; the Internal Revenue Service, Bureau of Customs, and the Secret Service, all of which are agencies of the Treasury Department; the Securities and Exchange Commission; and the U.S. Post Office Service.

Between 1961 and 1968 Congress enacted significant legislation protective of civil rights, addressed to such matters as elections and discrimination in public facilities, education, and employment. During this same period, a growing awareness of the existence of large organized criminal syndicates stimulated federal criminal legislation directed to their control. These laws and programs formulated by the Department of Justice greatly expanded the investigative role of the bureau.

The bureau's responsibilities in the internal-security field include matters relating to espionage, counterespionage, sabotage, treason, sedition, and related internal-security matters. In connection with these duties, the bureau has the responsibility of correlating information with respect to internal-security matters and disseminating it to other interested federal agencies. The bureau is represented on the United States Intelligence Board, a body created by the president's National Security Council.

Investigations of applicants and employees of the federal government who have or may be considered for sensitive positions are conducted by the bureau.

Federal Constitutional Court, German BUNDESVERFASSUNGSGERICHT, in Germany, special court for the review of judicial decisions, administrative decisions, and legislation to determine whether they are in accord with the Basic Law (constitution) of the country. While all German courts have the power to review the constitutionality of governmental action, the Federal Constitutional Court is the only court that may declare statutes unconstitutional under the Basic Law; the *Länder* (states) have their own constitutional courts. The Federal Constitutional Court was set up in 1951. While the institution of judicial review had some limited precedent in German constitutional history, the far-reaching jurisdiction of the Federal Constitutional Court was influenced by the model of the United States Supreme Court and the Austrian Constitutional Court.

The Federal Constitutional Court has two separate panels (senates), each with eight members and with jurisdiction over different areas of constitutional law. Judges are chosen from among members of the bar, the law faculties, the civil service, and politics for a nonrenewable 12-year term. Half the membership is elected by the Bundesrat, the other half by a special committee of the Bundestag. A tacit understanding among the major political parties prevents any party or coalition from determining the court's composition.

The decisions of the court are binding on state and federal legislatures and on all other courts. Any individual may bring a constitutional complaint for an infringement of his basic rights. In any case in which there is doubt as to the constitutionality of a law, lower courts must stay the proceedings and submit a question to the Constitutional Court. A federal or *Land* (state) government or one-third of the members of the Bundestag may also petition the court on the constitutionality of a statute. In addition to dealing with questions of constitutionality and individual rights, the court settles disputes between the *Länder* and the federal government, serves as a court for impeachment of the president and judges, and decides whether a political party is pursuing aims and using methods that conflict with the democratic order. The court hears an average of more than 1,700 cases a year; most of these are constitutional complaints by individuals, a form of action that is free of court costs and does not require counsel.

The Federal Constitutional Court has come to occupy a focal position in the German governmental system and has contributed greatly to the development of constitutional law. It does not avoid responsibility and is occasionally criticized, as is its U.S. counterpart, for lack of proper judicial restraint.

Federal Deposit Insurance Corporation (FDIC), independent U.S. government corporation created under authority of the Federal Reserve Act of 1933, with the duty to insure bank deposits in eligible banks against loss in the event of a bank failure and to regulate certain banking practices. It was established after the disastrous collapse of the banking system in early 1933 and after state plans to insure depositors in the past had not proved successful. The FDIC's income is derived from assessments on insured banks and from investments. Insured banks are assessed on the basis of their average deposits; they are currently allowed pro-rata credits totaling two-thirds of the annual assessments after deductions for losses and corporation expenses. The corporation is authorized to insure bank deposits in eligible banks up to a maximum amount for each deposit and is entitled to borrow up to $3,000,000,000 from the U.S. Treasury, a privilege it has never used.

From 1933, all members of the Federal Reserve System were required to insure their deposits, and nonmember banks—about half the United States total—were allowed to do so if they met FDIC standards. Almost all incorporated commercial banks in the United States participate in the plan. The FDIC is managed by a board of three directors; two are appointed for six-year terms by the president, and the third is the comptroller of the currency.

Federal District, Spanish DISTRITO FEDERAL, district in central Mexico, the seat of the national government in a territory that includes most of Mexico City. Administratively, it is under the direct supervision of the president. The district averages well over 8,000 feet (2,400 m) in elevation and occupies the southeastern corner of the Valley of Mexico. It is framed by mountain ranges, some of whose peaks (such as Ixtacihuatl and Popocatépetl) are volcanic. Vestiges of an important lacustrine region, including Lakes Texcoco and Xochimilco, remain in the southeastern portion of the district, and lava beds are extensive in its southern sections. The district's area of 571 square miles (1,479 square km) is coextensive with that of Mexico City, whose boundaries were expanded to those of the district's in 1970. The Federal District comprises 16 subordinate *delegaciones,* all under a presidentially appointed regent holding Cabinet rank. The regent administers by a congressionally approved organic statute that provides for the appointment of local officials and others concerned with justice, public works, and fiscal matters. Many of the district's administrative functions remain highly centralized in the regent's office, but the actual powers of the *delegaciones* were greatly expanded in the 1980s.

Each *delegación* has a complicated local history from pre-Columbian days, as well as a special role as urban, semirural, or agricultural district within the Federal District. The *delegaciones* are Alvaro Obregón, Azcapotzalco, Benito Juárez, Coyoacán, Cuajimalpa de Morelos, Cuauhtémoc, Gustavo A. Madero, Ixtacalco, Ixtapalapa, La Magdalena Contreras, Miguel Hidalgo, Milpa Alta, Tláhuac, Tlalpan, Venustiano Carranza, and Xochimilco.

The Federal District is crisscrossed by networks of bus, streetcar, and railway lines terminating in the city, and it contains about a third of the nation's automobiles. The district's transportation system is proving increasingly inadequate to care for its swelling population. Mexico City's subway system, completed in 1970, is alleviating this congestion.

Clusters of ruins and pre-Columbian remains of numerous sorts are still visible throughout the district, along with colonial Spanish, 19th-century Mexican, and ultramodern buildings. Pop. (1986 est.) 10,051,463.

Federal Reserve System, central banking authority of the United States. It acts as a fiscal agent for the U.S. government, is custodian of the reserve accounts of commercial banks, makes loans to commercial banks, and is authorized to issue Federal Reserve notes that constitute the entire supply of paper currency of the country. Created by the Federal Reserve Act of 1913, the system consists of the Board of Governors of the Federal Reserve System, the 12 Federal Reserve banks, the Federal Open Market Committee, the Federal Advisory Council, and, since 1976, a Consumer Advisory Council; there are several thousand member banks.

The Board of Governors of the Federal Reserve System determines the reserve requirements of the member banks within statutory limits, reviews and determines the discount rates established by the 12 Federal Reserve banks, and reviews the budgets of the reserve banks. A Federal Reserve bank is a privately owned corporation established pursuant to the Federal Reserve Act to serve the public interest; it is governed by a board of nine directors, six of whom are elected by the member banks and three of whom are appointed by the Board of Governors of the Federal Reserve System. The Federal Open Market Committee, consisting of the seven members of the Board of Governors and five members elected by the Federal Reserve banks, is responsible for the determination of Federal Reserve bank policy in the purchase and sale of securities on the open market. The Federal Advisory Council, whose role is purely advisory, consists of 12 members, one of whom is elected by the board of directors of each of the Federal Reserve districts. All national banks are required to be members of the Federal Reserve System, and state banks may become members if they meet membership qualifications.

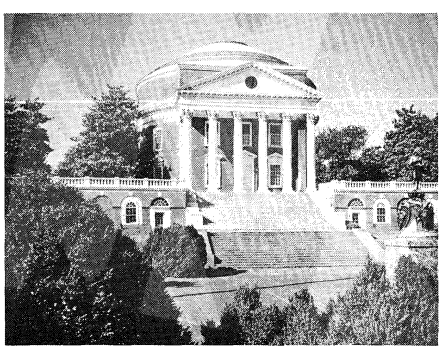
The Federal Reserve System exercises its regulatory powers in several ways, the most important of which may be classified as instruments of direct or indirect control. One form of direct control can be exercised by adjusting the legal reserve ratio—*i.e.,* the proportion of its deposits that a member bank must hold in its reserve account—thus increasing or reducing the amount of new loans that the commercial banks can make. Because loans give rise to new deposits, the potential money supply is, in this way, expanded or reduced. This policy tool has not been used very frequently in recent years.

The money supply may also be influenced through manipulation of the discount (also called rediscount) rate, which is the rate of interest charged by Federal Reserve banks on short-term secured loans to member banks. Since these loans are typically sought to maintain reserves at their required level, an increase in the cost of such loans has an effect similar to that of increasing the reserve requirement.

The classic method of indirect control is through open-market operations, first widely used in the 1920s and now employed daily to make small adjustments in the market. Federal Reserve bank sales or purchases of securities on the open market tend to reduce or increase the size of commercial-bank reserves; *e.g.,* when the Federal Reserve sells securities, the purchasers pay for them with checks drawn on their deposits, thereby reducing the reserves of the banks on which the checks are drawn.

The three instruments of control described here have been conceded to be more effective in preventing inflation in times of high economic activity than in bringing about revival from a period of depression. A supplemental control occasionally used by the Federal Reserve Board is that of changing the margin requirements involved in the purchase of securities.

Federal style, American revival of Roman architecture, especially associated with Thomas Jefferson and Benjamin Latrobe. It flourished from 1785 to 1820 and later in governmental building. The Federal style had definite philosophical ties to the concept of Rome as the republic that the new American country thought it reflected.



The rotunda, University of Virginia, Charlottesville, Va., designed by Thomas Jefferson, 1817–26
Arthur Griffin—EB Inc.

Jefferson suggested the Maison Carrée (a Roman temple of the 1st century BC in Nîmes, Fr.) and used it as the model for the Capitol Building at Richmond, Va. (1785–89), the first American public building to be modeled on a Roman temple in its entirety. Although adaptations for usage were made, the basic format and exterior appearance are similar to the original. The University of Virginia (1817–26) was Jefferson's greatest Federal-style project. The rotunda, or library, of the university was derived from the Pantheon in Rome. Through the excellent example of his buildings, Jefferson established a direction for the Federal style and, by his official position as president of the United States, got the project for a new Federal-style capital city under way.

The later work of William Thornton shows the influence of Jefferson's correct classicism. The other important architect to come under the direct personal influence of Jefferson was Benjamin Latrobe, who built the Roman Catholic cathedral of Baltimore, one of the most impressive examples of the Federal style in the United States. Finally, Latrobe was called to Washington to supervise the construction of the Capitol and undertook the largest project of the late Federal style.

Federal Theatre Project: *see* WPA Federal Theatre Project.

federal theology: *see* covenant theology.

Federal Writers' Project: *see* WPA Federal Writers' Project.

federalism, mode of political organization that unites separate states or other polities within an overarching political system in such a way as to allow each to maintain its own fundamental political integrity. Federal systems do this by requiring that basic policies be made and implemented through negotiation in some form, so that all the members can share in making and executing decisions. The political principles that animate federal systems emphasize the primacy of bargaining and negotiated coordination among several power centres; they stress the virtues of dispersed power centres as a means for safeguarding individual and local liberties.

The various political systems that call themselves federal differ in many ways. Certain characteristics and principles, however, are common to all truly federal systems.

Written constitution. First, the federal relationship must be established or confirmed through a perpetual covenant of union, usually embodied in a written constitution that outlines the terms by which power is divided or shared; the constitution can be altered only by extraordinary procedures. These constitutions are distinctive in being not simply compacts between rulers and ruled but involving the people, the general government, and the states constituting the federal union. The constituent states, moreover, often retain constitution-making rights of their own.

Noncentralization. Second, the political system itself must reflect the constitution by actually diffusing power among a number of substantially self-sustaining centres. Such a diffusion of power may be termed noncentralization. Noncentralization is a way of ensuring in practice that the authority to participate in exercising political power cannot be taken away from the general or the state governments without common consent.

Areal division of power. A third element of any federal system is what has been called in the United States territorial democracy. This has two faces: the use of areal divisions to ensure neutrality and equality in the representation of the various groups and interests in the polity and the use of such divisions to secure local autonomy and representation for diverse groups within the same civil society. Territorial neutrality has proved highly useful in societies that are changing, allowing for the representation of new interests in proportion to their strength simply by allowing their supporters to vote in relatively equal territorial units. At the same time, the accommodation of very diverse groups whose differences are fundamental rather than transient by giving them territorial power bases of their own has enhanced the ability of federal systems to function as vehicles of political integration while preserving democratic government. Examples are Yugoslavia, where each constituent republic is organized around a different nationality group, and Canada, where the province of Quebec contains a population of French descent.

Elements maintaining union. Modern federal systems generally provide direct lines of communication between the citizenry and all the governments that serve them. The people may and usually do elect representatives to all the governments, and all of them may and usually do administer programs that directly serve the individual citizen.

The existence of those direct lines of communication is one of the features distinguishing federations from leagues or confederations. It is usually based on a sense of common nationality binding the constituent polities and people together. In some countries this sense of nationality has been inherited, as in Germany, while in the United States, Argentina, and Australia it had to be at least partly invented. Canada, Switzerland, and Yugoslavia have had to evolve this sense in order to hold together strongly divergent nationality groups. In the newly formed federal systems of India, Malaysia, and Nigeria, the future of federalism is endangered by the absence of such a common national sense.

Geographic necessity has played a part in promoting the maintenance of union within federal systems. The Mississippi Valley in the United States, the Alps in Switzerland, the island character of the Australian continent, and the mountains and jungles surrounding Brazil have all been influences promoting unity; so have the pressures for Canadian union arising from that country's situation on the border of the United States and the pressures upon the German states generated by their neighbours to the east and west. In this connection, the necessity for a common defense against common enemies has stimulated federal union in the first place and acted to maintain it.

Elements maintaining noncentralization. The constituent polities in a federal system must be fairly equal in population and wealth or else balanced geographically or numerically in their inequalities. In the United States, each geographic section has included both great and small states. In Canada, the ethnic differences between the two largest and richest provinces have prevented them from combining against the others. Swiss federalism has been supported by the existence of groups of cantons of different size categories and religiolinguistic backgrounds. Similar distributions exist in every other successful federal system.

A major reason for the failure of federal systems has often been a lack of balance among the constituent polities. In the German federal empire of the late 19th century, Prussia was so dominant that the other states had little opportunity to provide national leadership or even a reasonably strong alternative to the policy of the king and government. In the Soviet Union, the existence of the Russian Soviet Federated Socialist Republic occupying three-fourths of the area and containing three-fifths of the population would severely limit the possibility of authentic federal relationships in that country even if the Communist system did not.

Successful federal systems have also been characterized by the permanence of their internal boundaries. Boundary changes may occur, but such changes are made only with the consent of the polities involved and are avoided except in extreme situations.

In a few very important cases, noncentralization is given support through the constitutionally guaranteed existence of different systems of law in the constituent polities. In the United States, each state's legal system stems directly and to a certain extent uniquely from English (and, in one case, French) law, while federal law occupies only an interstitial position binding the systems of the 50 states together. The resulting mixture of laws keeps the administration of justice substantially noncentralized,

even in federal courts. In Canada, the existence of common-law and civil-law systems side by side has contributed to French-Canadian cultural survival. Federal systems more often provide for modification of national legal codes by the subnational governments to meet special local needs, as in Switzerland.

The point has often been made that in a truly federal system the constituent polities must have substantial influence over the formal or informal constitutional-amending process. Since constitutional changes are often made without formal constitutional amendment, the position of the constituent polities must be such that serious changes in the political order can be made only by the decision of dispersed majorities that reflect the areal division of powers. Federal theorists have argued that this is important for popular government as well as for federalism.

Noncentralization is also strengthened by giving the constituent polities guaranteed representation in the national legislature and often by giving them a guaranteed role in the national political process. The latter is guaranteed in the written constitutions of the United States and Switzerland. In other systems, such as those of Canada and Latin America, the constituent polities have acquired certain powers of participation, and these have become part of the unwritten constitution.

Perhaps the most important single element in the maintenance of federal noncentralization is the existence of a noncentralized party system. Noncentralized parties initially develop out of the constitutional arrangements of the federal compact, but once they have come into existence they tend to be self-perpetuating and to function as decentralizing forces in their own right. The United States and Canada provide examples of the forms that a noncentralized party system may take. In the two-party system of the United States, the parties are actually coalitions of the state parties (which may in turn be dominated by specific local party organizations) and function as national units only for the quadrennial presidential elections or for purposes of organizing the national Congress. Party financing and decision making are dispersed either among the state organizations or among widely divergent nationwide factions.

In Canada, on the other hand, the parliamentary form of government, with its requirements of party responsibility, means that on the national plane considerably more party cohesiveness must be maintained simply in order to gain and hold power. There has been a fragmentation of the parties along regional or provincial lines. The party victorious in national elections is likely to be the one able to expand its provincial electoral bases temporarily to national proportions.

Federal nations with less-developed party systems frequently gain some of the same decentralizing effects through what the Latin Americans call *caudillismo*—in which power is diffused among strong local leaders operating in the constituent polities. Caudillistic noncentralization apparently exists also in Nigeria and Malaysia.

Elements maintaining the federal principle. Several devices found in federal systems serve to maintain the federal principle itself. Two of these are of particular importance.

The maintenance of federalism requires that the nation and its constituent polities each have substantially complete governing institutions of their own, with the right to modify those institutions unilaterally within limits set by the compact. Both separate legislative and separate administrative institutions are necessary.

The contractual sharing of public responsibilities by all governments in the system appears to be a central characteristic of federalism. Sharing, broadly conceived, includes common involvement in policy making, financing, and administration. Sharing may be formal or informal; in federal systems, it is usually contractual. The contract is used as a legal device to enable governments to engage in joint action while remaining independent entities. Even where there is no formal arrangement, the spirit of federalism tends to infuse a sense of contractual obligation.

Federal systems or systems strongly influenced by federal principles have been among the most stable and long-lasting of polities. But the successful operation of federal systems requires a particular kind of political environment, one that is conducive to popular government and has the requisite traditions of political cooperation and self-restraint. Beyond this, federal systems operate best in societies with sufficient homogeneity of fundamental interests to allow a great deal of latitude to local government and to permit reliance upon voluntary collaboration. The use of force to maintain domestic order is even more inimical to the successful maintenance of federal patterns of government than to other forms of popular government. Federal systems are most successful in societies that have the human resources to fill many public offices competently and the material resources to afford a measure of economic waste as part of the price of liberty.

Federalist, The, series of 85 essays on the proposed new U.S. Constitution and on the nature of republican government, published in 1787–88 by Alexander Hamilton, James Madison, and John Jay in an effort to persuade New York state voters to support ratification. Seventy-seven of the essays first appeared serially in New York newspapers, were reprinted in most other states, and were published in book form on May 28, 1788; the remaining eight papers appeared in New York newspapers between June 14 and August 16. All the papers appeared over the signature "Publius," and the authorship of some of the papers was once a matter of scholarly dispute. However, modern computer analysis, added to existing historical evidence, has caused almost all historians to agree that the authorship is the following: Hamilton wrote numbers 1, 6–9, 11–13, 15–17, 21–36, 59–61, and 65–85; Madison numbers 10, 14, 18–20, 37–58, and 62–63; and Jay numbers 2–5 and 64.

Taken together, *The Federalist* papers presented a masterly exposition of the new federal system and of the major departments in the proposed central government. They also argued that the existing government under the Articles of Confederation was defective and that the proposed Constitution would remedy its weaknesses without endangering the liberties of the people.

As a general treatise on republican government, *The Federalist* is distinguished for its comprehensive analysis of the means by which the ideals of justice, the general welfare, and the rights of individuals could be realized. The authors assumed that the primary political motive of man was self-interest and that men, whether acting individually or collectively, were selfish and only imperfectly rational. The establishment of republican government would not of itself provide protection against such characteristics. The representatives of the people might betray their trust; one part of the people might oppress another; both the representatives and the people themselves might give way to passion or caprice. The possibility of good government lay in man's capacity to devise political institutions that would compensate for deficiencies in both reason and virtue in the ordinary conduct of politics. This was the predominant theme in late 18th-century political thought in America and accounts in part for the elaborate system of checks and balances written into the U.S. Constitution.

Of particular note is the 10th essay. In it Madison rejected the then common belief that republican government was possible only for small states. He argued that stability, liberty, and justice were more likely to be achieved in a large area with a numerous and heterogeneous population. Though frequently interpreted as an attack on majority rule, the essay is in reality a defense of social, economic, and cultural pluralism and a defense of a composite majority formed by compromise and conciliation. Decision by such a majority, rather than by a monistic one, would be more likely to accord with the proper ends of government. This distinction between a proper and an improper majority typifies the fundamental philosophy of *The Federalist:* republican institutions, including the principle of majority rule, were not good in themselves but were good because they constituted the best means for the pursuit of justice and the preservation of liberty.

Consult the INDEX *first*

Federalist Party, early U.S. national political party, which advocated a strong central government and held power from 1789 to 1801. The term federalist was first used in 1787 to describe the supporters of the newly written Constitution, who emphasized the federal character of the proposed Union. Parties were generally deplored as inimical to republican government, and President George Washington was able to exercise nonpartisan leadership during the first few years of the new government (begun in 1789). Strong division, however, developed over the fiscal program of the secretary of the Treasury, Alexander Hamilton, whom Washington supported. Differences were intensified by ideological attitudes toward the French Revolution, and by 1795 administration supporters had hardened into a regular party, which succeeded in electing John Adams to the presidency in 1796.

Over the decade of the 1790s, the Federalists stood for the following economic policies: funding of the old Revolutionary War debt and the assumption of state debts, passage of excise laws, creation of a central bank, maintenance of a tariff system, and favourable treatment of American shipping. In foreign affairs they observed neutrality in the war that broke out between France and Great Britain in 1793; approved the Jay Treaty of 1794, which terminated the difficulties with Britain; and sponsored strong defense and internal-security legislation in the crisis of 1798–99 (*see* Alien and Sedition Acts), when French demands almost forced open war. These policies were strongly resisted, especially in the South; the opposition, organized by James Madison and Thomas Jefferson beginning in 1791, became the Republican Party, later known as the National Republican, and eventually as the modern Democratic Party.

The Federalists never held power again after 1801. Their failure is attributable to the Republicans' political skill and to the Federalists' own incapacity or unwillingness to organize politically, their internal divisions (especially between supporters of Adams and Hamilton), and their aversion to compromising principles for the sake of winning elections. Furthermore, New England Federalists adopted a divisive policy of sectionalism, moving dangerously near secession in 1808 and strenuously opposing the War of 1812 (*see* Hartford Convention). By 1817 the party was practically dead, though the opposing Republicans had adopted the Federalists' principles of nationality and had accepted many of their economic ideas.

The accomplishments of the Federalists were great: the party organized the enduring administrative machinery of national government; fixed the practice of a liberal interpretation of the Constitution; established traditions of federal fiscal integrity and credit worthiness; and initiated the important doctrine of neutrality in foreign affairs, allowing the infant nation to develop in peace for more than a century.

Federate, French FÉDÉRÉ, partisan of the Commune of Paris of 1871 (*see* Paris, Commune of). Many Communards called themselves Federates because they believed in a federal system for France.

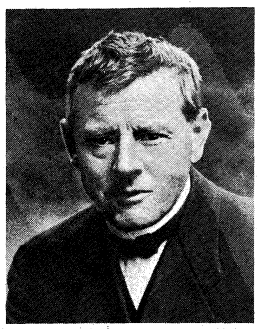
Federation Cup, trophy representing the women's amateur team-tennis championship of the world, inaugurated in 1963 by the International Lawn Tennis Federation in observance of its 50th anniversary. The first competition, an elimination tournament involving teams of three players from 16 nations, was held at the Queen's Club, in London. Each contest consisted of two singles and one doubles match, with the losing team being eliminated.

Fédération des Bourses du Travail (FBT), English FEDERATION OF LABOUR EXCHANGES, federation of French workers' organizations (*bourses*) established in 1892. The *bourse* was a combination of a labour exchange (dealing with job placement), a workers' club and cultural centre, and a central labour union. The federation advocated direct action to bring about a more equitable economic system that would emancipate the worker. In 1895 Fernand Pelloutier, an Anarchist and Syndicalist leader, became the federation's secretary. The FBT supporters included Socialists as well as Syndicalists. In 1902 it merged into the Confédération Générale du Travail (General Confederation of Labour).

Federer, Heinrich (b. Oct. 6/7, 1866, Brienz, Switz.—d. April 29, 1928, Zürich), novelist who imparted new vigour to Christian fiction in Switzerland.

Federer started to write when asthma, from which he suffered all his life, put an end to his work as a priest in 1899. He then worked as a journalist in Zürich and after 1907 as an independent writer. He had been raised in the Roman Catholic tradition among peasants and mountains of the Sarner region, and these themes remained, with local variations, predominant in his books. His unconventional, warmhearted Roman Catholicism was derived from his greatest inspiration, St. Francis of Assisi, whose country he often visited.

Federer's wide reading kept his delightful, realistic art free from the narrow outlook of *Heimatkunst,* the genre of a group of Swiss local colourists. His novels include *Der heilige Franz von Assisi* (1908; "Saint Francis of Assisi"), *Lachweiler Geschichten* (1911; "Lachweil Stories"), *Berge und Menschen* (1911; "Mountains and Men"), *Sisto e*



Federer
By courtesy of the Bibliotheque Nationale Suisse, Bern

Sesto (1913; "Sixtus and Sesto"), *Umbrische Reisegeschichtlein* (1921; "Umbrian Travel Stories"), *Papst und Kaiser im Dorfe* (1925; "Pope and Emperor in the Village"), and the autobiographical work *Am Fenster* (1927; "On the Window"). His complete works were published in 12 volumes (1931–38).

Federici, Camillo, original name GIOVANNI BATTISTA VIASSOLO (b. April 9, 1749, Garessio, Piedmont [Italy]—d. Dec. 23, 1802, Padua [Italy], Austrian Empire), Italian dramatist and actor, whose comedies were highly popular in the late 18th century.

Federici was educated at Turin and showed at an early age a great fondness for literature and especially for the theatre. The praises bestowed on his early attempts determined his choice of a career, and he obtained engagements with several companies both as writer and actor. He married in 1777 and soon after left the stage and devoted himself entirely to composition. He settled at Padua, and the reputation of his numerous comedies rapidly spread in Italy and, for a time, seemed to eclipse that of his predecessors. Most of his pieces were somewhat melodramatic, but he caught something of the new spirit that was manifesting itself in German dramatic literature in the works of Friedrich von Schiller and August von Kotzebue.

Federici found a helpful friend in a wealthy merchant of Padua, Francis Barisan, for whose private theatre he wrote many pieces. He was attacked in 1791 with an illness that disabled him for several years; and he had the misfortune to see his works, in the absence of any copyright law, published by others without his permission. In 1802 he undertook to prepare a collected edition, but only four volumes were completed by the time of his death.

Federico (Italian personal name): *see under* Frederick.

Fedin, Konstantin Aleksandrovich (b. Feb. 24 [Feb. 12, Old Style], 1892, Saratov, Russia—d. July 15, 1977, Moscow), Soviet writer noted primarily for his early novels that portray the difficulties of intellectuals in Soviet Russia.

Fedin, 1960
Novosti Press Agency

During the 1920s, Fedin belonged to a literary group called the Serapion Brothers, the members of which accepted the Revolution but demanded freedom for art and literature. His first novel, *Goroda i gody* (1924; "Cities and Years"), based partly on his experiences as an internee in Germany during World War I, was a social-psychological study of the reaction of the intelligentsia to the Russian Revolution. Gradually, however, he took a position more consistent with official Soviet literary policies and, in 1959, was appointed first secretary of the steering committee of the Union of Soviet Writers, a post he held until 1971, when he was elected chairman of the executive board.

His major work is generally considered to be the trilogy composed of *Pervyye radosti* (1945; *First Joys*), *Neobyknovennoye leto* (1947–48; *An Unusual Summer*), and *Kostyor* (1961–65; *The Conflagration*). Though they are Socialist Realist works, they are nonetheless fresh and vital and are free from the simplistic psychological portrayals that abound in many Soviet novels.

Fëdor, also spelled FEDOR (Russian personal name): *see under* Fyodor.

Fedorenko, Nikolai Trofimovich (b. Nov. 9 [Oct. 27, Old Style], 1912, Pyatigorsk, Northern Caucasus, Russian Empire), Soviet diplomat, ambassador to the UN (1963–68), and Oriental scholar.

The son of a carpenter who fought on the side of the Bolsheviks in the Russian Civil War, Fedorenko had a Communist upbringing, being a member of the Communist youth organizations the Pioneers and Komsomol. He studied Chinese at the Moscow Institute of Oriental Studies, from which he graduated in 1937 and (after graduate studies) received a doctor of philology degree in 1939. In the latter year he joined the Soviet diplomatic service and was sent to China, where he remained almost continually until 1952, when he returned to Moscow to head the first Far Eastern Department of the Foreign Ministry. Thereafter, he was deputy foreign minister (1955–58), ambassador to Japan (1958–62), and then ambassador to the United Nations for five years. At the United Nations, Fedorenko's speeches and diplomacy reflected not only a hard, sometimes bitter, Soviet line against the United States but also the growing breach between the Soviet Union and the People's Republic of China under Mao Zedong. (The latter had become a near-friend during Fedorenko's early years in China.)

In 1970 Fedorenko became editor in chief of the journal *Inostrannaya literatura* ("Foreign Literature"), and he later also held other posts in the intermediate Communist hierarchy. He wrote a number of books on Chinese and Japanese culture, art, and literature.

fee, also called FEE SIMPLE, in modern common law, an estate of inheritance (land or other realty) over which a person has absolute ownership. The owner may put it virtually to any use—sell it, give it away, rent or lease it, mortgage it, or bequeath it. Originally, in feudal times, a fee was not so absolute. Its meaning was equivalent to that of fief or feud; that is, land or other benefices held by a superior lord but granted to a man and his heirs on condition that services be rendered in return.

fee tail (law): *see* entail.

feeblemindedness, deficiency in intelligence. The term is no longer generally used medically or psychologically. The term mental retardation (*q.v.*) is preferred.

feed, also called ANIMAL FEED, foodstuff grown or developed for livestock and poultry, selected and prepared to provide highly nutritional diets that will both maintain the health of the animals and increase the quality of such end products as meat, milk, or eggs. The feeds produced today are the result of research, experimentation, and chemical analysis and are the subject of continuing study by agricultural scientists.

A brief treatment of animal feed follows. For full treatment, *see* MACROPAEDIA: Farming and Agricultural Technology.

Livestock and poultry feeds are derived from crops grown specifically for that purpose, such as hay or pasture grass, by-products of foods produced for human consumption, or those rendered from surplus crops. Most diets, however, involve a combination of feeds from these sources.

Animal feeds are divided into two general categories: concentrates and roughages. The concentrates are rated high in terms of the digestibility of their nutrients but low in fibre content, while the roughages are high in fibre and comparatively low in digestive nutrients.

The concentrates include wheat, corn (maize), oats, rye, barley, and the sorghums. Such cereals—processed whole or ground and generally mixed with supplements, vitamins, and minerals—are easily digestible and rich in starch. Other concentrates include the high-protein meals that are made from such vegetable seeds as soybeans, field peas, peanuts (groundnuts), sunflower seeds, and cottonseed. Still other forms of concentrate foods are the by-products that have been developed from foods processed for human usage, including supplements made from carbohydrate-rich sugar beets and sugarcane and a molasses from citrus fruits; the residues from cereal grains, such as wheat or rice bran, wheat-germ meal, and hominy; animal by-products; and dried dairy foods made from skim milk, buttermilk, and whey.

The most commonly cultivated roughages, as well as the most widely used livestock feed, are pasture grasses and plants. Pasture is highly nutritious, rich in protein and vitamins, and much cheaper to grow for grazing than feed products that must be harvested. Second in importance are the various kinds of hay, which are produced by drying grasses and legumes. The hay is dried in order to preserve nutrients that can be lost by exposure to rain and prolonged sunshine. Legume hay, such as alfalfa or clover, is the richest in protein. Other forms of roughage include silage, which comprises such green forage plants as corn, sorghum, and grass that are preserved and stored in silos; root crops, including rutabagas and mangels; straws made from cereal grains; and corncobs and the hulls from rice and cottonseed.

Livestock and poultry require approximately the same nutrients as human beings, the most basic of which are protein, carbohydrates, fat, minerals, and vitamins. Proteins, made up of various amino acids, aid in the maintenance and repair of muscles, tissue, and internal organs. Protein is most important in the diets of pigs, poultry, and the young of livestock. It is of minimal importance to full-grown cattle, sheep, and goats. Those feeds with the highest protein composition include such concentrates as fish meal; meat and bone meal; poultry waste; meals made from soybeans, peanuts, and sesame seeds; and brewer's yeast. None of the roughage feeds have a high protein rating.

Carbohydrates and fats are the nutrients that are converted by animals to provide heat to maintain body temperature and energy for growth, strength, and the maintenance of vital bodily functions. Simple carbohydrates, such as starches and sugar, are highly nutritious and easily digestible; complex carbohydrates, like those from the fibre of plants, are much less digestible and are important only to cattle, sheep, goats, and other ruminants. Fats are strong energy producers and are highly digestible. Cottonseed, soybean seeds, rice bran, and poultry waste are especially high in fats. Most roughage is high in fibre, especially the various hays, corn fodder and cobs, straws, sorghums, and the hulls of cottonseed, rice, and soybeans.

Mineral nutrients required by animals include sodium chloride (salt), calcium, phosphorus, sulfur, potassium, magnesium, manganese, iron, copper, cobalt, iodine, zinc, molybdenum, and selenium. The proper balance of minerals is achieved in animal diets through supplements and additives, although salt is often provided separately on a regular basis.

Among the vitamins needed by animals, the one most often lacking in basic animal feeds is vitamin A. It is especially important for growth, reproductive quality, and resistance to various diseases and infections. Green-growing crops are rich in carotene, a substance that animals easily convert to vitamin A. Vitamin D is also important in order to enable animals to assimilate and use calcium and phosphorus. Field-cured hay, fish oil, and other feed oils are good sources of vitamin D.

feedback, in biology, a response within a system (molecule, cell, organism, or population) that influences the continued activity or productivity of that system. In essence, it is the control of a biological reaction by the end products of that reaction.

Similar usage prevails in mathematics, particularly in several areas of communication theory. In every instance, part of the output is fed back as new input to modify and improve the subsequent output of a system. *See also* cybernetics.

feedback inhibition, in enzymology, suppression of the activity of an enzyme, participating in a sequence of reactions by which a substance is synthesized, by a product of that sequence. When the product accumulates in a cell beyond an optimal amount, its production is decreased by inhibition of an enzyme involved in its synthesis. After the product has been utilized or broken down and its concentration thus decreased, the inhibition is relaxed, and the formation of the product resumes. Such enzymes, whose ability to catalyze a reaction depends upon molecules other than their substrates (the ones upon which they act to form a product), are said to be under allosteric control. Feedback inhibition is a mechanism by which the concentration of certain cell constituents is limited.

feeding behaviour, any action of an animal that is directed toward the procurement of nutrients. The variety of means of food procurement reflects the diversity of foods used and the myriad of animal types.

A brief treatment of feeding behaviour follows. For full treatment, *see* MACROPAEDIA: Behaviour, Animal.

Feeding behaviour has evolved as a result of the interaction between an animal's structure and its environment. Each species selects, by means of experience or adaptation, food for which it can successfully compete. Some species monopolize one type of food, whereas others use a variety of resources.

An animal's food intake and metabolic expenditure must be balanced so as to ensure survival. Metabolism may be decreased to a level sustainable by intake capacity, such as during a famine, or intake may be limited by the capacity of the digestive system, as in some crustaceans. When food gathering and digestive capacity exceed normal metabolic use, food intake must be regulated by other mechanisms. In vertebrates, the activities of searching, obtaining, and ingesting food are in response to external stimuli, and the responsiveness varies with the hunger level. An increased appetite for salt in a sodium-deficient animal appears to be genetically determined, whereas increased intake of the correct foods in a thiamine-deficient animal results from a learning process. In caloric intake, each of the four critical regions—mouth, digestive tract, bloodstream, and storage sites—contains monitoring mechanisms. Depending on the type and amount of food consumed, various signals are sent to the brain that raise either the satiety level or the feeding motivation, and the consequent balance between caloric intake and energy expenditure results in a constant level of body weight.

Feeding behaviour in vertebrates is largely controlled by the hypothalamus. Stimulation of the lateral hypothalamus will produce continued feeding in satiated animals, while its destruction results in aphagia, or noneating. Individuals with lesions in the lower central nucleus of the hypothalamus will keep eating until an abnormal level of obesity is reached. Some discrepancies between intake and expenditure are normal for particular periods in the life cycle, such as the storing of fat before hibernation or migration.

The selection of particular foods from environments that offer a wide variety is almost entirely genetically determined among invertebrates but is learned in vertebrates, most of which will choose a varied diet when possible. The responsiveness of the young is initially wide in species that hunt almost from birth and narrow in those that depend upon parental feeding. Social responses often influence feeding; individual animals may start to feed or accept undesirable foods if they see others doing so. Feeding activities may be performed for the benefit of other individuals, as in the courtship feeding of many birds and insects or in the feeding of the young. In some species, such as ants and honeybees, individuals perform highly specialized roles in food gathering for the entire colony.

feeling, in psychology, the perception of events within the body, closely related to emotion. The term *feeling* is a verbal noun denoting the action of the verb *to feel,* which derives etymologically from the Middle English verb *felen,* "to perceive by touch, by palpation." It soon came to mean, more generally, to perceive through those senses that are not referred to any special organ. As the known special organs of sense were the ones mediating the perception of the external world, the verb to feel came also to mean the perception of events within the body. Psychologists disagree on the use of the term feeling. The preceding definition accords with that of the American psychologist R.S. Woodworth, who defines the problem of feeling and emotion as that of the individual's "internal state." Many psychologists, however, still follow the German philosopher Immanuel Kant in equating feeling to states of pleasantness and unpleasantness, known in psychology as affect.

Because of the essentially internal, subjective nature of feeling, its study has been concerned with two distinct problems—namely, how an event is perceived and what the perceived event is.

Study of internal sensitivity. At the turn of the 20th century, German psychologists Wilhelm Wundt and Edward Titchener suggested that the elementary psychological states that make up consciousness, such as sensations, images, and feelings, can be observed and analyzed by experimentation. In 1846 the German physiologist E.H. Weber distinguished only two senses in addition to sight, hearing, taste, and smell, whereas the American neurologist C.J. Herrick in 1931 distinguished 23 classes of receptors involved in such additional senses. Much information has been gained on the perception of relatively simple localized stimulation within the body. It is known, for instance, that moderate increases in temperatures of the skin are perceived as warmth, moderate decreases as cold, checkerboard combinations of moderate increases and decreases as heat, and intense increases as pain. Comparable information has not been gained, however, on the perception of such presumably widespread and heterogeneous internal states as the emotions.

Perception of emotions. A milestone in the psychology of feeling was the American psychologist William James's theory of emotion, which held that physiological changes precede emotion. Subsequent evidence indicates that the theory is essentially correct in that there is an internal sensory basis for feeling. More recent work has demonstrated an interaction between physiological arousal and cognition in determining emotional expression.

If emotion is in part a perception initiated by bodily responses, it is obviously desirable to know what these responses are. The best single answer to this question came from the work of the American physiologist W.B. Can-

non, who in a long series of experiments was able to show that the major emotions involve excitation of the sympathetic division of the autonomic nervous system and that such excitation, because of the diffuse conduction, gives rise to a widespread set of specific responses of smooth muscles and glands—increase in heart rate, increase in blood pressure, inhibition of peristaltic movements, increased perspiration, and many others. *Compare* emotion.

feet: *see under* foot, except as below.

feet, washing of, also called FOOT WASHING, Latin PEDILAVIUM, a religious rite practiced by the hierarchy of the Roman Catholic church on Maundy Thursday of Holy Week (preceding Easter) and by members of some other Christian denominations in their worship services.

The early Christian church introduced the custom to imitate the humility and selfless love of Jesus, who washed the feet of his disciples at the Last Supper (John 13:1–15), the night before his Crucifixion. The practice was originally an act of hospitality in Palestinian homes performed for guests (who wore sandals and walked on dusty roads) by a servant or the wife of the host. St. Paul refers to the custom in 1 Timothy 5:10, and St. Augustine mentions it in one of his letters about AD 400. The Maundy Thursday ceremony, observed in Rome by the pope and locally in parish churches, first appeared in the Spanish liturgy of the 7th century.

In several European countries the monarchs or members of the royal family washed the feet of poor people and gave them gifts on Maundy Thursday. The royal practice was continued for a time in England after the Reformation but ended in the Church of England in 1754. Foot washing, however, is generally still practiced in some Episcopal churches.

Protestant sects that include foot washing in their worship services include Pentecostal, Holiness, and Brethren groups and Churches of God. It is not practiced by the major Protestant churches.

fehmic court, German FEMGERICHT, medieval law tribunal properly belonging to Westphalia, though extending jurisdiction throughout the German kingdom.

After 1180, when ducal rights in Westphalia passed to the archbishop of Cologne, Westphalian jurisdiction still retained Carolingian features: in every county, or *Grafschaft,* the count's agent would hear minor cases; and thrice yearly the count himself would hold assizes, the tribunals being composed of free men. In the 13th century, *Freigrafen,* or permanent representatives of the counts, multiplied so much that eventually it was necessary to limit them, each county containing only about two or three *Freistuhlen,* or seats of justice. Westphalian judicial prestige increased, stemming, after about 1300, from direct imperial delegation, rather than coming via the count, to whom concession of royal authority became less frequent. Now many cases from all over Germany were transferred to fehmic courts. Sessions were of two types: the *offenes Ding,* or open assembly, to which all free men were admitted, judging property offenses and ordinary misdemeanours; and the *Stillding,* or secret assembly, attended only by the judge, the *Schöffen* (aldermen), and parties to the case. The *Stillding* had entirely superseded the *offenes Ding* by 1500. After 1422 royal authority in Westphalia was supposedly delegated to the archbishop of Cologne, but the fehmic courts maintained their character of royal institutions. Nevertheless, their secrecy, their severity, and the conflict that their jurisdiction aroused with territorial princes harmed them; and by the end of the 15th century only a few in Westphalia remained. Some, however, lingered on until Napoleonic times.

Fehrenbach, Konstantin (b. Jan. 11, 1852, Wellendingen, Baden [Germany]—d. March 26, 1926, Freiburg, Ger.), German statesman who was chancellor of the Weimar Republic (1920–21).

A noted criminal lawyer, Fehrenbach was elected to the Baden Landtag (provincial diet) in 1885 as a member of the Catholic Centre Party, but differences with the party leadership obliged him to resign his seat in 1887. Reelected in 1901, he remained a member until 1913 and in 1907–09 served as president of the assembly. Entering the German Reichstag (national parliament) in 1903, he soon distinguished himself as one of the most brilliant parliamentary speakers. In 1917 he headed the main parliamentary commission and in 1918 became president of the Reichstag—the last in the history of imperial Germany. Later, following the establishment of a republican government, he presided over the Weimar National Assembly (1919). Although his appointment as chancellor of the republic (June 1920) ushered in the first non-Socialist Cabinet of the Weimar period, he nonetheless pledged himself to the continuation of a general program of socialization. His inability to win concessions from the Allies in the matter of war reparations, however, prompted his resignation (May 1921). In 1923 he was elected chairman of the Catholic Centre Party.

Fei Xiaotong, Wade–Giles romanization FEI HSIAO-T'UNG (b. Nov. 2, 1910, Wu-chiang district, Kiangsu province, China), one of the foremost Chinese social anthropologists, noted for his studies of village life in China.

Fei was graduated in 1933 from Yen-ch'ing University in Peking and did graduate work at Ch'ing-hua University (also in Peking), the London School of Economics, and the University of London. He became professor of anthropology at Ch'ing-hua in 1945 and deputy dean there in 1949. Fei was a victim of the Cultural Revolution in 1967, but he resurfaced in 1972, when he was rehabilitated. He was made a professor and the director of the Institute of Sociology of Peking University and chairman of the Chinese Democratic League.

Among Fei's books originally written in English are *Peasant Life in China* (1939), *China's Gentry* (1953), *Chinese Village Close-up* (1983), and *Small Towns in China* (1986).

Feiffer, Jules (b. Jan. 26, 1929, New York City), American cartoonist and writer who became famous for his "Feiffer," a satirical cartoon strip notable for its emphasis on very literate captions. The verbal elements usually took the form of monologues in which the speaker (sometimes pathetic, sometimes pompous) exposed his own insecurities.

Feiffer was educated at the Art Students League of New York and Pratt Institute in New York City, later assisting several comic-strip artists as he learned his trade. From 1949 to 1951 he drew "Clifford," a Sunday cartoon-page feature. During the two years he served in the U.S. Army, he did cartoon animation for the Signal Corps.

In 1956 Feiffer's work was accepted by *The Village Voice,* a weekly newspaper published in Manhattan's Greenwich Village, where it was an immediate success and was syndicated, beginning in 1959.

Feiffer's first collection of cartoons, *Sick, Sick, Sick* (1958), was followed by *Passionella, and Other Stories* (1959). *Passionella* contained the character Munro, a four-year-old boy who was drafted into the army by mistake. Munro became the basis of an animated cartoon that received an Academy Award in 1961. Later cartoon collections include *Boy, Girl, Boy, Girl* (1961); *Feiffer's Album* (1963); *The Unexpurgated Memoirs of Bernard Mergendeiler* (1965); a retrospective, *Jules Feiffer's America: From Eisenhower to Reagan* (1982); *Marriage is an Invasion of Privacy* (1984); and *Feiffer's Children* (1986).

Feiffer also wrote satirical revues, such as *The Explainers* (1961) and *Hold Me!* (1962), and a one-act play, *Crawling Arnold* (1961). His full-length plays—*Little Murders* (1967), *The White House Murder Case* (1970), and *Grown Ups* (1981)—like his cartoons, blended farce and biting social criticism. Other literary efforts include the novels *Harry, the Rat with Women* (1963) and *Ackroyd* (1977); *The Great Comic Book Heroes* (1965), which he edited and annotated; and several screenplays. In 1986 he received a Pulitzer Prize for editorial cartooning.

feijoa (*Feijoa sellowiana*), small tree of the family Myrtaceae, related to the guava and often called pineapple guava. It is native to southern Brazil, Paraguay, Uruguay, and parts of Argentina and is cultivated in mild, dry climates for its fruit. The feijoa was introduced into southern Europe in 1890 and into California about 1900.

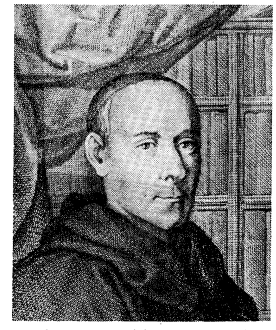
The tree is about 5 m (15 feet) high and has olivelike leaves, dark green above and silvery beneath. The large, white flowers have purplish crimson interiors. The oblong fruit is approximately 5 cm (2 inches) long and dull green in colour, marked with crimson. It has a translucent, tender pulp with a pineapplelike flavour.

The fruits fall when mature but must be kept in a cool place until soft enough to eat. They are made into jam and jelly and also crystallized. Feijoas are propagated by seeds, cuttings, whip grafting, and layering of low branches.

feijoada completa, the national dish of Brazil, black beans cooked with fresh and smoked meats and accompanied by traditional side dishes. The modern *feijoada completa* is an elaborated version of a simple dish of beans flavoured with meat. Most commonly smoked tongue, corned (salted) spareribs, dried or jerked beef, various types of bacon, sausages, and fresh beef and pork are used. The sliced meats are displayed on a large platter, accompanied by the semiliquid beans, rice, toasted *farofa* (manioc meal), sliced oranges, sliced onions, cooked cabbage or kale, and a piquant hot-pepper sauce.

Feijóo y Montenegro, Benito Jerónimo (b. Oct. 8, 1676, Casdemiro, Spain—d. Sept. 26, 1764, Oviedo), teacher and essayist, a leading 18th-century Spanish stylist.

A member of the Benedictine order, he taught philosophy and theology at the University of Oviedo. His essays publicized and encouraged the spread of the new scientific knowledge and exalted reason. His two principal works, *Teatro crítico universal* (1726–39) and *Cartas eruditas y curiosas* (1742–60), deal with an encyclopaedic variety of subjects: natural science, education, law, medicine, philology, and popular beliefs or superstitions.



Feijóo y Montenegro, detail of an engraving by Joaquín Ballester, 1765
Archivo Mas, Barcelona

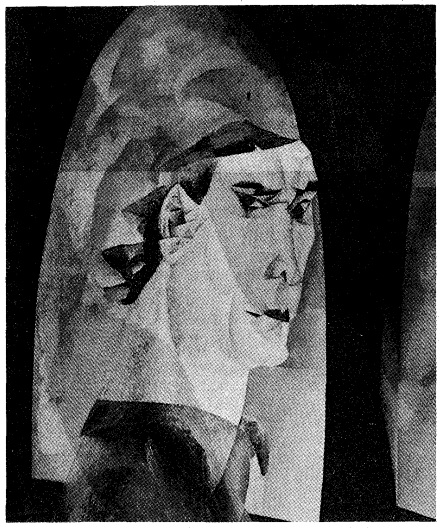
Feininger, Andreas (Bernhard Lyonel) (b. Dec. 27, 1906, Paris), American photographer and writer on photographic technique, noted for his nature and cityscape photographs.

The eldest son of the modernist painter Lyonel Feininger, he attended the Bauhaus in Weimar, Ger., graduating in 1925. He studied architecture at the Bauschule in Zerbst, graduating in 1928. In 1933 he moved to Sweden and established a firm specializing in architectural and industrial photography.

With the approach of World War II in 1939, he moved with his family to New York City and in 1943 became a staff photographer for *Life* magazine, a position he held until 1962. His photography for *Life* frequently involved the use of experimental techniques.

Feininger wrote prolifically on photographic technique, producing such books as *Feininger on Photography* (1949), *Advanced Photography* (1952), *The Complete Photographer* (1965), and *The Color Photo Book* (1969). Collections of his photographs include *The Anatomy of Nature* (1956); *The World Through My Eyes: 30 Years of Photography* (1963); *New York* (1964), with text by Kate Simon; *Forms of Nature and Life* (1966); *Trees* (1968); *Shells* (1972); and *The Mountains of the Mind* (1977).

Feininger, Lyonel (Charles Adrian) (b. July 17, 1871, New York City—d. Jan. 13, 1956, New York City), American artist whose paintings and teaching activities at the Bauhaus brought a new compositional discipline and lyrical use of colour into the predominantly Expressionistic art of Germany.



Self-portrait, oil on canvas by Lyonel Feininger, 1915; in the Sarah Campbell Blaffer Gallery, University of Houston, Texas

By courtesy of the University of Houston, Texas, the Blaffer Collections

Feininger left the United States for Germany in 1887 to study music but decided to become an artist instead. He studied painting in Hamburg, Berlin, and Paris between 1887 and 1893 and then worked as a cartoonist for German humour magazines and the *Chicago Tribune*. About 1910, under the influence of the Cubists—especially Robert Delaunay—he began to paint important canvases and soon established his own style, utilizing prismatic interpenetrating planes of colour. This work, with its intersecting light rays, so impressed the artists of the avant-garde Blaue Reiter ("Blue Rider") group that Feininger was invited to exhibit with them in Berlin in 1913.

After World War I Feininger joined the staff of the Bauhaus workshops. The structural direction of his own work was closely akin to the aim of the Bauhaus: a synthesis of art, science, and technology. In 1936, after the Nazis came to power, Feininger returned to the United States, where he remained.

Feinstein, Isidor (journalist): *see* Stone, I(sidor) F(einstein).

Feira de Santana, city, northeastern Bahia state, northeastern Brazil. It lies between the Jacuípe and Pojuca rivers, at 820 feet (250 m) above sea level. Formerly spelled Feira de Sant' Anna, it was given city status in 1873 and was known for its cattle fairs (hence its name, meaning "St. Ann's fair"). It is one of Bahia's major commercial centres serving a *sertão* (interior) livestock-raising region. The animals are prepared for export as charqui (jerked beef), belts, and skins. Tobacco, cassava, *feijão* (beans), and corn (maize) are grown in the agricultural hinterland, and ceramic tiles, furniture, bicycles, and castor oil are produced in the city. Highways fan out from Feira de Santana to Rio de Janeiro, Salvador (the state capital), and other urban centres. Pop. (1980 prelim.) 225,003.

Fejér, *megye* (county), central Hungary, occupying an area of 1,689 square miles (4,374 square km). It is the nation's major producer of corn (maize). The southern half of Fejér lies in the Mezőföld, a rolling fertile area of loess soils where corn, wheat, barley, sugar beets, potatoes, and peas are the main crops. Sunflower seeds are grown for oil, and orchards lie along the Danube River and other watercourses. In its northern half, fodder crops are declining as the Budapest market area (to the northeast) demands more vegetables, fruits, and meats. Székesfehérvár (*q.v.*), the *megye* seat, is a traditional market centre with some light industries. The major industrial city of Dunaújváros is on the Danube in the eastern part of the *megye*. The shallow Lake Velence is a popular fishing and resort area. Pop. (1986 est.) 426,000.

Feke, Robert (b. *c.* 1705, Long Island, N.Y.—d. *c.* 1750, West Indies), British-American painter, whose portraits depict the emerging colonial aristocracy.

Uncertainties about Feke's being termed a mariner, about his supposed travels, and about his artistic training cause differences of opinion among scholars. The record of his work, however—done at Boston, Philadelphia, and in his home at Newport, R.I.—is reasonably clear. About 15 portraits are signed and dated, and his manner is distinctive enough to support attribution to him of about 50 more. Among his better portraits is the likeness of "Samuel Waldo" (*c.* 1742). Feke's observation of character was sporadic and his figures often stiff and awkward. In his use of luminous colour, naturalistic rendering of textures, and vitality of composition, however, he is a major 18th-century colonial American talent.

Feld, Eliot (b. July 5, 1942, New York City), American dancer, choreographer, and director.

Feld began his classical training at the School of American Ballet and danced the role of the Little Prince in the New York City Ballet's *The Nutcracker* in 1954. He studied modern dance at the High School for the Performing Arts and with Donald McKayle and Pearl Lang.

Feld performed in the original stage and film versions of *West Side Story*, after which he studied ballet with Richard Thomas. He was accepted into the corps of the American Ballet Theatre (1963) and began to choreograph. His first work, *Harbinger* (1963), was a success. In 1968 Feld left the American Ballet Theatre to form his own group, the American Ballet Company, which lasted three years. It was reformed as the Eliot Feld Ballet in 1973 and thereafter became a company of international repute. Among Feld's most popular works are *Intermezzo* (1969), *Jive* (1973), *Mazurka* (1975), and *Papillon* (1979).

Feldkirch, town, *Bundesland* (federal province) Vorarlberg, western Austria. It lies along the Ill River, near the Liechtenstein border, about 48 miles (77 km) east-southeast of Zürich, Switz. First mentioned as Veldkirichae (Veldkirichum) in 830, the settlement belonged to the counts of Montfort from 1190 until it was sold to Austria in 1375. It was chartered in 1218. Schattenburg castle, the Montforts' seat, houses a local museum. Other historic buildings include the Gothic parish church of Sankt Nikolaus (1478), the town hall (1493), and Sankt Johannes' Church (1218). The most important of the many old town gates and towers is the Katzenturm (1491–1507). Feldkirch is known for its schools, notably the former Stella Matutina, a Jesuit college founded in 1648. Among the industries of the town are textile mills and breweries. Summer and winter sports facilities attract many tourists. Pop. (1981) 23,876.

Schattenburg (castle, centre) and the Katzenturm gate tower (right) in Feldkirch, Austria

Toni Schneiders—Bruce Coleman Inc./EB Inc.

Feldman, Morton (b. Jan. 12, 1926, New York City—d. Sept. 3, 1987, Buffalo, N.Y.), American composer associated with the New York group of composers led by John Cage.

Feldman studied composition with Wallingford Riegger and Stefan Wolpe. In the 1950s, much more influenced by Abstract Expressionist painters than by other composers, he began using a method of graphic notation that included such devices as indicating the length of a note by a horizontal line drawn in the

score, or specifying the number of notes to be played in a segment by a number. Pitch and rhythm were indicated in very general terms, the main interest being in the manipulation of contrasting densities and timbres, usually played very softly. After further experiments in the 1960s, he returned to conventional notation in his compositions. Feldman's music was typically minimalist in its simplicity, austerity, and meditative quality. He explored original timbres by means of slowly paced repetitions of unrelated, soft sounds, creating a hushed and ethereal mood with them.

Feldmuehle Nobel AG, formerly (until 1985) FLICK GROUP, German FLICK GRUPPE, diversified industrial and manufacturing company in Germany. The Flick Group was founded in the early 1920s by Friedrich Flick, who rapidly gained control of a massive empire in both steel and coal. But the end of World War II found three-quarters of the Flick operations inside the Soviet zone of occupation and thus lost to the corporation. The Allied administration of occupied West Germany followed a course of decartelization and forced the firm to dispose of either its steel or its coal operations; Flick chose to sell the coal resources. Friedrich Flick himself was sentenced to seven years in prison by the Nuremburg court for war crimes (he was charged with exploiting Soviet and other slave labourers in his mines and plants).

The Flick Group made a remarkable recovery from its wartime losses. By the early 1980s the firm was the largest paper manufacturer in West Germany, was heavily involved in chemicals and steel engineering, and also was the owner of a major European insurance company. It had widespread foreign investments, including a substantial ownership percentage in the American chemical and retailing corporation W.R. Grace Company. The Flick Group became embroiled in a major scandal in the 1980s when one of its senior executives became implicated in charges that he had bribed high West German government officials to grant the firm large tax breaks on capital gains it had made in the 1970s.

For many years the Flick Group was the largest family-owned firm in West Germany. But in 1985 its sole owner, Friedrich Karl Flick, sold the company to Deutsche Bank AG, which then converted the company to public ownership through stock issuances. The Flick Group's various foreign holdings were sold separately, leaving the company's core of industrial operations as a new public firm called Feldmuehle Nobel AG.

feldspar, any of a group of aluminosilicate minerals that contains calcium, sodium, or potassium. Feldspars are the most common minerals in the Earth's crust.

A brief treatment of feldspars follows. For full treatment, *see* MACROPAEDIA: Minerals and Rocks.

Feldspars constitute the major component in nearly all igneous rocks found on the Earth, on the the Moon, and in meteorites. They also are common in metamorphic and clastic sedimentary rocks. The complex chemical and structural properties of feldspars make them useful for interpreting the origins of rocks.

The basic structural unit of a feldspar mineral is a tetrahedron composed of four oxygen atoms surrounding either a silicon or aluminum atom. Each tetrahedral unit shares an oxygen atom with another tetrahedral unit to form a three-dimensional framework. If all tetrahedral units contained silicon, the framework would be neutral; however, in fact from one-fourth to one-half of the units contain aluminum, resulting in a net negative charge. To balance this charge either monovalent sodium (Na) and potassium (K) or divalent calcium (Ca) are located in the cavities.

Natural feldspars can be represented by two compositional series known as the alkali feldspars and the plagioclase feldspars. The alkali feldspars show a continuous composition series between orthoclase ($KAlSi_3O_8$) and albite ($NaAlSi_3O_8$), while the plagioclase series is continuous between albite and anorthite ($CaAl_2Si_2O_8$). Only limited substitution occurs between the potassium- and calcium-rich members.

An important property of the feldspars is the complex ordering of silicon and aluminum atoms into the nonequivalent tetrahedral sites. At high temperatures the distribution of atoms is random or disordered, but with decreasing temperature the aluminum and silicon atoms tend to order into certain sites (K-feldspar: sanidine → microcline; Na-feldspar: high albite → low albite). The degree at which the feldspars are ordered represents an important measurable parameter for interpreting the thermal history of a feldspar.

feldspathoid, any of a group of alkali aluminosilicate minerals similar to the feldspars in chemical composition but either having a lower silica-alkali ratio or containing chloride, sulfide, sulfate, or carbonate.

A brief treatment of feldspathoids follows. For full treatment, *see* MACROPAEDIA: Minerals and Rocks.

The two most abundant feldspathoids are nepheline and leucite. Other significant varieties include kalsilite, sodalite, nosean, and haüynite. The physical and chemical properties of the feldspathoids lie between those of the feldspar and zeolite groups. The feldspathoid structure consists of oxygen tetrahedrons with silicon and aluminum atoms at their centres. Each oxygen atom is shared by the SiO_4 and AlO_4 tetrahedrons, forming a three-dimensional network or framework structure typical of tectosilicates. Alkali ions as well as carbonate, sulfate, and chloride ions occupy the holes (*i.e.,* cavities) between the oxygen atoms.

Feldspathoids are found chiefly in igneous and metamorphic rocks. They commonly occur in place of feldspars in alkali-rich, silica-poor rocks. Some of them have commercial importance; they are used as raw materials in the production of alum, glass, and ceramics.

Feldspars

name formula	colour	lustre	Mohs hardness	specific gravity	habit or form	fracture or cleavage	refractive indices	crystal system space group	remarks
albite $NaAlSi_3O_8$	colourless or white; yellow, pink, green, black	vitreous	6–6½	2.6	transparent to subtranslucent, brittle, tabular crystals	one perfect, one good cleavage of 94°	$\alpha = 1.527$ $\beta = 1.531$ $\gamma = 1.538$	triclinic $C\bar{1}$	one end-member of the feldspar ternary system; forms solid solution series with anorthite and with both microcline and orthoclase; a high-temperature polymorph exists
anorthite $CaAl_2Si_2O_8$	white to grayish or reddish	vitreous	6–6½	2.75	transparent to translucent, brittle, prismatic crystals	one perfect, one good cleavage of 94°	$\alpha = 1.577$ $\beta = 1.585$ $\gamma = 1.590$	triclinic $P\bar{1}$	one end-member of the feldspar ternary system; forms solid solution series with albite in which Na replaces Ca and whose members are termed plagioclase
celsian $BaAl_2Si_2O_8$ (<10% impurities)	colourless, white, or yellow	vitreous	6–6½	3.1–3.4	cleavable masses; short, stout, twinned, prismatic crystals; twinned, acicular prisms	one perfect, one good cleavage	$\alpha = 1.579–1.587$ $\beta = 1.583–1.593$ $\gamma = 1.588–1.600$	monoclinic $I\frac{2}{c}$	
hyalophane $(K,Ba)AlSi_3O_8$ (usually with 5–30% $BaAl_2Si_2O_8$)	colourless, white, or yellow	vitreous	6–6½	2.6–2.8	twinned crystals; prismatic crystals; masses	one perfect, one good cleavage	$\alpha = 1.520–1.542$ $\beta = 1.524–1.545$ $\gamma = 1.526–1.547$	monoclinic	
microcline $KAlSi_3O_8$	white to cream-yellow; red; green (amazonite)	vitreous	6–6½	2.6	brittle, twinned crystals	two perfect cleavages of 90°	$\alpha = 1.514$ $\beta = 1.518$ $\gamma = 1.521$	triclinic $C\bar{1}$	forms solid solution series with albite in which Na replaces K
orthoclase $KAlSi_3O_8$	flesh-red; white to pale yellow; red, green	vitreous	6–6½	2.6	twinned crystals	two good cleavages of 90°	$\alpha = 1.518$ $\beta = 1.522$ $\gamma = 1.522$	monoclinic $C\frac{2}{m}$	one end-member of the feldspar ternary system; forms solid solution series with albite in which Na replaces K and whose members are termed alkali feldspar
sanidine $KAlSi_3O_8$	colourless or white	vitreous	6	2.6	transparent crystals	two good cleavages of 90°	$\alpha = 1.518$ $\beta = 1.522$ $\gamma = 1.522$	monoclinic $C\frac{2}{m}$	forms solid solution series with high-albite in which Na replaces K; a high-temperature polymorph exists

Félibrige, association organized in the 19th century for the maintenance of the Provençal customs and language that stimulated the renaissance of the literature, language and customs of the whole of southern France. The Félibrige was founded in 1854 by seven poets—Joseph Roumanille, Frédéric Mistral, Théodore Aubanel, Anselme Mathieu, Jean Brunet, Alphonse Tavan, and Paul Giéra—who took their name from a Provençal tale in which Jesus is discovered in the temple disputing with "Seven Doctors of the Law" ("li sèt felibre de la léi"). The group met near Avignon under the guidance of Roumanille, who, since the mid-1840s, had produced secular verse and delightfully humorous prose works in his native Provençal dialect. In 1852 he had collected and published *Li Prouvençalo,* an anthology of writing in Provençal; he also made the first attempt at regulating the orthography of Provençal in the introduction to his play, *La Part dou bon Dieu* (1853). Mistral was inspired by Roumanille to devote his energy to restoring the glory of the Provençal region, and he became the most powerful personality of the renaissance. He worked with Roumanille on standardizing the Provençal grammar and in 1855 co-founded with Roumanille the *Armana Prouvençau* ("Provençal Almanac"), an annual periodical that for eighty years published the best contemporary Provençal writing. Later, Mistral compiled a huge Provençal dictionary, *Lou Tresor dóu Félibrige* (1878); in 1905 he established a museum of Provençal culture in Arles, Fr., which is still in existence. Of the other members of the original Félibrige, only Théodore Aubanel proved himself worthy to rank with Mistral and Roumanille.

The Félibrige grew considerably in the period after Mistral, attracting followers not only from Provençal but also from other southern provinces, such as Gascony, Languedoc, Limousin, and Aquitaine, as well as Catalonia, Spain. The vigorous regional movement that resulted exerted a strong influence well into the 20th century.

Felicitas, Roman goddess of good luck to whom a temple was first built in the mid-2nd century BC. She became the special protector of successful commanders. Caesar planned to erect another temple to her, and it was built by the triumvir M. Aemilius Lepidus. The emperors made her prominent as symbolizing the blessings of the imperial regime.

feline distemper, also called PANLEUKOPENIA, or INFECTIOUS ENTERITIS, viral disease of cats, kittens two to six months old being most susceptible. About 3 to 10 days after exposure to the disease, infected kittens cough and sneeze, have running eyes and nose, are feverish, lose their appetites, vomit, and have diarrhea. The number of white cells in the blood drops severely. The disease rarely lasts more than a week, but the mortality rate is high. Vaccines offer effective immunity.

feline leukemia, also called FELINE LYMPHOSARCOMA, viral disease of cats, one of the most serious diseases affecting small domestic animals. Symptoms include enlargement of the lymph nodes, depression, emaciation, and, frequently, diarrhea; there is no known treatment, and the outcome is usually fatal. A fluorescent antibody test developed in the 1970s produced evidence that the virus is present in many apparently healthy cats. The disease can spread among animals; however, there is no proved connection with leukemia in humans.

feline respiratory disease, a complex of viral contagions of cats (including rhinotracheitis, pneumonitis, and influenza), marked by fever, sneezing, and running eyes and nose. Rhinotracheitis and pneumonitis are the most common and have identical symptoms. Mortality is low, but recovery from severe cases may be difficult and prolonged, with relapses. A vaccine is available against pneumonitis. Treatment is supportive. Antibiotics are used to prevent secondary bacterial infections.

Felipe (Spanish personal name): *see under* Philip.

Felix, name of three popes and two antipopes, grouped below chronologically and indicated by the symbol •.

• **Felix I,** SAINT (d. Dec. 30, 274, Rome; feast day May 30), pope from 269 to 274. Elected to succeed St. Dionysius, Felix was the author of an important dogmatic letter on the unity of Christ's Person. He received the emperor Aurelian's aid in settling a theological dispute between the anti-Trinitarian Paul of Samosata, the deposed bishop of Antioch, and the orthodox Domnus, Paul's successor. Felix was buried in the catacomb of St. Calixtus and mistakenly called a martyr.

• **Felix (II)** (d. Nov. 22, 365, Porto, near Rome), antipope from 355 to 358. Originally an archdeacon, Felix was irregularly installed as pope in 355 after the emperor Constantius banished the reigning pope, Liberius. In May 357 the Roman laity, which had remained faithful to Liberius, demanded that Constantius recall the true pope. The Emperor planned to have Felix and Liberius rule jointly, but Felix was forced to retire to Porto when Liberius returned.

He has been erroneously called saint after an error in the Roman martyrology that was based on spurious documents. The martyrology gave July 29 as his feast day, but he is now officially listed as an antipope in the *Annuario Pontificio.*

• **Felix III (or II),** SAINT (d. March 1, 492, Rome; feast day March 1), pope from 483 to 492. He succeeded St. Simplicius on March 13. Felix excommunicated Acacius, patriarch of Constantinople, in 484 for publishing with the emperor Zeno a document called the *Henotikon,* which appeared to favour Monophysitism, a doctrine that had been denounced at the Council of Chalcedon (451). The excommunication created the 35-year Acacian Schism. Felix' Lateran Council of March 487

Feldspathoid minerals

name formula	colour	lustre	Mohs hardness	specific gravity	habit or form	fracture or cleavage	refractive indices	crystal system space group	remarks
analcime $NaAlSi_2O_6 \cdot H_2O$	colourless, white, gray, pink	vitreous	5–5½	2.2–2.3	transparent to opaque, brittle, well-formed crystals or radiating aggregates	very poor cleavage	$n = 1.479–1.493$	isometric Ia3d	forms solid solution with pollucite when cesium replaces sodium; has leucite structure
cancrinite $Na_6Ca_2Al_6Si_6O_{24}(CO_3)_2 \cdot 3H_2O$	variable	subvitreous	5–6	2.3–2.5	transparent or translucent; massive	one perfect prismatic cleavage	$\varepsilon = 1.495–1.503$ $\omega = 1.507–1.528$	hexagonal $P6_3$	forms solid solution with vishnevite when sulfate replaces carbonate
leucite $KAlSi_2O_6$	white, gray, or pink	vitreous	5½–6	2.5	cube-like crystals	very poor cleavage	$n = 1.508–1.511$	tetragonal $I\frac{4_1}{a}$; isometric above 625° C Ia3d	
nepheline $Na_3KAl_4Si_4O_{16}$	light-coloured; also reddish, greenish, or brownish	vitreous to greasy	5½–6	2.6–2.7	small, glassy crystals or grains	poor cleavage	$\varepsilon = 1.526–1.542$ $\omega = 1.529–1.546$	hexagonal $P6_3$	forms solid solution with kalsilite when potassium replaces sodium
pollucite $Cs_4Al_4Si_9O_{26} \cdot H_2O$	colourless	vitreous	6½	2.9	cubes; massive		$n = 1.525$	isometric	forms solid solution with analcime when sodium replaces cesium; has leucite structure
scapolite (family name)									
marialite $Na_4Al_3Si_9O_{24}Cl$	usually white but variable	vitreous	5–6	2.5–2.6	glassy prisms	two good cleavages	$\varepsilon = 1.540–1.541$ $\omega = 1.546–1.550$	tetragonal $I\frac{4}{m}$	mixture of end-members marialite and meionite; luminesces yellow under ultraviolet light
meionite $Ca_4Al_6Si_6O_{24}CO_3$				2.6–2.8			$\varepsilon = 1.556–1.562$ $\omega = 1.590–1.600$		
sodalite $Na_4Al_3Si_3O_{12}Cl$	variable	vitreous	5½–6	2.3–2.5	dodecahedra; embedded grains; concentric nodules	poor cleavage	$n = 1.483–1.487$	isometric $P\bar{4}3n$	often luminesces yellow or orange under ultraviolet light

fixed conditions for readmission to the church of Africans who had been rebaptized by the Vandals. *See also* Acacian Schism.

• **Felix IV (or III),** SAINT (d. Sept. 22, 530, Rome; feast day January 30), pope from 526 to 530. He was elected on July 12 as the choice

Felix IV, detail from a mosaic, 6th century; in the Church of SS. Cosmas and Damian, Rome
Alinari—Art Resource/EB Inc.

of Theodoric the Great, king of the Ostrogoths, who had imprisoned Felix' predecessor, St. John I, and who died shortly after Felix' consecration. The new pope ended the controversy over grace at the second Council of Orange (529) by condemning Semi-Pelagianism (*see* Orange, councils of; Semi-Pelagianism). Felix converted a pagan temple at Rome into the Church of SS. Cosmas and Damian. To avoid a disputed succession, Felix named the archdeacon Boniface (Pope Boniface II) as his successor.

• **Felix (V)** (antipope): *see* Amadeus VIII *under* Amadeus (Savoy).

Felix (d. 818), bishop of Urgel, Spain, one of the chief proponents of Adoptionism (*q.v.*).

When Archbishop Elipandus of Toledo promulgated the Adoptionist doctrine, he was condemned by Pope Adrian I. Elipandus then sought the support of Felix, who expressed agreement, whereupon Charlemagne in 792 summoned Felix to the Council of Ratisbon (Regensburg, Bavaria), where Felix was induced to recant.

Although the Spanish church sent an open letter supporting the essential orthodoxy of Felix and Elipandus, the condemnation was renewed at a council summoned to Frankfurt am Main in 794. Felix, who had been transferred to Rome, returned to Urgel and engaged in a bitter doctrinal duel with Alcuin of York, who in 781 had become a member of Charlemagne's court at Aachen.

In 798 a new pope, Leo III, held a Roman council that condemned Felix' Adoptionism and anathematized him. A commission under Archbishop Leidrad of Lyons brought Felix to the Council of Aachen in 799, and there, after six days of dispute with Alcuin, he recanted again. Since his orthodoxy was still considered suspect, he was placed under Leidrad's surveillance but remained unrepentant and continued to administer his see undisturbed.

Felix OF VALOIS, SAINT (b. *c.* 1127, France—d. 1212, Cerfroid; feast day November 20), legendary religious hermit who, with St. John of Matha, has traditionally been considered a co-founder of the Trinitarians, a Roman Catholic religious order. Felix' existence is known only from a spurious history of the order compiled in the 15th century.

According to legend, Felix lived a solitary ascetic life in the forest near Cerfroid in the diocese of Soissons. The founding of the Trinitarians, an order originally devoted to freeing Christian slaves from Muslim captivity, was supposedly suggested by John of Matha, a disciple of Felix. Although he was 70 years old at the time, Felix is said to have agreed to help, establishing the new order in France and Italy, while John travelled to Spain and Barbary. Felix then returned to administer the motherhouse of the order at Cerfroid.

Although the tradition of the Trinitarians holds that the two were canonized in 1262 by Pope Urban IV, there is no evidence of any decree to that effect. Their cult was officially recognized, however, by Alexander VII in 1666.

Felix, Elisa (French actress): *see* Rachel, Mademoiselle.

Felixstowe, parish (town), Suffolk Coastal district, county of Suffolk, England. Though situated on the east coast, the town in fact faces south and has a frontage to the estuary of the River Orwell opposite Harwich. Felixstowe has been equipped since 1953 as an up-to-date container port. It is the nearest British port to Europoort, Neth., and has grown rapidly. It is also a seaside resort and centre for yachting in the estuary. Pop. (1981 prelim.) 20,858.

Fell, John (b. June 23, 1625, Longworth, Berkshire, Eng.—d. July 10, 1686, Oxford), English Anglican priest, author, editor, and typographer who as dean and bishop at Oxford was a benefactor to Oxford University and its press.

Ordained in 1647, Fell was deprived of his fellowship at Oxford in 1648 for having fought with the Royalists against Oliver Cromwell during the Civil War. Despite the opposition of the Cromwellian Protectorate to the

Fell, portrait by Sir Peter Lely; in the City Art Gallery, Bristol, county of Avon
By courtesy of the City Art Gallery, Bristol, Eng.

Church of England, Fell continued to hold services throughout the Commonwealth. At the Restoration of the monarchy in 1660, he was made chaplain to King Charles II as well as canon and, later, dean of Christ Church, Oxford. Vice chancellor from 1666 to 1669, he became bishop of Oxford in 1676.

During this period Fell recovered for Oxford the reputation it had lost under Cromwell. He renovated numerous structures, including his own college of Christ Church, where he built the bell tower and hung the celebrated Great Tom bell, which continues to toll nightly at 9 o'clock. He began the construction of the Sheldonian Theatre, installed the university press in it, set up a type foundry, and encouraged the foundation of a paper mill nearby.

In addition to introducing fonts of type acquired abroad, he designed the "Fell" type, discontinued in the 18th century but rediscovered and reintroduced in 1874. Among books printed by the press are Fell's own editions of Theocritus, Aratus, the New Testament, Athenagoras, Theophilus of Antioch, Eratosthenes, St. Clement of Alexandria, and St. Cyprian. He was also the author of *Interest of England Stated* (1659) and *The Vanity of Scoffing* (1674).

Fell was the subject of the famous verse (cited in various forms by different editors; in fact based on a translation from the Latin poet Martial) by one of his Oxford students, the satirist Thomas Brown:

I do not love thee, Dr. Fell,
The reason why I cannot tell;
But this I know, and know full well,
I do not love thee, Dr. Fell.

Fellenberg, Philipp Emanuel von (b. June 27, 1771, Bern—d. Nov. 21, 1844, Hofwil, near Bern), Swiss educational reformer.

In 1799 Fellenberg purchased the estate of Hofwil, where he founded a school combining manual training and agricultural and academic instruction. His social aim, to be achieved through education, was to try to raise

Fellenberg, lithograph by Franz Leopold
By courtesy of the Bibliotheque Nationale Suisse, Bern

the living conditions of the poor and to weld them and the upper classes together. At first he worked with J.H. Pestalozzi, but they separated over personal differences. Fellenberg's scheme initially provoked ridicule, but gradually pupils came to him from all over Europe, both for agricultural training and for the high moral training associated with his system.

Feller, Bob, byname of ROBERT WILLIAM ANDREW FELLER, also called RAPID ROBERT (b. Nov. 3, 1918, Van Meter, Iowa, U.S.), U.S. professional American League right-handed baseball pitcher whose fastball made him a frequent leader in games won and strikeouts during his 18-year career with the Cleveland Indians.

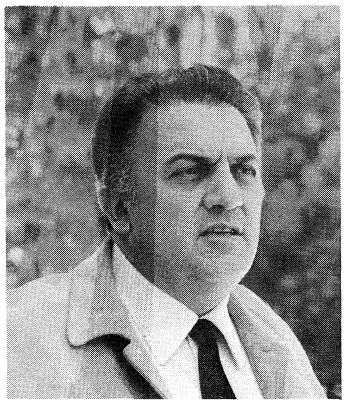
Feller learned baseball from his father and grandfather and while still in high school was making $100 a game in semiprofessional matches pitched throughout Iowa under other names. He was signed to a contract with the New Orleans Pelicans in 1935 and joined the Cleveland Indians mid-season in 1936. At first he had little control (his record of 208 bases on balls in one season stood into the early 1980s), but he led the league in pitching (1939–41), winning 24, 27, and 25 games, and also led the league in strikeouts (246, 261, 260). He was in military service from 1942 to 1944. After returning from service, he again led the league in strikeouts (1946–48) with 348, 196, and 194, the 348 strikeouts standing as a record until the advent of Sandy Koufax and Nolan Ryan in the 1960s and 1970s. He pitched three no-hit games, the first pitcher in the 20th century to do so, in 1940, 1946, and 1951. In his career he pitched 12 one-hit games. His pitching speed was the greatest until broken by Ryan's 100.9 mph. After retiring from baseball in 1956, he formed a baseball insurance business. He was elected to the Baseball Hall of Fame in 1962.

Felling, locality, South Tyneside district, metropolitan county of Tyne and Wear, England. It lies on the south bank of the Tyne Estuary. The town grew rapidly at the end of the 18th and beginning of the 19th century with the extension of coal mining and, later, with expansion of riverside industries, such as shipbuilding and manufacture of glass and heavy chemicals. New light industries later

were introduced to offset declining employment in the traditional staple industries. Pop. (1981 prelim.) 36,431.

Fellini, Federico (b. Jan. 20, 1920, Rimini, Italy), Italian film director who helped to inaugurate a wave of Neorealism but later turned to imagery and fantasy. He is especially well known for *La strada* (1954; "The Road"), *La dolce vita* (1960; "The Sweet Life"), *Otto e mezzo* (1963; *8½*), and *Amarcord* (1974; "I Remember").

Family and childhood influences. Fellini was born in a summer-resort area on the Adriatic. Throughout his films there are allusions to persons, scenes, and incidents associated



Fellini, 1965
Paris Match—Pictorial Parade

with his childhood and youth there. Fellini's father, a simple, middle-class food-products salesman who died in 1956, was recalled nostalgically both in *La dolce vita* and in *Otto e Mezzo*. His mother, his grandmother, and his aunts also played important roles in the world of childhood that some of his films, such as *Amarcord,* evoke. The Catholic boarding school that he attended in Fano is recreated imaginatively as a combination of meanness and liturgical pomp in *Otto e Mezzo*. Other salient childhood influences were the theatre and especially the circus, the dazzling impact of which may be seen in his 1970 film for television, *I clowns* (*The Clowns*). Fellini's adolescence, during which he often was the ringleader in the escapades of his schoolmates, is reproduced in his film *I vitelloni* (1953; "Spivs").

Bored with his aimless existence in Rimini, Fellini, who had a talent for drawing, went in 1938 to Florence, where he worked on a humorous weekly and on science fiction serials. In 1939 he went to Rome in the hope of becoming a journalist and sold caricatures in restaurants. At this time he met the actor Aldo Fabrizi, whose tales of the rough life of the small-time comic actor were to be used by Fellini in some of his films. In 1940 Fellini became an editor of *Marc'Aurelio,* a popular satirical weekly magazine. In 1943 he wrote a radio serial in which the actress Giulietta Masina appeared; she became Fellini's wife in that year. When Allied forces took Rome in 1944, Fellini opened a "funny face shop," in which he drew caricatures and made voice recordings of soldiers passing through.

Associations with Rossellini and Lattuada. Fellini became a friend and associate of the director Roberto Rossellini, who was then making *Roma città aperta* (1945; *Open City*), in which Fabrizi played the lead. The film became the best known example of Italian Neorealism. Fellini made an even more significant contribution to Rossellini's next film, *Paisà* (1946; *Paisan*). By then, Fellini had fallen in love with cinema, and he went on to contribute to the writing of some of the most important Neorealist films, including *Il miracolo* (1948; *The Miracle*), the highly controversial second part of Rossellini's *L'Amore*, which the U.S. Supreme Court later ruled could not be banned for being "sacrilegious."

A decisive step in Fellini's career came in 1950, when he codirected and coproduced *Luci del varietá* (*Variety Lights*) with Alberto Lattuada, a prominent Italian director for whom Fellini had worked as a writer. Fellini's wife appeared in it and played a small part in the next film he directed, this time on his own, *Lo sceicco bianco* (1952; *The White Sheik*), the story of a bride on her honeymoon who is infatuated with the hero of a photographic comic strip. Though neither film was successful financially, he went on the following year to make *I vitelloni,* which struck deep and with bitter sarcasm at the idle mammas' boys of the provinces. It won an award at the Venice Film Festival, and some critics still consider it to be Fellini's masterpiece.

The mature years. In 1954 Fellini resumed work on an old project, *La Strada*, the story of two wandering, scruffy mountebanks, starring Masina and Anthony Quinn. The film was shot on location in the desolate countryside between Viterbo and Abruzzo, with the great empty spaces reflecting the virtual inhumanity of the relationship between the principal characters. Although it was criticized by the left-wing press in Italy, the film was highly praised abroad, winning an Oscar from the Motion Picture Academy of Arts and Sciences and the New York Film Critics award as the best foreign-language film of 1956.

Fellini's next film, *Il bidone* (1955; *The Swindle*), dealt with petty swindlers. More successful was *Le notti di Cabiria* (1956; *The Nights of Cabiria*), again starring Masina, this time as a simple Roman prostitute whose confidence in the future never flags. It won another Academy Award for Fellini. He had a difficult time beginning production on his next film, however, because of its allegedly chaotic script and then nearly unknown star (Marcello Mastroianni), but he found an understanding producer in the publisher Angelo Rizzoli, with whom he worked for the next seven years. In the course of making the film *La dolce vita,* Fellini had Rome's main thoroughfare, the Via Veneto, rebuilt as a set. When the film was finished, it proved to be a panorama of the times—a compelling indictment of the ruthless journalists and *paparazzi* (unscrupulous yellow-press photographers) of television, of the movie-star craze, and of decadent intellectuals and aristocrats. Immediately hailed as one of the most important films ever made, it won first prize at the Cannes Film Festival.

Like *La dolce vita,* Fellini's next film has no conclusion but is a tale freed from conventional limitations. Entitled *Otto e Mezzo* (*8½*) for the number of films Fellini had made to that time, it shows the plight of a famous director who is in a creative paralysis, unable to make a film. It achieves a perfect balance between symbolism and realism. It met with both controversy and acclaim.

A world of fantasy was again explored in *Giulietta degli spiriti* (1965; *Juliet of the Spirits*), his first full-length colour film, again starring Masina. Its scant success and a series of misunderstandings led to an end to the relationship between Rizzoli and Fellini, who spent the next few years looking for new ideas and a new financial patron. His next major venture was the *Fellini Satyricon* (1969), inspired by the ancient Roman writer Petronius but also drawing on the works of Apuleius and others. The film tells of the wanderings of a group of aimless young men in the world of antiquity. Without concern for historical accuracy, Fellini attempted to explore the human condition in an age before Christianity and the concept of original sin. Fascinating in its flamboyant, colourful images, *Fellini Satyricon* is often bizarre. Perhaps as a reaction, Fellini's next film, *I clowns*—sponsored by Italian, French, and German television—returned to autobiography. A moving tribute to the world of the circus, it recalls, because of its simplicity and coherence, the poetic spell of *La strada.*

Roma (1972) is an impressionistic picture of the Eternal City itself, nostalgically interwoven with a self-portrait of Fellini at the time of his first encounter with Rome in the late 1930s. The film, a mounting crescendo of spectacle and fantasy, culminates in an ecclesiastical fashion show and an eerie ballet of motorcycles in the empty night city. *Amarcord,* a pageant of provincial life as recalled from Fellini's youth in the early 1930s and filled with rich imagery, won for him a third Oscar.

His later films, however, proved disappointing to many critics. *Casanova* (1976), a formless and uninvolved picaresque story with a few dazzling set pieces, features a protagonist whose much-vaunted conquests are ultimately so mechanical that his memory of the perfect partner remains that of a robot he once encountered in Venice. *Prova d'orchestra* (1979; *Orchestra Rehearsal*) is a film metaphor that, behind a deceptive simplicity, hides a mischievous ambiguity that angered some viewers; in it an orchestra rehearsal is used to symbolize a social organism that breaks down under the pressure of external threat and then retreats into paternalism and dictatorship. After the release of *La città delle donne* (1980; *The City of Women*), a long dream work of sexual fantasy that deals with the war between the sexes, Fellini was accused by several critics, both male and female, of being repetitious and self-indulgent. *E la nave va* (1983; *And the Ship Sails On*) is set on a luxury liner on a cruise in the Adriatic in 1914. A group of opera performers and their wealthy friends are honouring the memory of a late, famous diva who requested that her ashes be scattered in the Adriatic. The film contrasts the grand gestures of the artistes with the looming horror of world war.

Assessment. With a series of significant motion pictures that span three decades, Fellini assured for himself a place of prime importance in the history of filmmaking. His best films, all of which were partially written by him, are freely structured tales in which dream and reality, autobiography and fantasy, mingle in a world of symbols. Breaking with traditional techniques of motion-picture production, he succeeded in making the film such a personal medium that his own creative and personal problems became a legend. At the same time he revitalized the medium by emphasizing the dramatic solitude of man in the modern world. (A.So./Ed.)

MAJOR WORKS. *Luci del varietá* (1950; *Variety Lights*); *Lo sceicco bianco* (1952; *The White Shiek*); *I vitelloni* (1953; "Spivs"); *La strada* (1954; "The Road"); *Il bidone* (1955; The Swindle); *Le notti di Cabiria* (1956; *The Nights of Cabiria*); *La dolce vita* (1960; "The Sweet Life"); *Otto e mezzo* (1963; *8½*); *Giulietta degli spiriti* (1965; *Juliet of the Spirits*); *Fellini Satyricon* (1969); *I clowns* (1970; *The Clowns*); *Roma* (1972); *Amarcord* (1974; "I Remember"); *Casanova* (1976); *Prova d'orchestra* (1979; *Orchestra Rehearsal*); *La città delle donne* (1980; *City of Women*); and *E la nava va* (1983; *And the Ship Sails On*).

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fellow traveller, Russian POPUTCHIK, originally, a writer in the Soviet Union who was not

against the Bolshevik Revolution of 1917 but did not actively support it as a propagandist. The term was used in this sense by Leon Trotsky in *Literature and the Revolution* (1925) and was not meant to be pejorative. Implicit in the designation was the recognition of the artist's need for intellectual freedom and his dependence on links with the cultural traditions of the past. Fellow travellers were given official sanction in the early Soviet regime; they were regarded somewhat like experts who were filling the literary gap until a true proletarian art emerged. In the 1920s some of the most gifted and popular Soviet writers, such as Osip Mandelstam, Leonid Leonov, Boris Pilnyak, Isaac Babel, Ilya Ehrenburg, and members of the Serapion Brothers were fellow travellers. The period during which they dominated the literary scene is now regarded as the brilliant flowering of Soviet literature. They were opposed bitterly, however, by champions of a new proletarian art, and by the end of the decade the term came to be practically synonymous with counter-revolutionary.

Outside the Soviet Union the term was widely used in the Cold War era of the 1950s, especially in the U.S., as a political label to refer to any person who, while not thought to be an actual "card-carrying" member of the Communist Party, was in sympathy with its aims and supported its doctrines.

Fellows, Sir Charles (b. August 1799, near Nottingham, Nottinghamshire, Eng.—d. Nov. 8, 1860, London), English archaeologist who discovered ruins of the cities of Lycia—in antiquity a region of present-day southwestern Turkey—and transported a large number of marble sculptures to England.

Fellows, pencil and chalk drawing by W. Brockedon; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

In 1832 he began travelling through Italy, Greece, and the Middle East, sketching as he went. Many of his drawings were used to illustrate Lord Byron's *Childe Harold.* In 1838 he reached the region of Lycia and explored the Xanthus (modern Koca) River nine miles upstream to the ruins of the ancient Lycian capital, Xanthus (modern Kınık, Tur.). He published his findings in *A Journal Written During an Excursion in Asia Minor* (1839). Returning to the region shortly afterward, he identified 13 ancient cities and in 1841 published *An Account of Discoveries in Lycia, Being a Journal Kept During a Second Excursion in Asia Minor.* In 1842 he gained permission to ship 78 cases of Lycian sculpture and architectural fragments to England. In 1844, for the British Museum, he acquired 27 cases of statuary, the best known being 6th- and 5th-century-BC Greek tomb sculptures from Xanthus. This act earned him a knighthood in 1845.

Felltham, Owen (b. 1602?—d. Feb. 23, 1668, London), English essayist and poet, best known for his essays *Resolves Divine, Morall, and Politicall,* in which the striking images (some borrowed by the poet Henry Vaughan) are held to be more original than the ideas.

Felltham wrote the first edition of *Resolves* (1623), which contained 100 essays, when he was 18. The second edition, *Resolves, a Second Centurie,* published in 1628, contained a further 100 essays. After becoming the Earl of Thomond's steward sometime before 1640, Felltham printed *A brief Character of the Low Countries under the States* (1652), which appeared in a reissue of the *Resolves* in 1661 together with 41 poems, some letters, and occasional pieces. Felltham spent most of his life at Great Billing, Northamptonshire, or at the Earl of Thomond's London house.

felony and misdemeanour, in Anglo-American law, classification of criminal offenses according to the seriousness of the crime.

U.S. jurisdictions generally distinguish between felonies and misdemeanours. A class of minor offenses that may be described as petty offenses or quasi-crimes is also recognized. These last offenses are created by local ordinance, and the requirement of trial by jury does not apply.

In U.S. law, the classification of a crime as a felony or misdemeanour is ordinarily determined by the penalties attached to the offense. A felony is typically defined as a crime punishable by a term of imprisonment of not less than one year. Misdemeanours are often defined as offenses punishable only by fines or by short terms of imprisonment in local jails. A consequence of commission or conviction of a felony rather than a misdemeanour is that the offender may lose some of his civil rights.

Crimes in England are classified into indictable offenses (which may be tried by a jury) and summary offenses (which may be tried summarily without juries). Indictable offenses are further divided into treasons, other felonies, and misdemeanours. The law of England has employed no consistent principle to determine the classification of an offense as a felony. In some instances, crimes classified as misdemeanours involve greater social peril than many statutory felonies, and penalties for misdemeanours may exceed those for felonies.

The distinction between felony and misdemeanour is less significant for modern law than formerly, and many commentators have questioned its utility. Classifications distinguishing offenses of greater dangerousness from lesser crimes appear in continental European codes: thus, the French penal code distinguishes between *délits* and *contraventions* (*see* crime, délit, and contravention). The classification of offenses in English and U.S. law has been criticized as capricious and unsatisfactory.

felsenmeer (German: "sea of rock"), exposed rock surfaces that have been quickly broken up by frost action so that much rock is buried under a cover of angular shattered boulders. These mantles principally occur in Arctic regions and high mountain areas. Their continuity and depth varies with climate, vegetation, and rock type, but they may be as much as 4 metres (12 feet) deep. Felsenmeer are especially well developed on basalts and are consequently numerous on the Icelandic plateaus; they also develop quickly on sedimentary rocks and are widespread in the Canadian Arctic, extending to sea level.

Felsenmeer field, South Island, New Zealand

By courtesy of the New Zealand Geological Survey; photograph, S.N. Beatus

felsic rock, igneous rock dominated by the light-coloured, silicon- and aluminum-rich minerals feldspar and quartz (*qq.v.*). The presence of these minerals gives felsic rock its characteristic light gray colour. The silica (SiO_2) content of felsic rock is greater than about 60 percent by weight. Slight colour variations result from the presence of small amounts of mafic minerals (*i.e.,* dark minerals rich in magnesium and iron). The colour index or volume percent of dark minerals is used as a macroscopic quantitative measure of felsic (or mafic) character. Typical felsic rocks include granite and its fine-grain extrusive equivalent, rhyolite. *See also* mafic rock.

Felsina, city founded by Etruscans *c.* 510 BC on the site of modern Bologna, Italy, an area rich in Villanovan Iron Age remains. By the mid-4th century Felsina had fallen to invading Gauls (Boii tribe), who called it Bononia. Captured by Rome in 196 BC, it was colonized seven years later.

Before Etruscan times the Bologna area was an important centre of Villanovan Iron Age cultures of the central European Urnfield type that dominated north and west central Italy from the Po River to northern Campania and that in Tuscany and Latium provided the ethnic substratum of Etruscan culture. The site of Villanova is five miles northwest of Bologna, and the information found in the cemeteries west of Bologna provides the basis for dating all Villanovan material culture. Works are divided into three phases: Benacci I (*c.* 1050–900 BC); Benacci II (*c.* 900–700 BC); and Arnoaldi (*c.* 700–450 BC). The last phase overlaps but is culturally distinct from the Etruscan period, to which belong the graves at Certosa, a monastery a mile from Bologna.

felting, consolidation of certain fibrous materials by the application of heat, moisture, and mechanical action, causing the interlocking, or matting, of fibres possessing felting properties. Such fibres include wool, fur, and certain hair fibres that mat together under appropriate conditions because of their peculiar structure and high degree of crimp (waviness). Wool can produce felting even when mixed with other fibres. Unlike bonded fabrics, felts do not require an adhesive substance for their production.

Woven fabrics made of cotton or wool may be felted, making them thicker and more compact. Such fabrics, sometimes called woven felts, resemble true felts and serve many of the same purposes.

Felt is widely used in the hat industry. It is also used to make slippers and as a novelty fabric for garments and drapery. Felt padding is employed in both apparel and furniture. Industrial applications include insulation, packaging, and polishing materials. A special woven felt manufactured for the use of the paper industry serves as a carrying belt for moist paper.

Felton, Rebecca Ann, *née* LATIMER (b. June 10, 1835, near Decatur, Ga., U.S.—d. Jan. 24, 1930, Atlanta), U.S. political activist, writer, and lecturer, the first woman seated in the U.S. Senate.

Rebecca Latimer was graduated first in her class from the Madison Female College, Madison, Ga., in 1852 and the following year married William H. Felton, a local physician

active in liberal Democratic politics. She assisted her husband in his political career (as a U.S. Congressman and later in the state legislature), writing speeches, planning campaign strategy, and later helping to draft legislation. Together the Feltons promoted penal reform, temperance, and women's rights. Mrs. Felton was equally outspoken in her prejudice against Negroes and Jews and her advocacy of child labour and lynching, views for which her column in the *Atlanta Journal* was a popular forum. She served on the board of lady managers of the Chicago Exposition (1893), as head of the women's executive board of the Cotton States and International Exposition (1894–95) in Atlanta, and on the agricultural board at the Louisiana Purchase Exposition (1904) in St. Louis.

In 1922 Gov. Thomas W. Hardwick of Georgia, in a symbolic gesture, appointed Mrs. Felton to fill the U.S. Senate seat left vacant by the death of Sen. Thomas E. Watson, whose antagonism to former Pres. Woodrow Wilson and all of his policies she heartily shared. She served only two days, Nov. 21–22, 1922, before being succeeded by Walter F. George, the duly elected senator. Her writings include *My Memoirs of Georgia Politics* (1911).

Feltre, Latin FELTRIA, hill town, Belluno province, Veneto region, northern Italy.

Grouped around Alboino Castle, notable buildings include the cathedral, with a 14th-century campanile and a carved Byzantine cross of the 6th century, and the civic museum. In 1509 the heart of the town was destroyed during hostilities between the League of Cambrai and the Venetian Republic; it has been largely rebuilt. In 1917–18 Feltre was besieged by the Austrian Army.

Feltre was the birthplace of Panfilo Castaldi, 15th-century printer, and Vittorino da Feltre, Renaissance educator and humanist. It is now an agricultural centre, with textile and miscellaneous manufactures. Pop. (1981 prelim.) mun., 20,967.

Femgericht (law): *see* fehmic court.

feminist movement: *see* women's liberation movement.

femur, also called THIGHBONE, upper bone of the leg or hindleg. The head forms a ball-and-socket joint with the hip (at the acetabulum), being held in place by a ligament (ligamentum teres femoris) within the socket and by strong surrounding ligaments. In humans the neck of the femur connects the shaft and head at a 125° angle, which is efficient for walking. A prominence of the femur at the outside top of the thigh provides attachment for the gluteus medius and minimus muscles. The shaft is somewhat convex forward and strengthened behind by a pillar of bone called the linea aspera. Two large prominences, or condyles, on either side of the lower end of the femur form the upper half of the knee joint, which is completed below by the tibia (shin) and patella (kneecap). Internally, the femur shows the development of arcs of bone called trabeculae that are efficiently arranged to transmit pressure and resist stress. Human femurs have been shown to be capable of resisting compression forces of 1,800–2,500 pounds (800–1,100 kilograms). The femur in humans is long and relatively slender or delicate; in the great apes, shorter, more curved, and more robust. The orangutan lacks a ligamentum teres femoris, this allowing nearly complete rotary action of the lower limb but decreasing strength and stability.

fen, type of bog (*q.v.*), especially a low-lying area, wholly or partly covered with water and dominated by grasslike plants, grasses, sedges, and reeds. In strict usage, a fen denotes an area in which the soil is organic (peaty) and alkaline rather than acid.

Fen River, Wade–Giles romanization FEN HO, Pinyin FEN HE, river in Shansi Province, China. The Fen River is an eastern tributary of the Huang Ho. After rising in the Kuan-ts'en Shan (mountains) in northwestern Shansi, it flows southeast into the basin of T'ai-yüan and then southwest through the central valley of Shansi to join the Huang Ho near Ho-chin. Its total length is approximately 340 mi (550 km).

The Fen River and its tributaries drain the whole of central Shansi. Its basin falls into several separate sections: the high and rugged plateau drained by its headwaters to the east of the Lü-liang Shan and Lu-ya Shan; the extensive and heavily cultivated basin of T'ai-yüan; the narrow central valley, opening up into minor basins around Lin-fen and Ch'ü-wu; and finally the plains area in which the Fen River turns sharply west to join the Huang Ho.

The Fen River has a torrential course with steep gradients and rapids and has never been a useful waterway except in its lower reaches. Junk traffic is possible as far as Ch'ü-wu (near Hou-ma), and small craft can navigate as far as Lin-fen. The plain around T'ai-yüan has extensive irrigation systems, of which the most important is the Kuang-hui Ch'ü (canal). The Fen River Valley was an early centre of civilization and has remained an important route, linking the Peking area with the strategically vital Shansi Province and with the major land routes to Central Asia via Kansu Province.

fence, barrier erected to confine animals or exclude trespassers, or for decorative purposes. Timber, earth, stone, and metal are widely used for fencing. Fences of living plants have been made in many places, such as the hedges of Great Britain and continental Europe and the cactus fences of Latin America. In well-timbered country, such as colonial and 19th-century North America, many patterns of timber fence were developed, such as the split rail laid zigzag, the post rail, and the picket. On the plains of the Soviet Union and the western United States, fences of turf were erected that often stood for years in the absence of heavy rains.

Wire, the preeminent modern fencing material, was first used in the mid-19th century, with the development of methods of mass production. Woven wire fences, affixed to wood, steel, or concrete posts, proved economical and durable (wood posts may be treated with preservative). The invention of the barbed wire fence in the 1860s and of a machine for its manufacture in 1874 made possible effective fencing of cattle range (*see* barbed wire).

Electrified fences, frequently a single strand of barbed wire, are sometimes used for temporary confinement of animals. A mild shock is given to the animal at intervals of a few seconds if it is in contact with the fence.

fencing, sport involving the use of swords for attack and defense according to set movements and rules. While the use of swords dates to prehistoric times and swordplay to ancient civilizations, the organized sport of fencing began only at the end of the 19th century. The sport is divided into three major branches based on the weapon used: epée, foil, and sabre.

Early history. The earliest known fencing match is shown on a relief in the temple of Medīnat Habu, near Luxor in Egypt, built by Ramses III about 1190 BC. This relief depicts a practice bout or match because the sword points are covered and the swordsmen are parrying with shields strapped to their left arms and are wearing masks (tied to their wigs), large bibs, and padding over their ears. Also shown are Syrian, Sudanese, and Egyptian spectators and officials, recognizable by their feathered wands. Swordsmanship, as a pastime and in single combat and war, was also practiced widely by the ancient Persians, Babylonians, Greeks, and Romans, as well as by the Germanic tribes.

No further evidence of swordplay exists from the fall of the Roman Empire through the Middle Ages, during which swords were heavy and the use of complete armour made finesse and skill impossible. With the introduction of gunpowder in the 14th century, however, armour fell into disuse, and swords became lighter and more manageable. Skillful swordplay became of paramount importance, both in war and in a gentleman's daily life. By the 15th century guilds of fencing masters were formed throughout Europe, the most notable of which was the Marxbrüder, or the Association of St. Marcus of Löwenberg, which was granted letters patent by the Emperor Frederick in 1480, with headquarters at Frankfurt am Main and branches elsewhere. Such guilds, teaching students skill for use in war and in duels of honour, became very powerful and jealously guarded their secret strokes, which later became orthodox fencing movements and survived into modern times. Early fencing methods were somewhat rough-and-ready, and wrestling tricks were allowed.

Emergence of swordsmanship. The Italians discovered the effectiveness of the dexterous use of the point rather than the edge of the sword. By the end of the 16th century, their lighter weapon, the rapier, and simple, nimble, and controlled fencing style, emphasizing skill and speed rather than force, spread throughout Europe. Most of the wrestling tricks were abandoned, the lunge was discovered, and fencing became established as an art.

The long rapier was beautifully balanced, excellent in attack and for keeping an opponent at a distance but too heavy for all the movements of combat. Defense was effected by parrying with the left hand, protected by a gauntlet or cloak or armed with a dagger. Opponents' strokes were often avoided by ducking or sidestepping. Rapier fencing was thus a two-handed contest with the swordsmen squared off to each other as they circled, seeking advantage of terrain or light.

In the latter half of the 17th century, the sword and swordsmanship changed dramatically with a change in gentlemen's dress. In France the court of Louis XIV set the fashion of silk stockings, breeches, and brocaded coats, which replaced that of the doublet and hose, top boots, and cloaks. Fashion also decreed the wearing of a light, short court sword. The French style set in throughout Europe as the Italian had done earlier. Although at first derided, the short court sword was soon recognized as an ideal light weapon capable of performing all attacking and defensive movements, so that swordsmanship involved only one hand. Hits were made with the point only, defense was effected by the blade, and true fencing emerged as the French style displaced the Italian.

In England an edict of Edward I in 1285 that had forbidden fencing in London was not reversed until the reign of Henry VIII when sometime before 1540 he granted letters patent to the masters of defense to teach fencing in England. The early English style with broad sword and buckler ultimately gave way to the continental European kind of fencing. Academies combined the teaching of swordplay, boxing, even the use of the cudgel for self-defense, and late in the 17th century fencing matches were held for stakes or prizes, hence called prizefights—a term restricted to boxing in the 18th century as boxing supplanted fencing for spectators. The mask was reinvented in the 18th century by the French master La Boëssière.

After the epée and the foil, the third fencing weapon, the sabre, was introduced by the Milanese master Guiseppe Radaelli in the 1870s

and was later developed by the Hungarians, who had originally introduced the sabre as a military cavalry weapon in the 18th century.

Organized sport. Fencing became a competitive sport late in the 19th century, and the Amateur Fencing Association was founded in 1902 in Great Britain and the Fédération des Salles des Armes et Sociétés d'Escrime in France in 1906. Meanwhile, fencing for men had been part of the Olympic Games since their revival in 1896. By the 1912 Games, however, France had withdrawn and Italy refused to compete because of disagreement over the rules. As a result, in 1913 the Fédération Internationale d'Escrime was founded and thereafter was the governing body of international fencing for amateurs, both in the Olympic Games and in world championships. Individual dual foil for women was first included in the 1924 Olympic Games, and a team event for women was introduced in the 1960 games. Professional fencers have national governing bodies.

From the end of the 19th century until after World War II, epée and foil competition were dominated by the French and Italians; thereafter, with fencing becoming more popular worldwide, the Soviet and Communist-bloc fencers became dominant. The Japanese, who had for centuries practiced fencing with staves, kendo (*q.v.*), became proficient in sword fencing, especially with the foil. In 1955, the introduction of electrical scoring for epée and foil eliminated the uncertainty of human judgment by officials. Many world and Olympic champions began becoming champions in their teens, a situation that would have been unthinkable 20 years earlier.

Equipment. A fencer needs only a jacket, a mask, a glove, a weapon, trousers or fencing breeches, white stockings, and flat-soled shoes. The piste, or fencing mat, made of linoleum, cork, rubber, or composition, is a strip about 2 m (6.5 ft) wide and 14 m long, with an extension at either end of 2 m. The piste has a centre line, on-guard lines, warning lines, and rear-limit lines. A match starts with the fencers in the on-guard position so far apart as to require a lunge to reach the opponent. Epées and foils have covered points. Hits by the sabre are made by the whole front edge or the third of the back edge nearest the point. Judging of hits is by officials' judgment.

See Sporting Record: *Fencing. See also* Olympic Games.

Fénelon, François de Salignac de La Mothe- (b. Aug. 6, 1651, Château de Fénelon, Périgord, Fr.—d. Jan. 7, 1715, Cambrai), French archbishop, theologian, and man of letters whose liberal views on politics and education and involvement in a controversy over the nature of mystical prayer caused concerted opposition from church and state. His pedagogical concepts and literary works, nevertheless, exerted a lasting influence on French culture.

Fénelon, engraving by B. Audran, 1714, after a painting by J. Vivien

By courtesy of the Bibliotheque Nationale, Paris

Descended from a long line of nobility, Fénelon began his higher studies in Paris *c.* 1672 at Saint-Sulpice seminary. Ordained a priest in 1676, he was appointed director of Nouvelles Catholiques ("New Catholics"), a college for women who instructed converts from French Protestantism. When King Louis XIV heightened the persecution of the Huguenots (French Calvinists) in 1685 by revoking the Edict of Nantes, Fénelon strove to mitigate the harshness of Catholic intolerance by open meetings with the Protestants (1686–87) to present Catholic doctrine in a reasonable light. While unsympathetic to Protestant belief, he equally repudiated forced conversions.

From his pedagogical experiences at Nouvelles Catholiques, he wrote his first important work, *Traité de l'éducation des filles* (1687; "Treatise on the Education of Girls"). Although generally conservative, the treatise submitted innovative concepts on feminine education and criticized the coercive methods of his day.

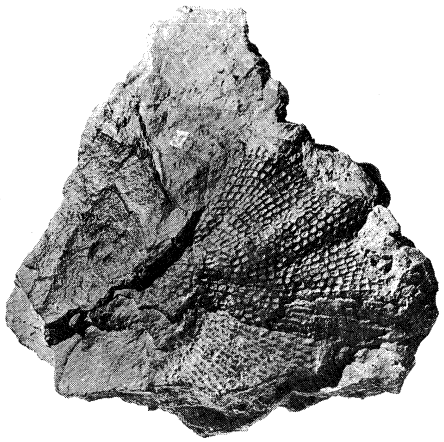
In 1689, with the support of the renowned bishop Jacques-Bénigne Bossuet, Fénelon was named tutor to Louis, duc de Bourgogne, grandson and heir to Louis XIV. For the Prince's education, Fénelon composed his best known work, *Les Aventures de Télémaque* (1699), in which the adventures of Telemachus in search of his father, Ulysses, symbolically expressed Fénelon's fundamental political ideas. During the period of his popularity in official circles, Fénelon enjoyed various honours, including his election to the Académie Française in 1693 and his selection as archbishop of Cambrai in 1695.

Anxious about his spiritual life, Fénelon sought an answer from the Quietist school of prayer. Introduced in October 1688 to Quietism's leading exponent, Mme Guyon, Fénelon sought from her some means of personally experiencing the God whose existence he had intellectually proved. But his search for spiritual peace was short-lived. Bossuet and other influential people at court attacked Mme Guyon's teaching, and a document investigating Quietism's doubtful orthodoxy even obtained Fénelon's signature. When Bossuet, however, next launched a personal attack on Mme Guyon, Fénelon responded with *Explication des maximes des saints sur la vie intérieure* (1697; "Explanation of the Sayings of the Saints on the Interior Life"). Defending Mme Guyon's integrity, Fénelon not only lost Bossuet's friendship but also exposed himself to Bossuet's public denunciation. As a result, Fénelon's *Maximes des saints* was condemned by the Pope, and he was exiled to his diocese.

Fenestella (b. 52 BC—d. AD 19, or b. 35 BC—d. AD 36), Latin poet and annalist whose lost work, the *Annales,* apparently contained a valuable store of antiquarian matter as well as historical narrative of the final century of the Roman Republic. Fenestella was used as a source by the 1st-century-AD historian Pliny the Elder, the 2nd-century biographer Suetonius, and the 4th-century grammarian Diomedes.

Fenestella's *Annales* was in at least 22 books and certainly included the year 59 BC, although the exact period it covered is unknown. The few surviving fragments ascribed to Fenestella refer to such varied subjects as the origin of the appeal to the people (*provocatio*), the use of elephants in the games, the wearing of gold rings, the material for making the toga, and details of the lives of Terence and Cicero.

Fenestella, extinct genus of bryozoans, small colonial animals, especially characteristic of the Mississippian Period (about 325,000,000 to 345,000,000 years ago). Close study of *Fenestella* reveals a branching network of structures with relatively large elliptical openings and smaller spherical openings that housed individual members of the colony. *Fenestella* was a marine form.



Fenestella, of Devonian age, collected from the Moscow Shale in western New York

By courtesy of the Buffalo Museum of Science, Buffalo, N.Y.

fenestration, disposition of windows in the wall of a building. The function of fenestration is ordinarily to provide an interior with daylight, but in various periods of time it was such a crucial element in architectural design that it became a principal means of discriminating among historical styles. In design, fenestration serves to provide areas of light, alternating with areas of darkness. The resulting surface pattern may be essentially decorative, or it may serve to articulate the building's structure.

The Roman variety of fenestration can be best seen in city gates, such as the Roman gateway in the city wall of Autun, Fr. Arched openings at ground level are surmounted by a series of smaller, round-headed openings. In Gothic architecture individual windows grew to immense size as vehicles for translucent decoration, although the overall placement of openings was dictated more by convenience than with an eye to symmetry or grouping. In the Renaissance, however, openings were again placed symmetrically, usually one above the other, though there are examples of a zigzag treatment. Perhaps the most celebrated fenestral device of all is the Palladian motif, a round-headed opening flanked by two small square-headed ones. These openings were generally used in arcades two tiers high, as in Palladio's mid-16th-century additions to the Basilica at Vicenza, Italy.

Modern forms of fenestration are the *fenêtre en longueur*—a long, unbroken horizontal opening identified as one of the main stylistic devices of Le Corbusier—and the all-glass curtain wall popularized by Ludwig Mies van der Rohe.

Feng Dao (Chinese minister): *see* Feng Tao.

Feng-fa-yao, Pinyin FENGFAYAO (Chinese: "Essentials of the Dharma"), discussion of Buddhist precepts written in the 4th century AD by Hsi Ch'ao, who, although Taoist, was a great admirer of Buddhism. One of the earliest discourses on the subject by a non-Buddhist, it is regarded as a milestone in the advance of Buddhist thought in China. Although it contains some erroneous interpretations of Buddhist ideas, the *Feng-fa-yao* is comparable in its accuracy to the works of Hsi Ch'ao's Chinese Buddhist counterparts.

Feng-hua, Pinyin FENGHUA, town and county (*hsien*) seat, Ning-po Prefecture (*ti-ch'ü*), Chekiang Province (*sheng*), eastern China. Located in a fertile plain area 17 mi (27 km) southwest of Ning-po, Feng-hua is an agricultural trade centre (rice, wheat) and special-

izes in orchard crops, especially peaches and plums. The Chinese Nationalist leader Chiang Kai-shek was born at Feng-hua in 1887. Pop. (mid-1970s est.) 10,000–50,000.

feng-huang, Pinyin FENGHUANG (Chinese: "phoenix"), in Chinese mythology, a creature whose rare appearance is said to indicate some great event or bear testimony to the greatness of a ruler. Tradition recounts an appearance of the *feng-huang* before the death of the legendary Yellow Emperor (Huang Ti), who ruled China in the 27th century BC. Its latest appearance is said to have taken place in Anhwei province at the grave of the father of Hung-wu, founder of the Ming dynasty in 1368. It is said that the song of the phoenix is exceptionally beautiful and meaningful and that the animal has a special appreciation of human music.

The *Shuo-wen* dictionary (1st or 2nd century AD) describes the bird as having the breast of a goose, the hindquarters of a stag, the neck of a snake, the tail of a fish, the forehead of a fowl, the down of a duck, the marks of a dragon, the back of a tortoise, the face of a swallow, and the beak of a cock. It was reportedly about 9 feet (2.7 metres) tall. In systematized mythology, the phoenix is the female counterpart of the male dragon.

Feng Kuei-fen, Pinyin FENG GUIFEN (b. 1809, Soochow, Kiangsu Province, China—d. May 28, 1874, Soochow), Chinese scholar and official whose ideas were the basis of the Self-Strengthening Movement (1861–95), in which the Ch'ing dynasty (1644–1911/12) introduced Western methods and technology in an attempt to renovate Chinese diplomatic, fiscal, educational, and military policy.

A native of South China, Feng came into frequent contact with Westerners in the large North China trading city of Shanghai. China's capital at Peking had just fallen to a combined British–French force, ending the "Arrow" War (1856–60) and forcing trading concessions to be granted to the West. It was then that Feng wrote his well-known *Chiao-pin-lu k'ang-i* ("Protest from the Chiao-pin Studio"). In it he warned the Chinese of the difference between the old Confucian world and the new world that had resulted from the intrusion of Western power and technology into China; he argued that the Chinese could best meet the Western challenge by learning the technology themselves.

Feng-man Dam, Wade–Giles romanization FENG-MAN SHUI-PA, Pinyin FENGMAN SHUIBA, hydroelectric and flood-control project on the Sungari River some 15 mi (24 km) southeast of Chi-lin (Kirin) in Kirin Province, China. The dam was constructed by the Japanese between 1937 and 1942 simultaneously with the Sup'ung Dam in Liaoning Province as part of a large-scale development of hydroelectric power for industry in their puppet state of Manchukuo (Manchuria). The project included the construction of a massive dam, 298 ft (91 m) in height and 3,542 ft long, as well as the flooding of the upper Sungari Valley to form a vast reservoir some 45 mi long. The original plan was for the installation of eight turbogenerators. The power plant began production in 1943, although it never operated at full capacity, and the project was never completed.

Toward the end of World War II, the dam itself suffered from damage and neglect and began to leak seriously. In 1945 the Soviet occupation forces removed almost all of the generating plant to the Soviet Union, together with a cement plant that had been installed to supply materials for construction of the dam. After 1949 restoration work was undertaken by the Chinese Communist government. The dam was extended and strengthened and its generating equipment restored (partly with aid from the Soviet Union) under the First Five-Year Plan (1953–57). The dam's importance was greatly increased with the completion in 1954 of a high-tension transmission line connecting major centres of industry in Manchuria.

The Feng-man Dam also plays a role in flood control on the Sungari River, which has a great variation in flow. But even its vast storage capacity and the improvements carried out in the early 1950s proved inadequate, and two subsidiary dams were subsequently added.

Feng-shan, formerly KAO-HSIUNG HSIEN, *shih* (municipality) and seat of Kao-hsiung *hsien* (county), southwestern Taiwan, situated about 5 mi (8 km) east of Kao-hsiung *shih* (municipality) in Taiwan's western coastal plain. Developed during a politically unsettled period of the 17th century in an interregnum dominated by the pirate Cheng Chih-lung (1604–61), the city has many Buddhist and Confucian relics. The major industries are rice and sugar milling, pineapple canning, and the manufacture of chemicals and small machinery. The city, an important junction on the southern section of Taiwan's West Line railway, is connected to points south by a railway bridge 5,000 ft (1,525 m) long, on the nearby Kao-p'ing Hsi (river). Feng-shan is also the southern terminus of the Sun Yat-sen Memorial Expressway (North-South freeway), connecting it to Chi-lung (Keelung) city 235 mi to the north. Ta-pei, or Ch'eng Ch'ing, Hu (lake) is about 4 mi north. Pop. (1982 est.) 227,310.

Feng Tao, Pinyin FENG DAO (b. 881, Ying-chou, Hopeh Province, China—d. 954, China), Chinese Confucian minister generally given credit for instigating the first printing of the Confucian Classics, in 932. As a result, Confucian texts became cheap and accessible, the number of scholars and the knowledge of literature greatly increased throughout the nation, and the number of people able to compete in the civil service examination multiplied. There is some doubt, however, as to whether Feng really deserves the major credit for starting this project.

He was greatly respected as one of the major Confucianists of his day, but he has been derided by later generations of Confucian historians for opportunism. Living during the chaotic Five Dynasties period (907–960), Feng served no fewer than 10 emperors and 5 different Imperial houses. Later Confucianists who felt that loyalty was a primary attribute of the moral man have considered Feng's cavalier attitude toward those he served disgraceful.

Feng Youlan (Chinese philosopher): *see* Fung Yu-lan.

Feng Yü-hsiang, Pinyin FENG YUXIANG (b. Sept. 26, 1882, Hsing-chi-chen, Chihli, present-day Hopeh Province, China—d. Sept. 1, 1948), Chinese warlord, known as the Christian General, who dominated parts of North China from 1918 to 1930.

A soldier at the age of 11, Feng was largely self-educated. He rose through the ranks, gathering under his command a highly disciplined body of troops. He urged his men to become Protestants, to engage in social reform, to acquire a practical education, and to become physically fit and morally sound.

In 1924 Feng reorganized his soldiers into the Kuominchün (Peoples' Army) and seized Peking, destroying the facade of parliamentary government existing there. He was defeated by Chang Tso-lin, the Manchurian warlord, but received enough aid from the Soviet Union to revitalize his army. He supported the Kuomintang (Nationalist Party) when Chiang Kai-shek led its forces northward in 1927 in an attempt to unify the country. Later that year, however, Feng disappointed the Soviets by supporting Chiang against his Communist and other left-wing opponents within the Kuomintang. In 1928 Feng reoccupied Peking, together with Yen Hsi-shan, the warlord of Shansi Province. In 1929 they declared their independence of the Kuomintang but were beaten in 1930 and driven into exile.

In 1933 Feng made an unsuccessful attempt to gain popular support by leading an army of volunteers against the invading Japanese. In 1947 he went to the United States, where he denounced what he called the "reactionary" policies of Chiang Kai-shek. He died in a fire aboard a Soviet ship on the return voyage.

Feng Yu-lan: *see* Fung Yu-lan.

Feng-yüan, *shih* (municipality) and seat of T'ai-chung *hsien* (county), west central Taiwan, situated about 7 mi (11 km) north of T'ai-chung city, in the western uplands. The city was developed during the reign of Ch'ien-lung (the 4th emperor of the Manchu [Ch'ing] dynasty; reigned 1735–99) and was originally known as Hulutun. It grew as the marketing centre for rice, sugar, bananas, and tobacco produced in the nearby fertile plains of the Ta-chia Hsi (river). Sawmilling and rice milling, food and pineapple canning, hemp processing, and sack making are the major industries. Feng-yüan is noted for its high-grade rice and tobacco production. The city is an important junction on Taiwan's West Line railway and is also served by the north–south Chungshan freeway. P'i-lu Ssu (temple) is about 3 mi northeast of Feng-yüan. Pop. (1982 est.) 128,944.

Feng Yün-shan, Pinyin FENG YUNSHAN (b. 1822, Hua-hsien, Kwangtung Province, China—d. June 1852, Ch'üan-chou, Kwangsi), Chinese missionary and social reformer, one of the original leaders of the Taiping Rebellion, an uprising that occupied most of South China between 1850 and 1864, brought death to an estimated 20,000,000 people, and radically altered governmental structure. Feng was a neighbour and schoolmate of Hung Hsiu-ch'üan, the religious mystic who became the supreme Taiping leader.

Feng was one of the first converts to Hung's unique version of Christianity, and in 1844 he accompanied the mystic on a preaching mission into their neighbouring southern province of Kwangsi. Hung returned home after a few months, but Feng remained to organize the Pai Shang-ti Hui, or God Worshippers Society, which combined Hung's religious ideas with a program of social reform. In 1847 Hung rejoined Feng and was accepted as the leader of the society.

When government troops attacked the God Worshippers in July 1850, the Taiping Rebellion broke out. On Sept. 25, 1851, Hung proclaimed his new dynasty, the T'ai-p'ing T'ien-kuo (Heavenly Kingdom of Peace). Hung became the T'ien-wang, or Heavenly King, and Feng was given the title of Nan-wang, or Southern King, and was made the general of the advance guard. A short time later, however, he was mortally wounded in battle.

Fenian, member of an Irish nationalist secret society active chiefly in Ireland, the United States, and Britain, especially during the 1860s. The name derives from *fiann, féinne,* the legendary band of Irish warriors led by Finn MacCumhaill (MacCool). The society was founded in the United States by John O'Mahony and in Ireland by James Stephens (1858). Plans for a rising against British rule in Ireland miscarried, but the American Fenians staged abortive raids across the border into British Canada in 1866, 1870, and 1871 and were a cause of friction between the U.S. and British governments.

The Irish wing of the society was sometimes called the Irish Republican Brotherhood, a name that continued to be used after Feni-

anism proper had virtually died out in the early 1870s. Arthur Griffith, a member of the Brotherhood, founded the Irish nationalist party Sinn Féin (We Ourselves) in 1905.

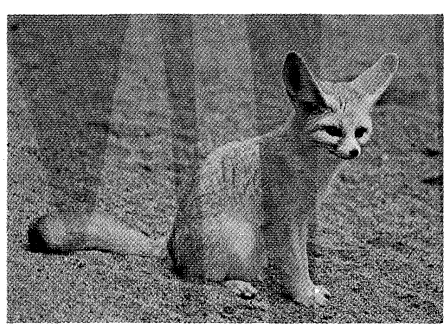
Fenian cycle, in Irish Gaelic literature, tales and ballads centring on the deeds of the legendary Finn MacCumhaill (MacCool) and his war band, the Fianna Éireann. An elite volunteer corps of warriors and huntsmen, skilled in poetry, Fianna flourished under the reign of Cormac mac Art in the 3rd century AD. The long-established Fenian lore attained greatest popularity about 1200, when the cycle's outstanding story, *The Interrogation of the Old Men,* was written down. Other earlier tales were recorded in manuscripts such as *The Book of the Dun Cow* (*q.v.; c.* 1100) and *The Book of Leinster* (*q.v.; c.* 1160). The Fenian cycle remains a vital part of Irish folklore and contains many of the best loved folk tales of the country.

An early tale, *The Boyish Exploits of Finn* (*Macgnímartha Finn*), tells how, after Cumhaill (Cool), chief of the Fianna, is killed, his posthumous son is reared secretly in a forest and earns the name Finn (The Fair) by his exploits. He grows up to triumph over his father's slayer, Goll MacMorna, to become head of the Fianna, which later includes his son Oisín (Ossian), the poet, his grandson Oscar, the handsome Diarmaid (Dermot), and his former clan enemy Goll MacMorna. Finn, reputedly a descendant from the Druids, was wise and sensitive to nature, and became a popular hero as a kingly figure in the 7th century. The other tales deal with the group's rise and fall. Its disintegration begins when Diarmaid elopes with Gráinne (Grace), a king's daughter whom Finn, as an old man, wishes to marry. Later, when Diarmaid is wounded, Finn lets him die for lack of water. The king and people finally turn against the overbearing Fianna, a conflict that culminates in the Battle of Gabhra, in which the Fianna is destroyed. Oscar is killed in battle; Oisín survives but is lured away by a fairy princess to Tír na nÓg (the Land of Youth). (*See also* Interrogation of the Old Men, The). Related to the Fenian sagas is a series of tales concerning Cormac mac Art, his grandfather Conn of the Hundred Battles, and his son Cairbré of the Liffey.

Fenland (region, England): *see* Fens.

Fenland, district, county of Cambridgeshire, England. It has an area of 213 sq mi (552 sq km) and was established in 1974 with headquarters in Wisbech. The district is much more restricted than the drained area of the Fens (*q.v.*), from which it takes its name. In addition to Wisbech, it includes the small towns of Chatteris, March, and Whittlesey but is mainly rural, with dispersed farms. Pop. (1982 est.) 68,100.

fennec (*Fennecus zerda*), desert-dwelling fox, family Canidae, found in north Africa and the Sinai and Arabian peninsulas. The fennec is characterized by its small size (head and body length 36–41 centimetres [14–16 inches], weight about 1.5 kilograms [3.3 pounds]) and large ears (15 cm or more in length). It has long, thick, whitish to sand-coloured fur and a black-tipped tail 18–31 cm long. Mainly nocturnal, the fennec spends the heat of the day underground in its burrow. It feeds on insects, small animals, and fruit. Its litters of two to five young are born after a gestation period of about 51 days.



Fennec (*Fennecus zerda*)

Anthony Mercieca—The National Audubon Society Collection/Photo Researchers

The name fennec is sometimes erroneously applied to the South African silver fox and to Ruppell's fox (*see* fox).

fennel (*Foeniculum vulgare*), perennial or biennial aromatic herb of the family Apiaceae (Umbelliferae). According to a Greek myth, knowledge came to man from Olympus in the form of a fiery coal contained in a fennel stalk. Native to southern Europe and Asia Minor, fennel is cultivated in the United States, Great Britain, and temperate Eurasia. All parts of the plant are aromatic and used in flavouring; the blanched shoots are eaten as a vegetable; and the seed is a traditional carminative.

Florence fennel (*Foeniculum vulgare*)

Derek Fell

The cultivated plant is about 3 feet (1 metre) tall and has stalks with finely divided leaves composed of many linear or awl-shaped segments. The grayish, compound umbels bear small yellow flowers. The fruits, or seeds, are greenish- to yellowish-brown oblong ovals about 6 millimetres (¼ inch) long with five prominent longitudinal dorsal ridges. Their aroma and taste are suggestive of anise. They contain 3 to 4 percent essential oil; the principal components are anethole and fenchone. The seeds and extracted oil are used for scenting soaps and perfumes and for flavouring candies, liqueurs, medicines, and foods, particularly pastry, sweet pickles, and fish.

Giant fennel is *Ferula communis,* a member of the same family, native to the Mediterranean region, where the stems, which grow about 10 ft high, are used for tinder. Hog's fennel, or sulfurweed, *Peucedanum officinale,* is another member of the Apiaceae family, but the fennel flower, *Nigella sativa,* is a member of the family Ranunculaceae.

Fenni, Y (Wales): *see* Abergavenny.

Fenno, John (b. Aug. 23, 1751, Boston—d. Sept. 14, 1798, Philadelphia), U.S. publisher and editor, founder in 1789 of the *Gazette of the United States,* an important political organ of the Federalist Party.

As a youth Fenno was an usher in the writing (i.e., penmanship) school of Samuel Holbrook. That he learned something of penmanship there is indicated by the fine hand he demonstrated in 1775 when for several months he was secretary to Gen. Artemas Ward. After teaching school and failing at the import business, Fenno went to New York to try his hand at printing. There he founded the *Gazette of the United States* in 1789, in time to report on preparations for Washington's inauguration. As its editor, Fenno ardently supported the young U.S. government and the Federalist cause championed by Alexander Hamilton, who strongly encouraged Fenno's efforts. He tried to achieve a national circulation, without much success. When the federal government moved to Philadelphia in 1790, Fenno and the *Gazette* followed. But the paper never prospered as Fenno had hoped, and its circulation never exceeded 1,400. Fenno's son, John Ward Fenno, edited the *Gazette* for two years after Fenno's death of yellow fever. The paper ceased general publication in 1818.

Fennoman movement, in 19th-century Finnish history, nationalist movement that contributed to the development of the Finnish language and literature and achieved for Finnish a position of official equality with Swedish—the language of the dominant minority.

Early Fennomen activities included the establishment of the Saturday Society (1830) and the Finnish Literary Society (1831), both devoted to Finnish language and letters. The publication of Elias Lönnrot's epic, the *Kalevala* (1835), and other artistic and scholarly works in Finnish proved to the opposition Swedish, or "Svecoman," movement that Finnish could serve as a vehicle for cultural development.

Because the Russian authorities (Finland was then under Imperial Russian rule) were generally sympathetic to the Fennoman cause, steady progress was made in the course of the century, especially during the reign of Emperor Alexander II (1855–81). In 1863, at the urging of Johan Vilhelm Snellman, the leading figure of the movement, Alexander II declared Finnish to be an official language of Finland in matters relating to the interests of Finnish-speaking people, and he ordered that it gain governmental and judicial parity with Swedish by 1883. In 1902 a Russian decree declared Finnish to be the official language of all areas where Finnish speakers were in the majority.

In the 1860s a "Finnish party" was formed to advance the Fennoman cause; this organization split over constitutional issues into the Old Finn and Young Finn parties in the late 1890s.

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

Fenollosa, Ernest F(rancisco) (b. Feb. 18, 1853, Salem, Mass., U.S.—d. Sept. 21, 1908, London), U.S. Orientalist and educator who made a significant contribution to the preservation of traditional art in Japan.

Fenollosa studied philosophy and sociology at Harvard, graduating in 1874. During his student years he had taken up painting. At the invitation of Edward Sylvester Morse, a U.S. zoologist and Orientalist then teaching at Tokyo Imperial University, Fenollosa in 1878 joined the university to lecture (in English) on political science, philosophy, and economics. At this early stage in the Meiji Restoration, traditional art—and many of Japan's ancient temples and shrines and their art treasures—were falling into neglect amid the national drive to modernize. Fenollosa interested himself in their preservation and became a student of the themes and techniques of traditional Japanese art and, before long, an articulate advocate of honouring and preserving those themes and techniques.

In 1881, Fenollosa financed an exhibition in Tokyo of representative Japanese art and a year later gave a notable lecture entitled "Bijutsu shinsetsu" ("The True Theory of Art"). His views interested painters such as Kanō Hogai and Hashimoto Gahō, who became pioneers

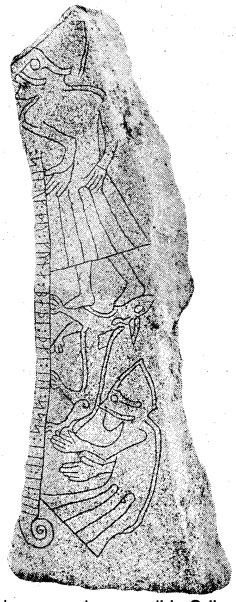
in a movement to revive the Japanese school of painting, largely inspired by Fenollosa. In this period he took up the study of Japanese Nō theatre, eventually translating some 50 of its texts and playing a significant role in the preservation of this traditional art form from the drive for modernization. His studies and travels and his quick fluency in Japanese and, later, Chinese brought him wide acquaintance with Buddhist monks and teachers, and during the 1880s he embraced Buddhism.

In 1886 Fenollosa and his friend the art critic Okakura Kakuzō were commissioned by the government to tour Europe studying methods of teaching and preserving the fine arts. As Fenollosa left temporarily for the United States, the emperor Meiji said to him, "You have taught my people to know their own art," and charged him to teach it to Americans. After returning to Tokyo, Fenollosa helped to found (1887) the Tokyo Fine Arts School and to draft a law for the preservation of temples and shrines and their art treasures.

For five years, from 1890, Fenollosa headed the Oriental department of the Boston Museum of Fine Arts, where his own great collection of some 1,000 paintings, sold earlier, was housed. There, heeding the emperor's injunction, he did much to further appreciation of Oriental art in the United States. His *East and West: the Discovery of America and Other Poems* appeared in 1893. He visited Japan briefly in 1896 and returned in 1897 for a longer stay, but by that time many Japanese scholars wished themselves to take control of the preservation of their artistic heritage. His reception by the Japanese academic establishment was therefore cool, and he was offered only the post of English-language instructor at the Imperial Normal School (for trainee teachers). Feeling rebuffed, he returned to the United States in 1900 to become a professor at Columbia University.

He began a fourth journey to Japan in 1908 but died in London en route. His ashes were taken to Japan and buried at the Miidera in Kyōto, a temple whose beautiful hillside setting was his favourite memory of Japan. Before his death he had completed a first draft of his two-volume masterpiece *Epochs of Chinese and Japanese Art* but left many names of painters and temples incomplete. His second wife saw to the correction of most of the omissions and errors, and the work was published in 1912. His widow also turned over to Ezra Pound a large body of her husband's translations of early Chinese poetry and Japanese Nō dramas, which Pound reworked into English poetic form and published to great acclaim in 1915–17. *Fenollosa and His Circle* (1962), a biographical essay by Van Wyck Brooks, captures the flavour of his years in Japan; Lawrence W. Chisholm's *Fenollosa: the Far East and American Culture* (1963) is a full-length biography.

Fenrir, also called FENRISÚLFR, monstrous wolf of Norse mythology. He was the son of the demoniac god Loki and a giantess, Angerboda. Fearing Fenrir's strength and knowing that only evil could be expected of him, the gods bound him with a magical chain made of the sound of a cat's footsteps, the beard of a woman, the breath of fish, and other occult elements. When the chain was placed upon him, Fenrir bit off the hand of the god Tyr. He was gagged with a sword and was destined to lie bound to a rock until the Ragnarök (Doomsday), when he will break his bonds and fall upon the gods. According to one version of the myth, Fenrir will devour the sun, and in the Ragnarök he will fight against the chief god Odin and swallow him. Odin's son Vidar will avenge his father, stabbing the wolf to the heart according to one account and tearing his jaws asunder according to another. Fenrir figures prominently in Norwegian and Icelandic poetry of the 10th and 11th centuries, and the poets speak apprehensively of the day when he will break loose.



Fenrir attacking a warrior, possibly Odin, while another warrior restrains him, engraved stone at Ledberg, Swed.

By courtesy of the Nordisk Presse Foto, Copenhagen

Fens, also called FENLAND, natural region of about 15,500 sq mi (40,100 sq km) of reclaimed marshland in eastern England, extending north to south between Lincoln and Cambridge. Across its surface the Rivers Witham, Welland, Nen, and Ouse flow into the North Sea indentation between Lincolnshire and Norfolk known as The Wash, but the natural drainage has largely been replaced by artificial channels. The area is essentially a flooded clay plain with slight "island" eminences, notably Ely. The basin gradually became infilled by sediment, leaving The Wash as the remnant of a more extensive indentation. Around The Wash is a belt of marine silts and clays, south of which an expanse of black peat covers the area. The peat, much thicker before drainage was undertaken, now varies in depth from a few inches to more than 10 ft (3 m).

The Romans cultivated both islands and silt lands, but in subsequent Anglo-Saxon times the Fens were a thinly settled waste. Throughout the Middle Ages piecemeal encroachment took place, but the peatlands remained untouched until the mid-17th century, when the 4th earl of Bedford engaged a Dutch engineer, Cornelius Vermuyden, to drain the southern peat area, later known as the Bedford Level. Most notable among the drains then constructed was the Old Bedford River; running from Earith to Salter's Lode, it was 70 ft wide and 21 mi (34 km) long. The New Bedford River, 100 ft wide, ran parallel to it about ½ mi to the east. The immediate prosperity that these drains helped create proved short-lived, because they had the effect of lowering by perhaps 10 to 12 ft the level of the peat surface.

The introduction of windmills, substituting pumped for gravity drainage, saved most of the drained Fens from being reinundated, but the peat continued to sink as the drainage became more effective, so that by about 1800 some areas once inhabited had become watery wastes. There were still tracts that had never been reclaimed, particularly the large reed-bordered lakes of Whittlesey Mere and Ramsey Mere. Fishing and fowling remained characteristic occupations, and ague, or fen fever, was prevalent. From 1810 windmills began to be replaced by steam-pumping stations, though a few windmills survived even into the 20th century to form familiar landmarks. Pumping is now done by diesel engines, but the perennial problem of protecting the low drained lands from the high-riding river remains and was dramatically illustrated in the severe floods of March 1947, when several riverbanks were breached.

The Fens are now one of the richest arable areas of England, supporting not only traditional crops such as wheat but also potatoes, flowers, fruit, and vegetables. A few stretches of peat survive, two of them nature reserves, valuable for the study of rare plants and insects. Wicken Fen, on the eastern edge, with its waterlogged surface rising several feet above the adjoining peatlands, gives some indication of what the whole fen region was like before Vermuyden's day.

fentanyl, also called N-(1-PHENETHYL-4-PIPERIDYL)PROPIONANILIDE, synthetic narcotic analgesic drug, the most potent narcotic in clinical use (50 to 100 times more potent than morphine). The citrate salt, fentanyl citrate, is administered by injection, either intramuscularly or intravenously, sometimes in combination with a potent tranquillizer. The duration of its pain-relieving action is short.

Fenton, Elijah (b. May 20, 1683, Shelton, Staffordshire, Eng.—d. July 16, 1730, Easthampstead, Berkshire), English poet perhaps best known for his collaboration in a translation of the Greek epic poem *Odyssey* with Alexander Pope and William Broome.

After graduating from Cambridge, Fenton became a teacher. He was promised the patronage of Henry St. John (later 1st Viscount Bolingbroke) and hence resigned the headship of Sevenoaks grammar school in Kent in 1710. His expectations, however, were not realized, and he was obliged to earn his living as children's tutor to various noble families. His *Poems on Several Occasions* (1717) was admired by Pope, who asked Fenton if he would assist in a translation of the *Odyssey.* Fenton translated books 1, 4, 19, and 20. He also wrote the *Life of John Milton* (1725), edited the poems of Edmund Waller (1729), and wrote *Mariamne* (1723), a tragedy. Pope composed his epitaph, and Samuel Johnson was his early biographer.

Elijah Fenton, engraving

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Fenton, Lavinia, also called (from 1751) DUCHESS OF BOLTON (b. 1708, London—d. Jan. 24, 1760, Greenwich, Kent, Eng.), English actress and colourful social figure who created the role of Polly Peachum in John Gay's masterwork, *The Beggar's Opera.*

Fenton was probably the daughter of a naval lieutenant named Beswick, but she bore the name of her mother's husband. She began as a street singer near her mother's coffeehouse in Charing Cross and made her debut in 1726 as Monimia in Thomas Otway's tragedy *The Orphan; or, the Unhappy Marriage,* in which she was an immediate success. She then joined the company of players under the management of John Rich at Lincoln's Inn Fields Theatre, London, where, on Jan. 29, 1728, Fenton

became a sensation as Polly; a famous painting by William Hogarth shows her in one of *The Beggar's Opera* scenes. While at the peak of her career that year, she made her last appearance and ran away with Charles Paulet, 3rd Duke of Bolton, remaining his mistress until they married 23 years later.

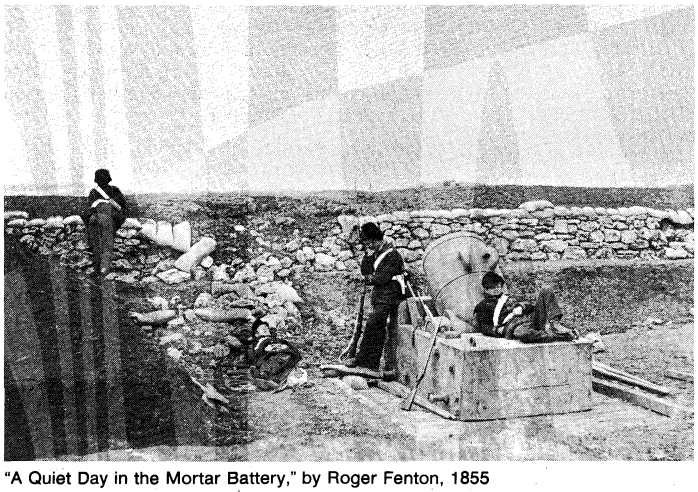
Lavinia Fenton, detail from an engraving by J. Faber, 1728, after a portrait by an unknown artist
By courtesy of the Victoria and Albert Museum, London

BIBLIOGRAPHY. Charles E. Pearce, *Polly Peachum* (1913, reprinted 1968), includes a bibliography.

Fenton, Roger (b. 1819, Heywood, near Rochdale, Lancashire, Eng.—d. Aug. 8, 1869, London), English photographer best known for his pictures of the Crimean War, which were the first extensive photographic documents of a war.

Fenton's reputation as a photographer was first made through his high-quality still lifes and his landscapes, which were extremely popular types of pictures during Victorian times. In the winter of 1855 Fenton was sent to the Crimea as the British government's official photographer. His governmental connections as the founder (1853) and first honorary secretary of the (Royal) Photographic Society of London helped him gain this appointment. Fenton and his assistant, Marcus Sparling, arrived on the ship *Hecla* and set up their darkroom in a wagon. Using the wet-collodion photographic process of the times, they took approximately 360 photographs of the war. Fenton and Sparling were agents of the government, however, and their vision was tainted by a glorified overview that saw only the "acceptable" parts of the war. The charge of the Light Brigade, for example, was one disaster that was favourably portrayed. Little of the real action or agony of war was shown.

Upon his return to England, Fenton's work was successfully exhibited in London and Paris, and wood engravings of the particularly notable photographs were printed in the *Illustrated London News*. Fenton's work on the Crimean War is regarded as a flawed but valuable documentary record of that event.



"A Quiet Day in the Mortar Battery," by Roger Fenton, 1855
By courtesy of the George Eastman House, Rochester, New York

fenugreek, also spelled FOENUGREEK (species *Trigonella foenum-graecum*), slender annual herb of the pea family (Fabaceae) or its dried seeds, used as a food, a flavouring, and a medicine. The seeds' aroma and taste are strong, sweetish, and somewhat bitter, reminiscent of burnt sugar. They are farinaceous in texture and may be mixed with flour for bread or eaten raw or cooked. The herb is a characteristic ingredient in some curries and chutneys and is used to make imitation maple syrup. In India young fenugreek plants are used as a potherb. In northern Africa the plants are used for fodder. Traditionally considered an aid to digestion, the seeds have been used as an internal emollient for inflammation of the digestive tract and as an external poultice for boils and abscesses; but their present medical use is principally confined to the treatment of cows and horses.

Native to southern Europe and the Mediterranean region, the plant is cultivated in central and southeastern Europe, western Asia, India, and northern Africa. The plants are erect, loosely branched, less than 3 feet (1 m) tall with trifoliate, light green leaves and small white flowers. The slender pods are up to 6 inches (15 cm) long, curved and beaked, and contain yellow-brown seeds—flat rhomboids characterized by a deep furrow, less than 0.2 inch (1 cm) long. They contain the alkaloids trigonelline and choline and a yellow colouring matter.

Feodor (Russian personal name): *see under* Fyodor.

Feodosiya, also spelled FEODOSII, or FEODOSIJA, city, Crimea *oblast* (province), Ukrainian S.S.R. It lies along a broad bay on the southern coast of the Crimean Peninsula. Founded by Miletan Greeks in the 7th–6th century BC, Feodosiya became part of the kingdom of the Cimmerian Bosporus. A Genoese factory (trading station) was established there in the 13th century under the name Kaffa. The town fell to the Turks in 1475 and to Russia in 1783. Modern Feodosiya is a major resort, as well as a coastal and fishing port. Pop. (1987 est.) 83,000.

feoffment, in English law, the granting of a free inheritance of land (fee simple) to a man and his heirs. The delivery of possession (livery of seisin) was done on the site of the land and was made by the feoffor to the feoffee in the presence of witnesses. Written conveyances were often customary and, after 1677, mandatory.

Feoktistov, Konstantin Petrovich (b. Feb. 7, 1926, Voronezh, Russian S.F.S.R.), Soviet spacecraft designer and cosmonaut who took part, with Vladimir M. Komarov and Boris B. Yegorov, in the world's first multimanned spaceflight, Voskhod 1 (1964).

Feoktistov, 1964
Tass—Sovfoto

When Voronezh was occupied in World War II, Feoktistov, who was then only 16, worked as a scout for the Soviet army. He was captured by the Germans and sentenced to death by firing squad. Shot through the neck, he feigned death and escaped from a burial trench.

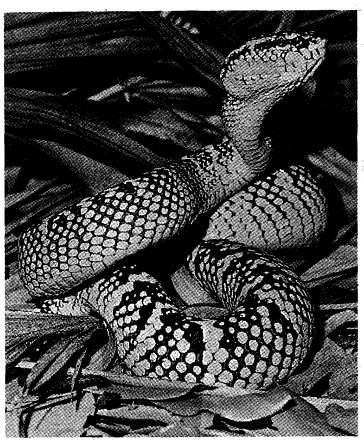
He later attended Bauman Higher Technical School in Moscow and worked for a time as a factory engineer. In 1955 he earned the equivalent of a Ph.D. and from that time worked in the Soviet space program designing spacecraft and equipment.

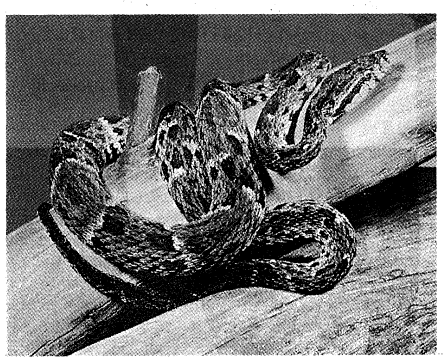
Feoktistov was awarded the Order of the Red Banner of Labour after the launching of the first artificial satellite, Sputnik 1 (Oct. 4, 1957), and again after the first successful manned flight by Yury Gagarin (April 12, 1961). During the flight of Voskhod 1, Oct. 12–13, 1964, Feoktistov carried out extensive scientific experiments and observations beyond the capability of previous cosmonauts. In addition to being the first craft to carry more than one man, Voskhod 1 was the first to carry specialists (a doctor and an engineer) and the first to make a soft landing on the ground. After the Voskhod I flight, Feoktistov returned to engineering and played a major role in designing the Salyut space stations.

fer-de-lance (genus *Bothrops*), extremely venomous snake of the viper family (Viperidae), found throughout tropical America in diverse habitats from cultivated lands to tropical forests. The fer-de-lance, known in Spanish as barba amarilla ("yellow chin"), is a pit viper (subfamily Crotalinae)—*i.e.,* distinguished by a small sensory pit between each eye and nostril. It has a broad, triangular head and is usually about 1.2 to 2 m (4 to 7 feet) long. It is gray or brown, marked by a series of black-edged diamonds often bordered in a lighter colour. Its bite can be fatal to humans.

The common French name fer-de-lance, or "lance head," is sometimes applied collectively to all snakes of the Central and South American genus *Bothrops* and the Asian genus *Trimeresurus*. Among these snakes, all venomous, are the habus (*Trimeresurus flavoviridis* and related species); jararaca (*Bothrops jararaca*); wutu (*B. alternatus*); jumping viper, or tommygoff (*B. nummifera*); and Wagler's pit viper (*Trimeresurus Wagleri*).

The Okinawa habu (*Trimeresurus flavoviridis*) is a large, aggressive snake found on the Amami and Okinawa groups in the Ryukyu Islands, often in human dwellings. It is usually about 1.5 m (5 feet) long and is marked with bold, dark green blotches that may merge to form a wavy, longitudinal band. Its venom is not especially potent but sometimes causes disability or death.





(Top) Fer-de-lance (*Bothrops atrox*); (centre) Wagler's pit viper (*Trimeresurus wagleri*); (bottom) jararaca (*Bothrops jararaca*)

(Top) Carlos Rivero, (centre) Copyright © 1971 Z. Leszczynski—Animals Animals, (bottom) Dade Thornton—The National Audubon Society Collection/Photo Researchers

The jararaca, often confused with the fer-de-lance, is found chiefly in Brazil, where it is abundant in grassy regions. Its bite causes many deaths. It usually grows to about 1.2 m (4 ft) and is olive- or grayish-brown with darker brown blotches. The wutu, also South American, is a dangerous snake about 1.2 m long. It is brown, boldly marked on its sides with thick, dark semicircles outlined in yellow. The jumping viper is an aggressive, brown or gray Central American snake with diamond-shaped, crosswise markings on its back. It is usually about 60 centimetres (2 feet) long. It strikes so energetically that it may lift itself off the ground. Its venom, however, is not especially dangerous to man.

Ferah (town, Afghanistan): *see* Farāh.

Ferahan carpet, handwoven floor covering from the Farāhān district, northeast of Arāk in western Iran, produced in the 19th or early 20th century. Like the rugs of Ser-e Band, Ferahans have been prized for their sturdy construction and their quiet, allover patterning. Most of them have a dark-blue ground showing an endless repeat of the *herāti* design, in which a diamond lattice peeps through a tangle of rose blossoms and leaves. The colouring may be continuously varied within such a repeat, producing attractive changes in effect. In other carpets the repeat is the *gol hannā'*, or henna flower, with clusters of six blossoms at intervals. Medallion schemes also occur. The most customary border is the "turtle" (a pair of split arabesques) on a ground of erosive green—produced by use of

Ferahan carpet from Iran, late 19th century; in a New York state private collection

In a New York state private collection; photograph, Otto E. Nelson—EB Inc.

a copper salt that causes the wool dyed with it to wear more rapidly than the portions dyed with other colours, resulting in a sculptured surface effect.

Ferahan carpets are usually made with the Senna (Sehna) knot on a cotton foundation. Their pattern, colouring, and sometimes extremely large size have been copied in other weaving centres. The manufacture of Ferahan carpets has been succeeded in the district by that of Muskabad carpets, the quality of which is much poorer.

Feraoun, Mouloud (b. 1913, Tizi-Hibel, Alg.—d. 1962, El-Biar), African novelist and teacher whose works give vivid and warm portraits of Berber life and values.

Feraoun, the son of a peasant farmer, passed his youth in the Kabyle mountains. His early successes at school led to a teaching degree from the École Normale at Algiers. He was a gentle man of integrity and supported the cause for Algerian independence, without himself taking up arms in the Algerian resistance. His stance incurred the enmity of the French colonialists, and he was assassinated by terrorists.

His works all describe Kabyle peasant life. *Le Fils du pauvre* (1950; "The Poor Man's Son") is a semiautobiographical story of a Berber youth struggling against poverty and hardship to achieve an education and self-advancement. The portrayal of the simple life in the mountains is filled with nobility, human compassion, and a love of family and native soil. *La Terre et le sang* (1953; "Earth and Blood") deals with an émigré whose life in France is burdened by the sequestration of his proud countrymen and with the importance of *nif* ("honour"), the basis of all traditional morality and the source of the sense of self-worth, dignity, pride, and community. *Les Chemins qui montent* (1957; "The Upward Roads") carries forward in more bitter tones the themes of the resignation, resistance, and endurance of the fellah (peasant) faced with the realities of colonial society; it also deals with the strictures placed on the youth and the narrowness of choices available to them. Feraoun's devotion to Kabyle culture is also evident in a collection of portraits and sketches in a translation of 19th-century Kabyle poetry, and in his journal. Through his works he achieved his goal of discovering the voice of "an indomitable people of flesh and blood."

Ferassie skeletons, La, hominid fossils found in a rock shelter gravesite north of Bugue, Dordogne, Fr., by R. Capitan and D. Peyrony between 1909 and 1921, but not fully reported until 1934. The fossils of La Ferassie are estimated to date from about 60,000 years ago and are associated with the Mousterian stone tool industry. The remains include six skeletons: a man, a woman, one child thought to be about ten years old, and three infants. The skulls have large brows, flat, sloping foreheads, protruding jaws, and small teeth. The feet were similar to those of modern man. A relatively large brain, plus tools found at the site, place these remains definitely within the classic Neanderthal species, considered a subspecies of *Homo sapiens*.

The site also provides evidence that Neanderthal man took considerable pains with burial of the dead. One grave on a slope contains the separated skull and lower skeleton of a child. The skull was covered with a limestone slab with markings on its underside. All the graves are artificially dug trenches cut in half spheres and covered with nearly equal parts of black earth and gravel. This evidence indicates a fairly complex system of belief among Neanderthals. The remains are held in the Musée de l'Homme in Paris and at the Musée des Eyzies in Les Eyzies, Dordogne.

Ferber, Edna (b. Aug. 15, 1887, Kalamazoo, Mich., U.S.—d. April 16, 1968, New York City), U.S. novelist and short-story writer who wrote with compassion and curiosity of the middle-class Midwestern American experience.

Ferber began her career at 17 as a reporter in Wisconsin. Her early stories introduced a travelling petticoat saleswoman named Emma McChesney, whose adventures are collected in several books, including *Emma McChesney & Co.* (1915). Ferber's characters are firmly tied to the land, and they experience conflicts between their traditions and new, more dynamic trends. Although her books are somewhat sentimental in their careful attention to exterior detail at the expense of profound ideas, they do offer an accurate, lively portrait of America in the 1920s and 1930s. After *So Big* (1924), for which she won a Pulitzer Prize, and *Show Boat* (1926), which became a popular play, critics hailed her as the greatest woman novelist of the period. Her autobiography, *A Peculiar Treasure* (1939), evinces her genuine and encompassing love for America.

ferberite, iron-rich variety of the mineral wolframite (*q.v.*).

Ferdinand, name of rulers grouped below by country and indicated by the symbol •.

Foreign-language equivalents:

Bulgarian	Ferdinand
Czech	Ferdinand
German	Ferdinand
Hungarian	Ferdinánd
Italian	Ferdinando
Portuguese	Fernando
Romanian	Ferdinand
Spanish	Fernando

AUSTRIA

• **Ferdinand I–III:** *see* Ferdinand I–III (Germany/Holy Roman Empire).

• **Ferdinand (I),** also called FERDINAND THE BENIGN, German FERDINAND DER GÜTIGE (b. April 19, 1793, Vienna—d. June 29, 1875, Prague), emperor of Austria from 1835 to 1848, when he abdicated his throne.

Ferdinand was the eldest son of the Holy Roman emperor Francis II (later Francis I of Austria) and Maria Theresa of Naples-Sicily. Despite Ferdinand's feeblemindedness and epilepsy, Francis, seeking to protect the principles of succession to the monarchy, insisted that Ferdinand be his heir. Ferdinand was crowned king of Hungary in 1830. On March 2, 1835, he succeeded to the throne of Austria. Because of the Emperor's limited abilities, government affairs were controlled by a body of counsellors, known as the "state conference," in which the decisive influence was exercised by the chancellor Metternich. In 1836 Ferdinand became the last Habsburg to be crowned king of Bohemia and, in 1838, he was crowned king of Lombardy and Venetia. During the Revolution of 1848 most of the insurgents' hostility was directed not against

Emperor Ferdinand of Austria, detail from a lithograph by Johann Babtist Clarot after a painting by Alexander Clarot

By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

Ferdinand but against his counsellors, who had rigidly refused any reforms. Nevertheless, Ferdinand abdicated in favour of his nephew, Francis Joseph, in Olmütz on Dec. 2, 1848.

BOHEMIA

• **Ferdinand I–III:** *see* Ferdinand I–III (Germany/Holy Roman Empire).

• **Ferdinand IV:** *see* Ferdinand IV (Hungary).

• **Ferdinand V:** *see* Ferdinand (I) (Austria).

BRUNSWICK

• **Ferdinand** (b. Jan. 12, 1721, Wolfenbüttel, Brunswick-Lüneburg-Wolfenbüttel, Ger.—d. July 3, 1792, Vechelde, Brunswick), duke of Brunswick-Lüneburg and Prussian general field marshal who defended western Germany for his brother-in-law Frederick II the Great in the Seven Years' War (1756–63), protecting the Prussian flank from French attack, while the King fought the Austrians.

Entering the Prussian Army in 1740, Ferdinand participated in the victorious engagements of Mollwitz (1741), Chotusitz (1742), and Sohr (1745) during the Silesian Wars against Austria. In the Seven Years' War, he campaigned with Frederick in Saxony and Bohemia until given an independent command as head of the allied (Prussian and English) armies in western Germany (1757). There, though nearly always outnumbered, he defeated the French at Krefeld (1758) and Minden (1759).

Ferdinand became estranged from Frederick in 1766 and retired from the Prussian service, accepting a field marshal's rank in the Aus-

Ferdinand, duke of Brunswick-Lüneburg, detail from a portrait by Ziesenis

Archiv fur Kunst und Geschichte, West Berlin

trian Army that same year but never actively serving the Habsburgs. At the outbreak of war between England and its North American colonies, Ferdinand was offered the post of commander in chief by the English, but he declined the appointment. After his retirement, relations with Frederick improved once again, and Ferdinand visited the King several times between 1772 and 1782.

BULGARIA

• **Ferdinand,** in full FERDINAND KARL LEOPOLD MARIA (b. Feb. 26, 1861, Vienna—d. Sept. 10, 1948, Coburg, Ger.), prince (1887–1908) and first king (1908–18) of modern Bulgaria.

The youngest son of Prince Augustus (August) I of Saxe-Coburg-Gotha, Ferdinand was elected prince of Bulgaria on July 7, 1887, as successor to the first ruler of the autonomous principality, Alexander I, who had abdicated the preceding year. Though dominated by his prime minister, Stefan Nikolov Stambolov, during the early years of his reign, he became the unquestioned master of national affairs after his minister's humiliating fall from power (1894). Ferdinand's dynastic position, long suffering for lack of recognition by the Great Powers, was strengthened by his marriage to the Bourbon princess Maria Louisa of Parma (April 1893) and later by his infant son Boris' reception into the Greek Orthodox Church (February 1896). The assurance of a Greek Orthodox successor to the Bulgarian throne prompted Russia to seek a diplomatic rapprochement, and in March 1896 Ferdinand finally received international confirmation of his rule.

Through the following years Ferdinand maintained a tight hold on Bulgarian domestic politics by the operation of a spoils system. On Oct. 5, 1908, he used the occasion of the eve of the Austro-Hungarian annexation of Bosnia–Hercegovina to proclaim the full independence of Bulgaria from the Ottoman Empire, and assumed the title of king, or tsar. Possessed of imperialistic ambition, he spearheaded the formation of the Balkan League (1912), consisting of Bulgaria, Serbia, Greece, and Montenegro (associated informally), that pursued the partitioning of European Turkey (First Balkan War, October 1912–May 1913). Ferdinand's territorial ambitions were thwarted when the victorious allies could not agree on the disposition of captured Turkish territory, causing Serbia and Greece to form an alliance against Bulgaria. Joined by the Turks and Romanians, they defeated the Bulgarians (Second Balkan War, June–July 1913) and turned Ferdinand against his Balkan neighbours. His resentments largely determined Bulgaria's participation (1915–18) in World War I on the side of Germany and Austria-Hungary. Following Bulgaria's military defeat in 1918, he was obliged to abdicate in favour of his son Boris III (Oct. 4, 1918). Thereafter he lived in Coburg.

GERMANY/HOLY ROMAN EMPIRE

• **Ferdinand I** (b. March 10, 1503, Alcalá de Henares, Spain—d. July 25, 1564, Vienna), Holy Roman emperor (1558–64) and king of Bohemia and Hungary from 1526, who, with his Peace of Augsburg (1555), concluded the era of religious strife in Germany following the rise of Lutheranism by recognizing the right of territorial princes to determine the religion of their subjects, and who converted the elected crowns of Bohemia and Hungary into hereditary possessions of the House of Habsburg.

The younger brother of the Holy Roman emperor Charles V, Ferdinand was granted Austria, with the regency of both the Habsburg German lands and Württemberg. For more than three decades he was Charles's deputy in German affairs, representing him at imperial diets and serving as president of the Reichsregiment (imperial governmental council). Initially he followed Charles's policies almost unquestioningly. Hostile toward Protestantism, he bore some responsibility for the Lutheran secession from the Diet of Speyer (1529) and, after he had lost Württemberg to the Lutheran landgrave Philip the Magnanimous of Hesse (1534), helped the Emperor defeat the Protestant Schmalkaldic League in 1546–47. Aggrieved, however, at Charles's refusal to reinstate him in recaptured Württemberg and at the Emperor's attempts to ensure the succession of his son Philip (the future Philip II of Spain) to the imperial crown, Ferdinand began to take a more independent stand. The imperial heir since 1531, he was not finally placated until Charles agreed in 1553 to exclude Philip from the German succession, which then passed to Ferdinand's son, the future Maximilian II. On the Protestant issue, Ferdinand, unlike Charles, eventually became convinced of the need for a compromise. In 1552 he negotiated the Treaty of Passau with the Lutheran elector Maurice of Saxony, who was at war with the Emperor; and in 1555 he signed the Peace of Augsburg, which, with few interruptions, brought half a century of peace to Germany's warring religious factions.

In foreign affairs Ferdinand was no less successful. In 1526, on the death of his brother-in-law, King Louis II of Bohemia and Hungary, Ferdinand claimed both domains. He took possession of Bohemia without difficulty but faced a rival claimant, János Zápolya, in Hungary. Each was elected by a rival faction, and Hungary remained divided among Ferdinand, Zápolya, and the Ottoman Empire. In 1538, by the Peace of Nagyvárad (German Grosswardein), Ferdinand became Zápolya's successor, but he was unable to enforce the agreement in his lifetime. The Ottoman Empire almost continually threatened Europe during Ferdinand's reign. The Turks failed to take Vienna in 1529 but threatened Austria again in 1532 and 1541. After repeated and mostly futile pleas for assistance from the German princes, Ferdinand finally reestablished an uneasy peace in 1562, when he agreed to pay tribute to the Sultan for Austria's share of Hungary.

Ferdinand took over Charles's imperial functions in 1555 and was elected emperor in 1558 after his brother's abdication. With his accession, the Habsburg domains became separated into more easily governable Austrian and Spanish parts, with Spain going to Philip and Germany to Ferdinand. The new Emperor centralized his administration and, though only with limited success, sought to revive Roman Catholicism in his lands. His eldest son, Maximilian, succeeded him in 1564. Though always overshadowed by his brother Charles V, Ferdinand had become one of the most successful Habsburg rulers of the 16th

century, increasing the hereditary possessions of the House of Austria significantly and restoring peace to the empire after decades of religious warfare.

• **Ferdinand II** (b. July 9, 1578, Graz, Styria—d. Feb. 15, 1637, Vienna), Holy Roman emperor (1619–37), archduke of Austria, king of Bohemia (1617–19, 1620–27), and king of Hungary (1618–25). He was the leading champion of the Catholic Counter-Reformation and of absolutist rule during the Thirty Years' War.

Early years. He was born in Graz, the eldest son of the archduke Charles, the ruler of Inner Austria (Styria, Carinthia, and Carniola), and Maria, a daughter of Albrecht V, duke of Bavaria. From 1590 to 1595 Ferdinand was educated at the University of Ingolstadt by Jesuits whose aim was to make him a strict, rigidly Catholic ruler. In 1596 he took over his hereditary lands and, after a pilgrimage to Loreto and Rome, set about suppressing Protestantism by forcing the great majority of his subjects to adopt the Catholic faith. In 1600 he married Maria Anna of Bavaria, who bore him four children. He avoided committing himself in a quarrel between his cousins, the emperor Rudolf II and his brother Matthias, who eventually succeeded Rudolf as emperor. Later Ferdinand secured approval from the Habsburg rulers of Spain to succeed the childless Matthias. In return he promised in a secret treaty (1617) to cede to them the Alsace and the imperial fiefs in Italy. In the same year Ferdinand was recognized by the Bohemian Diet as king of Bohemia and in 1618 was elected king of Hungary. In 1619, however, the largely Protestant diet of Bohemia deposed him, electing Frederick V, elector of the Palatinate, as their king. This was, in effect, the beginning of the Thirty Years' War. Though elected emperor on Aug. 28, 1619, Ferdinand was able to maintain himself only with support from Spain, Poland, and various German princes. Aided by Maximilian I, duke of Bavaria, his troops annihilated the rebel army on the White Mountain, near Prague, on Nov. 8, 1620. He confiscated the estates of the rebel magnates, reduced the Diet to impotence by a new constituent ordinance (1627), and forcibly catholicized Bohemia. Protestants of Upper and Lower Austria were subjected to compulsory conversion.

Ferdinand II, engraving

By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

Ferdinand and Wallenstein. During the first decade of the Thirty Years' War, Ferdinand strengthened his position by transferring the Palatinate's electoral office to Maximilian of Bavaria. In addition, with the help of Spain and the league of Catholic princes of Germany, and through the victories of his generalissimo Albrecht von Wallenstein (*q.v.*), he gained important successes over his German opponents and the King of Denmark. Until then the war largely had been confined to Germany, but Swedish and, later on, French intervention turned it into a European conflict. Ferdinand's Edict of Restitution (1629), which forced Protestants to return to the Roman Catholic Church all property seized since 1552, revealed to the German princes the threat of imperial absolutism. Their opposition forced Ferdinand in 1630 to dismiss Wallenstein, the mainstay of his power. The victorious advance of the Swedish army, however, made the Emperor recall Wallenstein. Eventually, for reasons of state, Ferdinand reluctantly gave his consent to a second dismissal and the assassination of Wallenstein, who had treacherously entered into negotiations with the enemy (1634). After his victory over the Swedes (September 1634) at Nördlingen, Ferdinand reached a compromise with the Protestant princes in the Peace of Prague (1635) and, in 1636, succeeded in having his son Ferdinand elected king of the Romans (successor-designate to the emperor). Ferdinand II, who had been married to his second wife, Eleonora Gonzaga of Mantua, since 1622, died in Vienna in 1637.

Assessment. In the prime of his life Ferdinand was described as a blue-eyed, somewhat corpulent, middle-sized man who wore Spanish court dress. A good-natured, benevolent, affable monarch, he was imbued with the belief in the splendour of the imperial crown and the greatness of his dynasty. Besides German he spoke Italian, French, and Spanish, was fond of music, and liked reading religious books, but his passion was hunting. Although he kept a frugal court, he was a bad financier who too generously gave away the greatest part of confiscated estates to his faithful followers. A very pious Catholic, he especially favoured the Jesuits. Yet, basing his policies chiefly on religious principles, he suffered from discrepancies between his religious goals and the maxims of a modern raison d'état. An indecisive man, he depended much on the influence of his counsellors and his Jesuit confessors. Yet in the face of the shifting fortunes of war he showed much steadfastness, although he often lacked political agility. A person of moderate talents and willpower, he nevertheless exerted a strong influence on the events of his time by his strict and uncompromising religious policy.

By promoting the Counter-Reformation, Ferdinand II set the course of Austrian Habsburg policy for the next century. By creating an independent Austrian court chancellery and by establishing in his will the principles of Austria's indivisibility and of primogeniture in his family, he made an essential contribution to the country's national integration. Yet by maintaining the country's historical provinces and estates, after their subjugation, he preserved the principle of federalism in Austria. Ferdinand's Catholic contemporaries considered him a saintlike monarch; his Protestant opponents feared him as a tyrant. Catholic historiography of the 19th century assigned him too high a place, while liberal historians were likely to underestimate his importance. Modern historians tend to view Ferdinand's religious policy as determined by his time, to acknowledge his importance in molding Austria's provinces into an integral whole, and to see in his imperial policy an attempt at creating a Catholic German state, however inconsistently carried out. (H.St.)

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• **Ferdinand III** (b. July 13, 1608, Graz, Austria—d. April 2, 1657, Vienna), Holy Roman emperor who headed the so-called peace party at the Habsburg imperial court during the Thirty Years' War and ended that war in 1648 with the Peace of Westphalia.

Ferdinand III, detail from a portrait from the studio of Peter Paul Rubens; in the Kunsthistorisches Museum, Vienna

By courtesy of the Kunsthistorisches Museum, Vienna

The eldest son of the emperor Ferdinand II and Maria Anna of Bavaria, the energetic and able Ferdinand took part in ministerial councils and affairs of state from 1626. Archduke of Austria from 1621, he was crowned king of Hungary in 1625 and of Bohemia in 1627. Denied command of the imperial armies by Generalissimo Albrecht von Wallenstein, he took part in the conspiracy against the generalissimo and was partly responsible for his death in 1634. Thereafter, Ferdinand nominally commanded the Habsburg armies and in 1634 captured Regensburg and defeated the Swedes at the first Battle of Nördlingen in the same year. As leader of the peace party at the Austrian court, he encouraged negotiations leading to the Peace of Prague (May 1635), by which the emperor Ferdinand II tacitly abandoned his centralist and absolutist plans and restored the status quo of 1627.

Elected king of the Romans (heir to the imperial throne) in 1636, Ferdinand became emperor on his father's death the next year. Although he refused to allow religious freedom in his own domains and would not reinstate dispossessed Protestant nobility, he did not hesitate to compromise with Europe's Protestant powers and agreed to the Peace of Westphalia, which ended 30 years of religious strife in central Europe and granted greater freedoms for Protestantism in Hungary. In internal affairs Ferdinand's creation of a standing army and his reform of the imperial council attest to his administrative ability. On his death his second son, Leopold I, succeeded him as emperor.

Hungary

• **Ferdinand I–III:** *see* Ferdinand I–III (Germany/Holy Roman Empire).

• **Ferdinand IV** (b. Sept. 8, 1633—d. July 9, 1654), king of Bohemia (from 1646) and of Hungary (from 1647) and king of the Romans (from 1653).

The eldest son of the emperor Ferdinand III and his first wife, Maria Anna, daughter of Philip III of Spain, Ferdinand was destined for the imperial crown. He was brought up to rule and, at his father's insistence, was elected king of the Romans at Augsburg on May 31, 1653, and crowned at Ratisbon on June 18. However, Ferdinand died prematurely the next year, at age 21; and, when his father died in 1657, the imperial crown went to Ferdinand III's younger son, Leopold I, a milder individual who had been destined for the church.

• **Ferdinand V:** *see* Ferdinand (I) (Austria).

Naples

• **Ferdinand I,** Italian FERRANTE, or FERDINANDO (b. 1423, Valencia, Spain—d. Jan. 25, 1494), king of Naples from 1458.

He was the illegitimate son of Alfonso V of Aragon, who, after establishing himself as king of Naples in 1442, had Ferdinand legitimized and recognized as his heir. Succeeding Alfonso in 1458, Ferdinand was soon faced

Ferdinand I, engraving by Barthel Beham, 1531

Archiv fur Kunst und Geschichte, West Berlin

with a baronial revolt in favour of René of Anjou, the pretender to the throne. He overcame the rebellion in 1464, but his rule was threatened by Ottoman expansionism, by the territorial ambitions of other Italian states, and by the rebelliousness of his own barons. Ferdinand, therefore, pursued an opportunist policy. In August 1480 the Turks seized the south Italian port of Otranto; Ferdinand, with the financial assistance of Florence, expelled them in 1481. Later he allied with Florence, and the two powers fought Venice in the War of Ferrara (1482–84).

Ferdinand's attempts to break the barons' power resulted in another baronial revolt (1485–87), in which the barons attempted to replace the King with either René II of Lorraine or with Frederick of Aragon, Ferdinand's second son. Pope Innocent VIII also declared war on Ferdinand but agreed to a separate peace in 1486. Ferdinand finally suppressed the barons by a series of arrests, trials, confiscations, and executions.

• **Ferdinand II** (b. June 26, 1467, Naples—d. Oct. 5, 1496, Naples), prince of Capua, duke of Calabria, and king of Naples (1495–96), who recovered his kingdom from French occupation.

A gifted Humanist prince, Ferdinand was loved by the people, who affectionately addressed him in the diminutive Ferrandino. When his father, the unpopular Alfonso II, became king (1494), Ferdinand took command of Neapolitan troops opposing the advance of the French king Charles VIII in northern Italy. Failing to halt the French, Ferdinand returned to Naples and became king upon the abdication of his father on Jan. 23, 1495. The following month, however, the French captured Naples, and Ferdinand withdrew to Sicily. Aided by a Spanish army and the Venetian fleet, he recovered almost all his lands by the summer of 1496 and was received triumphantly by the populace of Naples. His sudden death opened the way for Spanish usurpation of the Neapolitan throne.

• **Ferdinand III:** *see* Ferdinand II (Spain: Aragon).

• **Ferdinand IV:** *see* Ferdinand I (Two Sicilies).

Portugal

• **Ferdinand I,** byname FERDINAND THE HANDSOME, or THE FICKLE, Portuguese FERNANDO O FORMOSA, or O INCONSTANTE (b. Oct. 31, 1345, Lisbon—d. Oct. 22, 1383), ninth king of Portugal (1367–83), whose reign was marked by three wars with Castile and by the growth of the Portuguese economy.

The son of Peter I of Portugal, he became a contender for the Castilian throne after the assassination (1369) of Peter the Cruel of Castile, thus initiating the first (1369–71) of the unsuccessful wars with Castile. After Ferdinand allied himself in 1372 with John of Gaunt, duke of Lancaster, there ensued a second war with Castile (1372–73), in which Castilian troops invaded Portugal, surrounded Lisbon (1373), and obliged Ferdinand to repudiate the English alliance and to accept the conditions of Henry II of Castile.

The period of peace that followed was taken up with successive, and sometimes contradictory, diplomatic negotiations—with England, Castile, Aragon, and France—but the Anglo-Portuguese treaty of June 16, 1373, continued to form a basis of alliance between the two countries. The confirmation of the English treaties in 1380 gave rise to a third war with Castile (1381–82), which, like the earlier conflicts, was characterized by the lack of success of Portugal's military operations, in spite of forces sent from England under Edmund of Langley. Compelled once more to sign a peace treaty (August 1382) and to abandon his allies, Ferdinand obtained from the king of Castile the ships for repatriation of the English troops.

Notwithstanding his preoccupation with war, Ferdinand promulgated laws which encouraged the development of agriculture, external trade, the merchant marine, and the army. Ferdinand's marriage in 1372 with Leonor Teles, a lady of somewhat doubtful morals, provoked discontent. The subsequent marriage on April 30, 1383, of his only legitimate child, Beatriz, with John I of Castile also caused unrest and, on Ferdinand's death, precipitated one of the most serious dynastic and national crises in Portuguese history, leading to the formation of a new dynasty, the Aviz, by John I of Portugal.

• **Ferdinand II,** original name FERDINAND AUGUST FRANZ ANTON, PRINZ (prince) VON SACHSEN-COBURG-GOTHA (b. Oct. 29, 1816, Vienna—d. Dec. 15, 1885, Lisbon), second husband of Queen Maria II of Portugal, who proclaimed him king consort with the title of Ferdinand II upon the birth of their first son (the future Peter V) in 1837.

The son of Prince Ferdinand of Saxe-Coburg-Saalfeld (and cousin of Prince Albert of Great Britain), he was married to Maria in January 1836, only 10 months after the sudden death of her first husband after two months of marriage. When Maria died in 1853, in childbirth, Ferdinand acted as regent for two years until Peter V came of age.

Well educated and versed in music and the arts, Ferdinand did much to foster the arts in his adopted country and tried to give a rigorous but broad education to all his children.

Romania

• **Ferdinand I** (b. Aug. 24, 1865, Sigmaringen, Prussia—d. July 20, 1927, Bucharest), king of Romania from 1914 to 1927, who, though a Hohenzollern and a believer in German strength, joined the Allies in World War I.

The son of Prince Leopold of Hohenzollern-Sigmaringen, Ferdinand was adopted as crown prince of Romania in 1889 by his uncle, King Carol I, whose only child had died. In 1893 he married Lady Marie, daughter of the Duke of Edinburgh and granddaughter of Queen Victoria and of Tsar Alexander II of Russia. Though retiring in nature and occasionally vacillating, Ferdinand showed considerable interest in Romanian military affairs and commanded the army during the Second Balkan War (1913). When his uncle died he succeeded to the Romanian throne in October 1914. Early in World War I he waited on events before finally casting his lot with the Allied Powers (August 1916). With the occupation of Bucharest by the Germans late in 1916, he moved his beleaguered government to Iaşi. His promise of land reforms before Romanian troops in April 1917 averted a potentially revolutionary situation but raised an issue that was never fully resolved by postwar governments.

In March 1918 Romania was forced to surrender to the Central Powers but rejoined the Allies in November 1918 and later incorporated Transylvania, Bukovina, part of the Banat, and Bessarabia into a Greater Romanian state. Ferdinand thus found his postwar kingdom doubled in size, and in October 1922 he was solemnly crowned king of all Romanians at Alba Iulia. In 1920 he engineered a royal coup that installed Gen. Alexandru Averescu as premier; it was Averescu's government that in 1921 finally enacted a measure of the King's long promised land reform. In 1925 Ferdinand forced his son, the playboy crown prince Carol, to renounce his rights to the throne and, later, in his will secured the succession of his young grandson, Prince Michael.

Sicily

• **Ferdinand I–II:** *see* Ferdinand I–II (Spain: Aragon).

• **Ferdinand III:** *see* Ferdinand I (Two Sicilies).

Spain

• **Ferdinand I–IV:** *see* Ferdinand I–IV (Spain: Castile and Leon).

• **Ferdinand V:** *see* Ferdinand II (Spain: Aragon).

• **Ferdinand VI** (b. Sept. 23, 1713, Madrid—d. Aug. 10, 1759, Villaviciosa de Odón, Spain), second king of Spain of the House of Bourbon, reigning from 1746 to 1759. He pursued a policy of neutrality and gradual reform.

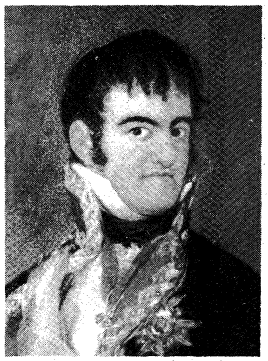
The second son of Philip V and his first wife, Marie-Louise, Ferdinand was given no part in political life during the reign of his father, who was much under the influence of his second wife, Elizabeth Farnese. When Ferdinand succeeded in July 1746, he decided to avoid entanglements and was able to avoid conflicts throughout his reign. He relied on his father's minister, the able Marqués de la Ensenada, who brought about administrative and financial reforms.

Ferdinand was a patron of the arts and learning, founding the Academy of San Fernando for the fine arts in 1752, as well as botanical gardens and an observatory. The economic Societies of Friends of the Country encouraged agricultural and technical advances. His queen, Maria Bárbara of Bragança, to whom he was devoted, shared his love of music and patronized the opera.

In 1753 Ferdinand concluded a concordat with the papacy by which he recovered rights forfeited under the last of the Habsburgs, Charles II—notably the right to appoint bishops and tax the clergy. After the death of Maria Bárbara in 1758, Ferdinand suffered from melancholia and did not long survive her. They had no children, and the crown passed to his half-brother, hitherto king of Naples, Charles III.

• **Ferdinand VII,** byname FERDINAND THE DESIRED, Spanish FERNANDO EL DESEADO (b. Oct. 14, 1784, El Escorial, Spain—d. Sept.

29, 1833, Madrid), king of Spain from March 1808 to 1833, though held a prisoner in France during the Napoleonic Wars.



Ferdinand VII, detail of an oil painting by Francisco de Goya, 1814–15; in the Prado, Madrid

By courtesy of the Museo del Prado, Madrid

Ferdinand was the son of Charles IV and Maria Luisa of Parma, who placed their whole confidence in Manuel de Godoy: since 1795 Godoy had flaunted the title of Prince of the Peace for his capitulation to France in the Peace of Basel. Ferdinand's tutor stirred up his jealousy of the favourite and encouraged him to seek the protection of Napoleon. Charles IV was sufficiently alarmed to arrest Ferdinand, but forgave him. When Godoy allowed French troops to enter Spain, Charles was overthrown by the Revolt of Aranjuez (March 17, 1808), and he abdicated in favour of Ferdinand. But the French troops occupied Madrid; Napoleon summoned Ferdinand to the frontier and obliged him to return the crown to his father, who granted it to Napoleon. Napoleon made his brother Joseph king of Spain and held Ferdinand in France for the duration of the war.

It was left to the Spanish populace to rise against the French invaders in the name of the absent Ferdinand, known as "the Desired." In 1812 independent Spaniards adopted the Constitution of Cádiz, but in December 1813 Napoleon released Ferdinand expressly to overthrow it. He resumed his obsolete powers and attempted to recover control of Spanish America, now partly independent. But his ministers could neither reinforce his armies in America nor persuade the British government to collaborate or connive at reconquest. In 1820 a liberal revolution restored the Constitution of 1812, which Ferdinand accepted; but in 1823 Louis XVIII of France sent the Duc d'Angoulême at the head of a large army to release Ferdinand from his radical ministers. Ferdinand's new government arrested the radicals or drove them into exile. By 1826 the Spanish possessions in America were all independent. Ferdinand's government now depended on a militia, the Royalist Volunteers, and the French forces of occupation.

Ferdinand had no children from his three marriages, and his absolutist supporters looked to his even more absolutist younger brother, Don Carlos (Carlos María Isidro de Borbón; *q.v.*), to succeed him. In 1830 his fourth wife, María Cristina, presented him with a daughter, the future Isabella II. During Ferdinand's illness, Don Carlos tried to persuade the Queen to recognize his rights, but Ferdinand recovered, banished Don Carlos, and looked for moderate liberal support for his little daughter. When he died in September 1833, she was recognized, but his widow was obliged to lean on the liberals as Don Carlos asserted his claims from Portugal and thus began the First Carlist War.

Spain: Aragon

• **Ferdinand I,** byname EL DE ANTEQUERA (He of Antequera), or EL INFANTE DE ANTEQUERA (the Infante of Antequera) (b. 1379?—d. April 2, 1416, Igualada, Catalonia), king of Aragon from 1412 to 1416, second son of John I of Castile and Eleanor, daughter of Peter IV of Aragon.

Because his elder brother, Henry III, was an invalid, Ferdinand took the field against the Muslims of Granada. When Henry III died in 1406, his son John II was an infant and the regency was divided between Henry's widow, Queen Catherine of Lancaster, and Ferdinand, who claimed positions on the royal council for his sons. In 1410 Ferdinand captured the Granadine fortress of Antequera, a feat that ensured his election to the throne of Aragon, vacant with the death of King Martin in 1412. Ferdinand was chosen by the Compromise of Caspe (1412), though the Catalans supported a rival. His election was due in part to the support of the Aragonese antipope Benedict XIII and the efforts of St. Vincent Ferrer. Once elected, however, he ceased to support Benedict and so helped to end the Great Schism.

On departing for Aragon he retained control of the Granadine frontier and of the positions held in Castile by his sons. His accession ended the long Catalan political domination of the Aragon state, which his nephew John II would bring into the orbit of Castile. Ferdinand's provision for his sons in Castile (where they were known as the "Infantes of Aragon") added to the distinctiveness of the reign of the Castilian John II.

• **Ferdinand II,** byname FERDINAND THE CATHOLIC, Spanish FERNANDO EL CATÓLICO (b. March 10, 1452, Sos, Aragon—d. Jan. 23, 1516, Madrigalejo, Spain), king of Aragon and king of Castile (as Ferdinand V) from 1479, joint sovereign with Queen Isabella I.

Ferdinand II, king of Aragon (right), detail of an oil painting by a Hispano-Flemish Master; in the Prado, Madrid

By courtesy of the Museo del Prado, Madrid

(As Spanish ruler of southern Italy, he was also known as Ferdinand III of Naples and Ferdinand II of Sicily.) He united the Spanish kingdoms into the nation of Spain and began Spain's entry into the modern period of imperial expansion.

Ferdinand was the son of John II of Aragon and Juana Enríquez, both of Castilian origin. In 1461, in the midst of a bitterly contested succession, John II named him heir apparent and governor of all his kingdoms and lands. Ferdinand's future was assured when he came of age, in 1466, and when he was named king of Sicily, in 1468, in order to impress the court of Castile, where his father ultimately wished to place him. In addition to participating in court life, the young prince saw battle during the Catalonian wars. In the summer of 1468, beginning to sow his wild oats, he went courting; the first fruits of these adventures were Alfonso of Aragon, future archbishop of Zaragoza and his father's favourite, and Juana of Aragon.

John II was careful about Ferdinand's education and took personal charge of it, making sure that Ferdinand learned as much as possible from experience. He also provided him with teachers who taught him humanistic attitudes and wrote him treatises on the art of government. Ferdinand had no apparent bent for formal studies, but he was a patron of the arts and a devotee of vocal and instrumental music.

Ferdinand had an imposing personality but was never very genial. From his father he acquired sagacity, integrity, courage, and a calculated reserve; from his mother, an impulsive emotionality, which he generally repressed. Under the responsibility of kingship he had to conceal his stronger passions and adopt a cold, impenetrable mask.

He married the princess Isabella of Castile in Valladolid in October 1469. This was a marriage of political opportunism, not romance. The court of Aragon dreamed of a return to Castile, and Isabella needed help to gain succession to the throne. The marriage initiated a dark and troubled life, in which Ferdinand fought on the Castilian and Aragonese fronts in order to impose his authority over the noble oligarchies, shifting his basis of support from one kingdom to the other according to the intensity of the danger. Despite the political nature of the union, he loved Isabella sincerely. She quickly bore him children: the infanta Isabella was born in 1470; the heir apparent, John, in 1478; and the infantas Juana (called Juana la Loca—Joan the Mad), Catalina (later called—as the first wife of Henry VIII of England—Catherine of Aragon), and María followed. The marriage began, however, with almost continual separation. Ferdinand, often away in the Castilian towns or on journeys to Aragon, reproached his wife for the comfort of her life. At the same time, the restlessness of his 20 years drove him into other women's arms, by whom he sired at least two female children, whose birth dates are not recorded.

Between the ages of 20 and 30, Ferdinand performed a series of heroic deeds. These began when Henry IV of Castile died on Dec. 11, 1474, leaving his succession in dispute. Ferdinand rushed from Zaragoza to Segovia, where Isabella had herself proclaimed queen of Castile on December 13. Ferdinand remained there as king consort, an uneasy, marginal figure, until Isabella's war of succession against Afonso V of Portugal gained his acceptance in 1479 as king in every sense of the word. That same year John II died, and Ferdinand succeeded to the Aragonese throne. This initiated a confederation of kingdoms, which was the institutional basis for modern Spain.

The events of this period bring out the young king's character more clearly. In portraits he appears with soft, well-proportioned features, a small, sensual mouth, and pensive eyes. His literary descriptions are more complicated, although they agree in presenting him as good-looking, of medium height, and a good rider, devoted to games and to the hunt. He had a clear, strong voice. He was something of a ladies' man, which caused Isabella jealousy for several years.

From 1475 to 1479 Ferdinand struggled to take a firm seat in Castile with his young wife

and to transform the kingdom politically, using new institutional molds partly inspired by those of Aragon. This policy of modernization included a ban against all religions other than Catholicism. The establishment of the Spanish Inquisition (1478) to enforce religious uniformity and the expulsion of the Jews (1492) were both part of a deliberate policy designed to strengthen the church, which would in turn support the crown.

The years 1482–92 were frantic for Ferdinand. In the spring months he directed the campaign against the Kingdom of Granada, showing his military talent to good effect, and he conquered the kingdom inch by inch, winning its final capitulation on Jan. 2, 1492. During the months of rest from war he visited his kingdoms, learning their geography and problems firsthand.

The conquest of Granada made it possible to support Christopher Columbus' voyages of exploration across the Atlantic. It is not known what Ferdinand thought of Columbus or how he judged his plans, nor can it be stated that the first trip was financed from Aragon; the sum of 1,157,000 maravedis came from the funds of the Santa Hermandad (Holy Brotherhood). Nevertheless, Ferdinand was present in the development of plans for the enterprise, in the negotiations to obtain the Pope's backing for it, and in the organization of the resulting American colonies.

At the age of 50 Ferdinand was an incarnation of royalty, and fortune smiled on him. For various reasons, particularly for his intervention in Italy, Pope Alexander VI gave him the honorary title of "the Catholic" on Dec. 2, 1496. But he also suffered a succession of tragedies: the heir apparent and his eldest daughter both died, and the first symptoms of insanity appeared in his daughter Juana. He was wounded in Barcelona in 1493, but this was unimportant compared with the family injuries he suffered, which culminated in the death of Isabella in 1504, "the best and most excellent wife king ever had."

To secure his position in Castile, Ferdinand married Germaine de Foix, niece of the King of France, on Oct. 19, 1505; this, too, was a political marriage, although he always showed her the highest regard. A stay in Italy (1506–07) demonstrated how badly he was needed by the Spanish kingdoms. Once more in Castile, he managed his European policy so as to obtain a hegemony that would serve his expansionary ends in the Mediterranean and in Africa. In 1512, immediately after the schism in the church in which the kings of Navarre participated, he occupied their kingdom and incorporated it into Castile—one of the most controversial acts of his reign.

In 1513 his health began to decay, though he was still able to direct his international policy and to prepare the succession of his grandson, the future emperor Charles V. In early 1516 he began a trip to Granada; he stopped in Madrigalejo, the little site of the sanctuary of Guadalupe, where he died. The day before his death he had signed his last will and testament, an excellent picture of the monarch and of the political situation at his death.

Many considered Ferdinand the saviour of his kingdoms, a bringer of unity. Others despised him for having oppressed them. Machiavelli attributed to him the objectionable qualities of the Renaissance prince. The German traveller Thomas Müntzer and the Italian diplomat Francesco Guicciardini, who knew him personally, compared him with Charlemagne. His will indicates that he died with a clear conscience, ordering that his body be moved to Granada and buried next to that of his wife Isabella, so that they might be reunited for eternity. He died convinced that the crown of Spain had not been so powerful for 700 years, "and all, after God, because of my work and my labour." (T.d.A.)

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SPAIN: CASTILE AND LEON

• **Ferdinand I,** byname FERDINAND THE GREAT, Spanish FERNANDO EL MAGNO (b. 1016/18—d. Dec. 27, 1065, León, Leon), the first ruler of Castile to take the title of king; he was also crowned emperor of Leon.

His father, Sancho III of Navarre, had acquired Castile and established hegemony over the Christian states. On his death in 1035 he left Navarre to his eldest son (García III) and Castile to his second son, Ferdinand, who had married Sancha, sister and heiress of Bermudo III of Leon. Ferdinand's Castilians defeated and killed Bermudo at Tamarón in 1037, and he had himself crowned emperor in León in 1039. In 1054 his Castilian troops defeated and killed his elder brother, García III, at Atapuerca, and he added Navarre to his possessions. In 1062 he forced the Muslim ruler of Toledo to pay him tribute and imposed vassalage on Saragossa and Seville. He conquered Coimbra in central Portugal and laid siege to Valencia, but failed to capture it.

He followed the custom of dividing his estates, leaving Castile to the eldest, Sancho II; Leon to the second, Alfonso VI; and Galicia to the third. The first two dispossessed the third; and, on the murder of Sancho, Alfonso VI recovered the whole, becoming emperor.

• **Ferdinand II** (b. 1137—d. Aug. 22, 1188, Benavente, Leon), king of Leon from 1157 to 1188, second son of Alfonso VII.

Despite several internal revolts against his rule, Ferdinand's reign was notable for the repopulation of Leonese Extremadura and for the victories he secured farther south against the Almohads in the last 20 years of his reign. These included the capture of Alcántara (1166) and Badajoz (1169). He also gave important support to the new military order of Santiago, founded with his approval in 1170. Ferdinand, who called himself *rex hispanorum* ("king of the Spaniards"), established a temporary tutelage over Castile during the minority of his nephew Alfonso VIII and occupied Segovia and Toledo (1162–66), though Alfonso later reacted violently against Ferdinand. Ferdinand was also frequently engaged in hostilities with the nascent Portuguese kingdom but came successfully to the rescue of the Portuguese when the Almohads invested the key city of Santarém (1184).

• **Ferdinand III,** also called SAINT FERDINAND, Spanish SAN FERNANDO (b. 1201?—d. May 30, 1252, Seville; canonized Feb. 4, 1671; feast day May 30), king of Castile from 1217 to 1252 and of Leon from 1230 to 1252 and conqueror of the Muslim cities of Córdoba (1236), Jaén (1246), and Seville (1248). During his campaigns, Murcia submitted to his son Alfonso (later Alfonso X), and the Muslim kingdom of Granada became his vassal.

Ferdinand was the son of Alfonso IX of Leon and Berenguela, daughter of Alfonso VIII of Castile. When born, he was the heir to Leon, but his uncle, Henry I of Castile, died young, and his mother inherited the crown of Castile, which she conferred on him. His father, like many Leonese, opposed the union, and Ferdinand found himself at war with him. By his will Alfonso IX tried to disinherit his son, but the will was set aside, and Castile and Leon were permanently united in 1230.

Ferdinand married Beatrice of Swabia, daughter of the Holy Roman emperor, a title that Ferdinand's son Alfonso X was to claim. His conquest of Lower Andalusia was the result of the disintegration of the Almohad state. The Castilians and other conquerors occupied the cities, driving out the Muslims and taking over vast estates.

Ferdinand's second wife was Joan of Ponthieu, whom he married in 1237; their daughter Eleanor married the future Edward I of England in 1254. Ferdinand settled in Seville, where he is buried.

• **Ferdinand IV** (b. Dec. 6, 1285, Seville—d. Sept. 7, 1312, Jaén, Andalusia), king of Castile and Leon, succeeding his father, Sancho IV, in 1295.

He survived his minority through the tact and bravery of his mother, María de Molina, who acted as regent. He was further aided by the loyalty of the citizens of Ávila, where he took refuge during an anarchic period marked by conspiracies and rebellions of the Castilian nobility against the crown. Upon coming of age, Ferdinand rejected his mother's guidance but proved to be a weak king. His forces recaptured Gibraltar from the Moorish kingdom of Granada in 1309.

TUSCANY

• **Ferdinand I,** original name FERDINANDO DE' MEDICI (b. July 30, 1549—d. Feb. 7, 1609), third grand duke (*granduca*) of Tuscany (1587–1609), who greatly increased the strength and prosperity of the country.

The younger son of Cosimo I, Ferdinand had been made a cardinal at age 14 and was living in Rome when his brother Francis (Francesco) died without a male heir, and he inherited the grand ducal title (1587). He did not renounce his cardinalate until 1589, when he married Christine of Lorraine, daughter of Charles III of Lorraine, and a granddaughter of Catherine de Médicis through her mother, Claude de France. This marriage, moreover, symbolized his policy of rapprochement with France in order to counteract Spanish influence in Italy, where Tuscany's independence and prosperity was assured by his skill at playing one great power off against another. For all his ecclesiastical background, he was a far more capable exponent of Cosimo's policy than Francis had been.

Secret loans from Ferdinand helped Henry of Navarre, even before his conversion to Catholicism, in his war to make himself king of France as Henry IV; and the occupation of the Château d'If by Tuscan forces (1591) obstructed Spanish designs on Marseille during the same war. There was some dispute between Ferdinand and Henry before Ferdinand withdrew his garrison from the Château d'If (1598), but their friendship was sealed by Henry's marriage, in 1600, to Ferdinand's niece Maria (Marie de Médicis). To preserve good relations with the Austrian Habsburgs, on the other hand, Ferdinand's son Cosimo was married in 1608 to the archduchess Maria Magdalena, a first cousin of the emperor Rudolf II; and Tuscan forces helped the Austrians in their war against the Turks. The Knights of St. Stephen won notable victories over the Turks in the Ionian and Aegean seas (1605–09) and on the African coast (Bône, 1607).

Ferdinand's wise administration, an increase of commercial activity, and the continuance of his predecessors' plans for draining the

marshes and for developing Livorno and its port (where political exiles from abroad were encouraged to settle) raised the grand duchy to a new zenith of prosperity. In Rome, as a cardinal before becoming grand duke, Ferdinand had distinguished himself as a lover of the arts and as the builder of Villa Medici; and in Tuscany under his rule Giovanni da Bologna and Buontalenti remained active among artists and architects. Ferdinand also patronized Giulio Caccini, Jacopo Corsi, and other musicians of the Camerata de' Bardi, whose work marked the birth of opera in Florence.

• **Ferdinand II,** original name FERDINANDO DE' MEDICI (b. July 14, 1610—d. May 24, 1670), fifth grand duke (*granduca*) of Tuscany, a patron of sciences, whose rule was subservient to Rome.

He was a boy of 10 when his father, Cosimo II, died in 1621; and his grandmother, Christine of Lorraine, and his mother, Maria Magdalena of Austria, were nominated regents. The young Ferdinand was sent to Rome and Vienna to complete his education, and the government of Tuscany remained in the hands of two jealous and quarrelsome people. Thus the administration of justice and finance speedily went to ruin. They conferred exaggerated privileges on the new Tuscan nobility, which became increasingly insolent. They resumed the old Medicean practice of trading on their own account, and, without reaping much benefit thereby, did the utmost damage to private enterprise.

In 1627 Ferdinand II, then aged 17, returned to Italy and assumed the reins of government; but, being of a very gentle disposition, he decided on sharing his power with the regents and his brothers and arranged matters in such a manner that each was almost independent of the other. He gained the love of his subjects by his great goodness; and, when Florence and Tuscany were ravaged by the plague in 1630, he showed admirable courage and carried out many useful measures. But he was totally incapable of energy as a statesman. He contrived with difficulty to remain neutral, despite pressure from Spain, in the War of the Mantuan Succession (1628–31) and in the later Franco-Spanish hostilities of the Thirty Years' War. On the other hand, his relations with the papacy were unhappy. Pope Urban VIII's annexation of Urbino to the Papal States (1626) precluded Ferdinand from acquiring anything more than the freehold property of the former dukes of Urbino when he married their heiress, Vittoria della Rovere, in 1634 (this patrimony, however, included important treasures); and though he allied himself with Venice and Modena to support his brother-in-law Odoardo Farnese, duke of Parma, against Urban during the War of Castro (1642–44) and won a victory at Mongiovino, near Perugia, in 1643, he received no advantage under the treaty of peace.

Deeply religious and austere, Ferdinand II was blamed for his acquiesence to the Holy Office's treatment of his teacher and protégé Galileo (1633); but he continued to take an interest in science, encouraging his brother Leopoldo, the future cardinal, in the foundation of the Accademia del Cimento in Florence (1657) and offering hospitality to scientists of all nations.

• **Ferdinand III** (b. May 6, 1769, Florence—d. June 18, 1824, Florence), grand duke of Tuscany whose moderate, enlightened rule distinguished him from other Italian princes of his time.

He became grand duke on July 21, 1790, when his father, Leopold II, succeeded as Holy Roman emperor. He continued the liberal reforms of his father and sought to maintain a neutral position toward the French Revolution. After he had established diplomatic relations with the French Republic (1793), however, he was constrained by England to join the coalition against France. Chased from his lands by the French in 1799, he took a command in the Austrian Army and soon returned to Florence. By the Treaty of Lunéville (Feb. 9, 1801), however, the French gained Tuscany; and, as compensation, he received the principality of Salzburg, with the title of elector. He later exchanged this principality for the duchy of Würzburg (Dec. 26, 1805) and joined the Confederation of the Rhine in 1806.

With the defeat of Napoleon, Ferdinand recovered Tuscany (1814) but shunned the reactionary violence associated with the restoration of princely power in Italy. Instead, he concentrated on the economic, social, and cultural redevelopment of his country. Having won the confidence of his people, he succeeded in maintaining a degree of independence from Austria.

Two Sicilies

• **Ferdinand I** (b. Jan. 2/12, 1751, Naples—d. Jan. 4, 1825, Naples), king of the Two Sicilies (1816–25) who earlier (1759–1806), as Ferdinand IV of Naples, led his kingdom in its fight against the French Revolution and its liberal ideas. A relatively weak and somewhat inept ruler, he was greatly influenced by his wife, Maria Carolina of Austria, who furthered the policy of her favourite adviser, the Englishman Sir John Acton.

Ferdinand became king of Naples as a boy when his father ascended the Spanish throne (1759) as Charles III. A regency ruled during Ferdinand's minority and continued the liberal reforms of the previous king. In 1767 Ferdinand reached his majority, and his marriage in 1768 to Maria Carolina signalled a reversal of this policy. The birth of a male heir gave Maria Carolina the right, according to the marriage contract, to enter the council of state (1777). She brought about the downfall of the former regent Bernardo Tanucci and engaged Naples in the Austro-English coalition against the French Revolution in 1793.

Ferdinand, encouraged by the arrival of the British fleet of Admiral Horatio Nelson, attacked the French-supported Roman republic in 1798. On December 21 of that year, however, the French invaded Naples, declaring it the Parthenopean Republic, and Ferdinand fled to Sicily. The Republic was overthrown in June 1799, and Ferdinand returned to Naples, where he put to death the Republic's supporters, violating the terms of their surrender.

In 1806 Napoleon's army captured Naples, forcing Ferdinand's flight to Sicily, where, yielding to British pressure to mitigate his absolutist rule, he removed Maria Carolina from the court, appointed his son Francis as regent, and granted the Sicilians a constitution. With the fall of Napoleon, he returned to Naples as Ferdinand I of the united kingdom of the Two Sicilies (December 1816). His renewal of absolute rule led to the constitutionalist uprising of 1820, which forced Ferdinand to grant a constitution. Having ceded power again to his son Francis, Ferdinand, under the pretext of protecting the new constitution, obtained his parliament's permission to attend the Congress of Laibach early in 1821. Once there, he won the aid of Austria, which overthrew Naples' constitutional government in March. The subsequent reprisals against the constitutionalists were his last important official acts before his sudden death.

• **Ferdinand II** (b. Jan. 12, 1810, Palermo—d. May 22, 1859, Caserta), king of the Two Sicilies from 1830. He was the son of the future King Francis I and the Spanish infanta María Isabel, a member of the branch of the House of Bourbon that had ruled Naples and Sicily from 1734.

Ferdinand II's initial actions on ascending the throne on Nov. 8, 1830, raised the hopes of the liberals in the kingdom. He granted amnesty to political prisoners, reinstated army officers suspected of republicanism, and showed himself eager to provide good government and to institute reforms. But he gradually came to adopt an authoritarian policy. He severely repressed a number of liberal and national revolts (including that of the Bandiera brothers in 1844). Even his marriage to an Austrian, the Archduchess Theresa, in 1837 (after the death of his first wife, the Piedmontese Maria Cristina), was taken as a sign of his growing conservatism.

A successful revolution at Palermo on Jan. 12, 1848, and subsequent agitation among Neapolitan liberals forced Ferdinand to grant a constitution on January 29. After his army defeated a group of Neapolitan rebels on May 15, 1848, Ferdinand regained his confidence. He ignored the constitution, recalled troops sent by his liberal ministers to help expel the Austrians from northern Italy, and regained control of Sicily. The heavy bombardment of Sicilian cities in this campaign gained him the name of "King Bomba," while his harsh treatment of the participants in the revolts earned him the dislike of many Europeans, notably of the future British prime minister William Ewart Gladstone, who denounced Ferdinand's regime as "the negation of God erected into a system of government."

During the final years of his life, Ferdinand became more and more isolated from his people and fearful of conspiracies against his life. The increasingly absolute character of his government denied the Kingdom of the Two Sicilies a role in the Risorgimento (movement for Italian unification) and contributed directly to the easy collapse of the kingdom and its incorporation into Italy in 1860, only shortly after Ferdinand's death.

Ferdinand, SAINT: *see* Ferdinand III *under* Ferdinand (Spain: Castile and Leon).

Ferdinand THE BENIGN: *see* Ferdinand (I) *under* Ferdinand (Austria).

Ferdinand THE CATHOLIC: *see* Ferdinand II *under* Ferdinand (Aragon).

Ferdinand THE DESIRED: *see* Ferdinand VII *under* Ferdinand (Spain).

Ferdinand THE FICKLE: *see* Ferdinand I *under* Ferdinand (Portugal).

Ferdinand THE GREAT: *see* Ferdinand I *under* Ferdinand (Spain: Castile and Leon).

Ferdinand THE HANDSOME: *see* Ferdinand I *under* Ferdinand (Portugal).

Ferdinand Maria (b. Oct. 31, 1636, Munich—d. May 26, 1679, Schleissheim, Bavaria), elector of Bavaria (1651–79), son of Maximilian I. A minor when he succeeded, he did much to repair the wounds caused by the Thirty Years' War, encouraging agriculture and industries, and building or restoring numerous churches and monasteries. In 1669, moreover, he again called a meeting of the imperial diet, which had been suspended since 1612.

Ferdinand Maximilian Joseph (emperor of Mexico): *see* Maximilian.

Ferdinando (Italian personal name): *see under* Ferdinand.

Ferdowsī, also spelled FIRDAWSĪ, FIRDUSI, or FIRDOUSI, pseudonym of ABŪ OL-QASEM MANṢŪR (b. *c.* 935, near Ṭūs, Iran—d. *c.* 1020–26, Ṭūs), Persian poet, author of the *Shāh-nāmeh* ("Book of Kings"), the Persian national epic, to which he gave its final and enduring form, although he based his poem mainly on an earlier prose version.

Ferdowsī was born in a village on the out-

skirts of the ancient city of Ṭūs. In the course of the centuries many legends have been woven around the poet's name but very little is known about the real facts of his life. The only reliable source is given by Neẓāmī-ye ʿArūẓī, a 12th-century poet who visited Ferdowsī's tomb in 1116 or 1117 and collected the traditions that were current in his birthplace less than a century after his death.

According to Neẓāmī, Ferdowsī was a *dehqān* ("landowner"), deriving a comfortable income from his estates. He had only one child, a daughter, and it was to provide her with a dowry that he set his hand to the task that was to occupy him for 35 years. The *Shāh-nāmeh* of Ferdowsī, a poem of nearly 60,000 couplets, is based mainly on a prose work of the same name compiled in the poet's early manhood in his native Ṭūs. This prose *Shāh-nāmeh* was in turn and for the most part the translation of a Pahlavi (Middle Persian) work, the *Khvatāy-nāmak,* a history of the kings of Persia from mythical times down to the reign of Khosrow II (590–628), but it also contained additional material continuing the story to the overthrow of the Sāsānians by the Arabs in the middle of the 7th century. The first to undertake the versification of this chronicle of pre-Islāmic and legendary Persia was Daqīqī, a poet at the court of the Sāmānids, who came to a violent end after completing only 1,000 verses. These verses, which deal with the rise of the prophet Zoroaster, were afterward incorporated by Ferdowsī, with due acknowledgements, in his own poem.

The *Shāh-nāmeh,* finally completed in 1010, was presented to the celebrated sultan Maḥmūd of Ghazna, who by that time had made himself master of Ferdowsī's homeland, Khūrāsān. Information on the relations between poet and patron is largely legendary. According to Neẓāmī-ye ʿArūẓī, Ferdowsī came to Ghazna in person and through the good offices of the minister Aḥmad ebn Ḥasan Meymandī was able to secure the Sultan's acceptance of the poem. Unfortunately, Maḥmūd then consulted certain enemies of the minister as to the poet's reward. They suggested that Ferdowsī should be given 50,000 dirhams, and even this, they said, was too much, in view of his heretical Shīʿīte tenets. Maḥmūd, a bigoted Sunnite, was influenced by their words, and in the end Ferdowsī received only 20,000 dirhams. Bitterly disappointed, he went to the bath and, on coming out, bought a draft of *foqāʿ* (a kind of beer) and divided the whole of the money between the bath attendant and the seller of *foqāʿ*.

Ferdowsī (lower left corner) with three poets in a garden, miniature from a Persian manuscript, 17th century; in the British Library

By courtesy of the trustees of the British Library

Fearing the Sultan's wrath, he fled first to Herāt, where he was in hiding for six months, and then, by way of his native Ṭūs, to Mazanderan, where he found refuge at the court of the Sepahbād Shahreyār, whose family claimed descent from the last of the Sāsānians. There Ferdowsī composed a satire of 100 verses on Sultan Maḥmūd that he inserted in the preface of the *Shāh-nāmeh* and read it to Shahreyār, at the same time offering to dedicate the poem to him, as a descendant of the ancient kings of Persia, instead of to Maḥmūd. Shahreyār, however, persuaded him to leave the dedication to Maḥmūd, bought the satire from him for 1,000 dirhams a verse, and had it expunged from the poem. The whole text of this satire, bearing every mark of authenticity, has survived to the present.

It was long supposed that in his old age the poet had spent some time in western Persia or even in Baghdad under the protection of the Būyids, but this assumption was based upon his presumed authorship of *Yūsof o-Zalīkhā,* an epic poem on the subject of Joseph and Potiphar's wife, which, it later became known, was composed more than 100 years after Ferdowsī's death. According to the narrative of Neẓāmī-ye ʿArūẓī, Ferdowsī died inopportunely just as Sultan Maḥmūd had determined to make amends for his shabby treatment of the poet by sending him 60,000 dinars' worth of indigo. Neẓāmī does not mention the date of Ferdowsī's death. The earliest date given by later authorities is 1020 and the latest 1026; it is certain that he lived to be more than 80.

The Persians regard Ferdowsī as the greatest of their poets. For nearly a thousand years they have continued to read and to listen to recitations from his masterwork, the *Shāh-nāmeh,* in which the Persian national epic found its final and enduring form. Though written about 1,000 years ago, this work is as intelligible to the average, modern Iranian as the King James version of the Bible is to a modern English-speaker. The language, based as the poem is on a Pahlavi original, is pure Persian with only the slightest admixture of Arabic. European scholars have criticized this enormous poem for what they have regarded as its monotonous metre, its constant repetitions, and its stereotyped similes; but to the Iranian it is the history of his country's glorious past, preserved for all time in sonorous and majestic verse. (J.A.Bo.)

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Ferenc (Hungarian personal name): *see under* Francis.

Ferenczi, Sándor (b. 1873, Miskolc, Hung., Austria-Hungary—d. 1933, Budapest), Hungarian psychoanalyst noted for his contributions to psychoanalytic theory and his experimentation with techniques of therapy.

After receiving his M.D. from the University of Vienna (1894), Ferenczi served as an army doctor, specializing in neurology and neuropathology and acquiring skill in hypnosis. He first met Sigmund Freud in 1908 and became a member of Freud's "inner circle," the Vienna Psychoanalytic Society. Thus began his long, close friendship and collaboration with Freud, whom he accompanied on many travels, including a journey to Clark University, Worcester, Mass. (1909). He founded the Hungarian Psychoanalytic Society in 1913 and became a professor of psychoanalysis at the University of Budapest in 1919.

Ferenczi began to diverge from classic psychoanalytic practice in the course of exploring new possibilities for improving therapeutic technique. He believed that the use of free association as a means of achieving the recollection of painful early emotional experiences could be supplemented by more active methods when obstacles to free association were encountered in therapy. He advocated abstention from sex and other pleasurable biological acts as a means of storing up libido (emotional energy) that could then be used to hasten the therapeutic process. This method proved impractical and even counterproductive, however, because of the intense hostility it aroused in dissatisfied patients.

Ferenczi advanced many of his ideas on psychotherapy in *The Development of Psychoanalysis* (1924), written in collaboration with Otto Rank. In this work, which became a centre of controversy among psychoanalysts, he also suggested that the recollection of certain traumatic memories is not essential for modifying neurotic patterns. In *Thalassa: A Theory of Genitality* (1924), he suggested that the wish to return to the womb and the comfort of its amniotic fluids symbolizes a wish to return to the origin of life, the sea.

From about 1929 Ferenczi came to a view of therapy that was the reverse of his earlier approach. His final technique favoured the creation of a loving, permissive atmosphere by the therapist to counterbalance the rejection and emotional deprivation the patient had experienced with his parents. Ferenczi's assertion that the therapist could openly express his affection for the patient and could even encourage him to act out childhood experiences was criticized by other psychoanalysts. Though Ferenczi never openly broke with Freud, there was an increasing distance between them during his later years.

Ferentino, Latin FERENTINUM, town, Frosinone *provincia,* Lazio (Latium) *regione,* central Italy. The town is situated on a hill that commands the Sacco valley and the Via Casilina (the ancient Roman road Via Latina), 46 miles (65 km) southeast of Rome. The ancient Ferentinum was the chief city of the Hernici people and passed to Rome in 361 BC. A favoured papal residence in the Middle Ages, it was in 1223 the scene of a meeting between Pope Honorius III and the emperor Frederick II.

Ferentino has considerable remains of its Roman and pre-Roman fortifications. The town is ringed by ancient walls; the bottom courses of these ramparts were built by the Hernici using cyclopean blocks of stone, upon which the Romans and then the medieval Italians built a complex superstructure of ramparts pierced by four town gates. Two of these gates, the Porta Sanguinaria and the Porta Santa Maria, are well preserved. The highest ground within the town was formerly occupied by a castle whose walls now form the foundations of the episcopal palace. Adjoining this is the ancient cathedral (rebuilt 1099–1118) which contains a 12th-century mosaic pavement made by Magister Paulus. The principal medieval monument in the lower section of the town is the fine Cistercian-type church of Santa Maria Maggiore (13th–14th century).

An agricultural centre producing wine and olive oil, Ferentino has since World War II expanded rapidly outside the walls. Pop. (1988 est.) mun., 18,762.

Fergana, *oblast* (province) eastern Uzbek Soviet Socialist Republic, with an area of 2,750 square miles (7,100 square km) in the southwestern Fergana valley. The climate is continental with hot summers and moderately

cold winters. The south is irrigated by streams descending from the Alay Mountains and by the Bolshoy (Great) Fergana and Yuzhny (Southern) Fergana canals. In the north the terrain is a combination of desert, semidesert, and marsh. Cotton cultivation and sericulture (raw silk production), with their attendant cottonseed-oil and textile industries, are important in the economy. There are cement and lime works at Kuvasay, oil fields at Chimion and Severny (Northern) Sokh, and sulphur and ozocerite mines at Shorsu. Industry is concentrated in Fergana city, the capital, in Kokand, and in the silk centre of Margilan. The population was about one-third urban in 1982. Over 90 percent of the inhabitants are Uzbek. Pop. (1983 est.) 1,858,000.

Fergana, also spelled FERGHANA, formerly (until 1910) NOVY MARGELAN, (1910–24) SKOBELEV, city and administrative centre of Fergana *oblast* (region), Uzbek Soviet Socialist Republic, at the foot of the Alay Mountains in the southern part of the Fergana Valley. It was founded by the Russians in 1877 as the military and administrative centre of the province of Fergana, formed from the newly conquered khanate of Kokand. It became part of the Turkestan A.S.S.R. in 1918 and a part of the Uzbek S.S.R in 1924. In addition to its considerable industrial development—including silk and cotton textile plants, an oil refinery, and chemical works producing fertilizers and artificial fibres—the city remains noteworthy for its wide tree-lined streets and extensive parks. In 1977 Fergana expanded its city limits to absorb the chemical and oil-refining suburb of Kirgili. There is a teacher-training institute, a theatre, and a museum. About 19 mi (30 km) north of the city is the ancient town of Margilan, still an important centre of silk production. Pop. (1983 est.) 187,000.

Fergana Valley, Russian FERGANSKAYA DOLINA, enormous depression between the Tien Shan and Gissar–Alay mountain systems, lying mainly in the eastern Uzbek Soviet Socialist Republic and partly in the Tadzhik and Kirgiz S.S.R.'s. The roughly triangular valley has an area of 8,500 sq mi (22,000 sq km). It is bordered on the northwest by the Chatkal and Kurama mountains, on the northeast by the Fergana Mountains, and on the south by the Alay and Turkistan ranges, which rise over 16,500 ft (5,000 m). In the west it is linked to the Golodnaya (Hungry) Steppe by the narrow Leninabad Gates.

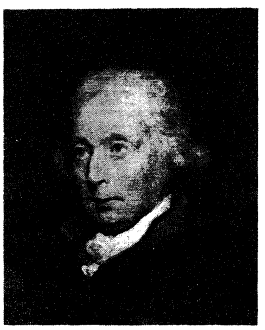
The valley was formed millions of years ago, and its floor, which slopes gently from an altitude of 3,300 ft (1,000 m) or more in the east to 1,050 ft at Leninabad, is composed of a thick bed of deposits brought down from the surrounding mountains. At the foot of the latter, and separated from them in places by a depression, is a belt of low, barren hills, called *adyr*. The numerous rivers descending from the mountains cut through the *adyr* zone to irrigate an almost unbroken chain of fertile oases, which surround the Yazyavan Steppe, an area of salt marshes and sand dunes in the lowest part of the valley. The climate is continental, with moderately cold winters and hot summers, and precipitation is low, particularly in the western part of the valley. The main river is the Syrdarya, which flows along the northern edge of the valley. Most of the other rivers are entirely used for irrigation, and there are several major irrigation canals, including the Bolshoy (Great), Yuzhny (Southern), and Severny (Northern) Fergana canals.

The Fergana Valley is one of the most densely populated areas of Central Asia and is a major producer of cotton, fruit, and raw silk. Among the mineral deposits that are exploited are coal, oil, mercury, antimony, and ozocerite. The chief cities are Leninabad, Kokand, Fergana, Margilan, Andizhan, and Namangan. Sedentary agriculture has been practiced for many centuries in the Fergana Valley, which also lay on one of the main trade routes to China. It was conquered by the Arabs in the 8th century, by Genghis Khan in the 13th, and by Timur (Tamerlane) in the 14th. The khans of Kokand ruled it from the late 18th century until it was taken by Russia in 1876.

Fergus Falls, city, seat of Otter Tail County, west central Minnesota, U.S., on Otter Tail River, in a lake area. Settled in 1857 by Joseph Whitford and named for James Fergus, financial backer of Whitford's expedition, it was laid out in 1870. Fergus Falls State Hospital was established in 1887. The city is the synodical headquarters of the Church of the Lutheran Brethren and site of a Lutheran academy and seminary. Its economy, primarily agriculturally based, includes flour mills and a large cooperative creamery. Fergus Falls Community College was opened in 1960. Maplewood State Park is nearby. Inc. village, 1872; city, 1881. Pop. (1980) 12,519.

Ferguson, Adam (b. June 20, 1723, Logierait, Perthshire, Scot.—d. Feb. 22, 1816, St. Andrews, Fife), philosopher of the Scottish "common sense" school of philosophy, historian, and patriot remembered as a forerunner of modern sociology for his emphasis on individual and social interactions.

Educated at St. Andrews University, Ferguson was appointed deputy chaplain to Scotland's Black Watch Regiment in 1745 and engaged in combat in Flanders. In 1757 he abandoned the clerical profession to succeed his friend David Hume, a Scottish Skeptic, as advocates' librarian at Edinburgh. There he became professor of natural philosophy in 1759 and of mental and moral philosophy in 1764. Before resigning his chair in 1785, he had written his major works, which include *The Morality of Stage Plays Seriously Considered* (1757); *Essay on the History of Civil Society* (1767); *Institutes of Moral Philosophy* (1769); and *Remarks* (1776), a work on Richard Price's *Observations on the nature of Civil Liberty*... (1776) in which Ferguson proposed peace terms for the North Americans fighting in the American Revolution.



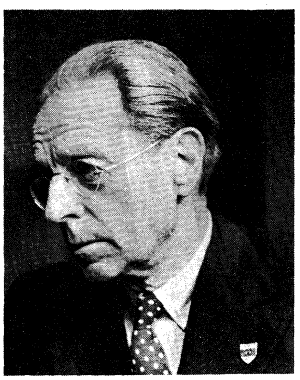
Adam Ferguson, detail of a portrait by an unknown artist; in the Scottish National Portrait Gallery, Edinburgh

By courtesy of the Scottish National Portrait Gallery, Edinburgh, Scot.

In 1774 Ferguson interrupted his professorial work for a visit to Europe to supervise the young earl of Chesterfield, and in 1778 he travelled to Philadelphia with a British commission sent to negotiate with American revolutionaries. After a few months spent in Germany and Italy in 1793, he lived in retirement at St. Andrews until his death. Sir Walter Scott composed his epitaph. Among Ferguson's other works are *The History of the Progress and Termination of the Roman Republic*, 3 vol. (1873) and *Principles of Moral and Political Science*, 2 vol. (1792). His life and work have been studied by W.C. Lehmann in *Adam Ferguson and the Beginnings of Modern Sociology* (1930).

Ferguson, Harry George (b. Nov. 4, 1884, Dromore, County Down, Ire.—d. Oct. 25, 1960, Stow-on-the-Wold, Gloucestershire, Eng.), British industrialist who designed and manufactured agricultural machines, notably the Ferguson tractor.

Ferguson began in 1900 to sell and repair automobiles and motorcycles, and in 1909 designed and built his own airplane, in which he made the first recorded flight over Ireland. During World War I he supervised the operation of farm machinery in Ireland. Impressed by the need for a dependable, low-cost tractor, in the late 1930s he perfected the Ferguson system of tractor-implement integration that utilized a hitch, the linkages and controls of which made the tractor and implement work as a single unit operated almost entirely from the driving seat.



Harry Ferguson

BBC Hulton Picture Library

In 1938 Henry Ford agreed to manufacture the Ferguson tractor in the U.S. The agreement terminated after World War II, and Ferguson began to manufacture his own equipment in Great Britain and the U.S.

Ferguson, Patrick (b. 1744, Pitfours, Aberdeenshire, Scot.—d. Oct. 7, 1780, Kings Mountain, S.C., U.S.), British soldier, marksman, and inventor of the Ferguson flintlock rifle.

He served in the British Army from the age of 14. In 1777, while he was a major at the Battle of Brandywine (Pa.), Ferguson's right arm was permanently crippled. A year later he resumed active duty but was killed in action in the Battle of Kings Mountain.

Ferguson's rifle (patented 1776), one of the earliest practical breechloaders, was considered the best military firearm used in the American Revolutionary War. His breechlock was grooved to prevent the action's being jammed with powder. The rifle could be fired six times a minute, a major advance in firepower for the time, but because of official conservatism not more than 200 of them were used in the war.

Ferguson, Robert (b. *c.* 1637, Aberdeenshire, Scot—d. 1714, London), Scottish conspirator and pamphleteer known as "the Plotter," who gave indiscriminate support to the opponents of Charles II and James II and to the Jacobites against William III.

Educated for the Presbyterian ministry, he went to England in the 1650s and received the living of Godmersham, Kent, only to be ejected in 1662. As a Protestant dissenter of known literary ability, he was later taken up by Anthony Ashley Cooper, 1st earl of Shaftesbury, and published in 1680 two notorious pamphlets purporting to demonstrate the legitimacy of James, duke of Monmouth, Charles II's illegitimate son. In the next two years he published at least six more exclusionist pamphlets and claimed the authorship of many more. He fled to The Netherlands with Shaftesbury in 1682, and he was outlawed

after the discovery of the Rye House Plot (1683).

He was one of Monmouth's right-hand men in the rising of 1685, but he enjoyed a less prominent position in William III's expedition in 1688. Whether out of resentment or simply a chronic itch for conspiracy, he now became an active Jacobite, and in his last notable work, *The History of the Revolution* (1706), he argued that this event was a Roman Catholic plot. Both sides, however, regarded him with understandable suspicion, and he died in deep poverty in London.

Ferguson, Tom R. (b. Dec. 20, 1950, Tahlequah, Okla., U.S.), American cowboy who six times consecutively (1974–79) won the all-around cowboy title of the Professional Rodeo Cowboys Association (before 1975, the Rodeo Cowboys Association), breaking Larry Mahan's record of five consecutive titles (1966–70).

When Ferguson and his older brother Larry were growing up in California, their father provided them with horses and cattle to practice rodeo events. Tom competed in rodeo at California Polytechnic State University (San Luis Obispo) and joined the professional circuit in 1972. In 1978 he became the first rodeo star to win more than $100,000 in the arena in a single year. In addition to his all-around titles, he won the title in steer wrestling in 1976–78.

The Ferguson family returned to Oklahoma in 1973, where they had a ranch near Miami. By the early 1980s Tom had become the biggest career money winner in rodeo, with nearly $700,000.

Fergusson, Robert (b. Sept 5, 1750, Edinburgh—d. Oct. 16, 1774, Edinburgh), Scottish poet, one of the leading figures of the 18th-century revival of Scots vernacular writing and the chief forerunner of Robert Burns.

Fergusson was educated at St. Andrews University and became a copying clerk in a lawyer's office in Edinburgh. In 1771 he began to contribute poems to Ruddiman's *Weekly Magazine*. Although he was noted for the vivacity of temperament reflected in his verse, from 1773 his good spirits were encroached upon by fits of depression and religious guilt, and after being severely injured in the head by a fall he became insane. He died in the Edinburgh asylum at the age of 24.

Fergusson's poems were popular from their first appearance, and a collected volume came out in 1773. He wrote in both Scots and English, but the English verse has little value. His Scots poems—racy, realistic, wittily descriptive and humorous—had a stimulating effect on Burns, whose "Holy Fair" and "The Cotter's Saturday Night" stem from Fergusson's "Leith Races" and "The Farmer's Ingle"; but vigorous poems like "The Daft Days," "Address to the Tron Kirk Bell," and the famous "Auld Reekie" prove how well Fergusson can stand as a poet in his own right.

Fergusson Island, largest of the D'Entrecasteaux Islands, 30 mi (50 km) across Ward Hunt Strait from the eastern tip of New Guinea, in the Solomon Sea, southwestern Pacific, a part of Milne Bay province of Papua New Guinea. It is separated from Goodenough Island (northwest) by Moresby Strait and from Normanby Island (southeast) by Dawson Strait. The volcanic island, measuring 40 mi by 30 mi, has a total land area of 518 sq mi (1,342 sq km). Rising to 5,000 ft (1,525 m) at Mt. Euagwaba, it is drained by numerous short streams, some of which offer potential for hydroelectric power. Although the central peak is extinct, there are signs of its former activity, including geysers and fumaroles. Seymour Bay is located on the west coast, Sebutuia Bay on the east, and Hughes Bay on the north. The principal settlements, Salamo and Mapamoiwa, are on the southern coast. Pop. (1980 prelim.) 14,587.

Feriae Latinae, in Roman religion, the Festival of Jupiter Latiaris (Latialis), held in the spring and fall each year on Mons Albanus (Monte Cavo, in the Alban Hills near Rome). Apparently antedating the foundation of Rome, it eventually was observed by all 47 members of the Latin League.

The ceremony was the initial responsibility of each newly chosen pair of Roman consuls, who offered milk as a libation; the other cities sent cheese and sheep. A white heifer that had never been yoked was then sacrificed. Its flesh was consumed by the delegates of all the league communities on behalf of their constituents.

Ferkéssédougou, town, administrative headquarters (since 1969) of Ferkéssédougou *département*, northern Ivory Coast, on the road and railroad from Ouagadougou (Burkina Faso [formerly Upper Volta]) to Abidjan. A trade centre (rice, millet, corn [maize], yams, and cotton) among the Senufo (Senoufo) and Diula (Dioula) farmers of the savanna, it is the site of a government agricultural research station and a rice factory. A major sugar factory was established there in 1974. The town is an important railroad centre. The Muslim Diula people, whose chief mosque in town is built in the Sudanese style, raise cattle and other livestock. Ferkéssédougou has a hospital, a vocational school (1963), a meteorological station, and a Roman Catholic church. Pop. (1975) town, 25,307; *département*, 91,516.

Ferlinghetti, Lawrence (b. March 24, 1920, Yonkers, N.Y., U.S.), most politically committed of the U.S. poets who founded the Beat movement (*q.v.*) in San Francisco in the mid-1950s. His City Lights bookstore was an early gathering place of the Beats; and the publishing arm of City Lights was the first to print the Beats' books of poetry.

His father died shortly before he was born, his mother was placed in a mental hospital, and a woman relative took him to France, where he spent most of his childhood. Later, they lived on a Long Island, N.Y., estate on which she was employed as a governess. He was a U.S. naval officer during World War II, received a B.A. at the University of North Carolina, an M.A. at Columbia University, and a doctorate at the Sorbonne in 1951.

Ferlinghetti sometimes composed poetry on tape, and most of it was designed to be read aloud. It was popular in coffee houses and campus auditoriums and struck a responsive chord in disaffected youth. *Pictures of the Gone World* (1955) and *A Coney Island of the Mind* (1958), with its notable verse "Autobiography," were highly popular, as was the long poem, *Tentative Description of a Dinner Given to Promote the Impeachment of President Eisenhower* (1958). His later poems continued to be politically oriented, as such titles as *One Thousand Fearful Words for Fidel Castro* (1961), *Where Is Vietnam* (1965), *Tyrannus Nix?* (1969), and *Who Are We Now?* (1976) suggest. Selected poems were printed in *Endless Love* (1981), and *Literary San Francisco* (1980), with Nancy J. Peters, provides a pictorial history.

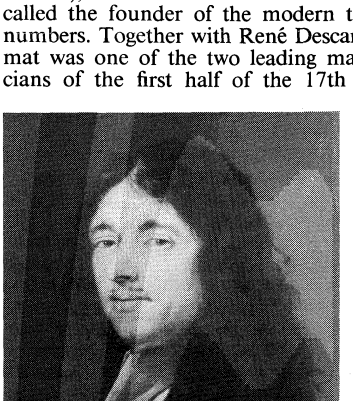
Ferlo, relic river valley and region of interior northern Senegal, West Africa. It lies south of the fertile valley of the Sénégal River and east of the peanut (groundnut) basin of the Western Plains. Ferlo is a dry, featureless expanse of savanna. Its inhabitants are the Fulani people, who cultivate peanuts near deep wells or seasonal streams in the south and practice transhumance in the north.

Fermanagh, Irish FEAR MANACH (District of the Monks), district, extreme southwestern Northern Ireland. Formerly a county, Fermanagh was established as a district (within the same boundaries) in 1973. It is bounded by the districts of Dungannon and Omagh to the northeast, and by the Irish Republic to the west, south, and east. It has an area (including water) of 715 sq mi (1,851 sq km). The district lies chiefly in the ruggedly scenic Erne Basin, which divides it into two nearly equal sections. The surface is hilly, rising to 2,192 ft (668 m) on the southern frontier at Cuilcagh. Upper and Lower Lough (lake) Erne stretch from southeast to northwest, being expansions of the River Erne, which enters the district from County Cavan, Irish Republic. Gneiss in the west and metamorphic rock from the Omagh district extend into northern Fermanagh, but limestone is the predominant formation.

Evidence of prehistoric settlement is indicated by the megaliths and cairns scattered throughout the district. Early Celtic Christian antiquities abound, particularly on the islands in the loughs. Devenish Island, in Lower Lough Erne, is the site of an ancient monastery that has a round tower 81 ft high and a standing cross. During the reign of James I (1603–25), king of Great Britain and Ireland, many English Anglicans were settled here as part of the Plantation of Ulster scheme. At Newtownbutler (now near the Irish Republic's border), in 1689, Enniskillen Protestants defeated the Roman Catholic army of James II and began the victorious tradition of the Inniskillings, now represented by two famous regiments in the British Army.

Fermanagh, well-known for its antiquities, extensive forests, fishing streams, and numerous limestone caves, is one of the most important tourist areas in Northern Ireland. Much of the local population either works in service industries or raises beef and dairy cattle. Knitwear is manufactured at Enniskillen, the administrative seat of Fermanagh district, and at Lisnaskea. The village of Belleek, at the Irish Republic border to the west, has long been associated with locally crafted porcelain. Formerly made from locally quarried feldspar, the industry now depends on clay imports from Cornwall in England and Norway. Agreement between the government of the Irish Republic and that of Northern Ireland led to the development, in the mid-1950s, of the hydroelectric capacity of the Erne. A large power station below Beleek generates electricity for the Irish Republic and aids flood control and drainage in Northern Ireland. Pop. (1981) 51,558.

Fermat, Pierre de (b. Aug. 17, 1601, Beaumont-de-Lomagne, Fr.—d. Jan. 12, 1665, Castres), French mathematician who is often called the founder of the modern theory of numbers. Together with René Descartes, Fermat was one of the two leading mathematicians of the first half of the 17th century.



Fermat, portrait by Roland Lefèvre; in the Musées de la Ville de Narbonne, France

By courtesy of the Musees de la Ville de Narbonne, France

Independently of Descartes, Fermat discovered the fundamental principle of analytic geometry. For his methods for finding tangents to curves and their maximum and minimum points, he has been regarded as the inventor of the differential calculus. Through his correspondence with Blaise Pascal he was a co-founder of the theory of probability.

Life and early work. Little is known of Fermat's early life and education; of Basque origin, he received his primary education in a local Franciscan school. He studied law, probably at Toulouse and perhaps also at Bordeaux. Having developed tastes for foreign languages, classical literature, and ancient science and mathematics, Fermat followed the custom of his day in composing conjectural "restorations" of lost works of antiquity. By 1629 he had begun a reconstruction of the long-lost *Plane Loci* of Apollonius, the Greek geometer of the 3rd century BC. He soon found that the study of loci, or sets of points with certain characteristics, could be facilitated by the application of algebra to geometry through a coordinate system. Meanwhile, Descartes had observed the same basic principle of analytic geometry, that equations in two variable quantities define plane curves. Because Fermat's *Introduction to Loci* was published posthumously in 1679, the exploitation of their discovery, initiated in Descartes's *Géométrie* of 1637, has since been known as Cartesian geometry.

In 1631 Fermat received the baccalaureate in law from the University of Orléans. He served in the local parliament at Toulouse, becoming councillor in 1634. Sometime before 1638 he became known as Pierre de Fermat; there is uncertainty as to the authority for this designation. In 1638 he was named to the Criminal Court.

Analyses of curves. Fermat's study of curves and equations prompted him to generalize the equation for the ordinary parabola $ay = x^2$, and that for the rectangular hyperbola $xy = a^2$, to the form $a^{n-1}y = x^n$. The curves determined by this equation are known as the parabolas or hyperbolas of Fermat according as n is positive or negative. He similarly generalized the Archimedean spiral $r = a\theta$. These curves in turn directed him in the middle 1630s to an algorithm, or rule of mathematical procedure, that was equivalent to differentiation. This procedure enabled him to find equations of tangents to curves and to locate maximum, minimum, and inflection points of polynomial curves, which are graphs of linear combinations of powers of the independent variable. During the same years he found formulas for areas bounded by these curves through a summation process that is equivalent to the formula now used for the same purpose in the integral calculus. Such a formula is:

$$A = \int_0^a x^n dx = a^{n+1}/(n+1).$$

It is not known whether or not Fermat noticed that differentiation of x^n, leading to na^{n-1}, is the inverse of integrating x^n. Through ingenious transformations he handled problems involving more general algebraic curves, and he applied his analysis of infinitesimal quantities to a variety of other problems, including the calculation of centres of gravity and finding the lengths of curves. Descartes in the *Géométrie* had reiterated the widely held view, stemming from Aristotle, that the precise rectification or determination of the length of algebraic curves was impossible; but Fermat was one of several mathematicians who, in the years 1657–59, disproved the dogma. In a paper entitled "De Linearum Curvarum cum Lineis Rectis Comparatione" ("Concerning the Comparison of Curved Lines with Straight Lines") he showed that the semicubical parabola and certain other algebraic curves were strictly rectifiable. He solved also the related problem of finding the surface area of a segment of a paraboloid of revolution. This paper appeared in a supplement to the *Veterum Geometria Promota,* issued by the mathematician Antoine de La Loubère in 1660. It was Fermat's only mathematical work published in his lifetime.

Disagreement with other Cartesian views. Fermat differed also with Cartesian views concerning the law of refraction (the sines of the angles of incidence and refraction of light passing through media of different densities are in a constant ratio), published by Descartes in 1637 in *La Dioptrique;* like *La Géométrie,* it was an appendix to his celebrated *Discours de la méthode.* Descartes had sought to justify the sine law through a premise that light travels more rapidly in the denser of the two media involved in the refraction. Twenty years later Fermat noted that this appeared to be in conflict with the view espoused by Aristotelians that nature always chooses the shortest path. Applying his method of maxima and minima and making the assumption that light travels less rapidly in the denser medium, Fermat showed that the law of refraction is consonant with his "principle of least time." His argument concerning the speed of light was found later to be in agreement with the wave theory of the 17th-century Dutch scientist Christiaan Huygens, and in 1849 it was verified experimentally by a French physicist, A.-H.-L. Fizeau.

Through the mathematician and theologian Marin Mersenne, who, as a friend of Descartes, often acted as an intermediary with other scholars, Fermat in 1638 maintained a controversy with Descartes on the validity of their respective methods for tangents to curves. Fermat's views were fully justified some 30 years later in the calculus of Sir Isaac Newton. Recognition of the significance of Fermat's work in analysis was tardy, in part because he adhered to the system of mathematical symbols devised by François Viète, notations that Descartes's *Géométrie* had rendered largely obsolete. The handicap imposed by the awkward notations operated less severely in Fermat's favourite field of study, the theory of numbers; but here, unfortunately, he found no correspondent to share his enthusiasm. In 1654 he had enjoyed an exchange of letters with his fellow mathematician Blaise Pascal on problems in probability concerning games of chance, the results of which were extended and published by Huygens in his *De Ratiociniis in Ludo Aleae* (1657).

Work on theory of numbers. Fermat vainly sought to persuade Pascal to join him in research in number theory. Inspired by an edition in 1621 of the *Arithmetic* of Diophantus, the Greek mathematician of the 3rd century AD, Fermat had discovered new results in the so-called higher arithmetic, many of which concerned properties of prime numbers (those positive integers that have no factors other than 1 and themselves). One of the most elegant of these had been the theorem that every prime of the form $4n + 1$ is uniquely expressible as the sum of two squares. A more important result, now known as Fermat's lesser theorem, asserts that if p is a prime number and if a is any positive integer, then $a^p - a$ is divisible by p. Fermat seldom gave demonstrations of his results, and in this case proofs were provided by Gottfried Leibniz, the 17th-century German mathematician and philosopher, and Leonhard Euler, the 18th-century Swiss mathematician. For occasional demonstrations of his theorems Fermat used a device that he called his method of "infinite descent," an inverted form of reasoning by recurrence or mathematical induction. One unproved conjecture by Fermat turned out to be false. In 1640, in letters to mathematicians and to other knowledgeable thinkers of the day, including Blaise Pascal, the French writer and scientist, he announced his belief that numbers of the form $2^{2^n} + 1$, known since as "numbers of Fermat," are necessarily prime; but a century later Euler showed that $2^{2^5} + 1$ has 641 as a factor. It is not known if there are any primes among the Fermat numbers for $n > 5$. Carl Friedrich Gauss in 1796 in Germany found an unexpected application for Fermat numbers when he showed that a regular polygon of N sides is constructible in a Euclidean sense if N is a prime Fermat number or a product of distinct Fermat primes. By far the best known of Fermat's many theorems is an unsolved problem known as his "great," or "last," theorem. This appeared in the margin of his copy of Diophantus' *Arithmetica* and states that the equation $x^n + y^n = z^n$, where x, y, z, and n are positive integers, has no solution if n is greater than 2.

Fermat was the most productive mathematician of his day. But his influence was circumscribed by his reluctance to publish. (C.B.B.)

BIBLIOGRAPHY. Much of Fermat's work, edited by his son, was published in *Opera mathematica,* 2 vol. (1679). The definitive edition, in Latin and French, is the *Oeuvres de Fermat,* ed. by Paul Tannery and Charles Henry, 5 pt. (1891–1922). A substantial and authoritative summary of Fermat's achievements is provided in Michael S. Mahoney, *The Mathematical Career of Pierre de Fermat, 1601–1665* (1973). For more specialized aspects of Fermat's work see C.B. Boyer, *History of Analytic Geometry* (1956) and *History of the Calculus and Its Conceptual Development* (1959); and Isaac Todhunter, *A History of the Mathematical Theory of Probability from the Time of Pascal to That of Laplace* (1865, reprinted 1949).

Fermat prime, prime number (one not divisible by an integer larger than 1 except itself) of the form $2^x + 1$, in which x is 2^n, n being an integer. On the basis of his knowledge that numbers of this form are prime for values of n from 1 through 4, the 17th-century French mathematician Pierre Fermat conjectured that all numbers of this form are prime. An 18th-century Swiss mathematician, Leonhard Euler, showed this conjecture to be false, for $2^{2^5} + 1$ is not a prime number; in fact it is known that these numbers are not prime for values of n from 5 through 16, placing doubt on the existence of primes of this form for higher values of n.

Consult the INDEX *first*

Fermat's last theorem, also called FERMAT'S GREAT THEOREM, the statement that there are no natural numbers x, y, and z such that $x^n + y^n = z^n$, in which n is a natural number greater than 2. About this the 17th-century mathematician Pierre Fermat wrote in 1637 in his copy of Claude-Gaspar Bachet's translation of Diophantus' *Arithmetica,* "I have discovered a truly remarkable proof but this margin is too small to contain it." Mathematicians have remained baffled by the statement, for they have not been able either to prove or to disprove it, although the statement has been proved for many specific values of n.

Fermat's principle, in optics, statement that light travelling between two points seeks a path such that the number of waves (the optical length between the points) is equal, in the first approximation, to that in neighbouring paths. Another way of stating this principle is that the path taken by a ray of light in travelling between two points requires either a minimum or maximum time. Thus, two beams of light diverging from a distant object point and converged by a lens to an image point will have identical optical path lengths. Fermat's principle was first enunciated in 1658

by Pierre de Fermat, a French mathematician. It is useful in the study of optical devices.

fermentation, originally, the foaming that occurs during the manufacture of wine and beer, a process at least 10,000 years old. That the frothing results from the evolution of carbon dioxide gas was not recognized until the 17th century. Louis Pasteur in the 19th century used the term fermentation in a narrow sense to describe the changes brought about by yeasts and other microorganisms growing in the absence of air (anaerobically); he also recognized that ethyl alcohol and carbon dioxide are not the only products of fermentation.

In the 1920s it was discovered that extracts of muscle catalyze, in the absence of air, the formation of lactate from glucose and that the same intermediate compounds formed in the fermentation of grain are produced by muscle. An important generalization thus emerged: that fermentation reactions are not peculiar to the action of yeast but also occur in many other instances of glucose utilization.

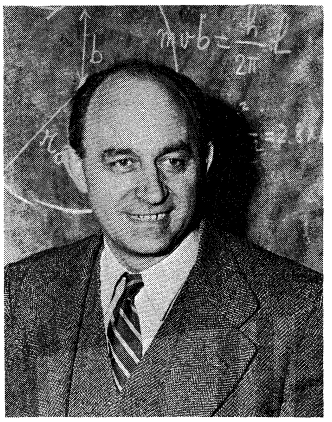
Glycolysis, which means dissolution of sugar, was originally defined around 1930 as the splitting of sugar into lactate. It can be further defined as that form of fermentation, characteristic of cells in general, in which the six-carbon sugar glucose is broken down into two molecules of the three-carbon organic acid, pyruvic acid (or its ionized form pyruvate), coupled with the transfer of chemical energy to the synthesis of adenosine triphosphate (ATP). The pyruvate may then be oxidized, in the presence of oxygen, through the tricarboxylic acid cycle, or in the absence of oxygen, be reduced to lactic acid, alcohol, or other products. The sequence from glucose to pyruvate is often called the Embden–Meyerhof pathway after two German biochemists, who, in the late 1920s and 1930s, postulated and analyzed experimentally the critical steps in that series of reactions.

The term fermentation now denotes the enzyme-catalyzed, energy-yielding pathway in cells by which fuel molecules such as glucose are broken down anaerobically. In most cells the enzymes occur in the soluble portion of the cytoplasm. The reactions leading to the formation of pyruvate thus are common to sugar transformation in muscle, yeasts, some bacteria, and plants. One product of the pathway is always the energy-rich compound adenosine triphosphate (ATP). The other product, pyruvate, can undergo various transformations, depending on the cell type and the availability of oxygen.

Industrial fermentation processes begin with suitable microorganisms and specified conditions; *e.g.,* careful adjustment of nutrient concentration. The products are of many types: alcohol, glycerol, and carbon dioxide from yeast fermentation of various sugars; butyl alcohol, acetone, lactic acid, monosodium glutamate, and acetic acid from various bacteria; citric acid, gluconic acid, and small amounts of antibiotics, vitamin B_{12}, and riboflavin (vitamin B_2) from mold fermentation.

Fermi, Enrico (b. Sept. 29, 1901, Rome—d. Nov. 28, 1954, Chicago), Italian-born U.S. physicist who was one of the chief architects of the nuclear age. He developed the mathematical statistics required to clarify a large class of subatomic phenomena, discovered neutron-induced radioactivity, and directed the first controlled nuclear chain reaction. He was awarded the 1938 Nobel Prize for Physics, and the Enrico Fermi Award of the U.S. Department of Energy is given in his honour.

Education and early career. Fermi was the youngest of the three children of Alberto Fermi, a railroad employee, and Ida de Gattis. Enrico, an energetic and imaginative student prodigy in high school, decided to become a physicist. At the age of 17 he entered the Reale Scuola Normale Superior, which is associated with the University of Pisa. There he earned his doctorate at the age of 21 with a thesis on research with X-rays.



Fermi
By courtesy of the University of Chicago

After a short visit in Rome, Fermi left for Germany with a fellowship from the Italian Ministry of Public Instruction to study at the University of Göttingen under the physicist Max Born, whose contributions to quantum mechanics were part of the knowledge prerequisite to Fermi's later work. He then returned to teach mathematics at the University of Florence.

In 1926 his paper on the behaviour of a perfect, hypothetical gas impressed the physics department of the University of Rome, which invited him to become a full professor of theoretical physics. Within a short time, Fermi brought together a new group of physicists, all of them in their early 20s. In 1926 he developed a statistical method for predicting the characteristics of electrons according to Pauli's exclusion principle, which suggests that there cannot be more than one subatomic particle that can be described in the same way. In 1928 he married Laura Capon, by whom he had two children, Nella in 1931 and Giulio in 1936. The Royal Academy of Italy recognized his work in 1929 by electing him to membership, as the youngest member in its distinguished ranks.

This theoretical work at the University of Rome was of first-rate importance, but new discoveries soon prompted Fermi to turn his attention to experimental physics. In 1932 the existence of an electrically neutral particle, called the neutron, was discovered by Sir James Chadwick at Cambridge University. In 1934 Frédéric and Irène Joliot-Curie in France were the first to produce artificial radioactivity by bombarding elements with alpha particles, which are emitted as positively charged helium nuclei from polonium. Impressed by this work, Fermi conceived the idea of inducing artificial radioactivity by another method: using neutrons obtained from radioactive beryllium but reducing their speed by passing them through paraffin, he found the slow neutrons were especially effective in producing emission of radioactive particles. He successfully used this method on a series of elements. When he used uranium of atomic weight 92 as the target of slow-neutron bombardment, however, he obtained puzzling radioactive substances that could not be identified.

Fermi's colleagues were inclined to believe that he had actually made a new, "transuranic" element of atomic number 93; that is, during bombardment, the nucleus of uranium had captured a neutron, thus increasing its atomic weight. Fermi did not make this claim, for he was not certain what had occurred; indeed, he was unaware that he was on the edge of a world-shaking discovery. As he modestly observed years later, "We did not have enough imagination to think that a different process of disintegration might occur in uranium than in any other element. Moreover, we did not know enough chemistry to separate the products from one another." One of his assistants commented that "God, for His own inscrutable ends, made everyone blind to the phenomenon of atomic fission."

Late in 1938 Fermi was named a Nobel laureate in physics "for his identification of new radioactive elements produced by neutron bombardment and for his discovery of nuclear reaction effected by slow neutrons." He was given permission by the Fascist government of Mussolini to travel to Sweden to receive the award. As they had already secretly planned, Fermi and his wife and family left Italy, never to return, for they had no respect for Fascism.

Meanwhile, in 1938, three German scientists had repeated some of Fermi's early experiments. After bombarding uranium with slow neutrons, Otto Hahn, Lise Meitner, and Fritz Strassmann made a careful chemical analysis of the products formed. On Jan. 6, 1939, they reported that the uranium atom had been split into several parts. Meitner, a mathematical physicist, slipped secretly out of Germany to Stockholm, where, together with her nephew, Otto Frisch, she explained this new phenomenon as a splitting of the nucleus of the uranium atom into barium, krypton, and smaller amounts of other disintegration products. They sent a letter to the science journal *Nature,* which printed their report on Jan. 16, 1939.

Meitner realized that this nuclear fission was accompanied by the release of stupendous amounts of energy by the conversion of some of the mass of uranium into energy in accordance with Einstein's mass–energy equation, that energy (E) is equal to the product of mass (m) times the speed of light squared (c^2), commonly written $E = mc^2$.

Work in the United States. Fermi, apprised of this development soon after arriving in New York, saw its implications and rushed to greet Niels Bohr on his arrival in New York City. The Hahn–Meitner–Strassmann experiment was repeated at Columbia University, where, with further reflection, Bohr suggested the possibility of a nuclear chain reaction. It was agreed that the uranium-235 isotope, differing in atomic weight from other forms of uranium, would be the most effective atom for such a chain reaction.

Fermi, Leo Szilard, and Eugene Wigner saw the perils to world peace if Hitler's scientists should apply the principle of the nuclear chain reaction to the production of an atomic bomb. They composed a letter, which was signed by Einstein, who, on Oct. 11, 1939, delivered it to Pres. Franklin D. Roosevelt, alerting him to this danger. Roosevelt acted on their warning, and ultimately the Manhattan Project for the production of the first atomic bomb was organized in 1942. Fermi was assigned the task of producing a controlled, self-sustaining nuclear chain reaction. He designed the necessary apparatus, which he called an atomic pile, and on Dec. 2, 1942, led the team of scientists who, in a laboratory established in the squash court in the basement of Stagg Field at the University of Chicago, achieved the first self-sustaining chain reaction. The testing of the first nuclear device, at Alamogordo Air Base in New Mexico on July 16, 1945, was followed by the dropping of atomic bombs on Hiroshima and Nagasaki a few weeks later.

Having satisfied the residence requirements, the Fermis had become American citizens in 1944. In 1946 he became Distinguished-Service Professor for Nuclear Studies at the University of Chicago and also received the Congressional Medal of Merit. At the Metallurgical Laboratory of the University of Chicago, Fermi continued his studies of the basic properties of nuclear particles, with par-

ticular emphasis on mesons, which are the quantized form of the force that holds the nucleus together. He also was a consultant in the construction of the synchrocyclotron, a large particle accelerator at the University of Chicago. In 1950 he was elected a foreign member of the Royal Society of London.

Fermi made highly original contributions to theoretical physics, particularly to the mathematics of subatomic particles. Moreover, his experimental work in neutron-induced radioactivity led to the first successful demonstration of atomic fission, the basic principle of both nuclear power and the atomic bomb. The atomic pile in 1942 at the University of Chicago released for the first time a controlled flow of energy from a source other than the Sun; it was the forerunner of the modern nuclear reactor, which releases the basic binding energy of matter for peaceful purposes. Element number 100 was named after him, and the Enrico Fermi Award was established in his honour. He was the first recipient of this award of $25,000 in 1954. (Be.J.)

BIBLIOGRAPHY. Laura Fermi, *Atoms in the Family* (1954, reprinted 1987), is a biography written by Enrico's wife; Emilio Segrè, *Enrico Fermi: Physicist* (1970), is a biography by his earliest and closest collaborator; and Pierre de Latil, *Enrico Fermi: The Man and His Theories* (1966), presents a brief survey.

Fermi-Dirac statistics, in quantum mechanics, one of two possible ways in which a system of indistinguishable particles can be distributed among a set of energy states: each of the available discrete states can be occupied by only one particle. This exclusiveness accounts for the electron structure of atoms, in which electrons remain in separate states rather than collapsing into a common state, and for some aspects of electrical conductivity. The theory of this statistical behaviour was developed (1926–27) by the physicists Enrico Fermi and P.A.M. Dirac, who recognized that a collection of identical and indistinguishable particles can be distributed in this way among a series of discrete (quantized) states.

In contrast to the Bose-Einstein statistics (*q.v.*), the Fermi-Dirac statistics applies only to those types of particles that obey the restriction known as the Pauli exclusion principle (*q.v.*). Such particles are named fermions, after the statistics that correctly describes their behaviour. Fermi-Dirac statistics applies, for example, to electrons, protons, and neutrons.

Fermi level, a measure of the energy of the least tightly held electrons within a solid, named after Enrico Fermi, the physicist who first proposed it. The value of the Fermi level at absolute zero is called the Fermi energy and is a constant for each solid. The Fermi level changes as the solid is warmed and as electrons are added to or withdrawn from the solid. Each of the many distinct energies with which an electron can be held within a solid is called an energy level. According to the laws of quantum mechanics, each energy level can accommodate only a limited number of electrons. The Fermi level is any energy level having the probability that it is exactly half filled with electrons. Levels of lower energy than the Fermi level tend to be entirely filled with electrons, whereas energy levels higher than the Fermi tend to be empty.

When materials with different individual Fermi levels are placed in contact, some electrons flow from the material with the higher Fermi level into the other material. This transfer of electrons raises the lower Fermi level and lowers the higher Fermi level. When the transfer is complete, the Fermi levels of the two materials are equal.

Fermi surface, in solid-state physics, abstract boundary or interface useful for characterizing and predicting the thermal, electrical, magnetic, and optical properties of metals, semimetals, and semiconductors. It is closely related to lattice periodicity, the underlying feature of all crystalline solids, and to the occupation of electron energy bands in such materials.

According to the band theory, every electron possesses some level of energy that places it in a valence band or a conduction band. The electrons in any given band may be thought of as occupying a volume in momentum-space, a conception that physicists believe provides the most suitable characterization of electron energy levels since the energies are related to momentum in the classical manner. Physicists, however, have found it convenient to use a modification of momentum called the wave vector k. For such simple metals as sodium and lithium, the volume of occupied states in k space is a sphere, known as the Fermi sphere. The Fermi sphere has a surface of constant energy—the Fermi surface. At absolute zero (−273.15° C), the Fermi surface separates the occupied electron states in k space from the empty states outside the Fermi sphere. Many of the more complex metals, however, do not have an occupied group of levels in k space. Correspondingly, the Fermi surfaces of such metals often have bumps and depressions of rather large magnitude, though these deviations from the spherical configuration must have the same basic symmetry as the appropriate crystal. In effect, the particular shape of the Fermi surface in a metal reflects the electronic structure of the metal. Moreover, the changes of energy of electrons at or near the Fermi surface greatly affect the metal's ability to conduct electricity, its magnetic effects, and certain other properties.

fermion, any member of a group of subatomic particles having odd half-integral angular momentum (spin $1/2$, $3/2$), named after the Fermi-Dirac statistics that describes its behaviour. Fermions include particles in the class of leptons (*e.g.,* electrons, muons), baryons (*e.g.,* neutrons, protons, lambda particles), and nuclei of odd mass number (*e.g.,* tritium, helium-3, uranium-233).

Fermions obey the Pauli exclusion principle, which forbids more than one particle of this type from occupying a single quantum state. This condition underlies, for example, the buildup of electrons within an atom in successive orbitals around the nucleus and thereby prevents matter from collapsing to an extremely dense state. Fermions are produced and undergo annihilation in particle-antiparticle pairs. *See also* boson.

fermium (Fm), synthetic chemical element of the actinide series in Group IIIb of the periodic table, atomic number 100. Fermium (as the isotope fermium-255) is produced by the intense neutron irradiation of uranium-238 and was first positively identified by Albert Ghiorso and coworkers at Berkeley, Calif., in debris taken from the first thermonuclear or hydrogen-bomb test explosion (November 1952), in the South Pacific. All fermium isotopes are radioactive. Mixtures of the isotopes fermium-254 (3.24-hour half-life), fermium-255 (20.1-hour half-life), fermium-256 (2.7-hour half-life), and fermium-257 (80-day half-life) can be produced by the intensive slow-neutron irradiation of elements of lower atomic number, such as plutonium.

The stability of the isotope fermium-257 makes it possible to work with weighable amounts of fermium. Fermium-250 (30-minute half-life), the alpha decay product of nobelium, served to ascertain the existence of nobelium-254. Fermium exists predominantly in the +3 oxidation state; there is also some evidence for the +2 state.

atomic number	100
stablest isotope	257
valence	2,3
electronic config.	2-8-18-32-30-8-2 or $(Rn)5f^{12}7s^2$

Fermo, Latin FIRMUM, town and archiepiscopal see, Ascoli Piceno *provincia,* Marche *regione,* Italy. It is situated on a hill overlooking the Tenna River, near the Adriatic Sea. An ancient stronghold (Firmum Picenum) of the Picenes (early inhabitants of the coast), it was taken by the Romans in 264 BC and became a colony with full rights in 42 BC. Conquered successively by the Goths, Byzantines (553–570), Lombards, and Franks, it passed in the 8th century to the papacy. As the centre of the duchy and later the march (frontier borderland) of Fermo, it was the capital of a large territory from the 9th century until it was merged with the march of Ancona in the 12th. In 1549 it passed once more under the direct rule of the papacy, to which it remained subject until it became part of Italy in 1860. The esplanade on the hill summit, Il Girone, marks the site of a Sforza castle destroyed in 1446. At one end of the esplanade stands the cathedral (1227; rebuilt 1789), on the site of an early Christian church (with a 5th-century mosaic pavement), which, in turn, had replaced a pagan temple. Other remains include a Roman theatre, Roman aqueduct settling tanks, and short stretches of wall, pre-Roman and Roman.

Fermo is the centre of a prosperous agricultural district, the Fermana. The town has a celebrated bronze foundry, noted for its bells, and manufactures cotton textiles. Pop. (1989 est.) mun., 35,223.

fern, any of several nonflowering vascular plants that possess true roots, stems, and complex leaves and reproduce by spores.

A brief treatment of ferns follows. For full treatment, *see* MACROPAEDIA: Ferns and Other Lower Vascular Plants.

Though ferns were once classed with the primitive horsetails and club mosses, botanists have since made a clear distinction between the scalelike, one-veined leaves of these lower plants and the more complexly veined fronds of the ferns, which are more closely related to the leaves of the higher, seed-bearing vascular plants.

There are approximately 10,000–12,000 known species of ferns, and the variety of size and shape is great. Many are small, fragile plants, like those in the family Ophioglossaceae, that produce a single frond each year, or like the filmy ferns (Hymenophyliaceae), which have fronds only one or two cells thick. The genus *Cyathea,* on the other hand, gives rise to a treelike form possessing a trunk up to 80 feet (24 m) tall that is capped by a luxuriant crown of fronds.

Ferns were a prominent form of plant life during the Carboniferous period (360 to 286 million years ago). They so dominated the first 25 million years of the Carboniferous that scientists sometimes call it "the Age of Ferns." The remains of these massive fern forests have contributed to the formation of the Earth's coal beds.

The life cycle of the fern is divided into two morphologically distinct phases, the sporophyte and the gametophyte. The sporophyte generation is the mature, fronded form familiar in greenhouses and gardens, while the gametophyte bears a strong superficial resemblance to a moss or liverwort.

The gametophyte generation begins with the germination of a spore, a single microscopic cell produced by a mature sporophyte. Spores are generally scattered widely by the wind. They can survive long periods of dryness, but, once the proper warm, moist, and shaded conditions arise, they germinate to produce a small heart- or ribbon-shaped structure a fraction of an inch in width. This gametophyte is haploid; that is, it possesses a single set of chromosomes.

The typical green gametophyte uses chlorophyll to manufacture its own food. Lying flat on the earth, it penetrates the soil with hairlike cells called rhizoids in order to absorb water and minerals. The underside of the gametophyte then produces the same microscopic reproductive structures found in mosses and liverworts, the antheridia (sperm producers) and the archegonia (egg producers).

The antheridia produce unicellular, flagellated sperms that are released in the presence of water (the capillary water of moist soil is sufficient). These sperms then try to enter the narrow cylinder of the archegonium to combine with the egg embedded in the tissues of the gametophyte. The union of the haploid egg and haploid sperm produces a diploid cell, that is, a cell with two sets of chromosomes. This begins the sporophyte generation.

As the fertilized egg grows, the gametophyte shrivels and dies. The first cellular differentiation occurs when the sporophyte develops an absorbing organ, the foot, to draw moisture and minerals from the soil. Two growth axes soon appear, one that eventually develops into the main root and another that pushes upward to form the first leaf. Successively larger and more complicated leaves grow from the base of this first leaf, and their adjacent bases ultimately form the stem. Once the stem is established, new fronds appear as tightly wound crosiers (also called fiddleheads) that slowly unfurl to produce a mature leaf.

The cuticle, a microscopic waterproof layer, covers the exposed parts of the fern in order to help the plant retain moisture. The cuticle is punctured (especially on the leaves) by many slitlike openings called stomata. Each stoma is surrounded by guard cells capable of expanding or contracting, thereby opening or closing the stoma. If a plant is well supplied with water and light, the stomata open in order to bring carbon dioxide to the food-manufacturing cells inside the plant; if moisture and light are lacking, the stomata close to prevent the drying of the fern's interior.

The spores of a mature fern are contained in cases called sporangia, which are borne on the leaves of the plant. Diploid spore mother cells line the inside of a sporangium. Each undergoes reduction division (meiosis) to produce four haploid daughter spores.

The wall of the sporangium has an annulus, a row of cells that have partially thickened walls and react to changes in humidity. When exposed to dry air, the annular cells contract, tearing open the sporangium; then they suddenly spring back into their original shape, violently discharging the spores.

In most ferns all leaves bear sporangia and are called sporophylls. In some ferns the sporophylls are specialized, usually with much-reduced vegetative tissue, and are easily distinguished from the purely vegetative leaves (trophophylls).

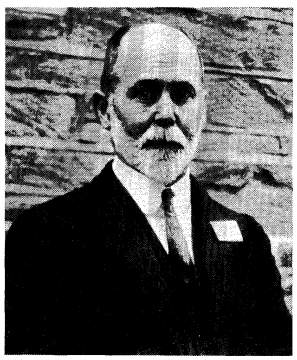
Ferns are popular as houseplants because of their attractive foliage and easy handling. In some parts of the tropics their foliage and rhizomes are eaten, and an ether extract of the rhizomes of the male fern (*Dryopteris filix-mas*) is used by veterinarians to expel parasitic worms.

Fern, Fanny: *see* Parton, Sara Payson Willis.

fern moss (genus *Thuidium*), any of several species of plants (order Bryales) that form mats in grassy areas and on soil, rocks, logs, and tree bases throughout the Northern Hemisphere. Fewer than 10 species are native to North America. A fern moss has fernlike branches and curved, cylindrical spore cases that mature in late summer or autumn.

Fernald, Merritt Lyndon (b. Oct. 5, 1873, Orono, Maine, U.S.—d. Sept. 22, 1950, Cambridge, Mass.), American botanist noted for his comprehensive study of the flora of the northeastern United States.

The publication of Fernald's first paper, at age 17, brought him to the attention of Sereno Watson, then head of the Gray Herbarium



Fernald

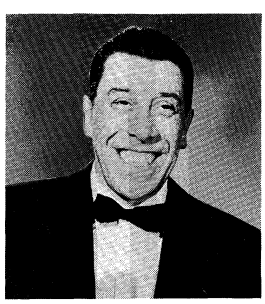
By courtesy of the Harshberger Collection, University of Pennsylvania, and the Hunt Institute, Pittsburgh

at Cambridge, Mass. Watson invited Fernald to work as a helper in the herbarium while he attended the Lawrence Scientific School of Harvard University (B.S.; 1897). Fernald remained at Harvard throughout his professional career as instructor, professor, and the curator and director of the Gray Herbarium.

Fernald studied the same floral regions (northeastern United States) as did his famous predecessor, the 19th-century botanist Asa Gray, and he prepared the centennial edition of Gray's *Manual of Botany* (1950), one of the best descriptive books ever written on the flora of the United States. In 1925 Fernald made an important contribution to glacial geology by refuting the popular theory that practically all of the northeastern United States and adjacent parts of Canada had been covered by a massive sheet of ice during the Pleistocene epoch. His so-called nunatak (Eskimo word for a hill or peak rising out of a glacier) theory was enunciated in *Persistence of Plants in Unglaciated Areas of Boreal America,* one of his more than 800 publications. According to Fernald's theory, there were land areas that escaped glaciation, and they were able to support a large number of species of plants and animals.

Fernandel, pseudonym of FERNAND-JOSEPH-DÉSIRÉ CONTANDIN (b. May 8, 1903, Marseille, Fr.—d. Feb. 26, 1971, Paris), popular French comedian whose visual trademarks were comic facial contortions and a wide, toothy grin.

After a brief career in banking, Fernandel became a music-hall singer in Nice, Fr., toured in a vaudeville show, and was a pantomime comedian in Parisian music-hall revues. His appearance in *Le Blanc et le noir* (1930; "White and Black") initiated a 40-year motion-picture career that included more than 100 films, seven of which were directed by the French master of comedy drama Marcel Pagnol. Other important releases were *La Fille du puisatier* (1940; *The Well-Digger's Daughter*); *Le Petit Monde de Don Camillo* (1952; *The Little World of Don Camillo*), the first of a series of pictures about the hot-tempered priest; *Le Mouton à cinq pattes* (1954; *The Sheep Has Five Legs*); *La Vache et le prisonnier* (1959; *The Cow and I*); and *Le Voyage du père* (1966; "Father's Journey"). He was also featured in stage comedies and in serious dramatic roles. Illness forced his retirement in 1970.



Fernandel

Culver Pictures

Fernandes, Álvaro (fl. mid-15th century), Portuguese sea captain, one of Prince Henry the Navigator's explorers of West Africa.

In 1445 Fernandes' uncle, João Gonçalves Zarco, also an explorer, furnished him with a caravel on condition that he devote himself to exploration. Fernandes joined the prince's fleet bound for Arguin Island, now in Mauritania, but sailed farther to the mouth of the Sénégal River. After rounding Cape Verde, he traveled about a hundred miles farther to the "Cape of Masts," named for its numerous bare palm trees. In 1447 he returned to West Africa and reached the site of present-day Conakry, Guinea.

Fernandes, António (b. 1570, Lisbon, Port.—d. Nov. 13, 1642, Goa, India), Portuguese Jesuit, explorer, and historian.

Fernandes was probably the first European to enter Rhodesia (now Zimbabwe) when he tried to cross the African continent in search of the treasure city of Mwene Matapa. While in Abyssinia (Ethiopia) in 1602, he was sent to Goa, on the west coast of India. He arrived in that territory in 1604 and later won the confidence of the country's ruler, Prince Socinios, who came to power in 1607.

Fernandes remained in Goa, between journeys in Africa, until his death. He recounted the story of his many adventures in Abyssinia and other countries in *Voyage a Gingiro* ("Voyage to Gingiro").

Fernandes, João (fl. mid-15th century), Portuguese traveler to West Africa whose seven-month stay among the nomads of Río de Oro (later in the Spanish Sahara) supplied Prince Henry the Navigator with intelligence for advancing the Portuguese slave trade.

In 1445 Fernandes went with a Portuguese trading ship to the Río de Oro. When a Moorish trader wished to return with the ship to Portugal to investigate trade possibilities, Fernandes volunteered to remain as a hostage with his family. He was welcomed by the nomad sheepherders of the region. Taken south across the desert to visit an old patriarch, Fernandes found that the nomads obtained their slaves from Negro kings who raided other tribes. Upon his return to Portugal, he furnished Prince Henry with detailed information of the western Sahara and the trade with the Guinea Coast, from about 15° N to 15° S. As a result, the Portuguese ceased the hazardous raiding of the African coast for slaves and from 1448 made profitable slave-trading agreements with Moorish and Negro chiefs. In 1446 and 1447 Fernandes again visited Río de Oro to make trade arrangements.

Fernandes de Oliveiro, Mário António: *see* António, Mário.

Fernández, Gregorio (Spanish sculptor): *see* Hernández, Gregorio.

Fernández, Juan (b. *c.* 1536—d. *c.* 1604), navigator in the service of Spain who in 1563 sailed from Callao, Peru, to Valparaíso, Chile, in 30 days, a remarkable feat that gained him the title of *brujo,* or wizard. Probably between 1563 and 1574 he discovered the Juan Fernández Islands west of Valparaíso. Obtaining a grant from the Spanish government, he stocked the islands with goats and pigs and lived there until 1580, when he returned to navigation. He also discovered the Pacific islands of San Félix and San Ambrosio (1574).

Fernández, Lucas (b. 1474?, Salamanca, Castile—d. 1542), Spanish dramatist and musician, whose plays are notable for their effective dialogue, simple humour, and skillful use of interpolated songs and music.

Fernández was educated at Salamanca and was professor of music there from 1522 until his death. His six plays show clearly the influence of his rival Juan del Encina. His most impressive work is the *Auto de la Pasión,* an Easter play. His *Diálogo para cantar* (1514; "Dialogue for Singing") is the first example of a rudimentary zarzuela, the distinctively Spanish musical play.

Fernández, Manuel Félix (president of Mexico): *see* Victoria, Guadalupe.

Fernández de Avellaneda, Alonso, probably the pseudonym of the otherwise unknown author of *Segundo tomo del ingenioso hidalgo Don Quijote de la Mancha* (1614; "Second Book of the Ingenious Knight Don Quixote of La Mancha"), a fraudulent sequel to the first volume of Miguel de Cervantes' *Don Quixote* (1605). In the 59th chapter of the second volume of *Don Quixote* (1615), Cervantes mocks the spurious book. Suggestions of identity include Fray Luis de Aliaga (confessor of Philip III), Lope de Vega, and even Cervantes himself.

Fernández de Córdoba, Gonzalo, byname EL GRAN CAPITÁN (the Great Captain) (b. Sept. 1, 1453, Córdoba, Andalusia—d. Dec. 1/2, 1515, Granada, Spain), Spanish military leader renowned for his exploits in southern Italy.

He was sent to the Castilian court at the age of 13 and distinguished himself in the fighting following Isabella I's accession (1474) and played an increasingly important role in the war against the Muslim kingdom of Granada. He was one of the two commissioners who conducted the final negotiations for the surrender of Granada (1492).

In 1495 the Queen gave him command of an expedition in support of the Aragonese king of Naples against the French in Italy. Fernández quickly achieved success on behalf of his ally and at the request of Pope Alexander VI defeated a lingering French garrison in Ostia, for which he was given a Roman triumph and a Golden Rose (March 1497). In 1500 he was sent to Italy in command of a larger force, for cooperation with Louis XII of France against the Ottoman Turks but also to be ready to counter French ambitions in regard to Naples. Together with the Venetians, he captured (December 1500) the strongly held island of Cephalonia. The immediate Turkish threat having been removed, a secret agreement was signed by the King of France and Ferdinand dividing the Kingdom of Naples between them. The French disputed and overran the agreed lines of the division and by 1502 were engaged in a war with the Spaniards under Fernández in which he won the striking victories of Cerignola, Monte Cassino, and the Garigliano. In this last battle Fernández brought about the surrender of far larger and more heavily armed forces by an unexpected night attack on Dec. 27, 1503, across the flooded estuary by means of pontoons, during one of the severest winters known in Italy. It was typical of the military ingenuity of el Gran Capitán (as Fernández was by then known).

Ferdinand recalled Fernández from the viceroyalty of Naples in 1507 but again gave him a command following a French threat after the Battle of Ravenna (1512).

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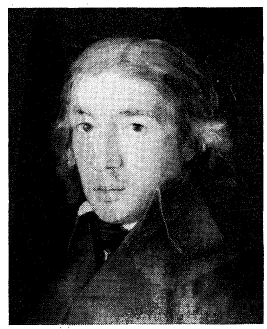
Fernández de Lizardi, José Joaquín (b. Nov. 15, 1776, Mexico City—d. June 21, 1827), Mexican editor, pamphleteer, and novelist, a leading literary figure in Mexico's national liberation movement.

Largely self-taught, he wrote as "the Mexican thinker," taking this pseudonym from the title of his radical journal *El pensador mexicano* (1812). For flouting both the monarchy and the papacy he was imprisoned and excommunicated. His *El periquillo sarniento* (1816; *The Itching Parrot,* 1942), the first picaresque novel of Spanish America, is a colourful tale that depicts the state of Mexican society in the early 19th century and reflects the ideas of the French Enlightenment and of Rousseau on education. He also wrote *La Quijotita y su prima* (1819; "Miss Quixote and Her Cousin") and *Las noches tristes y días alegres* (1823; "Sad Nights and Happy Days").

Fernández de Moratín, Leandro (b. March 10, 1760, Madrid—d. July 21, 1828, Paris), dramatist and poet, the most influential Neoclassic literary figure of the Spanish Enlightenment.

The son of the poet and playwright Nicolás Fernández de Moratín, he was an apologist



Fernández de Moratín, detail of an oil painting by Goya
Archivo Mas, Barcelona

of the French Encyclopaedists, a translator of Molière and Shakespeare, and a satirist of contemporary society. The two predominant themes of his plays are dramatic criticism, as seen in *La comedia nueva* (1792; "The New Comedy"), in which he satirizes the absurd characters and plots of the popular plays of the time, and attacks on excessive parental authority and marriages of convenience, as seen in *El sí de las niñas* (1806; *The Maiden's Consent,* 1962). Because of political and ecclesiastical opposition to his French sympathies, he spent most of his life after 1814 in France, where he died; he was buried between his models Molière and La Fontaine, but his remains were later transferred to Madrid.

Fernández de Navarrete, Juan, also called EL MUDO (Spanish: The Mute) (b. *c.* 1526, Logroño, Spain—d. March 28, 1579, Toledo), painter of the Spanish Mannerist school. In 1568 he was appointed painter to the King, who chose him (1576) to play a major role in the decoration of the Escorial, near Madrid; of the 32 altarpieces commissioned for the church, only eight were completed at the time of his death. El Mudo was strongly influenced by Titian, though there is no evidence that he was Titian's pupil.

Fernández Retamar, Roberto (b. June 9, 1930, Havana), Cuban poet, essayist, and literary critic and cultural spokesman for the Castro revolution.

After first studying art and architecture, Fernández Retamar studied literature in Havana, Paris, and London and then was coordinating secretary of the Cuban writers' union (1961–65). He taught at the University of Havana (from 1955) and from 1965 edited the magazine of the Casa de las Américas, the government publishing house. He also taught at Yale University (1957–58) and lectured at several U.S. universities.

He began to write poetry under the influence of José Lezama Lima and the Orígines group, and after the Castro revolution, he became one of its most eloquent spokesmen, censuring Orígenes poets who failed to become actively involved in the revolution.

Poesía reunida (1966; "Poetry Reunited"), a collection of his poetry written from 1948 to 1965, and *A quien pueda interesar* (1970; "To Whom It May Concern") maintain a balance between ideology and artistic expression. Other volumes of poetry include *Buena suerte viviende* (1967; "Good Luck in Living"), *Qué veremos arder* (1970; "What We Will See Burning"), *Cuaderno paralelo* (1973; "Parallel Frame"), and *Revolución nuestra, amor nuestro* (1976; "Our Revolution, Our Love").

Fernández Retamar's greatest impact was as an essayist. *Ensayo de otro mundo* (1967; "Examination of Another World") redefines Modernismo by emphasizing its ideological content and its relationship to the writers of the Spanish Generation of 1898, the time of the earlier Cuban revolution. Modernismo, especially in its rebellious prose, is often interpreted as a denunciation of U.S. imperialism.

His best known work is a study of culture in Latin America, *Calibán* (1971), which refutes the ideas of the Uruguayan writer José Enrique Rodó. He also wrote such works of criticism as *La Poesía contemporánea en Cuba (1927–1953)* (1954) and *Para una teoría de la literatura hispanoamericana y otras aproximaciones* (1975).

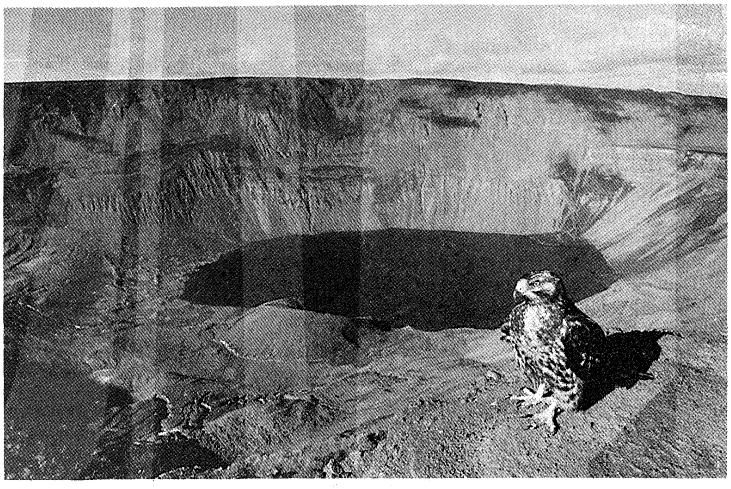
Fernandina Beach, city, seat (1824) of Nassau County, extreme northeastern Florida, U.S., on Amelia Island (22 mi [35 km] long by 2 mi wide), near the mouth of the St. Marys River, 25 mi northeast of Jacksonville. The site was occupied by Timucuan Indians when the French attempted settlement in the 16th century. Spaniards built a fort and a mission there (*c.* 1680) and named it for Don Domingo Fernández, a landowner. The Union Jack was raised in 1763, followed by the arrival of large numbers of Tories during the American Revolution, but most Tories left in 1783 when Florida was ceded back to Spain by England.

The settlement thrived as a haven for smugglers, pirates, and slave traders after becoming a free port (1808). In 1817 Sir Gregor MacGregor, a Scottish military adventurer and advocate of Spanish-American independence, held it captive for a few months. The pirate Luis Aury claimed the island for Mexico in the same year, but it was taken over by the United States (1818) and held "in trust" for Spain.

The United States took formal possession of the island after 1821 and built Ft. Clinch, which was seized by Confederates in 1861. The fort became a centre for blockade running until its capture by a Federal naval force (1862). In 1860 the Florida Railroad, the first cross-state line, linked Fernandina with Cedar Key on the west coast.

The economy of Fernandina Beach is based on pulp and paper milling and fishing (crab and shrimp). The Florida Marine Welcome Station and the city marina form a "state entrance" on the Atlantic Intracoastal Waterway. Fort Clinch State Park offers recreation facilities. The former city of Fernandina was consolidated with Fernandina Beach in 1951. Inc. town, 1824; city, 1952. Pop. (1980) 7,224.

Fernandina Island, Spanish ISLA FERNANDINA, formerly NARBOROUGH ISLAND, one of the Galápagos Islands of Ecuador, in the eastern Pacific Ocean, about 600 mi (965 km) west of Ecuador. Third largest of the islands, with an area of 245 sq mi (635 sq km), it is separated from Isabela Island by the Bolívar Strait. Its relief is dominated by a single vol-



Galápagos hawk perched above the caldera on Fernandina Island, Galápagos Islands
Tui De Roy Moore

canic crater (3,720 ft [1,134 m]), still intensely active. It is without human population.

Fernando (Portuguese, Spanish personal name): *see under* Ferdinand, except as below.

Fernando de Noronha Island, Portuguese ILHA FERNANDO DE NORONHA, island, South Atlantic Ocean, 225 mi (360 km) northeast of the Cabo (cape) de São Roque; with its adjacent islets it has constituted, since 1942, a territory of Brazil. The main island, rising to 1,089 ft (332 m), has an area of 10 sq mi (26 sq km) and is 11 mi long by 4 mi wide. The group is of volcanic origin.

Given in 1504 to its Portuguese discoverer, Fernando de Noronha, the island later became a dependency of Pernambuco, Brazil. Strategically important because of its position off the bulge of Brazil, it was attacked several times by naval powers in the 17th and 18th centuries, but the Portuguese successfully defended it. The island was used as a penal colony in the 18th century, and some prisoners are still sent there. It was used (1957–62) as a tracking station for guided missiles fired from Cape Canaveral, Florida. The main products, salt and guano, are of little economic importance. Pop. (1980 prelim.) 1,323.

Fernando Po, also spelled FERNANDO POO (Equatorial Guinea): *see* Bioko.

Ferozepore (India): *see* Fīrozpur.

Ferozepur (India): *see* Fīrozpur Jhirka.

Ferrabosco, Alfonso, I (baptized Jan. 18, 1543, Bologna, Papal States—d. Aug. 12, 1588, Bologna), Italian composer known for his madrigals, motets, and lute music. The son of a singer and composer, Domenico Maria Ferrabosco, he settled in England in 1562. He travelled abroad on several occasions, using his entrée to foreign courts to act as a spy for the English government, and he was granted a life pension by Elizabeth I. In 1578 he returned to Italy and entered the service of the Duke of Savoy. Ferrabosco was influential in bringing Italian musical style to England. His motets are particularly expressive.

Ferrabosco, Alfonso, II (b. *c.* 1575, Greenwich, London—d. March 1628, Greenwich), English composer, viol player, and lutenist, known especially for his music for viol. The illegitimate son of the composer Alfonso Ferrabosco I, he was educated in music at the expense of Queen Elizabeth I and remained in royal service until his death. He collaborated with Ben Jonson and the architect Inigo Jones in the extravagant masques produced at the court of James I. His fantasies and pavanes for viols are among the finest of their kind. His *Lessons for 1, 2 and 3 Viols* and his *Ayres* for voice and lute were published in 1609.

Ferrante I: *see* Ferdinand I *under* Ferdinand (Naples).

Ferranti, Sebastian Ziani de (b. April 9, 1864, Liverpool—d. Jan. 13, 1930, Zürich), British electrical engineer who promoted the installation of large electrical generating stations and alternating-current distribution networks in England.

After attending St. Augustin's College, Ramsgate, and University College, London, Ferranti collaborated with Sir William Siemens in experiments with electric furnaces and dynamos. By the age of 18 he patented an alternator that was later found to have been anticipated by Sir William Thomson (later Lord Kelvin). The device, covered by a new, joint patent, became known as the Ferranti–Thomson dynamo. It was noted for its compactness and for its capacity to produce five times more power than any other machine of its size.

In 1886 Ferranti was appointed engineer for the Grosvenor Gallery Electric Supply Corporation, which under his direction grew into one of the world's largest generating companies. In 1887, promoting the location of power stations away from the centres of cities, he designed the Deptford Power Station outside London. The largest station of its time, it developed an electric potential of 10,000 volts—four times greater than previously practical. As chief electrician of the London Electric Supply Corporation at Deptford, Ferranti advocated the use of alternating current—later adopted universally—as opposed to the supply of direct current proposed by Rookes Evelyn Bell Crompton.

Ferrar, Nicholas (b. Feb. 22, 1592, London—d. Dec. 4, 1637, Little Gidding, near Huntingdon, Huntingdonshire, Eng.), Anglican clergyman, founder and director of a celebrated Christian community devoted to spiritual discipline and social service. Ferrar was also a friend of the English devotional poet George Herbert and brought Herbert's poetry to public attention.

Ferrar, engraving by P.W. Tomkins after a portrait by C. Johnson
BBC Times Hulton Picture Library

After studying medicine in continental Europe, he returned to England and was elected (1624) a member of the British Parliament. He soon tired of controversy, however, and turned to a religious vocation; he was ordained a deacon in the Church of England in 1626. Declaring a desire to serve God, he then moved with various members of his family to the remote manor house of Little Gidding, where a school was established for his household of some 30 persons and for neighbouring children. The community mastered assorted crafts, including needlework and bookbinding. Believing that every hour of the day must be spent in a useful and an edifying manner, Ferrar devised a set of rules for the community's religious discipline.

On his deathbed George Herbert asked Ferrar to destroy his manuscript poems or have them published. Ferrar made the decision to publish, writing the preface for the first edition of *The Temple* (1633). He also wrote a series of books attempting to harmonize the Gospels. Among the numerous visitors to Little Gidding was Charles I, who held Ferrar in great esteem and visited the mansion three times. After Ferrar's death the community continued to observe the "rule of Little Gidding" for 20 years.

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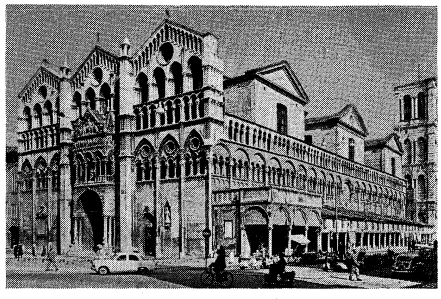
Ferrara, city, capital of Ferrara province, Emilia-Romagna region, northern Italy, on the Po di Volano, a branch channel of the Po River, northeast of Bologna. Although it is believed to be the site of the ancient Forum Alieni, from which its name is derived,



Cathedral of S. Giorgio, Ferrara, Italy
SCALA—Art Resource/EB Inc.

there is no record of Ferrara earlier than AD 753, when it was captured from the exarchate of Ravenna by the Lombards. It passed in 774 to the papacy, under which it became an independent commune by the 10th century. Occupied successively by Tedaldo di Canossa (988), Countess Matilda of Tuscany (1101), and Frederick I Barbarossa (1158), its internal history in the 12th century is largely that of the conflict between the rival families of the Salinguerra and the Adelardi. The rights and claims of the latter passed in 1184 by marriage to the House of Este, which after 1240 finally established its undisputed rule over the city.

Ferrara became the seat of a powerful principality and cultural centre but declined both commercially and politically after its incorporation into the Papal States in 1598. The seat of an Austrian garrison from 1832, it became part of the Kingdom of Italy in 1860. The only important survivals of the medieval city are the massive Castello Estense (Este Castle; 1385–1570) and the cathedral of S. Giorgio, consecrated in 1185, with later additions.

Little else in the city has survived from the Middle Ages. The Palazzo del Comune and the Palazzo della Ragione are both extensively restored, and the university founded in 1391 is housed in a late 16th-century building whose library contains a valuable collection of manuscripts, including works by the poets Ludovico Ariosto and Torquato Tasso. Ariosto's house, where he died in 1533, is preserved. The principal artistic treasure of Ferrara is the magnificent series of palaces of the later 15th and 16th centuries. These palazzi include the Diamanti, housing the municipal art gallery and other museums; the Schifanoia with the civic museum; and the Ludovico il Moro, now a national archaeological museum housing the finds from the ancient Etruscan port of Spina. Ferrara is an archbishopric. Its churches of San Francesco, Corpus Domini, Santa Maria in Vado, and the Certosa (San Cristoforo) are also Renaissance buildings.

Linked by rail with Bologna, Padua, Venice, Ravenna, and Comacchio, Ferrara is the centre of a flourishing agricultural area (fruit), much of it reclaimed marshland. The period following World War II saw a great expansion of industrial activity and the creation of a 6-square-mile (16-square-kilometre) industrial zone between Ferrara and Pontelagoscuro. The city's principal manufactures are chemicals, sugar, alcohol, shoes, and hemp products. Pop. (1988 est.) mun., 143,046.

Ferrara, Renée de France, Duchessa di (Duchess of): *see* Renée of France.

Ferrara-Florence, Council of, ecumenical council of the Roman Catholic church (1438–45) in which the Latin and Greek churches tried to reach agreement on their doctrinal differences and end the schism between them. The council ended in an agreed decree of reunion, but the reunion was short-lived. The Council of Ferrara-Florence was not a new council but was the continuation of the Council of Basel, which Pope Eugenius IV transferred from Basel and which opened in Ferrara on Jan. 8, 1438. The Greek delegation, numbering about 700, included the patriarch of Constantinople Joseph II, 20 metropolitans, and the Byzantine emperor John VIII Palaeologus.

Discussions were held on purgatory and on the phrase *Filioque* ("and from the Son") of the Nicene Creed, which sets forth the doctrine that the Holy Spirit proceeds from both the Father and the Son. The Greeks held that the Spirit proceeds from the Father only and had refused to accept the *Filioque.*

On Jan. 10, 1439, the council was moved from Ferrara to Florence when a plague hit Ferrara. After much discussion, the Greeks agreed to accept the *Filioque* and also the Latin statements on purgatory, the Eucharist, and papal primacy. The decree of union between the two groups (*Laetentur Caeli*) was signed on July 6, 1439. After their return to Constantinople, many of the Greeks repudiated the reunion. Meanwhile, the Latins completed union agreements with certain other Eastern churches. No extant document records the closing of the council, which moved to Rome in September 1443.

Doctrinally, the council is of interest because of the exposition of the Catholic doctrines of purgatory and of the primacy and plenary powers of the pope set out in *Laetentur Caeli.* The decree for union with the Armenians contains a long exposition of sacramental theology.

Ferrari, Enzo (b. Feb. 18, 1898, Modena, Italy—d. Aug. 14, 1988, Modena), Italian automobile manufacturer, designer, and racing-car driver whose Ferrari cars often dominated world racing competition in the second half of the 20th century.

Ferrari raced test cars for a small automobile company in Milan after World War I. In 1920 he became a racing-car driver for the Alfa Romeo Company, and in 1929 he formed a racing stable, Scuderia Ferrari, which remained Alfa Romeo's official racing team even after Ferrari himself ceased to drive in races in 1932. The first racing car completely designed by Ferrari himself was built in 1937, for Alfa Romeo. In 1939 Ferrari severed his team's connection with Alfa Romeo and founded the firm of Ferrari SpA, but the firm did not manufacture its first racing cars until 1946, after World War II. The firm's cars soon became known for their formidable speed and handcrafted quality. Ferrari's Formula One racers and sports cars won many Grand Prix races and manufacturers' championships from the 1950s on, at times dominating the competition. The luxury sports cars the firm built earned a similar reputation for speed and precise handling.

Enzo Ferrari sold a 50-percent share of his company to Fiat SpA in 1969, but he remained president of the firm until 1977 and retained control over the Ferrari racing team until his death.

Ferrari, Giuseppe (b. March 7, 1811, Milan, Kingdom of Italy—d. June 2, 1876, Rome), Italian historian and political philosopher who is best known for his study of Italian revolutions.

After receiving his doctorate in law at the University of Pavia (1831), Ferrari wrote two books on political thought and published a complete edition of the works of Giambattista Vico (1835). In 1838 Ferrari went to France, and in 1840 he received his doctorate in letters from the Sorbonne, meanwhile writing *Vico et l'Italie* (1839; "Vico and Italy"). First endowed with a chair in philosophy at the college at Rochefort, he became assistant professor of philosophy at the University of Strasbourg in 1842. After expressing unorthodox views that angered the Strasbourg clergy, he soon returned to Paris. In 1843 he wrote *Essai sur le principe et les limites de la philosophie de l'histoire* ("Essay on the Principle and Limits of the Philosophy of History") and was given another chair that year at Strasbourg; but again his views raised the ire of the academic community, and he was suspended in 1849.

During the 1850s Ferrari prepared several works, among them *Filosofia della rivoluzione,* 2 vol. (1851; "Philosophy of Revolution"), and *Histoire des révolutions d'Italie,* 4 vol. (1858; "History of the Revolutions of Italy"). The latter work was a survey of Italian revolutionary struggles from ancient Roman times to the collapse of the Florentine Republic in 1530 and a glorification of revolution as an impetus to national creativity and progress toward greater political liberty. His *Teoria dei periodi politici* (1874; "Theory of Political Periods"), influenced by Vico, elaborated more completely his scheme of history.

Ferrari returned to Italy in 1859 to take part in politics there. Elected deputy for Luino, he espoused a federal democratic republic for Italy. He received chairs at Milan and other universities. He continued to write prolifically and at his death was writing *L'aritmetica della storia,* in which he set forth the mechanistic view that history was statistically determined both in manner and in time.

Ferrari, Lodovico, also spelled LUDOVICO FERRARO (b. Feb. 2, 1522, Bologna, Papal States [Italy]—d. Oct. 5, 1565, Bologna), Italian mathematician who was the first to find an algebraic solution to the biquadratic, or quartic, equation (an algebraic equation that contains the fourth power of the unknown quantity but no higher power).

From a poor family, Ferrari was taken into the service of the noted Italian mathematician Gerolamo Cardano as an errand boy at the age of 15. By attending Cardano's lectures, he learned Latin, Greek, and mathematics. In 1540 he succeeded Cardano as public mathematics lecturer in Milan, at which time he found the solution of the quartic equation, later published in Cardano's *Ars magna* (1545; "Great Art"). The publication of *Ars magna* brought Ferrari into a celebrated controversy with the noted Italian mathematician Niccolò Tartaglia over the solution of the cubic equation. After six printed challenges and counter-challenges, Ferrari and Tartaglia met in Milan on Aug. 10, 1548, for a public mathematical contest, of which Ferrari was declared the winner. This success brought him immediate fame, and he was deluged with offers for various positions. He accepted that from Cardinal Ercole Gonzaga, regent of Mantua, to become supervisor of tax assessments, an appointment that soon made him wealthy. Later, ill health and a quarrel with the cardinal forced him to give up his lucrative position. He then accepted a professorship in mathematics at the University of Bologna, where he died shortly thereafter.

Ferraris, Galileo (b. Oct. 31, 1847, Livorno Vercellese, Kingdom of Sardinia [now in Italy]—d. Feb. 7, 1897, Turin, Italy), Italian physicist who established the principles of the induction motor, which is now the principal device for the conversion of electrical power to mechanical power.

Ferraris was the son of a pharmacist and the nephew of a Turin physician, to whom he was sent at age 10 and who supervised his education in the classics and the sciences. He was a graduate of the University of Turin and the Scuola d'Applicazione of Turin. While teaching physics he conducted research into light and optics, and the study of optical phase differences in light waves led him to look into similar phenomena in other forms of radiation, including magnetism.

Ferraris devised a motor using electromagnets at right angles and powered by alternating currents that were 90° out of phase, thus producing a revolving magnetic field. The motor, the direction of which could be reversed by reversing its polarity, proved the solution to the last remaining problem in alternating-current motors. The principle made possible the development of the asynchronous, self-starting electric motor that is still used today.

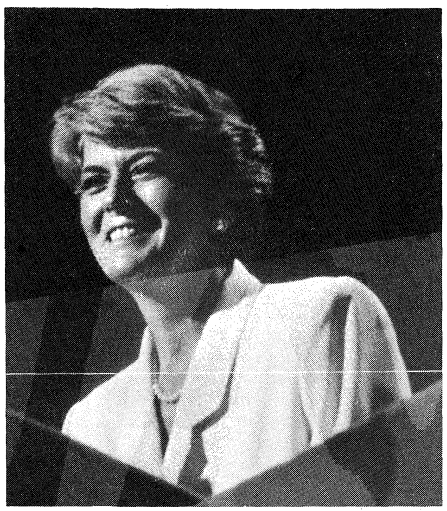
Believing that the scientific and intellectual values of new developments far outstripped material values, Ferraris deliberately did not patent his invention; on the contrary, he demonstrated it freely in his own laboratory to all comers. Meanwhile, other physicists came independently to the same principle—among them Nikola Tesla, who applied and patented it. Ferraris was also an early advocate of alternating-current distribution systems for electrical power.

Ferraro, Geraldine A(nne), married name GERALDINE A. ZACCARO (b. Aug. 26, 1935, Newburgh, N.Y., U.S.), politician who became the first woman to be nominated for vice president by a major political party in the United States.

The daughter of Italian immigrant parents, Ferraro attended Marymount College on a scholarship, and after graduating in 1956 she taught school in New York City while attending law classes at night at Fordham University. She earned her law degree in 1960, was admitted to the bar in 1961, and practiced privately until 1974. In that year she was appointed assistant U.S. district attorney for Queens county in New York, a job that she later credited with having changed her political outlook from conservative to liberal.

In 1978 she campaigned successfully to succeed the retiring Democratic representative in her 9th New York congressional district. In the House of Representatives she soon won a reputation as an effective and hardworking

politician. In 1984 she chaired the Democratic Platform Committee charged with establishing the party's agenda for that year's presidential campaign. Her skill in negotiating with various party factions helped persuade presidential nominee Walter F. Mondale to pick her for his running mate. Ferraro's campaign was slowed by controversies over her under-



Geraldine Ferraro, 1984
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payment of income taxes and her previous campaign financing, as well as by questions about the business activities of her husband, the real-estate developer John Zaccaro. Mondale and Ferraro lost the 1984 election to the Republican incumbents.

Ferré, Charles-Théophile (b. 1845, Paris, Fr.—d. Nov. 28, 1871, Bois de Satory, near Versailles), French revolutionary figure, a follower of the ideology of Auguste Blanqui, who served as director of police during the Paris Commune revolt (1871).

The record of his early years is rather obscure, although it seems likely that he was a law clerk. In July 1870 he was implicated in a plot to assassinate Napoleon III but was acquitted for lack of sufficient evidence.

During the German siege of Paris, Ferré was elected to the Montmartre Committee of Vigilance and then joined the Commune leadership (March 26, 1871). He served on the Committee of Public Safety and for a brief period directed the revolutionary police force. It seems likely that it was Ferré who ordered the execution of the archbishop of Paris, Georges Darboy, and four other clerical hostages when Adolphe Thiers, the leader of the new government, refused to release Blanqui from prison. Ferré was captured on Aug. 7, 1871, and duly condemned and executed.

Ferré, Luis A(lberto) (b. Feb. 17, 1904, Ponce, Puerto Rico), governor of Puerto Rico (1969–73) and founder of the New Progressive Party.

Ferré's first political office was as representative-at-large in the Legislative Assembly from 1953 to 1957. At that time he was a member of the Republican Statehood Party. He ran unsuccessfully against Governor Luis Muñoz Marín in 1956 and 1960 and lost again to the Popular Democrats' candidate, Roberto Sánchez Vilella, in 1964. He left the Republican Statehood party in 1967 and formed the New Progressive Party. Aided by a split in the Popular Democratic Party, Ferré was elected governor in 1968, thus ending the Popular Democrats' 20-year control of the governorship and their 28-year domination of the legislature.

As governor he increased workers' wages and benefits and began development projects in the southwest region of Puerto Rico which included the construction of roads, beaches, an airport, and copper mines. He also undertook programs to modernize agriculture. Ferré was defeated in his bid for a second term by the Popular Democrat Rafael Hernández Colón, whose party also recovered control of the legislature.

A wealthy industrialist and philanthropist, Ferré held a master's degree in engineering from M.I.T. and funded the construction of both the Museum of Art and the Free Public Library to the city of Ponce.

Ferreira, António (b. 1528, Lisbon, Port.—d. 1569, Lisbon), Portuguese poet who was influential in fostering the new Renaissance style of poetry and who strongly advocated the use of Portuguese, rather than Spanish or Latin, as the literary language.

Ferreira was a disciple of the poet Francisco de Sá de Miranda, who had introduced Renaissance styles of poetry into Portugal, and Ferreira did more than anyone else to foster the new school, by both exhortation and example. His verse epistles, inspired by the moral and aesthetic tenets of humanism, reveal his integrity as a critic of society as well as his clear and vigorous style. His tragedy *Castro* (written *c.* 1558) was one of the first in modern European literature. It deals with the Portuguese national heroine Inês de Castro, who was murdered by Afonso IV, father of her lover, Dom Pedro, for reasons of state. Throughout his life, Ferreira was a judge in Lisbon, where he chose to live quietly, devoted to humanistic pursuits.

Ferreira, Manuel (b. 1917, Gândara dos Olivais, Leiria, Port.), Portuguese-born scholar and fiction writer whose work centred on African themes.

Military service, after his graduation from the Technical University of Lisbon, took him to Cape Verde from 1941 to 1947 and later to Angola, where he spent two years. Ferreira's African experiences resulted in an appreciation of African cultures and traditions.

Ferreira's major contribution to African studies resides in his critical books and essays. His study of Cape Verdean culture and literature, *A Aventura Crioula* (1967), was the most thorough work to date on the subject. His three-volume anthology of Lusophone African poetry, *No Reino de Caliban* (1975–81), contains more than 1,000 pages of biographical and historical information on Lusophone African literatures. He also published a two-volume history of African literatures written in Portuguese, *Literaturas Africanas de Expressão Portuguesa* (1977). Ferreira was a professor of African literature at the University of Lisbon and was a frequent contributor to scholarly journals. He also wrote short stories and novels on Cape Verdean themes.

Ferreira, Virgílio, Virgílio also spelled VERGILIO (b. Jan. 28, 1916, Melo, Port.), Portuguese teacher and novelist who turned from an early social realism to more experimental and inward-looking forms of the novel.

Ferreira's literary career began during World War II, and his novels of the 1940s were written in the prevailing social-realist style that had dominated Portuguese fiction since approximately 1930. Works published during this phase of his career are *Onde Tudo Foi Morrendo* (1944; "Where All Was Dying") and *Vagão J* (1946; "Car J"). Beginning with *Mudança* (1949; "Change"), however, Ferreira moved away from the social concerns of his earlier fiction and toward an increasingly introspective and existential focus, which continued to prevail in his later works.

In his psychological novels published after 1950, Ferreira probes the recesses of the human condition with an almost existentialist eye to search for meaning and the process of self-discovery. Of the novels of this period—*Manhã Submersa* (1954; "Submerged Morning"), *Aparição* (1959; "Apparition"), *Cântico Final* (1959; "Final Song"), *Estrela polar* (1962; "Polar Star"), *Alegria Breve* (1965; "Brief Joy"), among others—the best known is *Aparição,* which explores the relationship of a teacher with his students in an almost essayistic manner; lengthy philosophical monologues and dialogues characterize this quasi-existentialist work, which widely influenced contemporary Portuguese fiction.

Ferreira de Castro, José Maria (b. May 24, 1898, Salgueiros, Port.—d. June 29, 1974, Porto), journalist and novelist, considered to be one of the fathers of contemporary Portuguese social-realist (or Neorealist) fiction.

Ferreira de Castro drew widely on his nine years' residence in the Amazon jungles of Brazil (1911–19) to vividly depict the Portuguese emigrant experience and the relationships among rubber workers of various regions and social classes in the frontier setting of the Brazilian rain forest. Two novels—*Emigrantes* (1928; "Emigrants") and *A Selva* (1930; "The Jungle," translated into more than a dozen languages)—launched Ferreira de Castro's literary career and offered an almost photographic portrayal of an exotic region and its human tensions and high drama. In later novels the author turned his attention to regional Portuguese themes from rural areas; typical of this period are *Terra Fria* (1934; "Cold Land"), *A Lã e a Neve* (1947; "The Wool and the Snow"), and *A Curva da Estrada* (1950; "The Curve in the Road").

Ferreira de Castro had a long and active career in journalism, and he considered his fiction writing to be an extension of documentary reporting. He prized the communication of local colour and human warmth and sought to be faithful to social realism. He founded newspapers in both Pará, Braz., and Portugal and maintained close ties with both countries throughout his life.

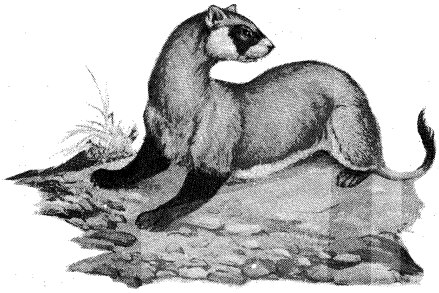
Ferrel, William (b. Jan. 29, 1817, Fulton county, Pa., U.S.—d. Sept. 18, 1891, Maywood, Kan.), American meteorologist known for his law of the deflection of air currents on the rotating Earth.

Ferrel taught school and in 1857 joined the staff of *The American Ephemeris and Nautical Almanac* in Cambridge, Mass. He served as a member of the U.S. Coast and Geodetic Survey from 1867 until 1882, when he became a member of the Signal Service; he retired in 1886.

Ferrel did research on tides, currents, and storms and invented a machine to predict tidal maxima and minima. He wrote *Meteorological Researches,* 3 vol. (1877–82), *Popular Essays on the Movements of the Atmosphere* (1882), *Temperature of the Atmosphere and the Earth's Surface* (1884), *Recent Advances in Meteorology* (1886), and *A Popular Treatise on the Winds* (1889).

Ferrel cell, model of the mid-latitude segment of the Earth's wind circulation, proposed by William Ferrel (1856). In the Ferrel cell, air flows poleward and eastward near the surface and equatorward and westward at higher altitudes; this movement is the reverse of the airflow in the Hadley cell (*q.v.*). Ferrel's model was the first to account for the westerly winds between latitudes 35° and 60° in both hemispheres. The Ferrel cell, however, is still not a good representation of reality because it requires that the upper-level mid-latitude winds flow westward; actually the eastward-flowing surface winds become stronger with height and reach their maximum velocities around the 10-kilometre (6-mile) level in the jet streams. *See also* tricellular theory.

ferret, also called FITCHET, either of two mammals belonging to the genus *Mustela* of



Black-footed ferret (*Mustela nigripes*)
Painting by Alan P. Nielsen

the weasel family (Mustelidae). The common ferret (*M. putorius furo*) is a domesticated form of the European polecat (*q.v.*), which it resembles in size and habits and with which it interbreeds. The common ferret differs from the polecat in the colour of its fur, which is usually yellowish white, and of its eyes, which are pinkish red. Some common ferrets have brown-coloured coats, however. The common ferret is also slightly smaller than the polecat, averaging 51 cm (20 inches) in length, including the 13-centimetre (5-inch) tail, and weighing about 1 kg (2 pounds). The female ferret bears two broods of six or seven young each year. Domesticated ferrets have become so dependent upon humans that they cannot survive without care and if lost often die within a few days. Because common ferrets are subject to foot rot, their cages must be kept scrupulously clean. The animals subsist on a diet of milk and meat that is similar to that given the domestic cat. Ferreting, the use of the ferret in driving rabbits, rats, and other vermin from their underground burrows, has been practiced since Roman times in Europe and even longer in Asia. The ferret's long, lithe body, short limbs, and aggressive hunting temperament made it ideal for this function.

The black-footed ferret (*M. nigripes*) of the North American plains was so named by early American settlers because it resembled the domesticated ferrets of Europe. The black-footed ferret does resemble the common ferret in general body colouring but has a black mask across the eyes and brownish black markings on the feet and tail tip. Its adult weight averages 0.7 kg (1.5 pounds). Its body length is 38–46 cm (15–18 inches), and its tail length is 11–15 cm (4–6 inches). Since the prairie dog, its main source of food, has almost disappeared, the black-footed ferret likewise faces a drastically diminished habitat. The *Red Data Book* lists it as an endangered species.

Ferri, Ciro (b. 1634, Rome, Papal States [Italy]—d. Sept. 13, 1689, Rome), Italian Baroque painter and printmaker of the Roman school who was the chief pupil and assistant of the painter and architect Pietro da Cortona.

When he was a little past 30, Ferri completed the painting of the ceilings and other internal decorations begun by his master in the Pitti Palace, Florence. He also cooperated in or finished several other works by Pietro in both Florence and Rome. Of his own independent productions, the chief is an extensive series of scriptural frescoes in the Church of Santa Maria Maggiore in Bergamo and a painting, considered to be his best work, of St. Ambrose healing an invalid, which is the principal altarpiece in the Church of Sant' Ambrogio in Rome. He executed a large number of etchings and frontispieces for books.

ferricrete, iron-rich duricrust, an indurated, or hardened, layer in or on a soil. Soil particles are cemented together by iron oxides (such as Fe_2O_3) precipitated from the groundwater to form an erosion-resistant layer. Often the soil covering is eroded from the surface of the ferricrete layer, which is exposed as a rock surface; parts of old ferricrete layers may remain as remnants of old erosion surfaces. Extensive ferricrete formations, such as occur in West Africa and Western Australia, may provide rich deposits of limonite or hematite, iron ores. The term laterite is often substituted for ferricrete but technically refers to a soil rich in iron oxides and aluminum.

Ferrié, Gustave-Auguste (b. Nov. 19, 1868, St. Michel-de-Maurienne, Savoie, Fr.—d. Feb. 16, 1932, Paris), French scientist and army general who contributed to the development of radio communication in France.

He was graduated from the École Polytechnique, Paris, in 1889 and entered the army engineers corps. From 1893 to 1898 he advanced in the military telegraph service. When Ferrié was named to a committee exploring wireless telegraph communications between France and England, he found the subject on which he would focus his scientific career. In 1899 in Paris he participated with Guglielmo Marconi in experimental wireless telegraphy between France and England. In 1903 he proposed using the Eiffel Tower in Paris to mount antennas for long-range radiotelegraphy. Under his direction a transmitter was set up in the tower, and its effective range increased steadily from an initial 400 km (250 miles) to 6,000 km (3,700 miles) in 1908. He then turned to the development of mobile transmitters to enable military units to stay in radio contact with Paris.

Ferrié created a radio section at the École Supérieur d'Électricité, Gif sur Yvette, Fr. He experimented with radio transmissions from aircraft to enable the aerial direction of artillery fire. When World War I began, Ferrié, then a colonel, was named director of French military radio communications and assembled a corps of scientists and technicians who set up a network of radio direction finders from the English Channel to the Jura.

In 1922 he was named to the Academy of Sciences. He was promoted to general in 1925.

Ferrier, Kathleen (b. April 22, 1912, Higher Walton, Lancashire, Eng.—d. Oct. 8, 1953, London), contralto who was one of the most widely beloved British singers of her day.

She won a national piano competition at the age of 15 and the following year earned a certificate as a piano teacher. She worked as a telephone operator until 1940, when she won a local singing competition. She then began to study voice and gave factory recitals for war workers, often arranging the songs herself.

Kathleen Ferrier
By courtesy of the British Broadcasting Corp.

In 1943, in George Frideric Handel's *Messiah,* she emerged as an oratorio singer of first rank. In 1946, at Benjamin Britten's request, she sang the title role in his opera *The Rape of Lucretia* at the Glyndebourne Festival. She also became closely identified with the role of Orfeo in Christoph Gluck's opera *Orfeo ed Euridice.* English (1947) and American (1948) performances of Gustav Mahler's *Das Lied von der Erde,* conducted by Bruno Walter, led her to specialize in Mahler's music and to give lieder recitals with Walter. The contralto parts in Britten's *Spring Symphony* and the canticle *Abraham and Isaac* were written for her, as was Sir Arthur Bliss's scena *The Enchantress.* Her career was cut short in its prime by her death from cancer.

Ferrier, Susan Edmonstone (b. Sept. 7, 1782, Edinburgh, Scot.—d. Nov. 5, 1854, Edinburgh), novelist who made an incisive exposé of the pretensions of Scottish society in the early 19th century.

The daughter of James Ferrier, who was principal clerk of the Court of Session and a colleague of Sir Walter Scott, she was in touch with Edinburgh intellectual circles from her early years. Scott greatly admired her writing and in his *Tales of My Landlord* (1816–19) called her his sister shadow. Ferrier's three anonymously published novels are distinguished by their vigour and sardonic wit. They are: *Marriage* (1818); *The Inheritance* (1824), often considered her best work; and *Destiny; or, The Chief's Daughter* (1831).

ferrierite, hydrated aluminosilicate mineral, one of the members of the zeolite family present in sedimentary rocks. The chemical composition of ferrierite is approximately $(Na,K)_2(Ca,Mg)_2Al_6Si_{30}O_{72} \cdot 18H_2O$; it forms colourless, platy crystals of orthorhombic symmetry. The original specimen of the mineral was found in British Columbia; it is the principal constituent of an altered volcanic-ash deposit in central Nevada.

ferrimagnetism, type of permanent magnetism that occurs in solids in which the magnetic fields associated with individual atoms spontaneously align themselves, some parallel, or in the same direction (as in ferromagnetism), and others generally antiparallel, or paired off in opposite directions (as in antiferromagnetism). The magnetic behaviour of single crystals of ferrimagnetic materials may be attributed to the parallel alignment; the diluting effect of those atoms in the antiparallel arrangement keeps the magnetic strength of these materials generally less than that of purely ferromagnetic solids such as metallic iron.

Ferrimagnetism occurs chiefly in magnetic oxides known as ferrites. The natural magnetism exhibited by lodestones, recorded as early as the 6th century BC, is that of a ferrite, the mineral magnetite, a compound containing negative oxygen ions O^{2-} and positive iron ions in two states, iron(II) ions, Fe^{2+}, and iron(III) ions, Fe^{3+}. The oxygen ions are not magnetic, but both iron ions are. In magnetite crystals, chemically formulated as Fe_3O_4, for every four oxygen ions, there are two iron(III) ions and one iron(II) ion. The iron(III) ions are paired off in opposite directions, producing no external magnetic field, but the iron(II) ions are all aligned in the same direction, accounting for the external magnetism.

The spontaneous alignment that produces ferrimagnetism is entirely disrupted above a temperature called the Curie point (*q.v.*), characteristic of each ferrimagnetic material. When the temperature of the material is brought below the Curie point, ferrimagnetism revives.

ferrite, a ceramic-like material with magnetic properties that are useful in many types of electronic devices. Ferrites are hard, brittle, iron-containing, and generally gray or black and are polycrystalline—*i.e.,* made up of a large number of small crystals. They are composed of iron oxide and one or more other metals in chemical combination.

A ferrite is formed by the reaction of ferric oxide (iron oxide or rust) with any of a number of other metals, including magnesium, aluminum, barium, manganese, copper, nickel, cobalt, or even iron itself.

A ferrite is usually described by the for-

mula $M(Fe_xO_y)$, where M represents any metal that forms divalent bonds, such as any of the elements mentioned earlier. Nickel ferrite, for instance, is $NiFe_2O_4$, and manganese ferrite is $MnFe_2O_4$; both are spinel minerals. The garnet mineral known as YIG, containing the rare-earth element yttrium, has the formula $Y_3Fe_5O_{12}$; it is used in microwave circuitry. The most familiar ferrite, known since biblical times, is magnetite (lodestone, or ferrous ferrite), $Fe(Fe_2O_4)$. Ferrites exhibit a form of magnetism called ferrimagnetism (*q.v.*), which is distinguished from the ferromagnetism of such materials as iron, cobalt, and nickel. In ferrites the magnetic moments of constituent atoms align themselves in two or three different directions. A partial cancellation of the magnetic field results, and the ferrite is left with an overall magnetic field that is less strong than that of a ferromagnetic material. This asymmetry on the part of the atomic orientations may be due to the presence of two or more different types of magnetic ions, to a peculiar crystalline structure, or to both. The term ferrimagnetism was coined by the French physicist Louis Néel, who first studied ferrites systematically on the atomic level. There are several types of ferrimagnetism. In collinear ferrimagnetism the fields are aligned in opposite directions; in triangular ferrimagnetism the field orientations may be at various angles to each other. Ferrites can have several different types of crystalline structures, including spinel, garnet, perovskite, and hexagonal.

The most important properties of ferrites include high magnetic permeability and high electrical resistance. High permeability to magnetic fields is particularly desirable in devices such as antennas. High resistance to electricity is desirable in the cores of transformers to reduce eddy currents. Ferrites of a type known as square-loop ferrites can be magnetized in either of two directions by an electric current. This property makes them useful in the memory cores of digital computers, since it enables a tiny ferrite ring to store binary bits of information. Another type of computer memory can be made of certain single-crystal ferrites in which tiny magnetic domains called bubbles can be individually manipulated. A number of ferrites absorb microwave energy in only one direction or orientation; for this reason, they are used in microwave wave guides.

Ferro, Spanish HIERRO, island, Santa Cruz de Tenerife *provincia,* Canary Islands *comunidad autónoma* ("autonomous community"), Spain, the westernmost and smallest of the Canary Islands in the North Atlantic. Ferro, then the most westerly place known to ancient European geographers, was chosen *c.* AD 150 by the classical geographer Ptolemy for the prime meridian of longitude, and until the 18th century some navigators continued to reckon from this line.

The island, with an area of 107 square miles (278 square km), is mountainous (reaching 5,000 feet [1,500 m]) and is ringed by sheer cliffs, except near Valverde, the capital, where wooded slopes meet the sea. Ferro lacks a harbour, and landings from an interinsular steamer are made by small boat at a short mole at Estaca, the port of the island. Mineral springs attract a small tourist trade, but the economy primarily depends on subsistence agriculture. Pop. (1981) 6,408.

ferroalloy, substance composed of iron (less than 50 percent) and one or more other metals, important as a source of various metallic elements in the production of alloy steels. Ferroalloys usually have lower melting ranges than do the pure elements and can be incorporated more readily in the molten steel. Ferromanganese, ferrotungsten, ferrochromium, ferromolybdenum, ferrotitanium, ferrovanadium, and ferrosilicon are brittle and unsuitable for direct use in fabricating products, but they are an economical source of these elements for the alloy steels. (Production of most of these pure elements from their ores is difficult and expensive.)

Ferroalloys are prepared from charges of the nonferrous metal ore, iron or iron ore, coal, and flux by treatment at high temperature.

ferroaugite, iron-rich variety of the mineral augite (*q.v.*).

ferrocene, also called DICYCLOPENTADIENYLIRON, the earliest and best-known of the so-called sandwich compounds; these are derivatives of transition metals in which two organic ring systems are bonded symmetrically to the metal atom. Its molecular formula is $(C_5H_5)_2Fe$.

First prepared in 1951 by reaction of sodium cyclopentadienide with iron(II) chloride, ferrocene occurs as highly stable orange crystals with a melting point of 174° C (345° F). Chemically, ferrocene behaves like benzene and other aromatic compounds in that it undergoes substitution reactions. Removal of one electron from the molecule raises the iron atom to the next-higher oxidation state (*i.e.,* from +2 to +3), leading to formation of salts containing the blue ferricinium cation, $(C_5H_5)_2Fe^+$.

ferrochromium, alloy of chromium with 30 to 50 percent iron, used to incorporate chromium into steel. It is produced in an electric furnace using chromium ore, iron or iron ore, and carbon, usually anthracite coal. In the intense heat the carbon reduces the metal oxides to the molten alloy, which is poured out into slabs.

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

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ferroelectricity, property of certain nonconducting crystals, or dielectrics, that exhibit spontaneous electric polarization (separation of the centre of positive and negative electric charge, making one side of the crystal positive and the opposite side negative) that can be reversed in direction by the application of an appropriate electric field. Ferroelectricity is named by analogy with ferromagnetism, which occurs in such materials as iron. Iron atoms, being tiny magnets, spontaneously align themselves in clusters called ferromagnetic domains, which in turn can be oriented predominantly in a given direction by the application of an external magnetic field.

Ferroelectric materials—for example, barium titanate ($BaTiO_3$) and Rochelle salt—are composed of crystals in which the structural units are tiny electric dipoles; that is, in each unit the centres of positive charge and of negative charge are slightly separated. In some crystals these electric dipoles spontaneously line up in clusters called domains, and in ferroelectric crystals the domains can be oriented predominantly in one direction by a strong external electric field. Reversing the external field reverses the predominant orientation of the ferroelectric domains, though the switching to a new direction lags somewhat behind the change in the external electric field. This lag of electric polarization behind the applied electric field is ferroelectric hysteresis, named by analogy with ferromagnetic hysteresis.

Ferroelectricity ceases in a given material above a characteristic temperature, called its Curie temperature, because the heat agitates the dipoles sufficiently to overcome the forces that spontaneously align them.

ferrohortonolite, silicate mineral, a member of the forsterite–fayalite series (*q.v.*) of olivines.

ferrohypersthene, silicate mineral belonging to the orthopyroxene (*q.v.*) series.

ferromagnetism, physical phenomenon in which certain electrically uncharged materials strongly attract others. Two materials found in nature, lodestone (or magnetite, an oxide of iron, Fe_3O_4) and iron, have the ability to acquire such attractive powers, and they are often called natural ferromagnets. They were discovered more than 2,000 years ago, and all early scientific studies of magnetism were conducted on these materials. Today, ferromagnetic materials are used in a wide variety of devices essential to everyday life—*e.g.,* electric motors and generators, transformers, telephones, and loudspeakers.

Ferromagnetism is a kind of magnetism that is associated with iron, cobalt, nickel, and some alloys or compounds containing one or more of these elements. It also occurs in gadolinium and a few other rare-earth elements. In contrast to other substances, ferromagnetic materials are magnetized easily, and in strong magnetic fields the magnetization approaches a definite limit called saturation. When a field is applied and then removed, the magnetization does not return to its original value—this phenomenon is referred to as hysteresis (*q.v.*). When heated to a certain temperature called the Curie point (*q.v.*), which is different for each substance, ferromagnetic materials lose their characteristic properties and cease to be magnetic; however, they become ferromagnetic again on cooling.

The magnetism in ferromagnetic materials is caused by the alignment patterns of their constituent atoms, which act as elementary electromagnets. Ferromagnetism is explained by the concept that some species of atoms possess a magnetic moment—that is, that such an atom itself is an elementary electromagnet produced by the motion of electrons about its nucleus and by the spin of its electrons on their own axes. Below the Curie point, atoms that behave as tiny magnets in ferromagnetic materials spontaneously align themselves. They become oriented in the same direction, so that their magnetic fields reinforce each other.

One requirement of a ferromagnetic material is that its atoms or ions have permanent magnetic moments. The magnetic moment of an atom comes from its electrons, since the nuclear contribution is negligible. Another requirement for ferromagnetism is some kind of interatomic force that keeps the magnetic moments of many atoms parallel to each other. Without such a force the atoms would be disordered by thermal agitation, the moments of neighbouring atoms would neutralize each other, and the large magnetic moment characteristic of ferromagnetic materials would not exist.

There is ample evidence that some atoms or ions have a permanent magnetic moment that may be pictured as a dipole consisting of a positive, or north, pole separated from a negative, or south, pole. In ferromagnets, the large coupling between the atomic magnetic moments leads to some degree of dipole alignment and hence to a net magnetization.

The French physicist Pierre-Ernest Weiss postulated a large-scale type of magnetic order for ferromagnets called domain structure. According to his theory, a ferromagnetic solid consists of a large number of small regions, or domains, in each of which all of the atomic or ionic magnetic moments are aligned. If the resultant moments of these domains are randomly oriented, the object as a whole will not display magnetism, but an externally applied magnetizing field will, depending on its strength, rotate one after another of the domains into alignment with the external field and cause aligned domains to grow at the expense of nonaligned ones. In the limiting state called saturation, the entire object will comprise a single domain.

Domain structure can be observed directly. In one technique, a colloidal solution of small magnetic particles, usually magnetite, is

placed on the surface of a ferromagnet. When surface poles are present, the particles tend to concentrate in certain regions to form a pattern that is readily observed with an optical microscope. Domain patterns have also been observed with polarized light, polarized neutrons, electron beams, and X rays.

In many ferromagnets the dipole moments are aligned parallel by the strong coupling. This is the magnetic arrangement found for the elemental metals iron (Fe), nickel (Ni), and cobalt (Co) and for their alloys with one another and with some other elements. These materials still constitute the largest group of ferromagnets commonly used. The other elements that possess a collinear ordering are the rare-earth metals gadolinium (Gd), terbium (Tb), and dysprosium (Dy), but the last two become ferromagnets only well below room temperature. Some alloys, although not composed of any of the elements just mentioned, nevertheless have a parallel moment arrangement. An example of this is the Heusler alloy $CuAlMn_3$, in which the manganese (Mn) atoms have magnetic moments, though manganese metal itself is not ferromagnetic.

Since 1950, and particularly since 1960, several ionically bound compounds have been discovered to be ferromagnetic. Some of these compounds are electrical insulators; others have a conductivity of magnitude typical of semiconductors. Such compounds include chalcogenides (compounds of oxygen, sulfur, selenium, or tellurium), halides (compounds of fluorine, chlorine, bromine, or iodine), and their combinations. The ions with permanent dipole moments in these materials are manganese (Mn), chromium (Cr), and europium (Eu); the others are diamagnetic. At low temperatures, the rare-earth metals holmium (Ho) and erbium (Er) have a nonparallel moment arrangement that gives rise to a substantial spontaneous magnetization. Some ionic compounds with the spinel crystal structure also possess ferromagnetic ordering. A different structure leads to a spontaneous magnetization in thulium below 32 K.

Above a critical temperature called the Curie point, or the Curie temperature, the spontaneous magnetization vanishes. This is due to the fact that at the Curie point the thermal energy is sufficient to overcome the internal aligning forces. The Curie temperatures for some important ferromagnets are: iron (Fe), 1,043 K; cobalt (Co), 1,388 K; nickel (Ni), 631 K; gadolinium (Gd), 289 K; and dysprosium (Dy), 85 K. Above the Curie point, the ferromagnetic material becomes a paramagnet.

ferrosalite, a silicate mineral intermediate in composition between hedenbergite and diopside (*q.v.*).

ferrosilite, silicate mineral belonging to the orthopyroxene (*q.v.*) series.

ferrotremolite, iron-rich variety of the silicate mineral actinolite (*q.v.*).

ferrotype (photography): *see* tintype.

Ferrovie Italiane, English ITALIAN RAILWAYS, state-owned railroad system of Italy that also operates railroads on the islands of Sicily and Sardinia linked to the system by train ferries. The railroads have been nationally owned since 1907.

The most heavily traveled line in the rail system is from Milan in the north down the peninsula, passing through the important rail junction of Bologna and south to Rome and Naples. Northward, international routes run from Turin through the Frejus Tunnel into France, from Milan through the Simplon and St. Gotthard tunnels to Switzerland, from Verona to Austria and Germany by way of the Brenner Pass, and from Venice to Vienna and eastern Europe. Other heavily traveled lines run through the industrial north from Turin to Milan to Venice and from Milan to Genoa. All the main routes, comprising half the network, have been electrified.

Italian passenger trains are of three kinds. The Rapidi are fast luxury trains that charge an extra fee above the regular first-class fare. The Expressi are fast express trains, both first-class and second-class. The Diretti stop at more stations. Like other state-run railroads, the Italian system is heavily subsidized. In 1986 the system's status was changed from a government department to a state corporation.

Ferry, Jules(-François-Camille) (b. April 5, 1832, Saint-Dié, Fr.—d. March 17, 1893, Paris), French statesman of the early Third Republic, notable both for his anticlerical education policy and for his success in extending the French colonial empire.

Pursuing his father's profession of law, he was called to the Paris bar in 1855 but soon made a name for himself as a biting critic

Ferry
H. Roger-Viollet

of the Second Empire, especially by his articles (1867–68) in *Le Temps* attacking Baron Haussmann's administration of Paris.

During the Franco-German War (1870–71), Ferry administered the *département* of Seine, holding the powers of prefect and being appointed mayor of Paris in November 1870. His administration of the besieged and hungry capital won him the nickname "Ferry-la-Famine," which haunted him the rest of his career.

Ferry was minister to Greece (1872–73) and thereafter for six years was in the republican opposition to the conservative governments and to the presidency of Patrice Mac-Mahon.

From 1879, Ferry held several high offices, serving twice (1880–81, 1883–85) as premier and once (1883–85) as minister of foreign affairs. He became best-known for his government's establishment of free, compulsory secular education, brought about mainly by a law of 1882. This policy was accompanied by other anticlerical measures, notably decrees (1880–81) dissolving the Jesuits and other congregations not authorized under the concordat with the papacy and forbidding their members to direct or teach in any educational establishment. Ferry also played a major part in the dramatic extension of France's colonial territories. Ferry and a few enthusiastic colonialists, in the face of popular apathy or hostility, were largely responsible for France acquiring Tunisia (1881), Tonkin (1885), Madagascar (1885), and the French Congo (1884–85). Public anger over the continuing expenditures needed to complete the conquest of Tonkin swept Ferry from office in March 1885. Despite continuing unpopularity, he was elected to the Senate by Vosges in 1891 and became its president in 1893. The violent polemics aroused against him at this time, however, caused a madman to attack him with a revolver, and he died from the wound.

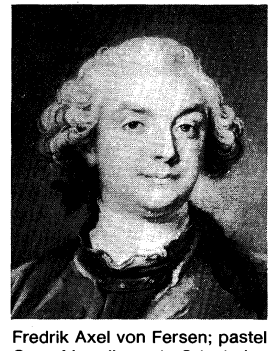
Ferryland, village, southeastern Newfoundland, Canada. It lies on the eastern side of the Avalon Peninsula, about 40 miles (65 km) south of St. John's. First visited by Portuguese and French fishermen early in the 16th century, it was named Ferryland, probably derived from the Portuguese *Farelhao.* It was colonized when Sir George Calvert (later Lord Baltimore) obtained a charter for a portion of the peninsula in 1623. The Baltimore colony showed promise until its proprietors procured the patent for Maryland and vacated it in 1629. Sir David Kirke, count palatine of the island, took over the village (1638) and established his headquarters there. Ferryland is now a quiet fishing community and a government fish-bait depot, catering to visitors who are attracted by remnants of its historic past, including the ruins of its founding-father's mansion. Pop. (1981) 795.

Ferryville (Tunisia): *see* Manzil Bū Ruqaybah.

Fersen, Fredrik Axel von (b. April 5, 1719, Stockholm—d. April 24, 1794, Stockholm), soldier and politician who led Sweden's Hat Party during the 18th-century Age of Freedom—a 52-year period of parliamentary government in his country.

Educated in Sweden and abroad, Fersen entered the Swedish army in 1737. In 1739 he was given leave to join the French army, in which he soon distinguished himself in the War of the Austrian Succession (1740–48). Returning to Sweden, he joined the ruling Hat Party in the Riksdag (parliament). His position in the party was enhanced not only by his father's having been a founder but also by Fersen's marriage into the prominent Hat family of De la Gardie (1752). He was elected speaker of the noble chamber of the Riksdag in 1756, and he used this powerful office to check all efforts by the crown to regain the power it had lost to the Parliament in 1720.

Fersen served with distinction in the Seven Years' War (1756–63). Afterward he unsuccessfully tried to effect an alliance between



Fredrik Axel von Fersen; pastel by Gustaf Lundberg; in Gripsholm Castle, Sweden
By courtesy of the Svenska Portrattarkivet, Stockholm

the Hats and the crown against a rise of a new generation of rivals (the Cap Party) to his own party. When King Gustav III began to reassert the governing power of the monarchy in 1772, Fersen at first supported him, but he again led an antiabsolutist faction after the start of the disastrous Russo-Swedish War of 1788–90. Fersen retired from public life in 1789.

Fersen, Hans Axel von (b. Sept. 4, 1755, Stockholm—d. June 20, 1810, Stockholm), Swedish-French soldier, diplomat, and statesman who was active in counter-revolutionary activity after the French Revolution of 1789 and the rise of Napoleon.

The son of Fredrik Axel von Fersen, Hans, like his father, transferred from the Swedish to the French army. He served under the Comte de Rochambeau, who aided the American forces during the United States War of In-

dependence (1775–83), distinguishing himself during the decisive Siege of Yorktown (1781).

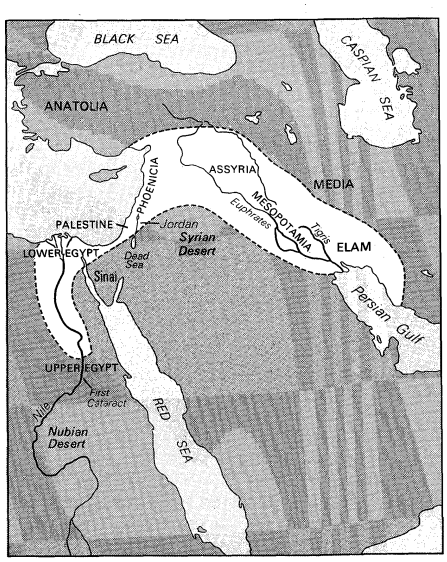
Hans Axel von Fersen, portrait by an unknown artist; in the Nationalmuseum, Stockholm

By courtesy of Svenska Portrattarkivet, Stockholm

Fersen became a close friend of Queen Marie-Antoinette of France in the early 1780s before returning to Sweden to join the diplomatic service. When the Russo-Swedish War of 1788–90 began, Fersen was sent back to Paris as a diplomatic agent. After the French Revolution, he arranged the (unsuccessful) escape attempt of the king and queen (1791) and himself drove the coach in which they left Paris. Later Fersen worked in Vienna and Brussels for a European coalition against the Revolution. In 1801 he was named *riksmarskalk* (earl marshal) of Sweden, and in 1805 he was adviser to King Gustav IV during the war of the Third Coalition against France. Fersen played no part in the 1809 revolution that overthrew the king, but he supported the candidacy of the king's son against that of the popular Christian August of Augustenburg. When the latter died suddenly as king-elect in 1810, a rumour spread that Fersen had conspired to cause his death. Fersen was killed by an enraged mob.

Fertile Crescent, the region in the Middle East where the civilizations of the Middle East and the Mediterranean basin began. The term was popularized by the American Orientalist James Henry Breasted (1865–1935).

The Fertile Crescent includes a roughly crescent-shaped area of relatively fertile land which probably had a more moderate, agriculturally productive climate in the past than today, especially in Mesopotamia and the Nile valley. Situated between the Arabian Desert on the south and the mountains of Armenia on the north, it extends from Babylonia and adjacent Susiana (the southwestern province of Persia) up the Tigris and Euphrates rivers to Assyria. From the Zagros Mountains east of Assyria it continues westward over Syria to the Mediterranean and extends southward to southern Palestine. The Nile valley of Egypt is often included as a further extension, especially since the short interruption in Sinai is no greater than similar desert breaks that disturb its continuity in Mesopotamia and Syria. Throughout the region irrigation is necessary for the best agricultural results and, indeed, is often essential to any farming at all.



The Fertile Crescent

The Fertile Crescent in its wider extension corresponds exactly to the region that plays a dominant role in the Hebrew traditions of Genesis; it also contains the ancient countries (Babylonia, Assyria, Egypt, Phoenicia) from which the Greeks and Romans derived civilization. This age-old belief that the earliest culture known to mankind originated in the Fertile Crescent has been confirmed by the development of radiocarbon dating since 1948. It is now known that incipient agriculture and village agglomerations there must be dated back to about 8000 BC, if not earlier, and that the use of irrigation followed rapidly.

fertility and infertility, respectively, the ability and inability of a human couple to conceive and reproduce. Fertility refers to the ability to become pregnant through normal sexual activity, and infertility is defined as the failure to conceive after one year of regular intercourse without contraception; approximately 80 percent of healthy fertile women are able to conceive during this period. Infertility can affect either the male or the female partner and can result from a number of causes. About one in every eight couples is infertile.

Normal fertility depends on the production of a sufficient number of healthy, motile sperm by the male, delivery of those cells through open pathways into the vagina, successful passage of the sperm through the uterus and into the fallopian tubes, and penetration of a normal ovum (egg) by one of the sperm. A successful pregnancy also requires that the fertilized ovum subsequently become implanted in the lining of the female uterus. A defect at any one of these stages can result in a couple's infertility.

Early efforts in the field of fertility management were aimed at preventing unwanted conception, and technological advances in the second half of the 20th century have made this a usually achievable goal. (*See* birth control.) The reverse situation, inability to conceive when desired, has been a problem throughout recorded history. Many kinds of infertility have responded to new medical management methods in the late 20th century, however.

Causes. Out of every 100 cases of infertility, about 30 to 40 involve sperm inadequacies or gonadal deficiencies in the male partner; 20 to 30 are caused by ovulatory or hormonal deficiencies in the female; 15 to 30 involve disorders or defects in the female's fallopian tubes; 10 involve a vaginal or cervical environment that is chemically hostile to sperm; and 10 are caused by unknown factors.

Failure to ovulate, or produce an ovum (egg), is a common cause of female infertility and usually results from hormonal imbalances—particularly the stimulation or suppression of the ovaries by other glands such as the pituitary, thyroid, or adrenals. The result can be an inadequate production of female hormones, and a consequent disruption of normal ovulation. If the primary hormonal deficit is corrected through replacement therapy, the woman may resume or begin normal ovulation and may thus become fertile. Blockages of or obstructions within the fallopian tubes—the two passages within which an ovum is fertilized by a sperm—are also a common cause of infertility in the female. The tubes may become blocked owing to endometriosis or inflammations stemming from gonorrhea or other infections. The female's cervical environment is also a major cause of infertility; the mucus and other fluids secreted there may be inadequate for sperm transport or may even be lethal to sperm because of hormonal abnormalities or unbalanced acid-alkaline ratios.

Male factors are implicated in as many as 40 percent of all infertilities. Male infertility usually rests on impotence or on defects in the male's sperm, specifically their concentration, shape, motility (ability to swim), and ability to penetrate the ovum. An infertile male may have too few sperm (a sperm count of less than 20 million per millilitre is usually inadequate for fertilization), or he may have too high a proportion of abnormal or defective sperm. Sperm quality is chiefly influenced by temperature; varicose veins in the scrotal sac, tight underwear, or other abnormnal sources of heat or constriction can raise the temperature of the scrotum and thus damage sperm quality. Male infertility may also be caused by obstructions in or an absence of the ducts (usually the epididymis) through which the sperm cells must pass on their trip from the testicles to the urethra during ejaculation.

Diagnosis. Because of the large number of possible causes of infertility, an examination of both members of the couple by a physician who specializes in fertility management is often needed to determine the cause of the infertility. A sperm count is taken from the male partner, and the number, shape, size, and motility of his sperm are analyzed, along with the nutrients in his semen. There is also a test to evaluate the fertilizing ability of his sperm. The testing for the female partner is more elaborate and can consist of many specialized examinations, including tests to determine if her fertility hormones are working properly and are in normal balance; tests to determine if her cervical mucus is thin enough to permit sperm penetration; and various examinations of her fallopian tubes to detect obstructions in them.

Treatment. The treatments of infertility range from the obvious to the esoteric. A simple solution that is effective if the male's production of sperm is low is for the couple to limit the frequency of intercourse and time their intercourse for periods of the female's maximum fertility (*i.e.,* when she is ovulating). A physical blockage of the pathways by which the sperm must travel, in either the male or female partner, can in many cases be eliminated by surgery to eliminate adhesions that have closed the tubal pathways or to remove obstructive growths such as cysts that may be present. Several drugs, notably clomiphene citrate, bromocriptine, and human menopausal gonadotropin, have been very successful in correcting the hormonal imbalances which cause a female's ovulation, or egg production, to be erratic or absent. These "fertility drugs" do, however, increase a woman's chances of having multiple births owing to the release of more than one egg at ovulation under the influence of the drug.

In addition to physical problems that may impede fertilization, emotional factors may also contribute to a couple's infertility. Normal fertility may return simply after counseling directed at relieving a couple's emotional difficulties. If more conventional therapies fail, it may be possible for the infertile couple to have a child through artificial insemination, in vitro fertilization, or surrogate parenting.

Artificial insemination has become a popular alternative method of ensuring fertility. If the male partner is normally fertile but for some reason is not transmitting sufficient

sperm to produce pregnancy, he may donate semen whose sperm cells can be concentrated and then introduced into the woman's uterus artificially. Another alternative is in vitro fertilization (*q.v.*), in which ova are removed from the female's body, fertilized by sperm in the laboratory, and returned to the uterus for normal gestation. The first successful in vitro fertilization was carried out in England in 1978. In another procedure, gamete intrafallopian transfer, sperm and several surgically obtained eggs are placed in a fallopian tube, where fertilization normally takes place. Like artificial insemination, these procedures have caused ethical controversies, as has surrogate parenting, in which a second female undergoes artificial insemination with the male's sperm to conceive and bear a child for a couple whose female partner is sterile.

fertilization, the reproductive process in which a male sex cell (spermatozoon) unites with a female sex cell (ovum, or egg) to form a zygote, which will divide to form an embryo.

A brief treatment of fertilization follows. For full treatment, *see* MACROPAEDIA: Reproduction and Reproductive Systems.

Before fertilization can occur, an egg must be surrounded by appropriate egg coatings, which stimulate acrosome reactions in sperm. In mammals, sperm must go through physiological changes (called capacitation) that occur during their passage through the female genital tract. Without capacitation, the sperm cannot penetrate the egg coating.

Fusion between a sperm and an egg is initiated by a prominence in the tip of the sperm's head that is called the acrosome. An opening forms in the sperm tip touching the egg, and an acrosomal granule disappears, apparently releasing lysin, a substance that dissolves the egg's protective coatings and allows the sperm to reach the egg. The sperm's acrosome membrane elongates into a tubule that extends to the surface of the egg and fuses with the egg's plasma membrane. The tubule provides a passageway for the sperm nucleus to reach the interior of the egg. This membrane fusion instigates the formation on the egg's surface of a resistant fertilization membrane that blocks the entrance of any more sperm.

Once the sperm nucleus, or male pronucleus, has been absorbed by the egg, it begins to swell and disperse its chromosomes. It moves toward the female pronucleus and the two pronuclei meet in the centre of the egg, where their threadlike genetic material organizes into chromosomes. The chromosomes of the two pronuclei then merge, creating a fertilized egg, or zygote.

The zygote contains all the components necessary to make the proteins comprising the embryo. Immediately after fertilization, the rate of protein synthesis increases greatly in the zygote. Because this protein production is directed by maternal RNA already in the unfertilized egg, an inhibitor to protein synthesis is probably removed by fertilization. At later states of embryonic development, protein synthesis is governed by the RNA of the new individual.

fertilizer, natural or artificial substance containing the chemical elements that improve growth and productiveness of plants. Fertilizers enhance the natural fertility of the soil or replace the chemical elements taken from the soil by previous crops.

A brief treatment of fertilizer follows. For full treatment, *see* MACROPAEDIA: Farming and Agricultural Technology; Industries, Chemical Process.

The use of manure and composts as fertilizers is probably almost as old as agriculture. Modern chemical fertilizers include one or more of the three elements that are most important in plant nutrition: nitrogen, phosphorus, and potassium. Of secondary importance are the elements sulfur, magnesium, and calcium.

Most nitrogen fertilizers are obtained from synthetic ammonia; this chemical compound (NH_3) is used either as a gas or in a water solution, or it is converted into salts such as ammonium sulfate, ammonium nitrate, and ammonium phosphate, but packinghouse wastes, treated garbage, sewage, and manure are also common sources of it. Phosphorus fertilizers include calcium phosphate derived from phosphate rock or bones. The more soluble superphosphate and triple superphosphate preparations are obtained by the treatment of calcium phosphate with sulfuric and phosphoric acid, respectively. Potassium fertilizers, namely potassium chloride and potassium sulfate, are mined from potash deposits. Mixed fertilizers contain more than one of the three major nutrients—nitrogen, phosphorus, and potassium. Mixed fertilizers can be formulated in hundreds of ways.

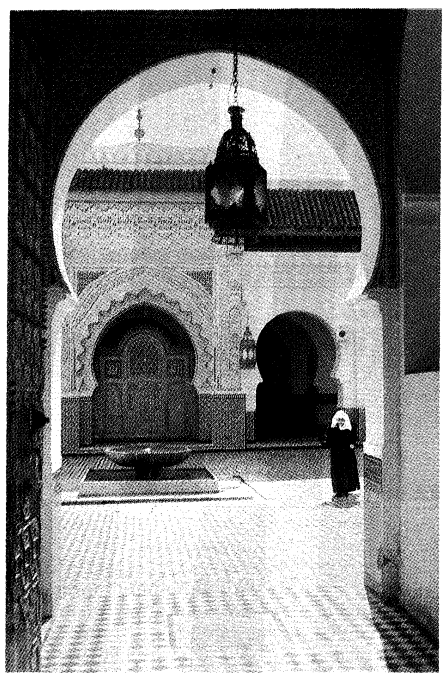
On modern farms a variety of machines are used to apply synthetic fertilizer in solid, gaseous, or liquid form. One type distributes anhydrous ammonia, a liquid under pressure, which becomes a nitrogenous gas when freed from pressure as it enters the soil. A metering device operates valves to release the liquid from the tank. Solid-fertilizer distributors have a wide hopper, with holes in the bottom; distribution is effected by various means, such as rollers, agitators, or endless chains traversing the hopper bottom. Broadcast distributors have a tub-shaped hopper from which the material falls onto revolving disks that distribute it in a broad swath. *See also* manure.

Fertőd, formerly ESZTERHÁZA, agricultural commune, Győr-Sopron *megye* (county), western Hungary. It lies near the south end of Fertő (German: Neusiedler) Lake on the Austrian frontier. It was a seat of the Esterházy princes, who were among the leading landed gentry of Hungary. At Fertőd they built the great Esterháza, or Esterházy Palace, called "the Hungarian Versailles," which was completed in 1766. This U-shaped palace has 126 rooms and is built in a style blending late Baroque with Rococo. The composer Joseph Haydn, long in the service of the Esterházy family (1761–90), was responsible for the elaborate musical productions staged at the palace. An annual music festival is held at the palace in his memory. Pop. (1983 est.) 2,824.

Fès, also spelled FEZ, Arabic FĀS, city, northern Morocco, on the Wadi Fès just above its influx into the Wadi Sebou. The oldest of Morocco's four imperial cities, it was founded on both banks of the Wadi Fès by Idrīs I (east bank, about 789) and Idrīs II (west bank, about 809). The two parts were united by the Almoravids in the 11th century to become a major Islāmic city. Fès reached its zenith under the Marīnids as a centre of learning and commerce in the mid-14th century and has kept its religious primacy through the ages. The Treaty of Fès (March 30, 1912) established the French protectorate in Morocco.

The city is almost completely surrounded by low hills covered with olive groves and orchards. The ancient battlements of Fès, flanked by stone towers, still partly enclose the old city, which is known as the Fès el-Bali. The old city contains the Qarawīyīn Mosque (*see* Qarawīyīn), the oldest mosque in northern Africa, and is the seat of both a famous Islāmic university (founded 859) and of the Sidi Mohammed ibn Abdellah University (founded 1974); it is also the sanctuary of Idrīs I and houses the tomb of Idrīs II. The Fès el-Jedid (New Fès) section of the city, founded in the 13th century by the Marīnids, contains the Royal Palace and the adjoining Great Mosque, which is noted for its 13th-century polychrome minaret. Just south of the Royal Palace is the Mellah, or Jewish quarter; many of the Jewish goldsmiths, silversmiths, and jewelers who once lived there emigrated to Israel in the decades following the founding of the Jewish state. The modern section of the city, the Ville Nouvelle, lies on a plateau to the southwest; it was founded by Marshal L.-H.-G. Lyautey of France in 1916. The city's industrial quarter is in this district, near the railway station.

Fès is a centre for trade and traditional crafts, and until the late 19th century it was the only place in the world where the fez (brimless, red felt hat in the shape of a truncated cone) was made. Most of the city's traditional crafts, such as leather- and pottery-making, are practiced in the narrow, winding streets of the old city and are sold in that section's traditional marketplaces, or suqs. Fès has an international airport. The area in which Fès is situated produces cereals (primarily wheat), beans, olives, and grapes; sheep, goats, and cattle are also raised. Pop. (1982) mun., 448,823.



The courtyard of the Qarawīyīn Mosque, Fès, Morocco
E.S. Ross

Fescennine verse, Latin FESCENNINI VERSUS, also called CARMINA FESCENNINA, early native Italian jocular dialogue in Latin verse. At vintage and harvest, and probably at other rustic festivals, these were sung by masked dancers. They were similar to ribald wedding songs. It is clear from the literary imitations by Catullus (84–54 BC), in one of his epithalamiums, that they were very free, even obscene, in language. Horace (65–8 BC) states that they became so abusive that a law that forbade a *malum carmen* ("evil song"—*i.e.*, charm intended to hurt) was invoked against them.

It was believed that the verses averted the evil eye; hence, some early historians connected the name with *fascinum* ("enchanting, bewitching"). The true derivation may be from Fescennia, an Etruscan city. In their origin they may have had a magico-religious intent—abuse, buffoonery, and obscenity being well-known fertility or luck charms. Whether they developed into the dramatic *satura* (medley, or hodgepodge) that was the forerunner of Roman drama has been debated by modern scholars. *See also* epithalamium.

Fesch, Joseph (b. Jan. 3, 1763, Ajaccio, Corsica [now in France]—d. May 13, 1839, Rome, Papal States [Italy]), French cardinal

who was Napoleon's ambassador to the Vatican in Rome.

Fesch was a Corsican and the half brother of Napoleon's mother. After studies at the Seminary of Aix (1781–86) he became archdeacon of the cathedral chapter of his native city of Ajaccio. During the French Revolution, the Bonaparte family opposed the Corsican revolution of Pasquale Paoli, a native revolutionary leader, and Fesch was forced to join them

Fesch, detail of a lithograph by the de Becquet brothers after a drawing by Fischer

By courtesy of the Bibliotheque Nationale, Paris

in emigration to Toulon, Fr., in 1793. Soon after, he left the church and made a considerable fortune through business ventures and accompanied Napoleon to Italy as a supply contractor (1795–97).

Fesch returned to the church in 1800 and two years later was appointed archbishop of Lyon. In 1803 he received his cardinal's hat and journeyed to Rome as French ambassador. In this post, Fesch, often without enthusiasm, was forced to try to work out the difficulties between imperial policies and papal resistance. Increasingly he became estranged from this aspect of Napoleon's designs. In 1809, after Napoleon had virtually imprisoned the pope, Fesch refused to accept the archbishopric of Paris as a protest gesture. In 1811 he opened a council of the Gallican (or French national) church with a forceful declaration of fidelity to the papacy. This indiscretion caused Fesch to have to retire to Lyon and, when the empire fell, to Rome. He lived the remainder of his life still archbishop of Lyon, for the pope would not comply with French demands that he be deposed.

fescue, any of about 100 species of grasses constituting the genus *Festuca* (family Poaceae),

Fescue (*Festuca*)

Syndication International—Photo Trends

native to temperate and cold regions of the Northern Hemisphere. Several species are important pasture and fodder grasses, and a few are used in lawn mixtures.

Meadow fescue (*F. pratensis;* formerly *F. elatior*), a plant about 0.5 to 1.2 m (1½ to 4 feet) tall, is used for fodder and as a permanent pasture grass. Both meadow fescue and tall or reed fescue (*F. arundinacea*) are Old World species that have become widespread in parts of North America. The shorter, fine-leaved sheep fescue (*F. ovina*), often found on mountainsides, grows in dense tufts and forms turfs in dry or sandy soil. One variety, known as blue fescue (*F. ovina* variety *glauca*), has smooth, silvery leaves and is planted in ornamental borders. Red fescue (*F. rubra*) is used in lawn grass mixtures.

Fessenden, Reginald Aubrey (b. Oct. 6, 1866, Milton, Que., Can.—d. July 22, 1932, Hamilton, Bermuda), Canadian-American radio pioneer who broadcast the first program of music and voice ever transmitted over long distances.

After study at Trinity College School, in Port Hope, Ont., and Bishop's College in Lennoxville, Que., Fessenden went to Bermuda as principal of the Whitney Institute, where he developed an interest in science that led him to resign and go to New York. Working as a tester at the Thomas Edison Machine Works, he met Thomas Edison and in 1887 became chief chemist of the Edison Laboratory at Orange, N.J. In 1890 he became chief electrician at the Westinghouse works at Pittsfield, Mass., and in 1892 turned to an academic career, as professor of electrical engineering first at Purdue University, West Lafayette, Ind., then at the Western University of Pennsylvania (now the University of Pittsburgh), where he worked on the problem of wireless communication.

In 1900 Fessenden left the university to conduct experiments in wireless telegraphy for the U.S. Weather Bureau, which wanted to adapt radiotelegraphy to weather forecasting. He then became interested in voice transmission and developed the idea of superimposing electric waves, vibrating at the frequencies of sound waves, upon a constant radio frequency, so as to modulate the amplitude of the radio wave into the shape of the sound wave. (This is the principle of amplitude modulation, or AM.) Fessenden also invented an electrolytic radio detector sensitive enough for use in radiotelephony.

In 1902 Fessenden joined two financiers in organizing the National Electric Signalling Company to manufacture his inventions. He directed Ernst Alexanderson of the General Electric Company in building a 50,000-hertz alternator that made possible the realization of radiotelephony, and Fessenden at once built a transmitting station at Brant Rock, Mass. On Dec. 24, 1906, wireless operators as far away as Norfolk, Va., were startled to hear speech and music from Brant Rock through their own receivers. That same year, Fessenden established two-way transatlantic wireless telegraphic communication between Brant Rock and Scotland.

Fessenden further contributed in 1902 to the development of radio by demonstrating the heterodyne principle of converting high-frequency wireless signals to a lower frequency that is more easily controlled and amplified. This was the forerunner of the superheterodyne principle, which made easy tuning of radio signals possible and was a critical factor for the growth of commercial broadcasting.

Fessenden has also been credited with inventing the radio compass, the sonic depth finder, submarine signalling devices, and the turboelectric drive for battleships.

Fessenden, William Pitt (b. Oct. 16, 1806, Boscawen, N.H., U.S.—d. Sept. 8, 1869, Portland, Maine), American Whig politician who was influential in founding the Republican Party in 1856.

Fessenden graduated from Bowdoin College, Brunswick, Me., in 1823 and began to study law. He was admitted to the bar in 1827 and served the Portland area (as a Whig) in the U.S. House of Representatives from 1841 to '43. Disliking congressional life, he left the capital but returned to Washington in 1854 to represent Maine in the Senate, a position he held until his death (save for a few months as a member of Lincoln's Cabinet). Fessenden was one of a small group of Northern senators who opposed the extension of slavery into the territories, and he was one of the leaders of the movement that resulted in the formation of the Republican Party. During the Civil War (1861–65), he was chairman of the Senate Finance Committee. On the resignation of Secretary of the Treasury Salmon P. Chase in 1864, Fessenden was appointed to the treasury post, where he served for eight months. Returning to the Senate in March

William Fessenden

By courtesy of the Library of Congress, Washington, D.C.

1865, he chaired the Joint Committee on Reconstruction, and, although he took issue with some of the more extreme proposals of the Radical Republicans, he was the main author of the Committee's report of 1866. In 1868, however, he alienated his fellow Republicans when, despite his dislike for President Andrew Johnson, he cast the deciding vote against impeachment.

festival: *see* feast.

festoon (architecture): *see* swag.

Festus, Sextus Pompeius (fl. 2nd or 3rd century AD, Narbo, Gaul [now Narbonne, Fr.]), Latin grammarian who made an abridgment in 20 books of Marcus Verrius Flaccus' *De significatu verborum* ("On the Meaning of Words"), a work that is otherwise lost. A storehouse of antiquarian learning, it preserves by quotation the work of other authors that has not survived elsewhere. The first half of Festus' work, too, is lost, but a further abridgment of it by Paul the Deacon in the 8th century survives. In his abridgment Festus made a few insertions of his own, and removed obsolete Latin words with the intention of publishing them as a separate work, but it is doubtful whether this was ever written. The remains of his abridgment exist in only one manuscript, the Codex Festi Farnesianus, at Naples. The glosses on it of Josephus Justus Scaliger (1565) were one of the first examples of modern classical scholarship.

Fet, Afanasy Afanasyevich, Fet also spelled FOETH, legitimatized name AFANASY AFANASYEVICH SHENSHIN (b. Dec. 5 [Nov. 23, Old Style], 1820, Novosyolki, near Mtsensk, Orlov district, Russia—d. Dec. 3 [Nov. 21], 1892, Moscow), Russian poet and translator, whose sincere and passionate lyric poetry strongly influenced later Russian poets, particularly the Symbolist Aleksandr Blok.

The illegitimate son of a German woman named Fet (or Foeth) and of a Russian landowner named Shenshin, whose name he

Fet, portrait by Ilya Repin
Novosti Press Agency

assumed by decree in 1876, Fet was still a student at the University of Moscow when, in 1842, he published several admirable lyrics in the literary magazine *Moskvityanin.* In 1850 a volume of his poems appeared, followed by another in 1856. He served several years in the army, retiring in 1856 with the grade of captain. In 1860 he settled on an estate at Stepanovka, in his home district, where he was often visited by his friends Ivan Turgenev and Leo Tolstoy.

His intense and brief lyrics, which aimed to convey vivid momentary sensations, were to have great influence on the later Symbolists, but during his lifetime he was decried because of his reactionary political views and somewhat unattractive personality. After 1863 he published very little, but he continued to write nature poetry and love lyrics (published posthumously in a four-volume collected edition, 1894). His works also include translations of Ovid, Virgil, J.W. von Goethe's *Faust,* and Arthur Schopenhauer's *The World as Will and Idea.*

feta, fresh, white, soft or semisoft cheese of Greece, originally made exclusively from goat's or sheep's milk but in modern times containing cow's milk. Feta is not cooked or pressed but is cured briefly in a brine solution that adds a salty flavour to the sharp tang of goat's or sheep's milk.

The making, or so-called pickling, of feta is an ancient practice. In Homer's *Odyssey,* Polyphemus the Cyclops made sheep's milk cheese, probably a forerunner of feta, which he ripened on racks in his cave. Considered the national cheese of Greece, feta is now made in many parts of the world. The best versions adhere to the original ingredients. Exported feta is usually pasteurized, but in Greece the cheese is still made in the traditional manner by mountain farmers. When stored in a liquid bath of brine, water, or milk, it will keep for months; otherwise it dries out quickly.

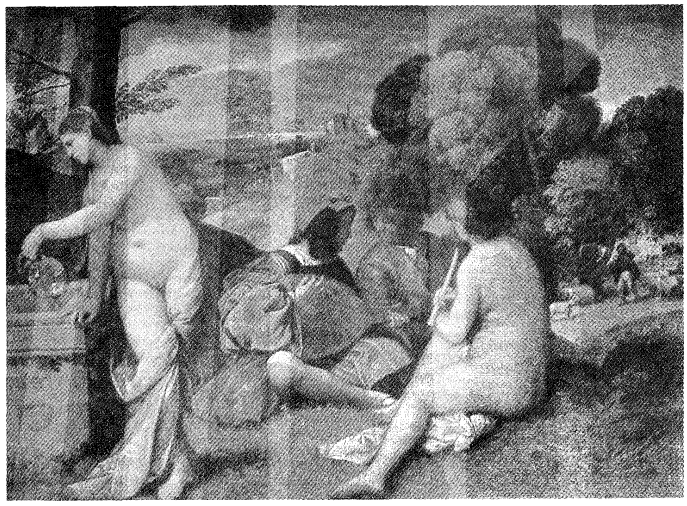
fetal alcohol syndrome (FAS), various congenital abnormalities in the newborn infant that are caused by the mother's ingestion of significant amounts of alcohol around the time of conception or during pregnancy. The principal symptoms of a child born with fetal alcohol syndrome are retarded growth both before and after birth; mental retardation and delayed mental development; and certain characteristic abnormalities of the face and head. The latter include microcephaly (small head); short palpebral fissures (small eye openings); ptosis (eyelid droop); epicanthic folds (skin folds over the inside eye corner); short, upturned nose; long, smooth philtrum (area between nose and mouth); thin upper lip; and a small jaw. There may also be abnormalities of the upper respiratory passageways, heart, and joints and limbs.

FAS is apparently caused by the effects of ethanol (alcohol) or its breakdown product (acetaldehyde) on the developing human embryo or fetus. FAS occurs with a frequency of anywhere from 0.5 to 3 live births per thousand in Western countries. The syndrome commonly appears in the newborns of mothers who are chronic alcoholics. The more heavily a mother drinks during pregnancy, the more severe will be her child's physical malformations and mental dysfunction. Fetal alcohol syndrome appears somewhat unpredictably, however: only about 40 percent of all pregnant women who drink heavily during pregnancy will have a child afflicted with FAS, and conversely, 11 percent of women who are not alcoholics and who drink only moderate amounts of alcohol during pregnancy will give birth to a child with FAS symptoms. The syndrome can usually be prevented by the mother's abstention from all alcoholic beverages shortly before and during pregnancy.

fetch, area of ocean or lake surface over which the wind blows in an essentially constant direction, thus generating waves. The term also is used as a synonym for fetch length, which is the horizontal distance over which wave-generating winds blow. In an enclosed body of water, fetch is also defined as the distance between the points of minimum and maximum water-surface elevation. This line generally coincides with the longest axis in the general wind direction. Fetch is an important factor in the development of wind waves, which increase in height with increasing fetch up to a maximum of 1,600 km (1,000 miles). Wave heights do not increase with increasing fetch beyond this distance.

fête champêtre (French: "rural feast"), in painting, representation of a rural feast or open-air entertainment. Although the term fête galante ("gallant feast") is sometimes used synonymously with fête champêtre, it is also used to refer to a specific kind of fête champêtre: a more graceful, usually aristocratic scene in which groups of idly amorous, relaxed, well-dressed figures are depicted in a pastoral setting.

A forerunner of the highly developed French fête champêtre of the 18th century may be seen in the art of 16th-century Venice and specifically in "Le Concert champêtre" (Louvre, Paris), a painting attributed by some to Giorgione.



(Top) "Le Concert champêtre," a fête champêtre, attributed to Giorgione, oil on canvas, *c.* 1510, in the Louvre, Paris; (bottom) "Réunion en plein air," a fête galante by Jean-Antoine Watteau, oil on canvas, *c.* 1716, in the Staatliche Kunstsammlungen, Dresden, E.Ger.

By courtesy of (bottom) the Staatliche Kunstsammlungen, Dresden, E.Ger.—Gemaldegalerie Alte Meister; photographs, (top) SCALA—Art Resource/EB Inc., (bottom) Gerhard Reinhold, Leipzig, E.Ger.

Antoine Watteau (d. 1721) brought the fête galante to its highest point when he created a mysterious, melancholy, dreamlike world populated by well-dressed people who flirt and play gracefully in parklike surroundings. The pastoral setting emphasizes the essential innocence and spontaneity of the participants, who are unafflicted by the stiffness imposed by the conventions of formal society. Eroticism is subtly rather than openly expressed. Fête galantes continued to be depicted by Watteau's pupils Nicolas Lancret and Jean-Baptiste Pater. The fête champêtre and fête

galante ended with the termination of the Rococo period in the late 18th century.

Fethiye, town, southwestern Turkey. It lies along a sheltered bay in the eastern part of the Gulf of Fethiye on the Mediterranean Sea that is backed by the western Taurus ranges. Fethiye's enlarged port is an outlet for the minerals and timber of the region. The hinterland is a centre of chromium mining; total output from its scattered mines exceeds that of the nation's richest single mine at Guleman. Fethiye stands on the site of the ancient Lycian city of Telmessus, whose remains include spectacular rock tombs and sarcophagi dating from the 5th–4th century BC. Other landmarks include a ruined Byzantine fortress on the summit of a nearby hill. Much of the town is new, having been rebuilt after a disastrous earthquake in 1958. Picturesquely situated with several Lycian sites nearby, notably Xanthus, Fethiye is a growing tourist centre linked by sea with İzmir and Istanbul. Pop. (1985) 21,442.

Feti, Domenico: *see* Fetti, Domenico.

fetial, any of a body of 20 Roman priestly officials who were concerned with various aspects of international relations, such as treaties and declarations of war. The fetials were originally selected from the most noble families; they served for life, but, like all priesthoods, they could only submit advice, not make binding decisions.

According to the Roman historian Livy, after Rome had been injured by another state, four fetials were sent out to seek redress. One member, the *verbenarius,* carried herbs gathered from the Arx on the Capitoline Hill. Another member, called the *pater patratus,* served as the group's representative. Upon reaching the border of the offending state, the *pater patratus* first announced his mission and addressed a prayer to Jupiter in which he affirmed the justness of his errand. Crossing the border, he repeated the same form several times. If, after 30 days (some sources give 33), no satisfaction was given, the *pater patratus* harshly denounced the offending state and returned to Rome, where he reported to the Senate. If Rome decided to wage war, the *pater patratus* returned to the border, pronounced a declaration of war, and hurled across the boundary either a regular spear or a special stake sharpened and hardened in the fire. This ritual was supposed to keep Rome from waging an unjust or aggressive war. If, however, the hostile country was far away, the spear soon came to be cast upon a piece of land in front of the Temple of Bellona in Rome; by a legal fiction, that land was treated as belonging to the enemy. Thus the ritual limitations were overcome by such legal fictions, and the state entered into any wars that were seen to be to its advantage.

When treaties were concluded, the *verbenarius* and the *pater patratus* were sent to the other nation; after reading the treaty aloud, they pronounced a curse on Rome should that state be the first to break it. The ceremony was concluded by killing a pig with a flint implement. By the time of the late republic, the institution had faded out, although the emperor Augustus (63 BC–AD 14) revived the group, ceremonially at least, and became a member himself in his effort to restore old Roman traditions.

fetid yew (tree): *see* stinking yew.

Fétis, François-Joseph (b. March 25, 1784, Mons, Austrian Netherlands [now in Belgium]—d. March 26, 1871, Brussels), prolific scholar and pioneer scientific investigator of music history and theory. He was also an organist and composer.

As a child Fétis played violin, piano, and organ; he produced a violin concerto at age nine. He entered the Paris Conservatory in 1800 and in 1803 went to Vienna to continue his musical studies. Fétis married into a wealthy family in 1806 and then began his long study of Catholic chant and liturgy. Following the loss of the family fortune in 1811, he devoted himself to theoretical research and composition, becoming a professor at the Paris Conservatory in 1821. From then on he produced a stream of scholarly writings and method books, including the classic *Traité du contrepoint et de la fugue* (1825; "Treatise on Counterpoint and Fugue") and pieces in the journal *La Revue Musicale* (1827–35), which he founded and edited. He was appointed conservatory librarian in 1827 and in 1832 initiated a concert-lecture series devoted to older music. In 1833 Fétis became chapelmaster to Leopold I of Belgium and director of the Brussels Conservatory. He was made a member of the Belgian Royal Academy in 1845. After his death his important library passed to the Royal Library of Brussels, where it remains.

None of Fétis' operas, church and chamber music, and orchestral and piano works is now performed; rather, he is remembered for his writings. Of lasting importance is his eight-volume *Biographie universelle des musiciens* . . . (1835–44; "Universal Biography of Musicians"), which, although marred by numerous inaccuracies, remains an invaluable research tool. He also wrote extensively on musical instruments and music history and theory. Despite his sometimes fanciful or unsupported facts and opinions, Fétis' scientific approach to music was an important influence on succeeding generations of scholars.

fetishism, in psychology, a form of sexual deviance involving erotic attachment to an inanimate object or an ordinarily asexual part of the human body.

The term fetishism was actually borrowed from anthropological writings in which "fetish" (also spelled fetich) referred to a charm thought to contain magical or spiritual powers. Its influence on psychiatric usage is indicated by Sigmund Freud's reference, in his *Three Contributions to the Theory of Sex,* to the sexual object of the fetishist as being comparable to "the fetich in which the savage sees the embodiment of his god."

Fetishism as a mental condition may be defined as the necessity to use a nongenital object in order to achieve sexual gratification. The object may be some other body part, an article of clothing, or, less frequently, some more impersonal object. The condition occurs almost exclusively among men, and most of the objects used relate to the female body or female clothing. Long hair or the foot may be the primary object of sexual attention; cases in which a certain hair colour or type of body blemish is required for sexual stimulation are also generally classified as fetishism. The articles of clothing most commonly used are shoes and items of female underclothes. Olfactory sensations are also frequently important.

Fetti, Domenico, Fetti also spelled FETI (b. 1588/89, Rome, Papal States [now in Italy]—d. 1623, Venice, Republic of Venice), Italian Baroque painter whose best-known works are small representations of biblical parables as scenes from everyday life—*e.g.,* "The Good Samaritan" (Metropolitan Museum of Art, New York City). These works, which Fetti painted between 1618 and 1622, were executed in a style that emphasized the use of rich colour and the changing effects of light and shade. They are important in the development of Baroque landscape for the way small-scale figures and landscape scenery are fused into an atmospheric whole.

In Rome Fetti was a pupil of Ludovico Cigoli but was principally influenced by the followers of Caravaggio and also by Adam Elsheimer. Through Cigoli he attracted the attention of Cardinal Ferdinando Gonzaga. The cardinal went to Mantua to become Duke Ferdinando II, and Fetti became his court painter about the end of 1613. At Mantua he saw the works of Peter Paul Rubens as well as those of Giulio Romano, and his style was considerably modified. Later, the influence of Venetian art was even more marked, although he probably first visited Venice in about 1621 to buy works of art for his patron; he took up residence in the city in 1622.

fetus, also spelled FOETUS, the unborn young of any vertebrate animal, particularly of a mammal, after it has attained the basic form and structure typical of its kind.

A brief treatment of the fetus follows. For full treatment, *see* MACROPAEDIA: Growth and Development, Biological.

Biologists arbitrarily speak of the earliest stages of development of the fertilized egg as the embryonic period, which ends when the external form of the embryo begins to resemble clearly the newborn of the group to which it belongs. The next period, culminating in birth, is the fetal period. In human development this transition occurs in approximately the eighth week after conception. The fetal stage is characterized by increased growth and by the full development of the organ systems.

Some fetal disorders may cause birth of the infant before term. If expulsion occurs before the human fetus has reached a stage of development advanced enough to allow it to live outside the womb (20 to 22 weeks), it is spoken of as an abortion or miscarriage. Expulsion of a dead fetus thereafter is considered a stillbirth and of a living fetus a premature birth. Postmature birth is one occurring more than three weeks beyond the expected date of delivery.

Feuchères, Sophie Dawes, baronne de (baroness of) (b. 1795, St. Helens, Isle of Wight, Eng.—d. Dec. 15, 1840, London), English adventuress, mistress of the last survivor of the princes of Condé.

The daughter of a drunken fisherman named Dawes, she grew up in the workhouse, went up to London as a servant, and became the mistress of the Duke de Bourbon, afterward the ninth Prince de Condé. She was ambitious, and he had her well educated not only in modern languages but in Greek and Latin. He took her to Paris and, to prevent scandal and to qualify her to be received at court, had her married in 1818 to Adrien-Victor de Feuchères, a major in the royal guards. The prince provided her dowry and made her husband his aide-de-camp and a baron. The baroness, pretty and clever, became a person of consequence at the court of Louis XVIII.

Feuchères, however, finally discovered the relations between his wife and Condé, who he had been assured was her father; he left her (he obtained a legal separation in 1827) and told the king, who thereupon forbade her appearance at court. Thanks to her influence, however, Condé was induced in 1829 to sign a will bequeathing about 10,000,000 francs to her, and the rest of his estate—more than 66,000,000 francs—to the Duke d'Aumale, fourth son of Louis-Philippe. Again she was in high favour. Charles X received her at court, Talleyrand visited her, her niece married a marquis, and her nephew was made a baron. Condé, wearied by his mistress's importunities and but half pleased by the advances made him by the government of July, had made up his mind to leave France secretly. When on Aug. 27, 1830, he was found hanging dead from his window, the baroness was suspected and an inquiry was held, but the evidence of death being the result of criminal means appearing insufficient, she was not prosecuted. Hated as she was alike by legitimists and republicans, life in Paris was no longer agreeable

for her, and she returned to London, where she died 10 years later.

Feuchtwanger, Lion (b. July 7, 1884, Munich—d. Dec. 21, 1958, Los Angeles), German novelist and playwright known for his historical romances.

Feuchtwanger
Bavaria-Verlag

Born of a Jewish family, he studied philology and literature at Berlin and Munich (1903–07) and took his doctorate in 1918. In 1918 he founded a literary paper, *Der Spiegel*. His first historical novel was *Die hässliche Herzogin* (1923; *The Ugly Duchess*, 1927), about Margaret Maultasch, duchess of Tirol. *Jud Süss* (written 1921, published in 1925; English *Jew Süss*, 1926; U.S., *Power*), set in 18th-century Germany, revealed a depth of psychological analysis that remained characteristic of his best work—the *Josephus-Trilogie* (*Der jüdische Krieg*, 1932; *Die Söhne*, 1935; *Der Tag wird kommen*, 1945); *Die Geschwister Oppenheim* (1933; *The Oppermanns*, 1933), a novel of modern life; and *Der falsche Nero* (1936; *The Pretender*, 1937).

Feuchtwanger was exiled in 1933 and moved to France, from where he escaped to the United States in 1940 after some months in a concentration camp, described in *The Devil in France* (1941). Of his later works the best known are *Proud Destiny* (1947), *Goya oder der arge Weg der Erkenntnis* (1951; *This Is the Hour*, 1952), and *Jepta und seine Tochter* (1957; *Jephthah and His Daughter*, 1958). His German translations of Marlowe's *Edward II* (in collaboration with Bertolt Brecht) and of plays by Aeschylus and Aristophanes also are highly regarded.

feud, also called BLOOD FEUD, a continuing state of conflict between two groups within a society (typically kinship groups) characterized by violence, usually killings and counterkillings. It exists in many nonliterate communities in which there is an absence of law or a breakdown of legal procedures and in which attempts to redress a grievance in a way that is acceptable to both parties have failed.

The feud is usually initiated to secure revenge, reprisal, or honour for a member of the injured group. The hostile groups are related in some way, such as being members of the same political or cultural unit. Within each group there is a strong sense of collective solidarity that protects individual members against injury by outsiders. Members of any other such group are held collectively responsible for any injury suffered at the hands of the members of that group. If, however, both parties accept as "due process" a counterkilling in response to an original homicide, a feud will not result.

Most nonliterate societies have institutions that forestall blood feud or bring it to a close. Even though many peoples, such as the Trobriand Islanders of Melanesia and the Nuer of the Sudan, profess that honour demands revenge, payment of compensation is more common than reciprocal killing (*see* blood money). Regulated combat was frequently used by the Australian Aborigines as a substitute for blood feud. The establishment of a strong centralized political authority generally results in the suppression of blood feud.

feudal land tenure, system by which land was held by tenants from lords. As developed in medieval England and France, the king was lord paramount with numerous levels of lesser lords down to the occupying tenant.

Tenures were divided into free and unfree. Of the free tenures, the first was tenure in chivalry, principally grand serjeanty and knight service. The former obliged the tenant to perform some honourable and often personal service; knight service entailed performing military duties for the king or other lord, though by the middle of the 12th century such service was usually commuted for a payment called scutage. Another type of free tenure was socage, primarily customary socage, the principal service of which was usually agricultural in nature, such as performing so many days' plowing each year for the lord. In addition to the principal service, all these tenures were subject to a number of conditions, such as relief, the payment made on transfer of a fief to an heir, and escheat, the return of the fief to the lord when the vassal died without an heir. Chivalric tenures were also subject to wardship, the guardianship of a fief of a minor, and marriage, payment made in lieu of marriage of the vassal's daughter to the lord.

Another form of free tenure was the spiritual tenure of bishops or monasteries, their sole obligation being to pray for the souls of the grantor and his heirs. Some ecclesiastics also held temporal lands for which they performed the required services.

The main type of unfree tenancy was villenage, initially a modified form of servitude. Whereas the mark of free tenants was that their services were always predetermined, in unfree tenure they were not; the unfree tenant never knew what he might be called to do for his lord. Although at first the villein tenant held his land entirely at the will of the lord and might be ejected at any time, the royal courts later protected him to the extent that he held tenancy at the will of the lord and according to the custom of the manor, so that he could not be ejected in breach of existing customs. Moreover, an unfree tenant could not leave without his lord's approval. Tenure in villenage in England then became known as copyhold tenure, in which the holder was personally free and paid rent in lieu of services.

feudalism, a social system of rights and duties based on land tenure and personal relationships in which land (and to a much lesser degree other sources of income) is held in fief by vassals from lords to whom they owe specific services and with whom they are bound by personal loyalty. In a broader sense, the term denotes "feudal society," a form of civilization that flourishes especially in a closed agricultural economy and has certain general characteristics besides the mere presence of lords, vassals, and fiefs. In such a society, those who fulfill official duties, whether civil or military, do so not for the sake of an abstract notion of "the state" or of public service but because of personal and freely accepted links with their overlord, receiving remuneration in the form of fiefs, which they hold hereditarily. Because various public functions are closely associated with the fief rather than with the person who holds it, public authority becomes fragmented and decentralized. Another aspect of feudalism is the manorial or seignorial system in which landlords exercise over the unfree peasantry a wide variety of police, judicial, fiscal, and other rights.

Several of the great civilizations of the world have passed through a feudal period in the course of their history. Some of these feudalisms—for instance, the Japanese (*see* Daimyo)—are indeed quite comparable with the feudalism of western Europe and of the Latin East.

The origins of European feudalism are to be found in the early Frankish kingdom (8th century), when the granting of fiefs on the one hand and the establishment of personal vassal–lord bonds on the other were linked together. In earlier centuries one type of land grant had been the benefice, given for the lifetime of the tenant and at his request; but it was not until the second half of the 8th century that the benefice was linked generally with vassalage. Whereas previously grants of the Frankish kings to their followers had been in full ownership, the kings began to keep the ownership to themselves and to grant land only in benefice with a wide right of use and exploitation. Not only their own lands but also church lands were distributed. About the same time public functions were also being given in benefice to royal vassals. The king's example was quickly followed by various lesser lords.

Feudalism spread with the Frankish conquests into northern Italy, Spain, and Germany and later into the Slavic territories. The Normans took it to England in 1066 and to southern Italy and Sicily a few years later. From England feudalism spread to Scotland and to Ireland. Finally the Near Eastern territories that the crusaders conquered were organized feudally.

Internally the system developed greatly in the course of the 9th century. Of particular importance was the transformation of the benefice into a hereditary fief. Royal power declined and local dynasties became, in fact, independent and started to build up small territorial states for themselves; often they were at war with each other. The church was largely feudalized. Secular lords, in return for homage, would invest bishops and abbots with their ecclesiastical offices and with the temporalities that went with them. In return, the bishops and abbots owed the secular lord various services, even military. In the field of law and justice, feudalism meant replacing the ancient courts of local dignitaries by courts composed of the vassals of a common lord. The consequent dispersal and multiplication of courts made the judicial apparatus extremely complex.

From the 12th century onward feudalism came under attack from various rival forces. The centralized state with its salaried officials and its mercenary armies was being built on Roman ideas about sovereignty and the safeguard of public order; the relationship between subject and sovereign replaced that of vassal and lord as the basis of a well-ordered society. The towns, growing in economic power and even forming their own militias, were able to a large extent to impose their own concepts about society against those of the knights. Finally, the manorial system, the material basis of the knightly class, in the 12th and 13th centuries underwent a deep economic crisis.

Although feudalism by the end of the 14th century was no longer a political and social force, it had left its mark on European society. It exercised its greatest influence in the elaboration of modern forms of constitutional government. Ideas about consent to taxes and resistance to and defiance of the lord and the whole balance of rights and duties between lords and vassals played a great role in colouring the outlook of early representative institutions.

Feuerbach, Anselm (b. Sept. 12, 1829, Speyer, Bavaria—d. Jan. 4, 1880, Vienna), one of the leading German painters of the mid-19th century working in the style of Romantic Classicism.

Feuerbach was the son of a classical archaeologist and nephew of the philosopher Ludwig Feuerbach. After studying art at the

Düsseldorf Academy and in Munich, he went twice to Paris, where he worked in the studio of Thomas Couture and was influenced by Courbet and Delacroix.

Feuerbach lived in Italy from 1855 to 1873, and much of his best work was produced during this period. Influenced by antique Greek and Roman art and Italian High Renaissance painting, he developed his characteristic interest in idealized figure compositions of a lyrical, elegiac nature. Perhaps his most important and original works are the formal, statuesque portraits he painted of the model Nanna Risi between 1860 and 1865 (*e.g.*, "Nanna," 1861; Staatsgalerie, Stuttgart) and Raphaelesque likenesses of his stepmother, Henriette Feuerbach.

"Nanna," oil painting by Anselm Feuerbach, 1861; in the Staatsgalerie, Stuttgart, Ger.
By courtesy of the Staatsgalerie, Stuttgart, Ger.

In 1873 Feuerbach became a professor at the Vienna Academy of Fine Arts and for the academy building painted "Fall of the Titans," generally regarded as his weakest work. Ill and discouraged by the harsh criticism of this work, Feuerbach left Vienna in 1876 and returned to Italy.

Feuerbach, Ludwig (Andreas) (b. July 28, 1804, Landshut, Bavaria—d. Sept. 13, 1872, Rechenberg, Ger.), German philosopher and moralist remembered for his influence on Karl Marx and for his humanistic theologizing.

The fourth son of the eminent jurist Paul von Feuerbach, Ludwig Feuerbach abandoned theological studies to become a student of philosophy under G.W.F. Hegel for two years at Berlin. In 1828 he went to Erlangen to study natural science, and two years later his first book, *Gedanken über Tod und Unsterblichkeit* ("Thoughts on Death and Immortality"), was published anonymously. In this work Feuerbach attacked the concept of personal immortality and proposed a type of immortality by which human qualities are reabsorbed into nature. His *Abälard und Heloise* (1834) and *Pierre Bayle* (1838) were followed by *Über Philosophie und Christentum* (1839; "On Philosophy and Christianity"), in which he claimed "that Christianity has in fact long vanished not only from the reason but from the life of mankind, that it is nothing more than a fixed idea." Continuing this view in his most important work, *Das Wesen des Christentums* (1841; *The Essence of Christianity,* 1845), Feuerbach posited the notion that man is to himself his own object of thought and reduced religion to a consciousness of the infinite. That is, it is "nothing else than the consciousness of the infinity of the consciousness; or, in the consciousness of the infinite, the conscious subject has for his object the infinity of his own nature." The result of this

Ludwig Feuerbach
Archiv fur Kunst und Geschichte, Berlin

view is the notion that God is merely the outward projection of man's inward nature. In the first part of his book, which strongly influenced Karl Marx, Feuerbach analyzed the "true or anthropological essence of religion." Discussing God's aspects "as a being of the understanding," "as a moral being or law," "as love," and others, he argued that they correspond to different needs in human nature. In the second section he analyzed the "false or theological essence of religion," contending that the view that God has an existence independent of human existence leads to a belief in revelation and sacraments, which are items of an undesirable religious Materialism.

Although Feuerbach denied that he was an atheist, he nevertheless contended that the God of Christianity is an illusion. As he expanded his discussion to other disciplines, including philosophy, he came to see Hegel's principles as quasi-religious and embraced instead a form of Materialism that Marx subsequently criticized in his *Thesen über Feuerbach* (written 1845). Attacking religious orthodoxy during the politically turbulent years of 1848–49, Feuerbach was seen as a hero by many of the revolutionaries. His influence was greatest on such anti-Christian publicists as David Friedrich Strauss, author of the skeptical *Das Leben Jesu kritisch bearbeitet* (1835–36; *The Life of Jesus Critically Examined*, 1846), and Bruno Bauer, who, like Feuerbach, had abandoned Hegelianism for naturalism. Some of Feuerbach's views were later endorsed by extremists in the struggle between church and state in Germany and by those who, like Marx, led the revolt of labour against capitalism. Among his other works are *Theogonie* (1857) and *Gottheit, Freiheit und Unsterblichkeit* (1866; "God, Freedom, and Immortality"); his collected *Werke* were published in 10 volumes (1846–66; 1903–11).

Feuerbach, Paul (Johann Anselm), Ritter von (knight of) (b. Nov. 14, 1775, Hainichen, near Jena, Thuringia—d. May 29, 1833, Frankfurt am Main), jurist and reformer of criminal law in Germany who was important mainly for achieving official recognition of the principle of *nullum crimen, nulla poena sine lege* ("no crime and no punishment unless provided by [statutory] law"), by which the power of German judges was curtailed.

Paul von Feuerbach, engraving, 1830
By courtesy of the Staatsbibliothek, Berlin

Although he protested agajnst vindictive punishment, he promulgated a "psychological-coercive," or intimidation, theory of penal law; in his view, punishment should be sufficient to deter potential lawbreakers.

Appointed to the Bavarian Ministry of Justice (1805), Feuerbach was ordered to prepare a penal code for the kingdom of Bavaria (Strafgesetzbuch für das Königreich Bayern, effective from 1813). Distinguished by its precise definitions and classifications of crimes, this code, together with the Code Pénal (1810) of Napoleonic France, served as a model for the criminal law of other European states for several decades. Feuerbach secured (1806) the abolition of torture in Bavarian criminal proceedings. Later, he was second president of the Court of Appeal at Bamberg (1814–17) and first president of the appellate court at Ansbach (1817–33).

Feuerbach's *Lehrbuch des gemeinen in Deutschland gültigen peinlichen Rechts* (1801; "Textbook of Criminal Law Generally Applied in Germany") remained authoritative in Germany for half a century. In other works he criticized the jury system and, believing that secrecy is inimical to justice, urged publicity for all court actions.

Feuillade, Louis (b. 1873, Lunel, Fr.—d. 1925, Paris), motion-picture director famous for internationally popular screen serials that were the most influential French films of the period around World War I.

Feuillade was a journalist who began his cinema career in 1906 as a scriptwriter. He soon was directing short adventure films. *Fantômas* (1913–14; *Master of Terror*), Feuillade's first serial, established his popularity in both France and the U.S. Its swift-moving, intricate plot featured a series of thrilling episodes involving clever disguises, trapdoors, kidnappings, hairbreadth escapes, and rooftop chases. It was followed by *Les Vampires* (1915), *Judex* (1916), and *La Nouvelle Mission de Judex* (1917–18; "The New Mission of Judex")—featuring Cresté, the daring detective with the sweeping black cape, a righter of wrongs who was the prototype of many future film heroes. The tremendous success of these pictures saved the French film industry, which had been threatened by competition from foreign imports.

Feuillants, Club of the, French CLUB DES FEUILLANTS, conservative political club of the French Revolution, which met in the former monastery of the Feuillants (Reformed Cistercians) near the Tuileries, in Paris. It was founded after Louis XVI's flight to Varennes (June 20, 1791), when a number of deputies, led by Antoine Barnave, Adrien Duport, and Alexandre de Lameth, left the Jacobin Club in opposition to a petition calling for the replacement of the King. These deputies, unlike those who remained with the Jacobins, feared the continuation of the Revolution, thinking it would result in the destruction of the monarchy and of private property.

The Feuillants made up a substantial group in the Legislative Assembly, elected in September 1791 to implement the newly written constitution. They sat on the right of the assembly (indicating their conservative attitude), opposed the democratic movement, and upheld the constitutional monarchy. But the Jacobins gradually overshadowed the Feuillants, and the club disappeared when the insurrection of Aug. 10, 1792, overthrew the monarchy.

Feuillet, Raoul-Auger (b. *c.* 1675—d. *c.* 1710), French dancer, dancing master, and choreographer whose dance notation system was published in his *Chorégraphie ou l'art de décrire la danse* (1700; "Choreography, or the Art of Describing the Dance," 1728). Working in Paris, he collaborated with André Lorin, conductor of the Académie Royale de Danse; he also wrote *Recueil de danses* (1704), describing dances performed at the Paris Opéra.

fever, also called PYREXIA, abnormally high bodily temperature or a disease of which an abnormally high temperature is characteristic. Although most often associated with infection, it is also observed in other pathologic states, such as cancer, coronary artery occlusion, and disorders of the blood.

Under normal conditions the temperature of deeper portions of the head and trunk does not vary by more than 1°–2° F in a day, and it does not exceed 99° (37.22° C) in the mouth or 99.6° (37.55° C) in the rectum. There is a small rhythmic diurnal variation in temperature, it being highest in the later afternoon and lowest in the early hours of the morning. In persons with fever the temperature may rise to 106° (41.11° C), and daily fluctuations of 5°–9° may occur; peak levels tend to occur in the late afternoon. Transient elevations to 112°–113° (44.44°–45° C) have been recorded but are rare.

During fever the blood and urine volumes become reduced as a result of loss of water through increased vaporization. Body protein is rapidly broken down, leading to increased excretion of nitrogenous products in the urine. At a time when the body temperature is rising rapidly the affected person may feel chilly, or even have a shaking chill; conversely, when the temperature is declining rapidly he may feel warm and have a flushed moist skin. Drugs such as aspirin, which reduce fever, seem to exert their effect on the temperature-regulating areas of the brain; they do not influence body temperature in health.

The mechanism of fever appears to involve a disturbance in the brain's control of various processes affecting heat production and heat loss—*i.e.,* muscle tone, flushing, sweating, etc. The generally accepted hypothesis is that in febrile diseases certain products of tissue injury, called pyrogens, are carried by the blood to the brain, where they disturb the function of the heat-control centres. A material capable of such an effect has been demonstrated in white blood cells. The liberation of products of this type from injured cells may be the cause of fever in disease.

Feversham, Louis de Durfort, 2nd earl of, VISCOUNT SONDES OF LEES COURT, BARON DURAS OF HOLDENBY, BARON OF THROWLEY, MARQUIS DE BLANQUEFORT (b. 1641, France—d. April 28, 1709), French-born soldier who played a notable role in military and diplomatic affairs in England under Charles II and James II.

Durfort (known as the Marquis de Blanquefort in France) met James, then Duke of York, in 1650 and went to England in 1665, where he was naturalized and created Baron Duras and where he acted as a royal adviser. In 1677, by special remainder, he succeeded to his father-in-law's earldom of Feversham.

On James II's accession (1685) he was made colonel of the first troop of horse guards and, on the news of the Duke of Monmouth's rising, commander of the royal forces in the west. He defeated the rebels at Sedgemoor (July 6, 1685). He remained in high favour but was a firm Protestant and was never associated with the pro-Catholic policies that lost James his throne. In the Revolution of 1688 he took command in the west against William of Orange but was given no opportunity to fight a campaign, partly because he encouraged James to build political support in London prior to military action. He refused to take oaths to the new king, but he would not intrigue on behalf of the exiled James. He lived out his life in retirement.

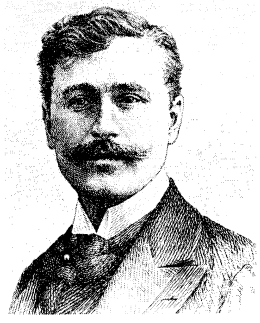
2nd Earl of Feversham, detail of a mezzotint by I. Smith after a portrait by I. Riley

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

feverwort, any of the four North American plant species of the genus *Triosteum,* all coarse perennials belonging to the family Caprifoliaceae. The other six species of the genus are Asian. The common names feverwort, wild ipecac, and horse gentian resulted from former medicinal uses of the plant. Other names for certain of the plants are tinker's weed and wild coffee.

The feverworts, reaching over a metre (about four feet) in height, have long, paired leaves, dull purplish or orange stalkless flowers, and bright red-orange or yellow-orange berries. The berries contain a few hard, oblong seeds. *T. perfoliatum* has clasping leaves; *T. aurantiacum, T. angustifolium,* and *T. illinoiense* have tapered leaves.

Feydeau, Georges(-Léon-Jules-Marie) (b. Dec. 8, 1862, Paris—d. June 5, 1921, Paris), French dramatist who delighted Parisian audiences in the years immediately prior to World War I and whose farces are still regularly performed.



Feydeau, lithograph by Lucien Dautrey

H. Roger-Viollet

Feydeau was the son of the novelist Ernest Feydeau (1821–73), the author of the novel *Fanny* (1858). The younger Feydeau was an able actor and director and wrote 39 plays between 1881 and 1916. Working in the tradition of the late 19th-century comic dramatist Eugène Labiche, he took the farce to new heights on the French stage. Though not a serious social critic, he made satirical capital out of every new fashion while continuing to exploit all the traditional butts of broad and undemanding comedy—cuckolds, silly wives, foreigners, the aged, and the deformed.

To a greater degree than earlier authors of farces, Feydeau made use of complicated mechanical props and elaborate stage settings. But, above all, his farces depend for their success on their plots. These are masterpieces of improbable contrivance, usually dependent on farfetched cases of mistaken identity and worked out in great detail without any consequent loss of speed. Among Feydeau's plays are *La Dame de chez Maxim* (1899; *The Girl from Maxim's*), *La Puce à l'oreille* (1907; *A Flea in Her Ear*), and *Occupe-toi d'Amélie!* (1908; *Keep an Eye on Amélie!*). Feydeau's farces have maintained their place in the repertory of the Comédie-Française in Paris and are also often performed in English-speaking countries.

Feyder, Jacques, pseudonym of JACQUES FRÉDÉRIX (b. July 21, 1888, Brussels—d. May 25, 1948, Geneva), popular French motion-picture director of the 1920s and '30s whose films are imbued with a sympathy for the common man and an attempt at psychological interpretation of character. His sharp criticism of French social and political trends was subordinated to his delineation of passionate and often poignant characters.

Feyder

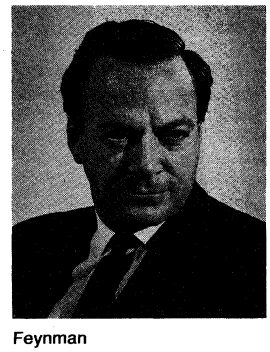
Brown Brothers

Feyder came to Paris as an actor in 1912 and directed his first film the next year. The realistic *L'Atlantide* (1921), based on the novel by Pierre Benoît, was his first box-office success, but it was *Crainquebille* (1922), from Anatole France's novel of daily Parisian life, that established his reputation as a director. He became a naturalized French citizen in 1928.

After filming *Thérèse Raquin* (1928), based on Émile Zola's novel, in Germany, Feyder returned to France to do *Les Nouveaux Messieurs* (1928; "The New Gentlemen"), a picture banned by the French government for its lightly satirical treatment of the French Parliament. Feyder spent the next five years in Hollywood, where his pictures included *The Kiss* (1929), an important silent film starring Greta Garbo; *Daybreak* (1931); and *Son of India* (1931).

Except for *Knight Without Armour* (1937), directed in England, Feyder's remaining pictures were made in France and starred his wife, the actress Françoise Rosay. Outstanding among them were *Le Grand Jeu* (1934; "The Great Game"), *Pension Mimosas* (1934), and *La Kermesse héroïque* (1935; *Carnival in Flanders*). Their complexity of characterizations and naturalistic fatalism foreshadowed the French film revival of the late 1930s that was led by Marcel Carné, who at one time had been Feyder's assistant.

Feynman, Richard P(hillips) (b. May 11, 1918, New York City—d. Feb. 15, 1988, Los Angeles), American theoretical physicist, corecipient (with Julian S. Schwinger of the United States and Tomonaga Shin'ichirō of Japan) of the Nobel Prize for Physics in 1965 for work in correcting inaccuracies of earlier



Feynman

Harvey of Pasadena

formulations of quantum electrodynamics, the theory that explains the interactions between electromagnetic radiation (photons) and charged subatomic particles such as electrons and positrons (anti-electrons). Feynman introduced simple diagrams, now called Feynman diagrams, that are easily visualized graphic analogues of the complicated mathematical expressions needed to describe the behaviour of systems of interacting particles. His work greatly simplified some of the calculations used to observe and predict such interactions.

Feynman graduated from the Massachusetts Institute of Technology in 1939 and received his Ph.D. at Princeton University in 1942. He served as a staff member of the U.S. atomic bomb project at Princeton University (1941–42) and Los Alamos, N.M. (1942–45), during World War II. He was an associate professor of theoretical physics at Cornell University from 1945 to 1950 and in the latter year became professor of theoretical physics at the California Institute of Technology, where he remained. In 1948 he completed his reconstruction of a large part of quantum mechanics and electrodynamics and resolved the meaningless results that the old quantum electrodynamic theory sometimes produced. In the early 1950s he provided an atomic basis for the Soviet physicist Lev D. Landau's theory of the behaviour of liquid helium. In 1958 Feynman and Murray Gell-Mann formulated a theory that accounted for most of the phenomena associated with the so-called weak interaction of subatomic particles. Among his publications are *Quantum Electrodynamics* (1961), *The Feynman Lectures on Physics,* 3 vol. (1963–65), and *QED* (1985).

Feyẓābād, also spelled FAIZĀBĀD, town, northeastern Afghanistan. It lies along the Kowkcheh River, at 4,000 feet (1,200 m) above sea level. Feyẓābād was destroyed by Morād Beg of Qondūz in 1821 and its inhabitants removed to Qondūz, but, after Badakhshan was annexed by 'Abd ar-Raḥmān, ruler of Afghanistan (1880–1901), the town recovered some of its former importance. In 1955 it was leveled by an earthquake. After the Soviet invasion of Afghanistan in 1979, Afghan guerrillas seized the town. After intermittent fighting, a Soviet military command was established in Feyẓābād in 1980. The town has rice and flour mills. Pop. (1982 est.) 9,564.

Fez (Morocco): *see* Fès.

Fezzan, also spelled FAZZĀN, Latin PHAZANIA, historic region of northern Africa and until 1963 one of the three provinces of the United Kingdom of Libya. It is part of the Sahara (desert) and now comprises the southwestern sector of Libya.

Fezzan's climate is extreme, with very hot summers and cool winters. Rainfall is scarce and irregular and is somewhat more plentiful in the north than in the south. Most of Fezzan's nearly 80,000 inhabitants dwell in desert oases in the south, while a smaller number graze their herds on thin seasonal scrub vegetation in the north. The inhabitants are of basically Arab origin, mixed with Berber and black African elements. Fezzan is noted for its extensive production of date palms, which cover several hundred thousand acres scattered in numerous oases and reputedly number about 10,000,000 trees. Dates are the staple food and are supplemented by some millet and vegetables.

The Greek historian Herodotus mentioned Fezzan as part of the territory of the Garamantes. The Romans conquered the Garamantes in 19 BC and annexed their country, which the Romans called Phazania, to the Roman Empire. In 666 the Arabs conquered Phazania and subjected it to Islām. Thereafter it was ruled by a succession of Arab and native dynasties until subdued by the Turks and made a part of the Ottoman Empire in 1842.

Emissaries of the Sanūsīyah religious brotherhood began founding lodges in Fezzan in the mid-19th century and were for a time the dominant influence in the region. Fezzan was amalgamated with Cyrenaica and Tripolitania under Italian rule in 1912. In 1951 a United Kingdom of Libya was proclaimed, and the three regions remained provinces until 1963, when Libya became a unitary state.

fiacre, French coach for hire, named for the Hôtel Saint-Fiacre, in Paris, where it was introduced in the 1640s. The first fiacres were boxlike, four-wheeled, open, hooded vehicles that were drawn by three horses and were designed to navigate the muddy Parisian streets.

Fiacre, 1853

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In 1794 about 800 were in use in Paris, and by the 19th century there were more than 1,500. The 19th-century fiacre resembled the carriages for hire used in England and the United States that were known as hackneys.

Fianarantsoa, town, east-central Madagascar. The town was founded in 1830 and was given its present name, meaning "where one learns what is good." It lies on the eastern fringe of a forested escarpment at an elevation of 4,000 feet (1,200 m) and consists of upper and lower towns, surrounded by woodland. It has a regional centre (1977) of the University of Madagascar. It lies on the island's main north–south highway linking it with the national capital, Antananarivo (180 miles [290 km] north) and Toliary (southwest); a railway connects it with the port of Manakara, about 70 miles (110 km) southeast.

The upper section of Fianarantsoa, Madagascar

Agence Hoa-Qui

The area in which Fianarantsoa is situated lies in the historic kingdom of the Betsileo people. The area is strongly agricultural; the main crop is rice, and beans, peanuts (groundnuts), corn (maize), cassava, potatoes, and yams are also grown. Cattle herding is also important. Pop. (1982 est.) 72,901.

Fianna Fáil (Irish: "Warriors of Ireland"), one of the dominant political parties in Ireland. It is sometimes called, loosely, the Republican Party.

The party, which was formally constituted in May 1926, originally was made up of those opposed to the terms of the treaty with Great Britain that in 1921 brought the Irish Free State into existence. The anti-treaty republicans, known from 1925 as Fianna Fáil, were organized and led by Eamon De Valera, who had been imprisoned in 1923 for supporting the republican armed resistance to the treaty. They at first refused to be seated in the Dáil (assembly) but finally entered in 1927; in 1932 they gained 47 percent of the seats, De Valera becoming prime minister. The party was repeatedly successful in the elections of the 1930s and '40s, although in 1948 the main opposition, Fine Gael, was able to form a minority government with the aid of smaller parties.

Fianna Fáil regained an effective majority in 1957 and up to 1973 remained the governing party, although from 1961 it did so with the aid of other parliamentary groups, particularly Labour. Fianna Fáil was defeated by a coalition of Fine Gael and Labour in 1973 but returned to power in 1977–81. Out of power again, it briefly returned to power in 1982 for nine months in a minority government.

The party at first drew much of its support from small farmers, labourers, and factory workers; but its conservatism in office, as well as its protective tariff policy, soon attracted support from small business people.

The rather minimal ideology associated with Fianna Fáil mostly reflected De Valera's austere patriotism and his vision of an independent, united, frugal, and self-supporting Ireland; this philosophy changed little after De Valera's death in 1975 at the age of 92. The party also traditionally attached special importance to the revival of the Irish language. In the late 20th century the party became increasingly preoccupied with economic issues related to Ireland's participation in the Common Market and the desire to improve domestic prosperity and welfare.

Fiat SpA, formerly FABBRICA ITALIANA AUTOMOBILI TORINO, international holding company and major Italian manufacturer of automobiles, trucks, and industrial vehicles and components. It is the largest family-owned corporation in Italy. Headquarters are in Turin.

Fiat was incorporated in 1906 as the successor to a company formed in 1899 by Giovanni Agnelli. Because of the high level of skilled workers in Turin and the local school of engineering, the company was able to gain an early lead on its competitors.

The success of Fiat was in large part the work of two men. Founder Giovanni Agnelli, whose family still holds a major interest in the company, led the firm throughout its formative years. An intellectual socialist, he saw the automotive industry as a means of providing transportation to the masses, as well as producing jobs for workers. This odd combination of socialism and industrialism proved to be a potent combination in the Italian automotive industry. By 1910 the firm was the largest in Italy, a position it has maintained since. The other major figure in the firm's development was Vittorio Valletta, an unusually skilled administrator, who as general manager guided the day-to-day activities of the company.

In 1979 the corporation converted to a holding company by spinning off a number of autonomous companies covering various separate operations. In 1986 Fiat acquired Alfa Romeo SpA (*q.v.*), an ailing Italian company that manufactured sports cars. Today Fiat is a massive, multinational firm with assembly plants and licenses in many European and overseas countries. Among its automotive names are Ferrari and Lancia. The company also has interests in nuclear energy and bioengineering in addition to manufacturing farm equipment, earth-moving machinery, machine tools, motors, aviation engines and components, and railway equipment. Fiat markets

its products throughout the world and has a strong presence in Latin America.

fiber, fiber-, etc.: *see under* fibre, fibre-, etc.

Fibiger, Johannes (Andreas Grib) (b. April 23, 1867, Silkeborg, Den.—d. Jan. 30, 1928, Copenhagen), Danish pathologist who received the Nobel Prize for Physiology or Medicine in 1926 for achieving the first controlled induction of cancer in laboratory animals, a development of profound importance to cancer research.

A student of the bacteriologists Robert Koch and Emil von Behring in Berlin, Fibiger became professor of pathological anatomy at the University of Copenhagen (1900). In 1907, while dissecting rats infected with tuberculosis, he found tumours in the stomachs of three animals. After intensive research, he discovered that the tumours, apparently malignant, followed an inflammation of stomach tissue caused by the larvae of a worm now known as *Gongylonema neoplasticum*. The worms had infected cockroaches eaten by the rats.

Fibiger
H. Roger-Viollet

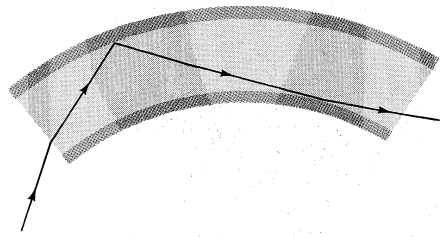
By 1913 he was able to induce gastric tumours consistently in mice and rats by feeding them cockroaches infected with the worm. By showing that the tumours underwent metastasis (the formation of cancerous tumours in unconnected organs without transfer of parasites or microorganisms), he added important support to the then-prevailing concept that cancer is caused by tissue irritation. Fibiger's work immediately led the Japanese pathologist Yamagiwa Katsusaburo to produce cancer in laboratory animals by painting their skins with coal-tar derivatives, a procedure soon adopted by Fibiger himself. Fibiger's findings were a necessary prelude to the production of chemical carcinogens (cancer-causing agents), a vital step in the development of modern cancer research.

Fibonacci, Leonardo (mathematician): *see* Leonardo Pisano.

fibre, also spelled FIBER, in textile production, basic unit of raw material having suitable length, pliability, and strength for conversion into yarns and fabrics. A fibre of extreme length is a filament. Fibres can occur naturally or can be produced artificially. *See* man-made fibre; natural fibre.

fibre optics, also spelled FIBER OPTICS, technique of data and image transmission through the use of flexible, threadlike fibres of glass or plastic and laser-generated light waves.

Fibre optic technology has gained increasingly wider use for communication purposes because it can transmit substantially larger volumes of information in the form of computer data, voice messages, and video over longer distances than can conventional copper-wire lines and coaxial cables. Since the mid-1980s, thousands of kilometres of optical fibre cable have been laid in the United States and Japan to carry long-distance telephone communications. Fibre optics has found application in other areas as well. For example, various medical instruments used to examine the interior of the body employ optical fibres, since the images transmitted by these devices can be magnified and rotated for close observation of the colon, stomach, and other hollow organs. Optical fibres are also used in many laser-based computer printers to produce high-quality copies.



Optical fibre

Glass or plastic filaments are spun to diameters between 5 and 100 micrometres (0.005–0.1 mm, or about 0.0002–0.004 inch) and packed into bundles of several thousand each. The bundles may be fabricated as rods or in ribbons and sheets. Because these bundles maintain some of the flexibility of the individual fibres, they can be twisted and bent to conduct light and images around corners. In order to protect the optical surface of each fibre and bond them together, fibres are clad (coated) with a thin layer of another material. The cladding material must be of a lower index of refraction, as shown in the Figure. (Here, a ray of light is shown entering a segment of a filament and being internally reflected.) Optimum transmission is realized when the radius of curvature of a light guide is at least 20 times the diameter of an individual fibre.

fibreboard, also spelled FIBERBOARD, construction material made of low-quality wood fibres by pulping, forming into sheets, pressing, and mixing with binders or other additives to impart water resistance, strength, and fire resistance. The sheets are felted or matted and bonded together by either a dry or a wet process. Denser sheets of fibreboard are used for paneling or exterior siding, the less dense for insulation. Fibreboard may be decorated with patterns or overlays.

fibreglass, also spelled FIBERGLASS, also called SPUN GLASS, fibrous form of glass that is used as insulation wool, to make yarns and textiles, and as a reinforcing ingredient in plastics.

Early in the history of glassmaking, it was discovered that hot glass could be drawn into threads, and such threads of glass were wound as decorations around vessels in ancient Egypt and in the Roman Empire. In the 18th century, finer fibres were drawn in a thread from a heat-softened rod of glass onto a spinning wheel; in the 20th century the spinning wheel was replaced by a drum on which a number of fibres were wound simultaneously, either drawn from holes in the bottom of a refractory glass-melting chamber or from glass rods. In modern operations the continuous-filament process is used when the fibres are to be formed into yarn. Very fine filaments are drawn from tips, called spinnerets, at the end of bushings through which molten glass is fed. Hundreds of these filaments may be united to form a single strand. Glass fabrics treated by crimp setting are used as fireproof curtains. Continuous glass filaments are also used in electrical insulation.

In the production of glass wool, modern centrifugal processes use a spinning metal dish with hundreds of fine holes, from each of which a fibre is drawn by centrifugal force and attenuated by blowers. Glass wool has excellent heat, electrical, and sound insulating properties. Finer fibres result in higher densities, smaller air pockets, and improved insulating properties.

fibrillation: *see* atrial fibrillation; ventricular fibrillation.

fibrin, final product of the body's blood-clotting mechanism, consisting of a nonsoluble, whitish, fibrous substance that binds together blood platelets to form blood clots when bleeding occurs. Fibrin is a tough protein substance that is arranged in long fibrous chains; it is formed out of fibrinogen, a soluble protein that is produced by the liver and found in blood plasma. When tissue damage results in bleeding, fibrinogen is transformed at the wound into fibrin by the action of thrombin, a clotting enzyme. The fibrin entangles platelets, building up a spongy mass that gradually hardens and contracts to form the blood clot. This hardening and stabilizing process is aided by an enzyme known as fibrin-stabilizing factor XIII.

Certain rare hereditary disorders may cause malfunction of this stage of the blood-clotting mechanism. A few individuals have a hereditary deficiency of fibrinogen, the prefibrin substance in the blood, or produce abnormal fibrinogen. Upon injury to these persons fibrin cannot form in sufficient quantity to enable a proper clot to form. Another rare hereditary disease involves a lack of fibrin-stabilizing factor XIII, resulting in a condition in which bleeding is difficult to stop.

fibroblast, the principal type of stationary connective-tissue cells; fibroblasts are large, flat, elongated (spindle-shaped) cells possessing processes extending out from the ends of the cell body. The cell nucleus is flat and oval. Fibroblasts produce tropocollagen, which is the forerunner of collagen and ground substance.

fibrocystic disease, either of two unrelated diseases, one affecting the breast and the other affecting the pancreas. For a discussion of the disease of the pancreas, *see* cystic fibrosis.

Fibrocystic disease of the breast, also called chronic mastitis, or mammary dysplasia, most often occurs in women between the ages of 30 and 50. It is characterized by benign, noncancerous cysts (harmless swellings caused by fluid trapped in breast tissues) that often increase in size and become tender during the premenstrual phase. Aside from discomfort, the chief problem posed by the disease is that it makes the detection of other abnormalities more difficult. Nevertheless, women with the disease are three times more likely to develop breast cancer as they age than are women without the disease. Fibrocystic disease may be monitored by routine breast self-examinations and through regular check-ups by a physician.

Diagnosis of the disease requires accurate differentiation between the several types of fibrocystic disease and carcinoma; some physicians hold that the term fibrocystic disease has little clinical use and that more meaningful distinctions ought to be made.

fibrolite (mineral): *see* sillimanite.

fibroma, also called NONOSSIFYING FIBROMA, tumourlike growth of fibrous tissue found in the large long bones; it is relatively common in older children and young adults. Fibromas may remain symptomless throughout life, or they may cause thinning of bone and produce pathological fractures. Treatment usually involves removal of the growth by surgery and repair by bone graft.

fibrosarcoma, an uncommon malignant tumour of fibrous tissue found in young adults and most often occurring in the thighbone, upper arm bone, or jaw. The mass is felt before pain occurs. This tumour grows slowly, tends not to metastasize (seed itself elsewhere in the body), and may be cured with adequate surgery, though recurrence in the sur-

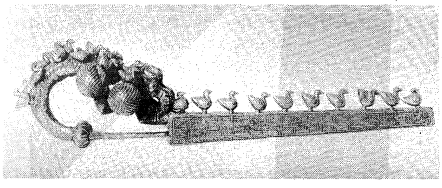
gical wound is not uncommon. Fibrosarcoma of the jaw tends to resist treatment.

fibrous dysplasia, also called McCUNE–ALBRIGHT SYNDROME, rare congenital developmental disorder beginning in childhood, characterized by cyst formation and replacement of solid, calcified bone with fibrous tissue, often only on one side of the body, in the long bones and pelvis. Other signs include unilateral (one-sided) enlargement of the bones of the face and base of the skull, café au lait (pale brown) spots on the skin, and endocrine imbalance leading to precocious puberty, especially in girls. Orthopedic care may be necessary for disability resulting from pathologic fractures and bony overgrowth.

fibula (Latin: "brooch"), outer of two bones of lower leg or hindlimb, probably so named because the other bone, the tibia, and the fibula together resemble an ancient brooch, or pin. In man the head of the fibula is joined to the head of the tibia by ligaments and does not form part of the knee. The base of the fibula forms the outer projection (malleolus) of the ankle and is joined to the tibia and to one of the ankle bones, the talus. Tibia and fibula are further joined throughout their length by an interosseous membrane between the bones. The fibula is slim and roughly four sided—its shape varies with the strength of the attached muscles. In many mammals, such as the horse and rabbit, the fibula is fused for part of its length with the tibia.

fibula, brooch, or pin, originally used in Greek and Roman dress for fastening garments. The fibula developed in a variety of shapes, but all were based on the safety-pin principle.

Greek fibulae from the 7th century BC were elaborately decorated along the long catch plate: rows of animals, such as ducks, lions, and sphinxes, might be soldered on, or a frieze



Etruscan fibula from Marsiliana, late 8th century BC; in the Museo Archeologico, Florence

By courtesy of the Museo Archeologico, Florence

of animals might be worked in relief. The fibula was in widespread use throughout the ancient world. An example from Iran from the 7th century BC has fastenings in the form of a human hand and is decorated with two lions placed head to tail. The Etruscans were fond of fibulae, some of which were very large and decorated with elaborate granulation and processions of animals done in relief. The Roman conquests spread the use of the fibula, which became the basis for more complicated brooches. By the Middle Ages the Roman safety-pin type of fibula had fallen into disuse.

Fichte, Johann Gottlieb (b. May 19, 1762, Rammenau, Upper Lusatia, Saxony—d. Jan. 27, 1814, Berlin), German philosopher and patriot, one of the great transcendental Idealists.

Early life and career. Fichte was the son of a ribbon weaver. Educated at the Pforta school (1774–80) and at the universities of Jena (1780) and of Leipzig (1781–84), he started work as a tutor. In this capacity he went to Zürich in 1788 and to Warsaw in 1791 but left after two weeks' probation.

The major influence on his thought at this time was that of Kant, whose doctrine of the inherent moral worth of man harmonized with Fichte's character; and he resolved to devote himself to perfecting a true philosophy, the principles of which should be practical maxims. He went from Warsaw to see Kant himself at Königsberg, but this first interview was disappointing. Later, when Fichte submitted his *Versuch einer Kritik aller Offenbarung* ("An Attempt at a Critique of All Revelation") to Kant, the latter was favourably impressed by it and helped to find a publisher (1792). Fichte's name and preface were accidentally omitted from the first edition, and the work was ascribed by its earliest readers to Kant himself; when Kant corrected the mistake while commending the essay, Fichte's reputation was made.

Fichte, lithograph by F.A. Zimmermann after a painting by H.A. Daehling

Deutsche Fotothek, Dresden, Ger.

In the *Versuch,* Fichte sought to explain the conditions under which revealed religion is possible; his exposition turns upon the absolute requirements of the moral law. Religion itself is the belief in this moral law as divine, and such belief is a practical postulate, necessary in order to add force to the law. The revelation of this divine character of morality is possible only to someone in whom the lower impulses have been, or are, successful in overcoming reverence for the law. In such a case it is conceivable that a revelation might be given in order to add strength to the moral law. Religion ultimately then rests upon the practical reason and satisfies the needs of man, insofar as he stands under the moral law. In this conclusion are evident the prominence assigned by Fichte to the practical element and the tendency to make the moral requirements of the ego the ground for all judgment on reality.

In 1793 Fichte married Johanna Maria Rahn, whom he had met during his stay in Zürich. In the same year he published anonymously two remarkable political works, of which *Beitrag zur Berichtigung der Urteile des Publikums über die französische Revolution* ("Contribution to the Correction of the Public's Judgments Regarding the French Revolution") was the more important. It was intended to explain the true nature of the French Revolution, to demonstrate how inextricably the right of liberty is interwoven with the very existence of man as an intelligent agent, and to point out the inherent progressiveness of the state and the consequent necessity of reform or amendment. As in the *Versuch,* the rational nature of man and the conditions necessary for its realization are made the standard for political philosophy.

The philosophy of Fichte falls chronologically into a period of residence in Jena (1793–1798) and a period in Berlin (1799–1806), which are also different in their fundamental philosophic conceptions. The former period is marked by its ethical emphasis, the latter by the emergence of a mystical and theological theory of Being. Fichte was prompted to change his original position because he came to appreciate that religious faith surpasses moral reason. He was also influenced by the general trend that the development of thought took toward Romanticism.

Years at the University of Jena. In 1793 there was a vacant chair of philosophy at the University of Jena, and Fichte was called to fill it. To the ensuing period belongs his most important philosophical work. In this period he published, among other works: *Einige Vorlesungen über die Bestimmung des Gelehrten* (1794; *The Vocation of the Scholar,* 1847), lectures on the importance of the highest intellectual culture and on the duties that it imposed; several works on the science of knowledge (*Wissenschaftslehre*), which were revised and developed continually throughout his life; the practical *Grundlage des Naturrechts nach Principien der Wissenschaftslehre* (1796; *The Science of Rights,* 1869 and 1889); and *Das System der Sittenlehre nach den Principien der Wissenschaftslehre* (1798; *The Science of Ethics as Based on the Science of Knowledge,* 1897), in which his moral philosophy, grounded in the notion of duty, is most notably expressed.

The system of 1794 was the most original and also the most characteristic work that Fichte produced. It was incited by Kant's critical philosophy and especially by his *Kritik der praktischen Vernunft* (1788; *Critique of Practical Reason . . . ,* 1949). From the outset it was less critical, precisely because it was more systematic, aiming at a self-sufficient doctrine in which the science of knowledge and ethics were intimately united. Fichte's ambition was to demonstrate that practical (moral) reason is really (as Kant had only intimated) the root of reason in its entirety, the absolute ground of all knowledge as well as of humanity altogether. To prove this, he started from a supreme principle, the ego, which was supposed to be independent and sovereign, so that all other knowledge was deduced from it. Fichte did not assert that this supreme principle was self-evident but rather that it had to be postulated by pure thought. He followed, thereby, Kant's doctrine that pure, practical reason postulates the existence of God, but he tried to transform Kant's rational faith into a speculative knowledge on which he based both his theory of science and his ethics.

In 1795 Fichte became one of the editors of the *Philosophisches Journal,* and in 1798 his friend F.K. Forberg, a young, unknown philosopher, sent him an essay on the development of the idea of religion. Before printing this, Fichte, to prevent misunderstanding, composed a short preface, "On the Grounds of Our Belief in a Divine Government of the Universe," in which God is defined as the moral order of the universe, the eternal law of right that is the foundation of all man's being. The cry of atheism was raised, and the electoral government of Saxony, followed by all of the German states except Prussia, suppressed the *Journal* and demanded Fichte's explusion from Jena. After publishing two defenses, Fichte threatened to resign in case of reprimand. Much to his discomfort, his threat was taken as an offer to resign and was duly accepted.

Years in Berlin. Except for the summer of 1805 (which he spent at Erlangen, delivering a longer version of his Jena lectures of 1794), Fichte resided in Berlin from 1799 to 1806. Among his friends were the leaders of German Romanticism, A.W. and F. Schlegel and Friedrich Schleiermacher. His works of this period include *Die Bestimmung des Menschen* (1800; *The Vocation of Man,* 1848), in which he defines God as the infinite moral will of the universe who becomes conscious of himself in individuals; *Der geschlossene Handelsstaat* (also 1800), an intensely socialistic treatise in favour of tariff protection; two new versions of the *Wissenschaftslehre* (composed in 1801 and in 1804; published posthumously), marking a great change in the character of the doctrine; *Die Grundzüge des gegenwärtigen*

Zeitalters (1806; lectures delivered 1804–05; *The Characteristics of the Present Age,* 1844), analyzing the Enlightenment and defining its place in the historical evolution of the general human consciousness but also indicating its defects and looking forward to belief in the divine order of the universe as the highest aspect of the life of reason; and *Die Anweisung zum seligen Leben, oder auch die Religionslehre* (1806; *The Way Towards the Blessed Life,* 1844). In this last-named work the union between the finite self-consciousness and the infinite ego, or God, is handled in a deeply religious fashion reminiscent of the Gospel According to John. The knowledge and love of God is declared to be the end of life. God is the All; the world of independent objects is the result of reflection or self-consciousness, by which the infinite unity is broken up. God is thus over and above the distinction of subject and object; man's knowledge is but a reflex or picture of the infinite essence.

Last years. The French victories over the Prussians in 1806 drove Fichte from Berlin to Königsberg (where he lectured for a time), then to Copenhagen. He returned to Berlin in August 1807. From this time his published writings were practical in character; not until after the appearance of the *Nachgelassene Werke* ("Posthumous Works") and of the *Sämmtliche Werke* ("Complete Works") was the shape of his final speculations known. In 1807 he drew up a plan for the proposed new university of Berlin. In 1807–08 he delivered at Berlin his *Reden an die deutsche Nation* (*Addresses to the German Nation,* 1922), full of practical views on the only true foundation for national recovery and glory. From 1810 to 1812 he was rector of the new Berlin University. During the great effort of Germany for national independence in 1813, he lectured "Über den Begriff des wahrhaften Krieges" ("On the Idea of a True War").

At the beginning of 1814, Fichte caught a virulent hospital fever from his wife, who had volunteered for work as a hospital nurse; he died shortly thereafter. (R.Kr.)

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Life. For analytical evidence about Fichte's life, see Fritz Medicus, *Fichtes Leben* (1914; 2nd rev. ed. 1922); Xavier Léon, *Fichte et son temps,* 3 vol. (1922–27, reprinted 1959), and Hans Schulz, *Fichte in vertraulichen Briefen seiner Zeitgenossen* (1923), which builds up a picture of Fichte as his contemporaries saw him.

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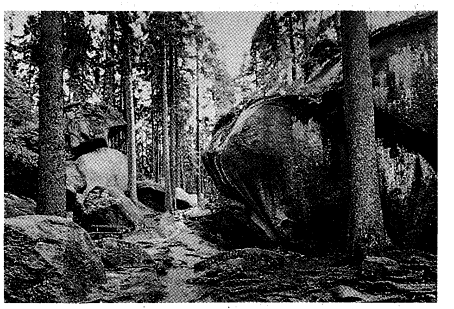
Bibliography. For citations of books and articles on specific aspects of Fichte's work, see *J.G. Fichte: Bibliographie,* ed. by H.M. Baumgartner and W.G. Jacobs (1968).

Fichtelgebirge, Czech SMRČINY, mountains in northeastern Bayern *Land* (Bavaria state), eastern West Germany; they lie at the Czechoslovak border between the Frankenwald (Franconian Forest) in the northwest, the Erzgebirge (Ore Mountains, Czech Krušné Hory) in the northeast, and the Oberpfalzerwald (Upper Palatinate Forest, section of the Bohemian Forest) in the south. The Fichtelgebirge forms a watershed, draining northward and eastward through the Saale and Eger (Czech Ohře) to the Elbe, southward through the Naab to the Danube, and westward through the Weisser Main to the Rhine. The highest point is Schneeberg (3,448 ft [1,051 m]). Granite rocks, stands of spruce (*Fichte,* from which the region takes its name), and bog characterize the higher lands. The interior is under cultivation and meadowland; much of the forest was cleared in the Middle Ages. Its relatively high density of population is due to a local cotton-textile industry, timber working, and granite quarrying. Selb, a porcelain-making centre, is the chief city; Alexandersbad, Wunsiedel (with its rock museum), and the granite labyrinth of Luisenburg are of interest. The Fichtelgebirge Nature Preserve has its headquarters at Wunsiedel.



Granite labyrinth of Luisenburg in the Fichtelgebirge, West Germany

Hans Huber

Ficino, Marsilio (b. Oct. 19, 1433, Figline, Republic of Florence—d. Oct. 1, 1499, Careggi, near Florence), Italian philosopher, theologian, and linguist whose translations and commentaries on the writings of Plato and other Classical Greek authors generated the Florentine Platonist Renaissance that influenced European thought for two centuries.

Ficino, bronze medal from the school of N. Fiorentino, *c.* 1499; in the National Gallery of Art, Washington, D.C.

By courtesy of the National Gallery of Art, Washington, D.C., Samuel H. Kress Collection

After being trained in Latin language and literature, Ficino studied Aristotelian philosophy and medicine, probably at Florence. Introduced to the Latin versions of the works of Plato and the Neoplatonists by such Western writers as Augustine of Hippo (5th century) and the leading medieval Scholastic Thomas Aquinas, he then acquired a thorough knowledge of Greek in order to read and interpret the Classical philosophers in their original texts. He devoted the remainder of his life to the translation and interpretation of Plato and the succeeding Platonic school, whose thought he attempted to integrate more closely with Christian theology.

Supported by the great Florentine ruler and patron of learning Cosimo de' Medici and his successors, Ficino continued to disseminate Platonic thought and in 1462 became head of the Platonic Academy of Florence. Situated at the Medici villa at Careggi, outside Florence, the academy with its endowment of Greek manuscripts became one of the foremost intellectual centres of Europe. After translating from Greek into Latin several early Christian writers, he produced new Latin versions of the works of Plato and the 3rd-century Neoplatonist Plotinus. Completed *c.* 1470 but not printed until 1484, Ficino's was the first complete translation of Plato into any Western language and was in general use until the 18th century.

Ficino was ordained a priest in 1473 and later was named a church official of Florence Cathedral. Closely identified with the Medici family as protégé and tutor, he retired to the Tuscan countryside after the expulsion of the Medici in 1494.

Noteworthy among Ficino's commentaries are those on Plato's *Symposium* (1469), also called *De amore* ("On Love"), and on various treatises of Plotinus. Of his original writings the *Theologia Platonica* (1482; "Platonic Theology"), actually a philosophical study of the soul, and the *Liber de Christiana religione* (1474; "Book on the Christian Religion") are the most significant. His thought also was expressed in a collection of letters and in *De vita libri tres* (1489; "Three Books on Life"), a series of tracts on medicine and astrology.

Envisioning Platonism as a safeguard against what he considered the degenerate and antireligious Aristotelianism of the 15th century, Ficino revised the thought of Plato in a Renaissance perspective. He saw Plato's thought as one of the most noble expressions of the spirit, exceeded only by the truth of Christianity. Seeing a parallel in the Platonic and Christian concept of love, he explained that the highest form of human love and friendship is a communion based ultimately on the soul's love for God. This theory of spiritual or "Platonic" love dominated poetry and literature from the 16th century onward.

Ficino's interpretation of Platonism exerted a wide influence on subsequent European thought. His teaching that man naturally tends toward religion, distinguishing him from the lower animals, and that all religions have a measure of truth, appears to have inspired 17th-century Deist thought as exemplified in Edward Herbert, 1st Baron Herbert of Cherbury. Not only the 17th-century Cambridge Platonists but similar movements in France and Italy reflect Ficino's original Platonist revival. P.O. Kristeller edited a supplement to the standard 1576 edition of Ficino's works (2 vol., 1937).

Fick, August (b. May 5, 1833, Petershagen, Prussia—d. March 24, 1916, Hildesheim, Ger.), German linguist and a pioneer in Indo-European etymological research who made the first comprehensive study of the common vocabulary of Indo-European languages and sought to determine its prototype.

Fick presented his reconstruction of a parent language of remote prehistoric times in the first edition of his major work (1868), later titled *Vergleichendes Wörterbuch der indogermanischen Sprachen* ("Comparative Dictionary of the Indo-European Languages"), emphasizing the lexical comparison of ancient recorded languages. Another important work, *Die griechischen Personennamen nach ihrer Bildung erklärt . . .* (1874; "Greek Proper Names As Explained by Their Formation . . ."), showed similarities in the formation of Greek names and those of the other Indo-European languages, except Latin.

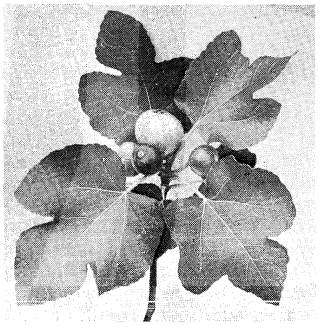
This demonstration suggested the concept of the original Indo-European community as a stable aristocracy whose descendants became rulers of the Greek, Hindu, Iranian, Celtic, Germanic, and other major civilizations of antiquity.

In 1876 Fick became professor at the University of Göttingen and then at the University of Breslau (modern Wrocław, Pol.; 1888–91). Though ill health compelled him to retire, he continued private research. His lucid presentation and his orderly grasp of an immense repertory of facts made his writings useful for more than a generation, and much of his research was incorporated rather than superseded by later researchers.

fiction, legal (law): *see* legal fiction.

fictitious force (physics): *see* inertial force.

Ficus, genus of about 800 species of trees, shrubs, or vines, commonly called figs, of the mulberry family (Moraceae), native primarily to tropical areas of eastern Asia. Many are tall forest trees that are buttressed by great spreading roots; others are planted as ornamentals. The common fig (*q.v.; Ficus carica*) is cultivated for its pear-shaped, edible fruits, which



Branch of common fig (*Ficus carica*)
Walter Singer

are really hollow fleshy receptacles containing hundreds of male and female flowers.

The sycamore fig (*F. sycomorus*) has mulberry-like leaves, hard wood, and edible fruit. Some fig species are known as strangler figs because they climb up other plants, and their roots grow downward, forming thick mats that can, in time, strangle the host plants. The banyan (*q.v.; F. benghalensis*) and some related species have aerial roots that become greatly enlarged and spread away from the main stem, acting as auxiliary trunks to support the massive crowns. The India rubber plant (*F. elastica*), a large tree that was formerly an important source of rubber, is now cultivated as an indoor pot plant. The fiddle-leaf fig (*F. lyrata*), the Benjamin fig (*F. benjamina*), and some climbing species such as the climbing fig (*F. pumila*) are other popular ornamentals. The Bo tree (*q.v.*), or pipal (*F. religiosa*), is considered a sacred tree in India.

fiddle, German FIEDEL, French VIELLE, medieval European bowed stringed musical instrument. The medieval fiddle, a forerunner of the violin, emerged in 10th-century Europe, possibly deriving from the lira, a Byzantine version of the *rabāb,* an Arab bowed instrument. Medieval fiddles varied in size and shape but characteristically had front or back tuning pegs set in a flat and round or heart-shaped peg disk with three to five strings tuned in fifths (as c–g–d′, etc.). The body was often waisted.

"Fiddle" also refers generically to any bowed, stringed instrument with a neck (bowed lute), especially the violin. If the neck appears to

Woman playing a medieval fiddle, detail of "Church Militant and Triumphant," fresco by Andrea da Firenze, *c.* 1365; in the Spanish Chapel, Sta. Maria Novella, Florence
SCALA—Art Resource/EB Inc.

skewer the body, the instrument is called a spike fiddle.

fiddler crab, also called CALLING CRAB, any of the approximately 65 species of the genus *Uca* (order Decapoda of the class Crustacea). They are named "fiddler" because the male holds one claw, always much larger than the other, somewhat like a violin. Both claws in the female are relatively small. If a male loses his large claw, the small one develops into a large claw, and a small one replaces the lost large claw.

Fiddler crabs often occur in large numbers on beaches in temperate to tropical regions

Red-jointed fiddler crab (*Uca minax*)
William H. Amos—Helen Wohlberg, Inc.

of the world. They live in water-covered burrows up to 30 centimetres (about one foot) deep and feed on algae and other organic matter. Common North American species include the marsh fiddler crab (*Uca pugnax*), the china-back fiddler (*U. pugilator*), and the red-jointed fiddler (*U. minax*). These species, which range in body size from about 2.5 to 3 cm (one to 1.2 inches), occur all along the Atlantic coast of the U.S. The males of all species are more brightly coloured than the females. Colours range from coral red, bright green, and yellow to light blue.

fiddler ray: *see* guitarfish.

fidei commissum, in Roman law and civil-law systems, a gift of property to a person (usually by will), imposing upon that person the obligation to transfer it to a specified ultimate recipient, the latter being a person legally incapable of taking the property directly or at least not in the amount designated. It constituted a means of evading the inheritance requirements in Roman and civil law.

fidei defensor: *see* defender of the faith.

fideism, a philosophical view extolling theological faith by making it the ultimate criterion of truth and minimizing the power of reason to know religious truths. Strict fideists assign no place to reason in discovering or understanding fundamental tenets of religion. For them blind faith is supreme as the way to certitude and salvation. They defend such faith on various grounds; *e.g.*, mystical experience, revelation, subjective human need, and common sense. A nonrational attitude so pervades their thinking that some assert that the true object of faith is the absurd, the nonrational, the impossible, or that which directly conflicts with reason. Such a position was approached in the philosophies of the 2nd-century North African theologian Tertullian, the medieval English scholar William of Ockham, the 17th-century French philosopher Pierre Bayle, and more recently in the works of the 18th-century German philosopher Johann Georg Hamann and the 19th-century Danish philosopher Søren Kierkegaard. This modern attitude is often motivated by man's apparent inability to find rational solutions for the world's ills.

Moderate fideists, on the other hand, generally assert that some truths at least (*e.g.*, God's existence, moral principles) can be known by reason subsequently reinformed and clarified by faith—reason can or must play a role in the search for religious truths. This position often affirms that reason can, in some cases, partially comprehend religious truths after they have been revealed; or at least it shows negatively that no contradiction is necessarily involved in them or that there is a rational basis for accepting truths of faith that the human mind can in no way comprehend. Faith predominates, but reason is not ignored. Thus, the 17th-century French writer Blaise Pascal held that natural faculties are inadequate for religious certainty but suffice to justify religious faith in matters otherwise unknowable.

Fidenza, town, Parma province, Emilia-Romagna region, northern Italy. It is believed to have been the scene of St. Domninus' martyrdom under the Roman emperor Maximian and was called Borgo San Donnino for more than 1,000 years. The town was renamed Fidenza in 1927, recalling its ancient name, Fidentia. Its Romanesque-Gothic cathedral dates from the 12th century. During World War II, Fidenza sustained heavy damage. It is now rebuilt and functions as an agricultural centre with various light industries. Pop. (1981 prelim.) mun., 23,847.

Fides, Roman goddess, the deification of good faith and honesty. Many of the oldest Roman deities were embodiments of high ideals (*e.g.*, Honos, Libertas); it was the function of Fides to oversee the moral integrity of the Romans. Closely associated with Jupiter, Fides was honoured with a temple built near his on the Capitoline Hill in 254 BC. In symbolic recognition of the secret, inviolable trust between gods and mortals, attendants presented sacrificial offerings to her with covered hands.

In the later Roman period, she was called Fides Publica (Public Faith) and was considered the guardian of treaties and other state documents, which were placed for safekeeping in her temple. There, too, the Senate often convened, signifying her importance to the state.

fiduciary, in law, a person who occupies a position of such power and confidence with

regard to the property of another that the law requires him to act solely in the interest of the person whom he represents. Examples of fiduciaries are agents, executors and administrators, trustees, guardians, and officers of corporations. They may be contrasted with persons in an ordinary business relationship, in which each party is free to seek purely personal benefits from his transactions with the other.

fiedel (musical instrument): *see* fiddle.

Fiedler, Arthur (b. Dec. 17, 1894, Boston—d. July 10, 1979, Brookline, Mass., U.S.), maestro of the Boston Pops Orchestra for 50 seasons and best-selling classical artist of all time; his recordings with the Pops sold some 50,000,000 discs. The Pops Orchestra is the Boston Symphony minus its principal players. Fiedler, whose principal aim was "to give audiences a good time," led the Pops in performances of popular tunes, show music, and classics.

From 1911 to 1915 Fiedler studied violin, piano, and conducting at the Royal Academy of Music in London before joining the Boston Symphony as a member of the second violin section. He also was proficient on the viola, celesta, piano, and organ. Fiedler organized (1924) the Arthur Fiedler Sinfonietta when he was refused the conductorship of the Pops, and in 1929 he organized the outdoor Esplanade concerts in Boston. In 1930 he became conductor of the Pops.

As conductor of the Boston Pops Fiedler developed a varied and light-hearted repertoire that struck a responsive chord in the public. He excelled at adapting popular dance music and other songs to performance by a symphonic orchestra. Fiedler was viewed by many critics as a highly able technician and a superb showman rather than as a first-rate interpreter of classical music, however.

fief, in European feudal society, a vassal's source of income, held from his lord in exchange for services. The fief constituted the central institution of feudal society (*see* feudalism). It normally consisted of land to which a number of unfree peasants were attached; the land was supposed to be sufficient to support the vassal and to secure his knight service for the lord. Its size varied greatly, according to the income it could provide. It has been calculated that a fief needed from 15 to 30 peasant families to maintain one knightly household. Fief sizes varied widely, ranging from huge estates and whole provinces to a plot of a few acres. Besides land, dignities and offices and money rents were also given in fief.

Consult the INDEX *first*

Field, Cyrus W(est) (b. Nov. 30, 1819, Stockbridge, Mass., U.S.—d. July 12, 1892, New York City), U.S. financier noted for the success of the first transatlantic cable. He was the younger brother of the law reformer David Dudley Field and of U.S. Supreme Court Justice Stephen J. Field.

Cyrus Field

By courtesy of the Library of Congress, Washington, D.C.

After an early career in the paper business, Field became interested in a proposal to lay a transatlantic telegraph cable. He was one of the founders (1854) of the New York, Newfoundland and London Telegraph Company, formed to carry out the project. Two years later he helped organize a British company, the Atlantic Telegraph Company.

In August 1857 the first of several unsuccessful attempts to lay a cable were made. Success was finally achieved in July 1866, and Field was acclaimed on both sides of the Atlantic.

Later he ventured into other enterprises. In 1877 he bought a controlling interest in the New York Elevated Railroad Company and for the next three years served as its president. Field also worked with Jay Gould in developing the Wabash Railroad and became the owner of a New York newspaper, the *Mail and Express*. Field suffered heavy financial losses, however, in his later years.

Field, David Dudley (b. Feb. 13, 1805, Haddam, Conn., U.S.—d. April 13, 1894, New York City), U.S. lawyer whose advocacy of law codification had international influence. The "Field Code" of civil procedure, enacted

David Field

By courtesy of the Library of Congress, Washington, D.C.

by New York state in 1848, was subsequently adopted in whole or in part in many other U.S. states, in the federal court system, and in England, Ireland (both 1873), and several British overseas possessions, notably India. He was the brother of the financier Cyrus W. Field.

After attending Williams College, Williamstown, Mass., Field was admitted to the bar in 1828 and practiced in New York City. In 1837 he began a campaign for reform of the New York judicial system. Ten years later the state legislature appointed him to a pleading and practice commission, which, with Field as chief draftsman, prepared a civil procedure code and later a code of criminal procedure. Next he was appointed chairman of a commission for codifying the entire body of New York law, substantive as well as procedural. Ultimately he was responsible for five "Field codes," which were adopted completely by California (where his brother Stephen J. Field was then a state supreme court justice) but only in part by New York. He also prepared *Draft Outlines of an International Code* (1872).

As a practicing attorney, Field had some clients who led him into dubious actions. He was nearly disbarred for his activities on behalf of the financiers Jay Gould and James Fisk in their struggle with Cornelius Vanderbilt for control of the Erie Railroad (late 1860s). He also was counsel (1873–78) for the notorious New York City politician William Marcy ("Boss") Tweed.

Field, Eugene (b. Sept. 2, 1850, St. Louis, Mo., U.S.—d. Nov. 4, 1895, Chicago), U.S. poet and journalist, best known, to his disgust, as the "poet of childhood."

Field attended several colleges but took no degree; at the University of Missouri he was

Eugene Field

Piaget

known less as a student than as a prankster. After his marriage in 1873, Field did editorial work for a variety of newspapers, including the *Denver Tribune*. From his *Tribune* column, "Odds and Ends," he gathered comic paragraphs to form his first book, *The Tribune Primer* (1882), journalistic joking in the tradition of Artemus Ward and Josh Billings. These squibs served as apprentice work for his "Sharps and Flats" column in the *Chicago Morning News* (renamed the *Record* in 1890). Here Field satirized the cultural pretensions of the newly rich Chicago meat barons. *A Little Book of Western Verse* (1889), drawn in part from his column, included poems in Pike county dialect after the manner of Bret Harte and John Hay, verses for children in an affected Old English dialect, translations of Horace, and the well-known "Little Boy Blue" and "Dutch Lullaby" ("Wynken, Blynken, and Nod"). Field's collected works in 10 volumes were published the year after his death, and two more volumes were added in 1900.

Field's sense of humour, which often took the form of elaborate practical joking, is revealed in two volumes of personal reminiscences by his friends Charles Dennis (*Eugene Field's Creative Years*, 1924) and Slason Thompson (*Life of Eugene Field*, 1927).

Field, John (b. July 26, 1782, Dublin—d. Jan. 23, 1837, Moscow), Irish pianist and composer, whose nocturnes for piano were among models used by Chopin.

Field first studied music at home with his father and grandfather and afterward in London with Muzio Clementi, under whose tuition,

John Field, engraving by Carl Mayer

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

given in return for Field's services as a piano demonstrator and salesman, the boy made rapid progress. In 1802 Clementi took Field to Paris and later to Germany and Russia. Field quickly secured recognition as a pianist and

composer and in 1803 settled in Russia, becoming for a time a popular and fashionable teacher. He played extensively throughout Europe during the next 30 years and had great success with one of his E flat piano concerti at a Philharmonic Society concert in London in 1832. He is credited with being one of the earliest to develop the use of the sustaining pedal, both in the prescription of it for his music and in his own performance.

Field was one of the earliest of the purely piano virtuosos, and his style and technique strikingly anticipated those of Chopin. As a composer he was at his best in shorter pieces, where his expressive melodies and his imaginative harmonies, often chromatic, are not exposed to the strain of long development. Field wrote seven piano concerti and four sonatas, in which high quality is often apparent but not consistently maintained. In the nocturnes, more concise and intimate than his larger works, Field's music is distinguished in style and varied in mood.

field, magnetic: *see* magnetic field.

Field, Marshall (b. Aug. 18, 1834, near Conway, Mass., U.S.—d. Jan. 16, 1906, New York City), American department-store owner whose pioneering activities in retail merchandising were continued and extended into publishing by successive generations of his family.

Born on a farm, Field became at 16 an errand boy in a dry-goods store in Pittsfield, Mass., where he developed rapidly into an adept salesman. After going to Chicago, he was hired in 1856 by the mercantile house of Cooley, Wadsworth and Company (afterward Farwell, Field and Company), in which he attained full partnership. In 1865 he and Levi Zeigler Leiter (1834–1904), one of his junior partners, joined the merchandising firm of Potter Palmer (1826–1902). When Palmer

Marshall Field, engraving by Henry Taylor, Jr.
By courtesy of the Chicago Historical Society

formally withdrew in 1867, the organization became known as Field, Leiter and Company and in 1868 rented from Palmer an ornate building on State Street to serve as their firm's department store. In 1881 Field bought out Leiter for $2,500,000, changing the name of the firm to Marshall Field and Company. In an age of shoddy and unethical merchandising practices, Field instead emphasized customer service, stressing liberal credit, the one-price system, and the privilege of returning merchandise. He also introduced the department-store restaurant for shoppers.

Field left an estate valued at $125,000,000. Among his benefactions were gifts to the University of Chicago and the Columbian Museum, which later became the Field Museum of Natural History. His grandson Marshall Field III (1893–1956) founded the *Chicago Sun* (afterward the *Chicago Sun-Times*). Marshall Field IV (1916–65), the first Field's great-grandson, followed by Marshall Field V (1941–), became publisher of the *Sun-Times* and the *Chicago Daily News* (ceased publication in 1978) and chairman of the board of Field Enterprises, Inc. Field family members sold the *Sun-Times* in 1983.

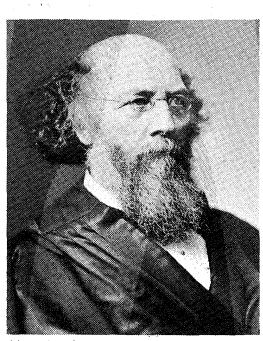
Field, Nathan, also called NAT FIELD, byname of NATHANIEL FIELD (baptized Oct. 17, 1587, London—d. June/August 1619?), one of the principal actors of England's Elizabethan stage.

Nathan Field, engraving by William Nelson Gardiner after a drawing by S. Harding
By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Field attended St. Paul's School, London, and in about 1600 became a member of the Children of the Queen's Revels, remaining with this theatre company throughout its various changes of name and composition until 1616–17, when he joined the King's Men, possibly to replace Shakespeare as actor. His name appears on the list of actors given in the First Folio (1623) of Shakespeare's plays. He was accounted an outstanding player, but he led a notoriously wild life and was forced to quit the stage after a scandal in 1619. Field also wrote two comedies, *A Woman Is a Weathercock* (acted 1609?, printed 1612) and *Amends for Ladies* (acted by 1611, printed 1618); he collaborated with Francis Beaumont and John Fletcher and with Philip Massinger.

Field, Stephen J(ohnson) (b. Nov. 4, 1816, Haddam, Conn., U.S.—d. April 9, 1899, Washington, D.C.), associate justice of the U.S. Supreme Court and chief architect of the constitutional approach that largely exempted the rapidly expanding industry of the United States from governmental regulation after the Civil War. He found the judicial instrument for the protection of private enterprise principally in the Fourteenth Amendment (1868), which had been passed as a civil-rights measure. In his interpretation, the privileges and immunities of citizens secured by the amendment included the right to run a business without government interference, a view that prevailed in the court from the 1890s until the 1930s.

A graduate of Williams College, Williamstown, Mass. (1837), Field practiced law in New York City with one of his brothers, the legal reformer David Dudley Field. In 1849 he went to California, where he bought land in the Sacramento River gold-mining area,



Stephen Field, 1875
By courtesy of the Library of Congress, Washington, D.C.

organized a town government, and became a state legislator and (in 1857) a state supreme court justice. Appointed by President Abraham Lincoln, Field sat on the U.S. Supreme Court from March 10, 1863, until Dec. 1, 1897, the second longest service in the court's history (after that of William O. Douglas).

Field spoke for the court when it invalidated federal and state loyalty oaths required after the Civil War. His opposition to interference with private enterprise came to the fore in the Slaughter-House cases, 16 Wallace 36 (1873), in which a state law granting a monopoly to a single livestock-butchering business was challenged by rival entrepreneurs as an infringement of their rights under the Fourteenth Amendment. Field dissented against the majority decision upholding the state law. The court eventually adopted his interpretation of the amendment's "due process" clause; corporations were regarded as persons whose liberty or property was not to be taken by the federal government (Fifth Amendment) or by the states (Fourteenth Amendment) without due process of law, the standard of which came to be so rigorous as to exclude governmental control. In joining the court majority that declared unconstitutional the federal income tax law of 1894, Field expressed fear of "a war of the poor against the rich."

In 1880 and 1884 Field was a serious contender for the Democratic presidential nomination. His second candidacy was frustrated by party leaders in his own state because of his courageous upholding of the rights of California's Chinese minority.

field archery, also called ROVING, form of archery in which targets of different sizes or shapes are placed at varying distances in uneven, often wooded, terrain in an attempt to simulate hunting conditions. As an organized sport it dates from the formation in 1939 of the National Field Archery Association of the United States. In 1969 a field event was included for the first time in the world archery championships of the Fédération Internationale de Tir à l'Arc, and in 1970 a separate world field-archery championship competition was held in Wales, in which American archers won three of four titles.

A standard field contest, or round, includes 28 targets. The largest is 60 cm (24 inches) in diameter, and the longest shooting distance is 60 m (about 66 yards; in American events the longest is 80 yards). The targets have a black aiming spot in the centre, a white inner ring, and a black outer ring. The archer receives 5 points for a hit within the inner ring and 3 for a hit on the outer ring. Contestants are grouped into two divisions: freestyle, those using artificial bow sights; and bare bow, those competing without sights. They take four shots at each target, in some cases from varying distances or positions.

Field archery is practiced with many variations, including use of life-size animal figures as targets. *See also* archery. *Compare* roving.

field artillery, any large-calibre, crew-operated, mounted firearm designed for easy movement in the field. *See* artillery.

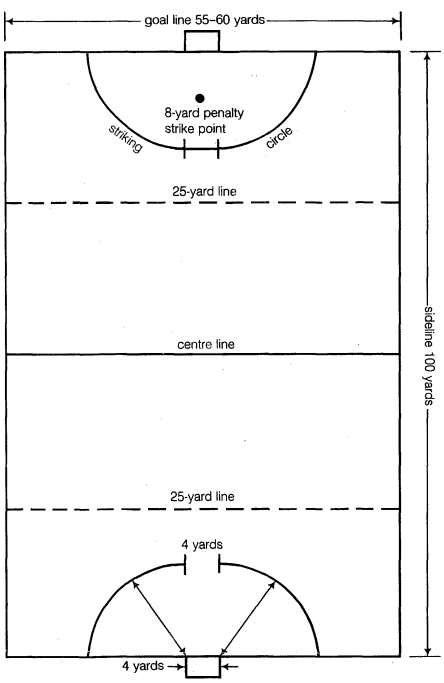
field emission, also called COLD EMISSION, discharge of electrons from the surface of a material subjected to a strong electric field. In the absence of a strong electric field, an electron must acquire a certain minimum energy, called the work function, to escape through the surface of a given material, which acts as a barrier to electron passage. If the material is placed in an electric circuit that renders it strongly negative with respect to a nearby positive electrode (*i.e.*, when it is subjected to a strong electric field), the work function is so lowered that some electrons will have sufficient energy to leak through the surface barrier. The resulting current of electrons through the surface of a material under the in-

fluence of a strong electric field is called field emission. This effect is utilized in the field-emission electron microscope, which in some instances achieves resolution of atomic dimensions. Field emission is sometimes called high-field emission to distinguish it from the Schottky effect (*q.v.*), which influences electron emission at lower values of the applied field.

Positive ions (atoms that have lost at least one electron) also may be emitted from a solid subjected to a high electric field at its surface. *See also* thermionic emission.

field hockey, outdoor game played by two opposing teams of 11 players each who use sticks curved at the striking end to hit a small, hard ball into their opponent's goal. It is called field hockey to distinguish it from the similar game played on ice.

Hockey is believed to date from the earliest civilizations. The Arabs, Greeks, Persians, and Romans each had their own versions, and traces of a stick game played by the Aztec Indians of South America have been found. Hockey can also be identified with other early games, such as hurling and shinty (*qq.v.*). During the Middle Ages a French stick game called *hoquet* was played, and the English word may be derived from it.



Field-hockey playing field for men

Hockey began to be played in English schools in the late 19th century, and the first men's hockey club, at Blackheath in southeastern London, recorded a minute book in 1861. Teddington, another London club, introduced several major variations, including the ban of using hands or lifting sticks above the shoulder, the replacement of the rubber cube by a sphere as the ball, and most importantly, the adopting of a striking circle, which was incorporated into the rules of the newly founded Hockey Association in London in 1886.

The British army was largely responsible for spreading the game, particularly in India and the Far East. International competition began in 1895. By 1928 hockey had become India's national game, and in the Olympic Games that year the Indian team, competing for the first time, won the gold medal without conceding a goal in five matches. It was the start of India's domination of the sport, an era that ended only with the emergence of Pakistan in the late 1940s. The call for more international matches led to the introduction in 1971 of the World Cup. (For champions, *see* Sporting Record: *Field Hockey.*) Other major international tournaments include the Asian Cup, Asian Games, European Cup, and Pan-American Games. Men's field hockey has been included in the Olympic Games since 1908, and women's competition since 1980. (*See* Olympic Games.) Indoor hockey, played by teams of six players with six interchanging substitutes, has become popular in Europe.

Despite the restrictions on sports for ladies during the Victorian era, hockey became increasingly popular among women. Although women's teams had played regular friendly games since 1895, serious international competition did not begin until the 1970s. The first Women's World Cup was held in 1974, and women's hockey became an Olympic event in 1980. The international governing body, the International Federation of Women's Hockey Associations, was formed in 1927. The game was introduced into the United States in 1901 by Constance M.K. Applebee, and field hockey subsequently became a popular outdoor team sport among women there, being played in schools, colleges, and clubs.

The game is played by two teams of 11 players on a rectangular ground that is usually covered with grass (*see* Figure). The field is 100 yards (91.4 m) long and 60 yards (55 m) wide. The goals are 4 yards (3.66 m) wide and 7 feet (2.13 m) high. For a goal (which counts for one point) to be scored, the ball must go into the goal and while within the striking circle (semicircle) must have been touched by the stick of an attacker. The ball was originally a cricket ball (cork centre, string-wound, and covered with leather), but plastic balls are also approved. It is about 9 inches (23 cm) in circumference. The stick is usually 36 to 38 inches (about 1 m) long and weighs 12 to 28 ounces (340 to 790 g). Its striking surface is flat on the left side only, and only the flat surface may be used.

The usual composition of a team is five forwards, three halfbacks, two fullbacks, and a goalkeeper. A game consists of two halves—in men's play, of 35 minutes each, and in women's play, 30 minutes each—with a 5-minute intermission. A time-out is called only in case of injury. The goalkeeper wears heavy pads and, while in the striking circle, is allowed to kick the ball or stop it with the foot or the body. All other players, however, may stop the ball with the hand or stick only.

Play is started (and restarted after a goal is scored and after half-time) by a face-off, or bully, in the centre of the field. Two players, one from each team, face each other with the ball on the ground between them. After alternately tapping the ground and then his opponent's stick three times, each player tries to strike the ball, thus putting it into play. Until the ball is in play all other players must be onside (*i.e.,* between the ball and their own goal line). There are various provisions for putting the ball into play in case it goes off the field.

There are various fouls in field hockey. The off-side rule, which is similar to that of soccer, is designed to prevent a player from getting an advantage by staying up the field ahead of the ball and ahead of fewer than, in men's play, two members of the opposing team and, in women's play, three. Raising the stick above the shoulder while playing the ball is illegal. Advancing the ball with the hand instead of stopping it dead is a foul, as is stopping it with the body or foot. Raising the ball by undercutting it, as well as hooking an opponent's stick, are also fouls. Finally, there is the obstruction rule: a player is not permitted to obstruct an opponent by putting his stick or any part of his body between the opponent and the ball or by running between the opponent and the ball. Most fouls are penalized by giving the opposition a free hit from the point of infraction. There is one umpire for each half of the field.

field mouse, also called WOOD MOUSE, in general, any mouse that normally lives in fields; more strictly, any of about seven species of mice of the genus *Apodemus,* family Muridae (order Rodentia). The members of this genus are small, long-tailed, and typically mouselike. They are found in fields, woodlands, and mountain meadows in the warm and temperate parts of Eurasia. They are grayish, light brown, or reddish brown and have soft fur except for the bristly-haired *A. speciosus* of the Orient. Their length is 6 to 12 cm (2 to 5 inches) without the tail.

Field mouse (*Apodemus sylvaticus*)
Stephen Dalton—EB Inc.

Field mice generally live in burrows and build nests of grass and other plants. At times, they enter barns or houses. They jump well, and some are good climbers. They eat seeds, roots, and other plant material, occasionally damaging crops or young trees. Females bear up to six litters of two to nine young in a year; gestation takes about a month.

Field Museum of Natural History, museum in Chicago, established in 1893 as the Columbian Museum with a gift from Marshall Field (from whom it derived its present name in 1905). On his death in 1906 Field bequeathed generous sustaining funds and a sum to erect a new museum building (completed in 1921) to house exhibits, research collections, and a library primarily devoted to anthropology, botany, geology, and zoology.

The American naturalist Carl Akeley, a member of the staff from 1895 to 1909, invented new methods of taxidermy and began the practice of displaying stuffed animals in dioramas, or painted scenes of their natural habitats. The Field Museum's research library contains more than 200,000 volumes.

Field of Cloth of Gold: *see* Cloth of Gold, Field of.

Field of Mars: *see* Campus Martius.

field theory, quantum (physics): *see* quantum field theory.

field trial, any of the competitions among individual sporting dogs, under conditions that approximate or simulate those found in the hunting field. Competing dogs need not necessarily be of the same breed. In the United States many of the field trials in the bird-dog (pointing dog) category are staged under the sanction of the American Kennel Club, the official governing body of dog shows. The majority, however, are held under the sponsorship of the Amateur Field Trial Clubs of America. In Great Britain field trials are sponsored by the Kennel Club. In both countries, winners in various stakes staged by the member clubs are eligible for regional and national amateur championship stakes. Various stakes are held, including puppy (for dogs not more than 18 months old), derby (not more than 30 months), all-age, shooting dog, and championship events. Novice and limited stakes are sometimes added to the program. Many events are confined to amateur handlers only.

Dogs in bird-dog trials are judged on speed,

range, hunting intelligence, handling response, game finding, game and gun manners, style, and intensity. Game birds involved in the U.S. are quail, pheasant, prairie chicken, grouse, and woodcock; those in Great Britain are grouse, partridge, and pheasant.

In field trials for spaniels (springers and cockers), the dog should promptly stop at the flush and remain steady at the shot, staying until he is ordered to retrieve or resume hunting. The dogs are judged on pace, range, handling response, style, game finding, marking of fallen game, retrieving (promptness, tender-mouthed or hard-mouthed), carry of game, and steadiness to flush and shot. In field trials for retrievers, each dog is called upon to demonstrate tractability, steadiness under the guns, immediate handling response, and ability to mark fallen game.

Field trials for hounds are intended to demonstrate hunting ability, keenness of nose, and ability to carry a trail. The heat winners run against each other until all have been eliminated except the four winning dogs. The first-place dog must have defeated the second-place dog, etc. This same system is used in field trials for basset hounds.

In foxhound trials judges score the hounds on the basis of hunting and trailing, speed, driving, and endurance.

fieldball (game): *see* team handball.

Fielden, John (b. Jan. 17, 1784, Todmorden, Yorkshire, Eng.—d. May 29, 1849, Skegness, Lincolnshire), radical British reformer, a notable proponent of legislation protecting the welfare of factory workers.

On his father's death in 1811, Fielden and his brothers inherited the family cotton-spinning business at Todmorden, which became one of the greatest manufacturing concerns in Great Britain. Unlike most mill owners, Fielden soon became a supporter of legislation to protect factory labour. Declaring himself a radical, he won a seat in the House of Com-

Fielden, detail of an engraving by Henry Cousins after a painting by John Bostock, 19th century

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

mons in the first general election after the Reform Bill passed in 1832. Fielden voted for every radical proposal. He vigorously opposed the New Poor Law of 1834 and was the main Lancashire spokesman for limiting the working day. Triumphantly returned to Parliament in 1835, 1837, and 1841, he devoted his main energies to the local and national struggle to resist the introduction of the poor law and to the fight for a ten-hour working day bill. He sponsored the successful Ten Hours Act of 1847 but was defeated at the general election of that year and retired from politics.

Fielding, Henry (b. April 22, 1707, Sharpham Park, Somerset, Eng.—d. Oct. 8, 1754, Lisbon), novelist and playwright, who, with Samuel Richardson, is considered a founder of the English novel. Among his major novels are *Joseph Andrews* (1742) and *Tom Jones* (1749).

Early life. Fielding was born of a family that by tradition traced its descent to a branch of the Habsburgs. The 1st earl of Denbigh, William Fielding, was a direct ancestor, while

Henry Fielding, frontispiece to Fielding's *Works* (1st ed., 1762), engraving by James Basire after a drawing by William Hogarth

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co., Ltd.

Henry's father, Col. Edmund Fielding, had served under John Churchill, duke of Marlborough, an early 18th-century general, "with much bravery and reputation." His mother was a daughter of Sir Henry Gould, a judge of the Queen's Bench, from whom she inherited property at East Stour, in Dorset, where the family moved when Fielding was three years old. His mother died just before his 11th birthday. His father having married again, Fielding was sent to Eton College, where he laid the foundations of his love of literature and his considerable knowledge of the classics.

Leaving school at 17, a strikingly handsome youth, he settled down to the life of a young gentleman of leisure; but four years later, after an abortive elopement with an heiress and the production of a play at the Drury Lane Theatre in London, he resumed his classical studies at the University of Leiden in Holland. After 18 months he had to return home because his father was no longer able to pay him an allowance. "Having," as he said, "no choice but to be a hackney-writer or a hackney-coachman," he chose the former and set up as playwright. In all, he wrote some 25 plays. Although his dramatic works have not held the stage, their wit cannot be denied. He was essentially a satirist, and his target was the political corruption of the times. In 1737 he produced at the Little Theatre in the Hay (later the Haymarket Theatre), London, his *Historical Register, For the Year 1736,* in which the prime minister, Sir Robert Walpole, was represented practically undisguised and mercilessly ridiculed. It was not the first time Walpole had suffered from Fielding's pen, and his answer was to push through Parliament the Licensing Act, by which all new plays had to be approved and licensed by the lord chamberlain before production.

The passing of this act marked the end of Fielding's career as a playwright. The 30-year-old writer had a wife and two children to support but no source of income. He had married Charlotte Cradock in 1734, this time after a successful elopement, the culmination of a four-year courtship. How much he adored her can be seen from the two characters based on her, Sophia Western in *Tom Jones* and Amelia in the novel of that name: one the likeness of her as a beautiful, high-spirited, generous-minded girl, the other of her as a faithful, much-troubled, hard-working wife and mother. To restore his fortunes, Fielding began to read for the bar, completing in less than three years a course normally taking six or seven. Even while studying, however, he was editing, and very largely writing, a thrice-weekly newspaper, the *Champion; or, British Mercury,* which ran from November 1739 to June 1741.

Maturity. As a barrister, Fielding, who rode the Western Circuit (a judicial subdivision of England) twice a year, had little success. In 1740, however, Samuel Richardson published his novel *Pamela: or, Virtue Rewarded,* which tells how a servant girl so impressed her master by resistance to his every effort at seduction that in the end "he thought fit to make her his wife." Something new in literature, its success was unparalleled. A crop of imitations followed. In April 1741 there appeared a parody entitled *An Apology for the Life of Mrs. Shamela Andrews,* satirizing Richardson's sentimentality and prudish morality. It was published anonymously and, though Fielding never claimed it, *Shamela* was generally accepted as his work in his lifetime, and stylistic evidence supports the attribution. Moreover, there is a similarity to his *Joseph Andrews.*

Described on the title page as "Written in Imitation of the Manner of Cervantes, author of *Don Quixote,*" *Joseph Andrews* begins as a burlesque of *Pamela,* with Joseph, Pamela's virtuous footman brother, resisting the attempts of a highborn lady to seduce him. The parodic intention soon becomes secondary, and the novel develops into a masterpiece of sustained irony and social criticism, with, at its centre, Parson Adams, one of the great comic figures of literature and a striking confirmation of the contention of the 19th-century Russian novelist Fyodor Dostoyevsky that the positively good man can be made convincing in fiction only if rendered to some extent ridiculous. Fielding explains in his preface that he is writing "a comic Epic-Poem in Prose." He was certainly inaugurating a new genre in fiction.

Joseph Andrews was written in the most unpropitious circumstances: Fielding was crippled with gout, his six-year-old daughter was dying, and his wife was "in a condition very little better." He was also in financial trouble, from which he was at least temporarily rescued by the generosity of his friend the philanthropist Ralph Allen, who appears in *Tom Jones* as Mr. Allworthy.

In 1743 Fielding published three volumes of *Miscellanies,* works old and new, of which by far the most important is *The Life of Mr. Jonathan Wild the Great.* Here, narrating the life of a notorious criminal of the day, Fielding satirizes human greatness, or rather human greatness confused with power over others. Permanently topical, *Jonathan Wild,* with the exception of some passages by his older contemporary, the Anglo-Irish satirist Jonathan Swift, is perhaps the grimmest satire in English and an exercise in unremitting irony.

After the *Miscellanies* Fielding gave up writing for more than two years, partly, perhaps, out of disappointment with the rewards of authorship, partly in order to devote himself to law. His health was bad; his practice at the bar did not flourish; worst of all, his wife was still ill. In the autumn of 1744 he took her to Bath for the medicinal waters; she "caught a fever, and died in his arms." According to Lady Mary Wortley Montagu, the 18th-century letter writer and Fielding's cousin, his grief "approached to frenzy," and it was almost a year before he recovered his fortitude. By then he had taken a house in London in the Strand (on the site of the

present law courts), and there he lived with his daughter, his sister Sarah, also a novelist, and Mary Daniel, who had been his wife's maid. In 1747, to the derision of London, he married Mary, who was pregnant by him. According to Fielding himself, writing shortly before his death, she discharged "excellently well her own, and all the tender offices becoming the female character . . . besides being a faithful friend, an amiable companion, and a tender nurse."

In 1745 came the Jacobite Rebellion (an attempt to restore the descendants of the deposed Stuart king James II), which led Fielding to write the pamphlet "A Serious Address to the People of Great Britain. In Which the Certain Consequences of the Present Rebellion, Are Fully Demonstrated. Necessary To Be Perused by Every Lover of his Country at This Juncture." An upholder of the Church of England, he warned of the implications of this rising led by the Roman Catholic pretender to the throne, Prince Charles Edward. A month later, he became editor of a new weekly paper, *The True Patriot: And the History of Our Own Times,* which he wrote almost single-handedly until it ceased publication on the defeat of the Pretender at the Battle of Culloden (April 16, 1746). A year later, Fielding edited another one-man weekly called *The Jacobite's Journal,* the title reflecting its ironical approach to current affairs. Its propaganda value was deemed so great that the government purchased 2,000 copies of each issue for free distribution among the inns and alehouses of the kingdom.

Fielding was now a trusted supporter of the government. His reward came in 1748, when he was appointed justice of the peace (or magistrate) for Westminster and Middlesex, with his own courthouse, which was also his residence, in Bow Street in central London. The office carried no salary; former Bow Street magistrates had made what they could out of the fees paid by persons brought before them and, often, out of bribes. Fielding was a magistrate of a different order. According to a 20th-century British historian, G.M. Trevelyan, he was one of the two best magistrates in 18th-century London, the other being his blind half brother Sir John Fielding, who succeeded him at Bow Street. Together, they turned an office without honour into one of great dignity and importance and established a new tradition of justice and the suppression of crime in London. Among other things, Fielding strengthened the police force at his disposal by recruiting a small body of able and energetic "thieftakers"—the Bow Street Runners. To improve relations between the law and the public, he started a newspaper, *The Covent Garden Journal,* in which the following appeared regularly:

> All persons who shall for the future suffer by robbers, burglars, etc., are desired immediately to bring or send the best description they can of such robbers, etc., with the time, and place, and circumstances of the fact, to Henry Fielding, Esq., at his house in Bow Street.

Last years. *The History of Tom Jones, a Foundling* was published on Feb. 28, 1749. With its great comic gusto, vast gallery of characters, and contrasted scenes of high and low life in London and the provinces, it has always been the most popular of his works. Like its predecessor, *Joseph Andrews,* it is built around a romance plot. The hero, whose true identity remains unknown until the denouement, loves the beautiful Sophia Western, and at the end of the book he wins her hand. Many obstacles have to be overcome before he achieves this, however, and in the course of the action the various sets of characters pursue each other from one part of the country to another, giving Fielding an opportunity to paint an incomparably vivid picture of England in the mid-18th century. The introductory chapters at the beginning of each Book make it clear how carefully Fielding had considered the problem of planning the novel. No novelist up until then had so clear an idea of what a novel should be, so that it is not surprising that *Tom Jones* is a masterpiece of literary engineering. The characters fall into several distinct groups—romance characters, villainous characters, Jonsonian "humours," "low" comic characters, and the virtuous Squire Allworthy, who remains in the background and emerges to ensure the conventional happy ending. The novel is further marked by deft alternations between humour and romance, occasional tricks straight from the theatre, and above all the speed and ease of the dialogue. The reading of this work is essential both for an understanding of 18th-century England and for its revelation of the generosity and charity of Fielding's view of humanity.

Two years later *Amelia* was published. Being a much more sombre work, it has always been less popular than *Tom Jones* and *Joseph Andrews.* Fielding's mind must have been darkened by his experiences as a magistrate, as it certainly had been by his wife's death, and *Amelia* is no attempt at the comic epic poem in prose. Rather, it anticipates the Victorian domestic novel, being a study of the relationship between a man and his wife and, in the character of Amelia, a celebration of womanly virtues. It is also Fielding's most intransigent representation of the evils of the society in which he lived, and he clearly finds the spectacle no longer comic.

His health was deteriorating. By 1752 his gout was so bad that his legs were swathed in bandages, and he often had to use crutches or a wheelchair. In August of 1753 he decided to go to Bath for rest and the waters. That year was a particularly bad one for crime in London, however, and on the eve of his leaving he was invited by Thomas Pelham-Holles, Duke of Newcastle (then secretary of war), to prepare a plan for the Privy Council for the suppression of "those murders and robberies which were every day committed in the streets." His plan, undertaking "to demolish the then reigning gangs" and to establish means of preventing their recurrence, was accepted, and despite the state of his health—to gout had been added asthma and dropsy—he stayed in London for the rest of the year, waging war against criminal gangs with such success that "there was, in the remaining month of November, and in all December, not only no such thing as a murder, but not even a street-robbery committed."

In the following June, Fielding set out for Portugal to seek the sun, writing an account of his journey, *The Journal of a Voyage to Lisbon.* This work presents an extraordinarily vivid picture of the tortuous slowness of 18th-century sea travel, the horrors of contemporary medicine, the caprices of arbitrary power as seen in the conduct of customs officers and other petty officials, and, above all, his indomitable courage and cheerfulness when almost completely helpless, for he could scarcely walk and had to be carried on and off ship. Fielding landed at Lisbon on Aug. 7, 1754. He died in October and was buried in the British cemetery at Lisbon.

Assessment. Sir Walter Scott called Henry Fielding the "father of the English novel," and the phrase still indicates Fielding's place in the history of literature. Though not actually the first English novelist, he was the first to approach the genre with a fully worked-out theory of the novel; and in *Joseph Andrews, Tom Jones,* and *Amelia,* which a modern critic has called comic epic, epic comedy, and domestic epic, respectively, he had established the tradition of a realism presented in panoramic surveys of contemporary society that dominated English fiction until the end of the 19th century. In his lifetime a controversial figure, Fielding was often seen by the Victorians as a writer who was "offensive to delicacy"; what is impressive today, apart from his uninhibited comedy, is the breadth of his sympathies, his concern for morality, and his compassion for human weaknesses. His other activities, too, are important for his work as a novelist. As a playwright he learned how to handle dialogue and how to compose the scenes he incorporated in his fiction, while both his novels and his zeal as a police magistrate reflect his aim of reforming the manners of his age. He was at once its historian and its critic, and in his works a relatively new literary form achieves a degree of perfection that, despite changes in literary fashion, is still unsurpassed.

(W.E.A.)

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Fielding, Sir John (b. 1721, London, Eng.—d. Sept. 4, 1780, London), English police magistrate and the younger half brother of novelist Henry Fielding, noted for his efforts toward the suppression of professional crime and the establishment of reforms in London's administration of criminal justice.

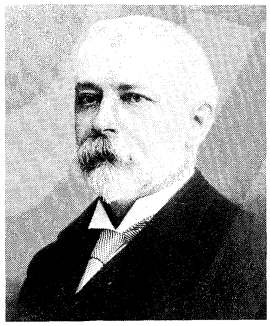
John Fielding was blinded in an accident at the age of 19. Despite this handicap he was appointed a magistrate in London, at first as his brother's assistant, about 1750, and soon became locally famous as the "Blind Beak," who was reputedly able to recognize some 3,000 thieves by their voices. With his brother he was a founder of the Bow Street Runners, and he persuaded the government to contribute to the expenses of his small force of professional detectives. He also provided for the circulation among the police and the public of descriptions of offenders.

A pioneer in the treatment of juvenile offenders, Fielding sought to analyze and remove the causes of crime and advocated a system of stipendiary magistrates that was adopted in 1792, after his death. His only authentic writings published are *A Plan for Preventing Robberies Within 20 Miles of London* (1775); *An Account of the Origins and Effects of a Police . . .* (1758); and *Extracts From Such of the Penal Laws as Relate to the Peace and Good Order of This Metropolis* (1768). In recognition of his services, Fielding was knighted in 1761.

Fielding, William Stevens (b. Nov. 24, 1848, Halifax, Nova Scotia [Canada]—d. June 23, 1929, Ottawa), journalist and statesman whose 19-year tenure as dominion finance minister was the longest in Canadian history.

In 1864 Fielding joined the staff of the Halifax *Morning Chronicle,* the leading Liberal newspaper in Nova Scotia, where for 20 years he worked in various departments. From 1884 to 1896 Fielding was premier of Nova Scotia. An opponent of confederation (Nova Scotia had become a province of Canada in 1867), he represented the forces of discontent in the Maritime provinces and in 1886 won a provincial election on the promise to advocate repeal of the British North America Act.

Entering the Cabinet of Sir Wilfrid Laurier in 1896, Fielding stood for economy, balanced budgets, federal subsidies to industry, and bilateral trade agreements. He introduced a new tariff granting preference to British manufactures and negotiated commercial treaties.



William Stevens Fielding
By courtesy of the Public Archives of Canada

The most famous of these, the Canadian–U.S. agreement of 1911, provided for reciprocal free trade in natural products. Its rejection by the Canadian electorate brought down the Laurier administration.

During World War I, Fielding broke with Laurier over the conscription issue and supported the Union government. At the national Liberal convention in 1919 Fielding was narrowly defeated for the party leadership by W.L. Mackenzie King, in whose government he served as finance minister from 1921 to 1925.

fieldlark (bird): *see* pipit.

Fields, Dame Gracie, original name GRACE STANSFIELD (b. Jan. 9, 1898, Rochdale, Lancashire, Eng.—d. Sept. 27, 1979, Capri, Italy), English music-hall comedienne.

In music halls from childhood, Fields gained fame playing the role of Sally Perkins in a touring revue called *Mr. Tower of London* (1918–25). She became tremendously popular in Great Britain with an act composed of low-comedy songs, such as "The Biggest Aspidistra in the World," and sentimental ballads, such as "My Blue Heaven." Fields made nine command performances between 1928 and 1964. Records and work in radio, film, and television spread her name throughout the world. She was made a Dame of the British Empire in 1979.

Fields, James T(homas) (b. Dec. 31, 1817, Portsmouth, N.H., U.S.—d. April 24, 1881, Boston, Mass.), author and leading publisher in the United States.

At 14 Fields went to Boston, working as clerk in a bookseller's shop. While he was employed there, he began to write for the local newspapers. In 1838 he became junior partner in the bookselling firm of Ticknor, Reed and Fields, which became Ticknor and Fields in 1854 and Fields, Osgood and Co. in 1868. His Old Corner Bookstore, which served as a meeting place of the literary world, was a Boston institution. He was the publisher of the foremost contemporary American writers, with most of whom he was on terms of close personal friendship; John Greenleaf Whittier, for instance, depicted him in *The Tent on the Beach.* He was also the American publisher of some of the best-known British writers of his time. In 1861–70, as the successor of James Russell Lowell, he edited *The Atlantic Monthly.* Fields's writings include: *Poems* (1849), *Yesterdays With Authors* (1872), and *Hawthorne* (1876).

James Fields, engraving by H.W. Smith
By courtesy of the Library of Congress, Washington, D.C.

Fields, Lew, byname of LEWIS MAURICE FIELDS: *see* Weber, Joe; and Fields, Lew.

Fields, W.C., original name WILLIAM CLAUDE DUKENFIELD (b. Jan. 29, 1880, Philadelphia, Pa., U.S.—d. Dec. 25, 1946, Pasadena, Calif.), actor whose humorous pretensions, delivered with a wooden expression, soft nasal drawl, and flawlessly timed gestures (a lifted eyebrow, a flick of cigar ash), made him one of America's greatest comedians.

Fields ran away from home at the age of 11 and within three years had begun a vaudeville juggling career that gained him considerable recognition. In 1915–21 he performed a comic juggling act on Broadway in the Ziegfeld Follies. He made the transition to comic acting on the stage in *Poppy* (1923), creating the character type of the grandiose fraud who flouts the conventional virtues of hard work and honesty.

W.C. Fields
Pictorial Parade—EB Inc.

Fields's first important motion picture was *Sally of the Sawdust* (1925). By 1931 he had moved to Hollywood and soon was writing, directing, and improvising the action of most of his films. Fields was acclaimed for his portrayal of Mr. Micawber in *David Copperfield* (1935), as well as for landmarks of film comedy that include *The Man on the Flying Trapeze* (1935), *You Can't Cheat an Honest Man* (1939), *The Bank Dick* (1940), *My Little Chickadee* (1940), and *Never Give a Sucker an Even Break* (1941). Fields's screen persona is generally that of a pompous but kind-hearted windbag who dislikes small children and is occasionally bedeviled by a nagging wife.

BIBLIOGRAPHY. *W.C. Fields by Himself: His Intended Autobiography* (1973), with a commentary, was compiled by his grandson Ronald J. Fields; he also wrote *W.C. Fields: A Life on Film* (1984), a well-illustrated guide.

Fiennes, Celia (b. June 7, 1662, Newton Toney, Wiltshire, Eng.—d. April 10, 1741, Hackney, London), English travel writer who journeyed on horseback all over England at the end of the 17th century, and whose journals are an invaluable source for social and economic historians.

The daughter of a colonel and the granddaughter of a parliamentary leader in the English Civil Wars, she lived in the family manor house until 1691 and then probably went to live in London. After making many shorter journeys, she made an extended trip through northern England in 1697, traveling more than 600 miles (1,000 km) in six weeks. This trip was followed by others which eventually took her to every county in England. Her journeys extended over the period from about 1684 to 1703.

Fiennes was an indefatigable and meticulous observer who paid special attention to urban life, industry, and the growing material prosperity of her country. She traveled partly to improve her health (she drank and bathed at every available watering place) and partly to visit her relatives, but mainly out of sheer curiosity. Her journals were written up in 1702 from notes she had made during her travels. These provide the first comprehensive eyewitness account of England written since Elizabethan times. In her rambling, unpunctuated literary style, Fiennes describes her visits to stately homes and natural and man-made "curiosities." She observed quarries, mines, and industries, she sampled the local food and drink everywhere she went, and she described the spas she visited and the roads she traveled to reach them. Her journals were edited by Christopher Morris and published as *The Journeys of Celia Fiennes* (1949).

Fiennes, William: *see* Saye and Sele, William Fiennes, 1st Viscount.

fierasfer (fish): *see* pearlfish.

Fieschi FAMILY, a noble Genoese family whose members played an important role in Guelf (papal party) politics in medieval Italy. The Fieschi allied with the Angevin kings of Sicily and later with the kings of France; the family produced two popes, 72 cardinals, and many generals, admirals, and ambassadors.

Ugo, son of the Count of Lavagna, was the first to assume the name Fieschi. Ugo's son Sinibaldo became pope in 1243 as Innocent IV, an event that at once established the family as leaders of the Guelf party against the Holy Roman emperor. Driven from power in Genoa during the democratic revolution of 1257, the Fieschi took part in a plot against the popular leader Guglielmo Boccanegra and were exiled, but they returned in 1262 with another Guelf family, the Grimaldi (*q.v.*), to execute a counterrevolution. Dominating the city, the Fieschi and Grimaldi allied themselves with the French prince Charles of Anjou, under whose protection they placed Genoa. Public reaction to this move drove them from power in 1270, when the Ghibelline leaders Oberto Doria and Oberto Spinola became captains of the people.

In the early years of the 14th century the family adopted a policy of encouraging conflict between the Dorias and Spinolas, a tactic that returned them to power in Genoa in 1317, when Carlo Fieschi and Gaspare Grimaldi became captains of the people. The coup was followed by a long struggle between the two rival factions in Genoa, with periodic intervention by the Guelfs and Ghibellines of other cities. The conflict was terminated by King Robert of Naples' seizure of Genoa in 1331, which was followed by the democratic revolution of 1339 and the institution of the popular dogeship in Genoa. The Fieschi, like the other noble families, were excluded from government but served as ambassadors and military men. Toward the end of the century, however, by allying with the counts of Savoy and the kings of France, they recouped their fortunes. After Filippo Maria Visconti of Milan took Genoa in 1422, the Fieschi put up determined opposition to the Visconti until a

revolt in 1436 ended the latter's rule in the city.

Throughout the 15th century the Fieschi continued their factional involvement, first favouring, then opposing the Sforza of Milan.

After the great Genoese statesman Andrea Doria's conquest of Genoa for the Holy Roman emperor Charles V (1528), Gian Luigi Fieschi (*q.v.*; 1522–47) plotted to assassinate Doria and return Genoa to French, and thus Fieschi, rule. The failure of the conspiracy marked the end of his line and of Fieschi power, though other branches of the family survived, producing government officials and diplomats for Genoa and a saint, Catherine of Genoa.

Fieschi, Gian Luigi, IL GIOVANNE (the Younger) (b. *c.* 1522—d. Jan. 2, 1547, Genoa [Italy]), Genoese nobleman, whose conspiracy against the Doria family is the subject of much literature. The Fieschi family (*q.v.*) was one of the greatest families of Liguria.

Sinibaldo Fieschi, his father, had been a close friend of Andrea Doria (*q.v.*) and had rendered many important services to the Genoese republic. On his death in 1532 Gian Luigi found himself at the age of nine the head of the family and possessor of immense estates. In 1540 he married Eleanora Cibo, Marchesa de Massa.

While Andrea Doria had taken the side of the Holy Roman emperor Charles V, the Fieschi family adhered to the French or "popular" party in Genoa; the feud, rooted in the opposite political traditions of the two families, was said to have been aggravated by suspicions that Andrea Doria's son Giannettino was the lover of Fieschi's wife. When Fieschi conspired against Doria, he found friends in many quarters. Both Pier Luigi Farnese, Duke of Parma, and Francis I of France encouraged him. Among his associates in Genoa were his brothers Girolamo and Ottobuono, as well as Giovanni Verrina and R. Sacco. A number of armed men from the Fieschi fiefs were secretly brought to Genoa, and it was agreed that on Jan. 2, 1547, during the interregnum before the election of the new Genoese doge, the galleys in the port should be seized and the city gates held. The first part of the program was easily carried out, and Giannettino Doria rushed down to the port and was killed, but Andrea Doria escaped from the city in time. Gian Luigi Fieschi, while boarding one of the galleys, fell into the water and was drowned.

The news spread consternation among the Fieschi faction, and Girolamo found few adherents. They came to terms with the Genoese senate and were granted a general amnesty. Doria returned to Genoa on January 4 thirsting for revenge and, in spite of the amnesty, confiscated the Fieschi estates. Girolamo Fieschi and Verrina were captured, tried, tortured, and executed. Ottobuono Fieschi, who had escaped, was captured eight years afterward and put to death by Doria's orders.

The conspiracy has been treated in many poems and dramas, the most famous being *Die Verschwörung des Fiesko zu Genua* (1783; *Fiesco; or, The Genoese Conspiracy*) by Friedrich von Schiller.

Fieschi, Giuseppe Maria (b. Dec. 13, 1790, Murato, Corsica, Fr.—d. Feb. 19, 1836, Paris), French republican conspirator who on July 28, 1835, unsuccessfully attempted to assassinate King Louis-Philippe.

As a youth Fieschi served in the Neapolitan army. After returning to Corsica, he was imprisoned for theft for 10 years, from 1816 to 1826. Making his way to Paris after the July Revolution of 1830, he obtained government employment under the name Gérard. Apparently he also served for a time as a secret police agent among the Bonapartists. Later, however, he made contact with the republicans of the Société des Droits de l'Homme (Society for the Rights of Man), and with two of its members, Pierre Morey and Pierre Pépin, he contrived an "infernal machine" of 25 guns that could be discharged simultaneously. They fired the device at Louis-Philippe as he passed Fieschi's lodging on the Boulevard du Temple on his way to a review of the troops. The king and his sons escaped injury, but 18 persons were killed and many others wounded. The conspirators were guillotined.

Fiesole, Latin FAESULAE, town and episcopal see of Firenze (Florence) *provincia,* Toscana (Tuscany) *regione,* north-central Italy. It is situated on a hill overlooking the Arno and Mugnone valleys just northeast of Florence. A chief city of the Etruscan confederacy, it probably dates from the 9th–8th century BC, but its first record (as Faesulae) is in 283 BC, when it was conquered by the Romans. In 80 BC it was occupied by the forces of the dictator Lucius Cornelius Sulla, and a splendid town sprang up, which was conquered by barbarians in AD 405. It later declined and was superseded by Florence.

Fiesole is a noted tourist centre. Portions of the town's Etruscan wall survive, and the Civic Museum contains relics from Etruscan to medieval times. The well-preserved Roman baths and theatre (discovered 1809, excavated 1873) date from the 1st century BC. Notable medieval landmarks include the church (*c.* 1330) and friary of San Francesco, on the site of Etruscan and Roman citadels; the Romanesque cathedral (begun 1028, restored); and the 14th-century Palazzo Pretorio (Communal Palace), containing the coats of arms of the town's podestas (mayors) from 1502 to 1808. The Bandini Museum displays art and furniture collections, including terra-cottas by the Della Robbia family. Fiesole is noted for its many beautiful villas and its formal gardens. The longtime residence of the art critic and historian Bernard Berenson, I Tatti, is now a study centre for Harvard University.

Fiesole's chief industries are straw plaiting and stone quarrying. Pop. (1988 est.) mun., 15,226.

Fiesole, Mino da (sculptor): *see* Mino da Fiesole.

Fife, region of eastern Scotland, created by the administrative reorganization of 1975, with an area of 509 square miles (1,319 square km). It incorporates the former county of Fife and is bounded on the north by the Firth of Tay, on the east by the North Sea, on the south by the Firth of Forth, and on the west by Central and Tayside regions. Fife region is divided into the districts of Kirkcaldy, North East Fife, and Dunfermline.

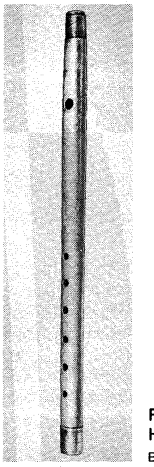
Fife generally consists of lowlands that have an undulating relief, with the Ochil and Lomond hills rising in the western part of the region. The River Eden flows northeastward through the heart of Fife to empty into the sea near the town of St. Andrews. The Eden's broad valley is known as the Howe (hollow) of Fife and contains some of Fife's best agricultural land. Coalfields lie in the southern and western portions of Fife. The climate is relatively dry—rainfall is 25–35 inches (625–900 mm)—and sunny, with a tendency toward cool coastal mists.

Fife's ancient status as an independent Pictish kingdom probably earned it the byname of the Kingdom. Fife became one of Scotland's leading provinces, constituting one of that kingdom's seven earldoms. Though remote from the rest of settled Scotland in the Middle Ages, Fife contained 14 of the 66 Scottish royal burghs. The coastal town of St. Andrews became both the seat of an archbishopric and the site of Scotland's first university in the 15th century. The town of Falkland was a favourite residence of Scottish royalty, and seven Scottish kings are buried at the Abbey of Dunfermline. St. Andrews and its university were deeply involved in the events of the Scottish Reformation in the 16th century. The region has many mansions and churches, as well as the remains of several monasteries beside that at Dunfermline.

Modern Fife consists largely of an agricultural northeast and an industrial southwest. The chief crops grown are oats, hay, potatoes, barley, turnips, wheat, and sugar beets, and sheep and beef and dairy cattle are pastured. The region's traditional fishing ports along the Forth have declined, and fishing activity is now largely confined to the ports of Anstruther and St. Monance.

Fife's industrial economy was long dominated by coal mining, but coal had declined somewhat in importance by the late 20th century. Kirkcaldy, Dunfermline, and other industrial towns of southern and western Fife became noted manufacturers of linen, paper, linoleum, whiskey, and ships, among other products, and have now supplemented their economic base by such new industries as electronics, metal fabrication, food-processing, and chemicals manufacture. New industries have also been sited at Glenrothes, which is one of the largest new towns in Britain. Pop. (1987 est.) 344,600.

fife, small transverse (side-blown) flute with six finger holes and a narrow cylindrical bore that produces a high pitch and shrill tone. The modern fife, pitched to the A♭ above middle C, is about 15.5 inches (39 cm) long and often has an added E♭ hole covered by a key. Its compass is about two octaves. Fifes of conical bore have also been made since the 19th century.



Fife without keys, *c.* 1800; in the Horniman Museum, London
By courtesy of the Horniman Museum, London

Antedating the orchestral transverse flute, the fife is first attested in Europe during the 12th century. From the time of the Crusades it has been played with cylindrical side drums as an infantry instrument, notably in Switzerland and Germany. It is a folk instrument in Spain and in the Alps and Carpathians.

Fife, Duncan: *see* Phyfe, Duncan.

Fifinella (foaled 1913), English racehorse (Thoroughbred) who in 1916 won the Derby, and two days later the Oaks; she was the last horse to win both events in one year.

Fifinella, sired by Polymelus and foaled by Silver Fowl, was owned by Edward Hulton and trained by Richard Dawson at Newmarket. As a two-year-old filly, she had two victories, and as a three-year-old she lost the 1000 Guineas by half a length before winning the Derby by a neck and the Oaks by five lengths. After a last race, she was retired. She was not very successful in breeding.

fifth column, clandestine group or faction of subversive agents who attempt to undermine a nation's solidarity by any means at their dis-

posal. The term is credited to Gonzalo Queipo de Llano y Sierro, a Fascist revolutionary general during the Spanish Civil War (1936–39). As four of his army columns moved on Madrid, the general referred to his militant supporters within the capital as his "fifth column," intent on undermining the Loyalist government from within.

A cardinal technique of the fifth column is the infiltration of sympathizers into the entire fabric of the nation under attack and, particularly, into positions of policy decision and national defense. From such key posts, fifth-column activists exploit the fears of a people by spreading rumours and misinformation, as well as by employing the more standard techniques of espionage and sabotage.

Fifth Monarchy Men, an extreme Puritan sect that came into prominence in England during the Commonwealth and Protectorate. They were so called from their belief that the time of the fifth monarchy was at hand—that is, the monarchy that (according to a traditional interpretation of parts of the Bible) should succeed the Assyrian, Persian, Greek, and Roman monarchies and during which Christ should reign on earth with his saints for 1,000 years. After the fall of the monarchy, they at first supported Oliver Cromwell; and the Nominated, or Barebones, Parliament of 1653, chosen from nominees of the Independent churches, raised their hopes of speedily accomplishing the rule of the saints. The establishment of the Protectorate, however, dashed these hopes and turned the sect against Cromwell. The violence of their agitation led to the arrest of their leaders—Major General Thomas Harrison, Major General Robert Overton, Christopher Feake, John Rogers, and others; and an attempt at an armed uprising, led by Thomas Venner in April 1657, was easily suppressed. Venner attempted another, equally abortive uprising in January 1661. He and a number of others were executed, and the special doctrines of the sect died out.

fig, plant of the genus *Ficus,* of the mulberry family (Moraceae), especially *Ficus carica,* the common fig. *Ficus carica,* which yields the well-known figs of commerce, is indigenous to an area extending from Asiatic Turkey to

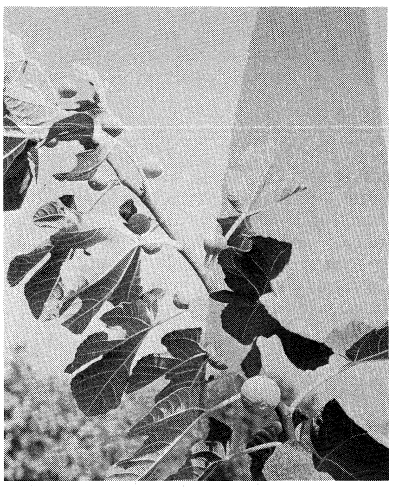


Fig (*Ficus*)
Grant Heilman—EB Inc.

northern India, but natural seedlings grow in most Mediterranean countries. It is a bush or small tree, from 1 m (3 feet) to 10 to 12 m (33 to 39 feet) high, with broad, rough, deciduous leaves that are deeply lobed or sometimes nearly entire.

Fig fruits are borne singly or in pairs above the scars of fallen leaves or in axils of leaves of the present season. The flowers are staminate (male) or pistillate (female). Long-styled female flowers are characteristic of the fruits produced on most garden and orchard fig trees. Short-styled female flowers are found only in fruits of the caprifig tree and are adapted to the egg-laying habits of the fig wasp, or *Blastophaga.* Male flowers, which produce pollen, are found in caprifigs, usually near the apex.

In addition to the caprifig, there are three other horticultural types of fig: Smyrna, White San Pedro, and Common. Smyrna-type figs develop only when fertile seeds are present, and these seeds account for the generally excellent quality and nutty flavour of the fruit. Figs of the White San Pedro type combine the characteristics of both the Smyrna and the Common type on one tree. First-crop figs develop without flower pollination, while second-crop figs in axils of leaves require it. Common figs such as the Dottato, Fraga, and Brown Turkey do not require pollination of flowers of either crop, the seeds in the mature fruit usually being hollow. The flowers of such figs were once regarded as incapable of fecundation and were therefore designated as mule flowers; but it has been proved that all common figs can produce fertile seeds if the flowers are pollinated.

The varieties of figs grown in various parts of the world run into the hundreds. Their nomenclature is very much confused, since the same fig is often grown in neighbouring provinces under entirely different names. When a fig is introduced into other countries, a new name is commonly coined. Thus Lob Injir of Smyrna became Calimyrna in California, and Dottato of Italy became Kadota. The Italian San Piero is known in England as Negro Largo, in France as Aubique Noire, and in California as San Pedro Black, Brown Turkey, or Black Spanish.

The fig was one of the earliest fruit trees cultivated by primitive man and spread in remote ages over all the districts around the Aegean Sea and Levant. The Greeks are said to have received it from Caria (hence the specific name); Attic figs became celebrated throughout the East, and special laws were made to regulate their exportation. The fig was one of the principal articles of sustenance among the Greeks; the Spartans especially used it at their public tables. Pliny the Elder enumerates many varieties and describes those of home growth as furnishing a large portion of the food of slaves. In Latin myth the fig was held sacred to Bacchus and employed in religious ceremonies; the fig tree that overshadowed the twin founders of Rome in the wolf's cave was an emblem of the future prosperity of the race.

In Mediterranean countries the fig is so widely used, both fresh and dried, that it is called "the poor man's food." The fruit contains significant amounts of calcium, phosphorus, and iron.

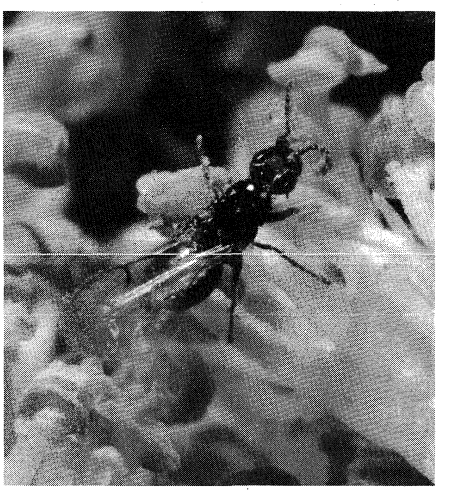
Fig trees are propagated from cuttings of dormant wood taken in February in the Northern Hemisphere and planted in nursery rows. These grow in one season to a height of 1 m (3 feet) and are ready to transplant at the end of the growing season. The trees thrive in a wide range of soil types and in most Mediterranean countries receive water only from the natural rainfall. Some varieties produce only one crop, in summer or fall. Some bear two crops, the first maturing in June or July on wood of the previous growth and the second ripening in summer or fall in the axils of the leaves of the same season. In cool climates such as those of England and central France, most varieties mature only the first crop. Pot culture of figs in greenhouses has long been practiced in England and other countries.

In most districts, figs are gathered when they fall and placed on trays for drying. Turning and manipulating during the drying process improves the texture and quality of the product. In the Old World, figs are grown commercially in Italy, Turkey, Algeria, Greece, Portugal, and Spain.

fig insect: *see* fig wasp.

Fig Tree Series, division of early Precambrian rocks in southern Africa (the Precambrian began with the formation of the Earth's crust about 4,600,000,000 years ago and ended 570 million years ago). The Fig Tree Series overlies the Onverwacht Series and consists of about 2,300 m (about 7,500 feet) of fine- and coarse-grained slates and graywackes as well as cherts, ironstones, and jaspers. Rocks of the Fig Tree Series contain economically significant deposits of gold and sulfide minerals. Carbon, in the form of graphite, is widely distributed throughout the shaly horizons. The cherts and shaly beds of the Fig Tree contain traces of very early and primitive organisms that have been described as blue-green algae, flagellate protozoans, and bacteria-like organisms; it is thought that some of the blue-green algae were able to precipitate metal salts directly from water. In northwestern Swaziland the Fig Tree consists in part of banded ironstones containing concentrations of almost pure iron oxides.

fig wasp, also called FIG INSECT, any member of the insect family Agaonidae, a group of tiny chalcid wasps of the order Hymenoptera.



Female fig wasp (*Blastophaga psenes*) collecting pollen from the male flowers as she makes her way out of the interior of a caprifig
By Robert F. Sisson © 1970 National Geographic Society

Fig wasps mature from eggs deposited inside the caprifig (*Ficus carica sylvestris,* a wild, inedible fig). The wingless male emerges from the gall in which he has developed, searches out a gall that contains a female, chews a hole in the gall, fertilizes the female, and dies within the fig. The female emerges from her gall—if fertilized, from the gnawed hole, or if unfertilized, from a hole of her own making—and proceeds toward the eye of the fig (the part opposite the stem end), because she must deposit her eggs in a second fig. Before she leaves her natal fig, she must pass by many male flowers, and she emerges covered with pollen.

The female fig wasp's role in pollinating edible figs is critical to the fig grower, as most economically valuable figs require fertilization to ripen. Though she cannot lay her eggs within the edible fig (she must lay them at the base of the pistil, and the pistils of cultivated figs are longer than her ovipositor), she carries with her the pollen that fertilizes the figs and causes them to ripen. Unfertilized females perform the same role in pollination.

Two species of fig wasp occur in North America. *Blastophaga psenes,* about 1.5 mm (0.06 inch) in length, was introduced into the

western United States to pollinate the smyrna fig (*Ficus carica*), a commercially important variety. *B. nota,* originally found in the Philippines, pollinates the flowers of *Ficus nota.*

Fig wasps are also notable for their unusual sexual dimorphism; *i.e.,* the males and females are markedly different. The males, for example, are wingless.

Figaro, Le, morning daily newspaper published in Paris, one of the great newspapers of France and of the world.

Founded in 1826 as a sardonic and witty gossip sheet on the arts—named for the Barber of Seville—by 1866 *Le Figaro* was a daily that engaged some of the finest writers in France and filled its pages with political discourse. The paper was a pioneer in dividing the coverage and presentation of news into departments and in publishing interviews with celebrated personages. *Le Figaro* was purchased in 1922 by François Coty, the cosmetics manufacturer, and soon its reputation suffered as it became little more than a promotional sheet for Coty's political ambitions. Coty died in 1934, and under the editorship of Pierre Brisson *Le Figaro* quickly moved back into a position of leadership among French newspapers.

At the start of World War II, *Le Figaro* was France's leading daily newspaper. When the Nazis occupied Paris the paper moved to the town of Vichy but shortly suspended publication rather than submit to censorship by the Pétain government. It returned to Paris and resumed publication in 1944 before the Germans had departed. After World War II the paper became the voice of the French upper middle class while maintaining an independent editorial stance.

In the postwar years the paper has increasingly covered medicine and other scientific fields, the entertainment and artistic worlds, and literary developments while maintaining its outstanding international coverage. In the 1960s and '70s the staff of *Le Figaro* was rent by tensions and conflicts over management and ownership as the paper—after Brisson's death—was headed by a succession of individuals accused of wartime collaboration with the Nazis or the Vichy government.

Figg, James (b. *c.* 1695, Thame, Oxfordshire, Eng.—d. Dec. 8, 1734, London), first recognized champion of England at fighting with bare fists. Also an expert at wrestling, swordplay, and fighting with cudgels, he became prominent as a pugilist about 1719.

Standing six feet and weighing 185 pounds, Figg was a stalwart figure who was always ready to accept a challenge to fight. He lost only one match, and on that occasion he was said to be ill. He opened an academy of arms, including boxing, in London; Figg's Amphitheatre was the prototype of several other 18th-century schools of pugilism. Figg is considered the first heavyweight champion in boxing history, although weight divisions were unknown until long after his time.

fighter aircraft, aircraft designed primarily to secure control of the air by destroying enemy aircraft in combat. The opposition may consist of high-performance fighters of equal capability, or of high-altitude high-speed bombers carrying armour or protective armament. For such purposes fighters must be capable of the highest possible performance in order to be able to outfly and outmaneuver opposing fighters; in addition, they must be armed with specialized weapons capable of hitting and destroying enemy aircraft.

At the speeds and altitudes at which such aircraft can operate, the problem of striking and destroying enemy aircraft becomes extremely complicated and requires an array of electronic, navigational, and computational gear. A single-seated, high-performance fighter of the 1980s might weigh as much as, and be vastly more complicated than, one of the multiengined bombers of World War II. In many cases the search and attack functions are completely automatic, the pilot's role in combat being virtually reduced to monitoring the operation of the equipment. Indeed, with modern jet-powered fighter airplanes, a point has been reached where the performance capabilities of the machine exceed the capabilities of a human pilot to control it.

Fighter airplanes have been described by a variety of labels. At first they were used as scout planes for artillery spotting, but it was quickly discovered that they could be armed and do combat with one another, shoot down enemy bombers, and conduct other tactical missions. An interceptor is a fighter whose design and armament best fit it for intercepting and defeating or routing invading fighters. A night fighter is one equipped with sophisticated radar and other instruments for navigating in unfamiliar or hostile territory at night. Virtually all modern fighters require radar and other electronic search and gunnery controls. A day fighter is an airplane in which weight and space are saved by eliminating the special navigational equipment of the night fighter. The air supremacy, or air superiority, fighter must have long-range capability, to enable it to travel deep into enemy territory to seek out and destroy enemy fighters. Maneuverability and high rate of fire are also desirable qualities, often more valuable than night-fighter equipment. Fighter-bombers fill the dual role suggested by their name.

In the days of aerial "dogfights" during World War I, light machine guns were synchronized to fire through the airplane's propeller, and by the end of the war, fighters such as the German Fokker D.VII and the French Spad were attaining speeds of 135 miles (215 kilometres) per hour. Most of these were biplanes, as were many of the standard interwar fighters.

During World War II, piston-engined fighters exceeded 450 mi per hour and reached ceilings of 35,000 to 40,000 feet (10,700 to 12,000 metres). Famous fighters of the period were the British Hurricane and Spitfire, the German Messerschmitt 109 and FW-190, the U.S. P-47 Thunderbolt and P-51 Mustang, and the Japanese Zero (AGM Type Zero). Both Allied and Axis powers put jet aircraft into production, but these became operational too late to affect the outcome of the war.

During the Korean War jet fighters, notably, the U.S. F-86, or Sabre, and the Soviet MiG-15, were extensively used. The U.S. F-100, F-105, and F-4; the Soviet MiG-21; and the French Mirage III saw combat service in the Middle East in the 1960s and '70s, and U.S. and Soviet fighter planes were employed in the Vietnam War during the 1960s and early '70s.

Modern supersonic jet fighters can fly at more than 1,000 mi per hour. They have fast rates of climb, great maneuverability, and heavy firepower, including air-to-air missiles. One of the most effective performers in the Vietnam War was the U.S. F-4 Phantom II fighter-bomber.

Fighting Marine, The (boxer): *see* Tunney, Gene.

Figner, Vera Nikolayevna (b. July 7 [June 25, old style], 1852, in Khristoforovka, Kazan province, Russia—d. June 15, 1942, Moscow), leader in the Russian Revolutionary Populist (Narodnik) movement.

Abandoning her marriage and medical studies for a life devoted to the revolutionary movement, Figner worked in rural areas of Russia, attempting to educate the peasants and to undermine their faith in the tsar as their protector. She also became involved in the Zemlya i Volya ("Land and Freedom Party"); following a major policy split within the party (1879), she joined the terrorist branch, which formed the new Narodnaya Volya ("People's Will Party"). As a member of the party's executive committee, she helped prepare plans for the assassination of key political figures, including Emperor Alexander II.

After Alexander was killed (March 1881), she left St. Petersburg to organize terrorist plots in southern Russia and to become the leader of the skeleton Narodnaya Volya organization that escaped immediate arrest. On Feb. 10, 1883, the police finally captured her, and in September 1884 a military tribunal condemned her to death. Her sentence was commuted, however, to life imprisonment, and for the next 20 years she remained in solitary confinement in the Shlisselburg Fortress. After being exiled to Arkhangelsk in 1904, she was allowed in 1906 to go abroad. There she joined the Russian Socialist Revolutionary Party, the descendant of the Populist movement, but upon her return to Russia in 1915 she devoted herself to literary and social work.

Figueira da Foz, seaport and *concelho* (municipality), in Coimbra district, north central Portugal, at the mouth of the Rio Mondego on the Atlantic Ocean, west of Coimbra city. Little is known of its origin, save that it received the title and privileges of a city in 1882. Tourism is a primary economic concern, and the local beaches are considered the finest in Portugal. Other attractions include the Dr. Santos Rocha Municipal Museum, with archaeological relics from the surrounding region as well as a library containing more than 50,000 volumes, and the Santa Catarina fort, which guards the harbour entrance. Figueira da Foz is an important fishing station and the centre of the coastal trade in grain, fruits, wine, olive oil, cork, and coal. Salt, panned locally, is exported, and lignite is mined; manufactures include cement and glass. Figueira da Foz has held an annual international film festival since 1970. Pop. (1981) city, 13,397; *concelho,* 59,400.

Figueiredo, João Baptista de Oliveira (b. Jan 15, 1918, Rio de Janeiro), four-star general and president of Brazil from 1979 to 1985.

One of the planners of the 1964 coup that established 21 years of military rule, Figueiredo was the last in the succession of five officers chosen by the armed forces to govern Brazil as president in that period. He was an instructor specializing in intelligence in the military's advanced training schools when the coup took place. Promoted to colonel, he was immediately transferred to intelligence operations. His military career culminated with his appointment as chief of the national intelligence service under Pres. Ernesto Geisel in 1974, a post in which he gained the reputation of "minister of silence" due to his inaccessibility and aloofness from public life.

Hand-picked by Geisel as his successor, Figueiredo announced his intention to restore democracy to the country. He faced severe national economic problems when he took office, including an inflation rate of 43 percent and a grossly unequal distribution of income. What economic growth there was benefited only the wealthy, without affecting the standard of living of the lower classes. He responded to the situation by providing a schedule of workers' pay increases pegged to inflation, by allowing collective bargaining for the first time since the military coup of 1964, and by devaluing the currency and fixing interest rates. On the political front he signed amnesty legislation for political dissenters (although Amnesty International still pointed out instances of police brutality) and permitted the creation of new political parties, a move which angered the extreme right. In 1980 he demonstrated his commitment to redistribution of wealth by authorizing the expropriation of 47,000 acres from large estates in Mato Grosso do Sul to be

redistributed among 1,000 dispossessed farmers. He also relaxed somewhat the censorship of the press. In contrast to his earlier image, Figueiredo adopted a more outgoing stance after he became president and appeared frequently in public. In 1985 he was succeeded in office by the first civilian president since 1964.

Figueres Ferrer, José (b. Sept. 25, 1906, San Ramón, Costa Rica—d. June 8, 1990, San José), moderate socialist Costa Rican statesman who served as president in 1948–49, 1953–58, and 1970–74.

Figueres was educated in universities in Costa Rica and Mexico and at the Massachusetts

Figueres Ferrer, 1953

By courtesy of the Organization of American States

Institute of Technology. He returned to Costa Rica and engaged in coffee planting and hemp production. His criticism of the right-wing government of Rafael Ángel Calderón in July 1942 brought him exile in Mexico for two years.

When Calderón was defeated by Otilio Ulate for reelection in 1948, the Legislative Assembly tried to annul the election and reinstall Calderón. Figueres, who had hidden arms and ammunition on his plantation near Cartago, led an uprising in support of Ulate. The two-month civil war ended when Calderón's forces, despite being backed by Nicaraguan strongman Anastasio Somoza, capitulated. A junta dominated by Figueres wrote a new constitution which, among other reforms, abolished the army and granted women the right to vote. The government was turned over to Ulate in 1949.

Elected president by a landslide in 1953, Figueres pledged his government would be "pro-United States" and described the 1948 uprising as a "revolution of the middle class." Figueres was a firmly anticommunist social democrat, and he instituted many social and economic reforms. When an invasion force crossed the border from Nicaragua in 1955, Figueres appealed to the Organization of American States (OAS) for assistance. With material assistance from the United States, Costa Rica successfully repelled the invasion.

Figueres' National Liberation Party candidate for president lost the election in 1958. Figueres worked in several UN agencies, wrote numerous articles on Costa Rican and Caribbean politics, and served as visiting professor at Harvard University (1963–64) and the State University of New York (1967). Elected to his second term in 1970, he was charged with having received financial support from Robert Vesco, a fugitive American financier who settled in Costa Rica in 1972. Figueres was a relentless opponent of dictatorship and became a symbol of the "democratic left" in Latin America. From 1948 Figueres' party dominated the politics of Costa Rica, which became known as the most stable and democratic country in the region.

Figuig, town, northeastern Morocco, located at the juncture of the Hauts ("High") Plateaux and the northwestern edge of the Sahara. It is an oasis town, surrounded on three sides by the Algerian border. Consisting of seven *ksar*s (walled villages), Figuig lies in a basin of the Wadi Zousfana that is nearly 3,000 feet (900 m) above sea level. In 1845, during the French conquest of Algeria, the town was designated as being within the Moroccan sphere of influence; it was conquered by French forces in 1904 and became part of the French Protectorate of Morocco in 1912. The population of the villages is of mixed racial origins, and both a local Berber language and Arabic are spoken. The town's date palms are not commercially important because of disease and the high elevation of the oasis; fruits and vegetables are grown mostly for local consumption. Water for irrigation is obtained from underground channels (*foggaras*) from a subterranean water table.

The surrounding region includes a number of oases and, to the north, semiarid grazing land used by sheep and goats. The local industry includes the fashioning of pottery, the tanning of goatskins, the manufacturing of leather goods, and the weaving of fabrics. Pop. (1982) 14,542.

Figulus, Daniel Ernst: *see* Jablonski, Daniel Ernst.

Figulus, Publius Nigidius (fl. not later than 98–45 BC), Roman savant and writer, next to Marcus Terentius Varro the most learned Roman of his age.

Figulus was a friend of Cicero, to whom he gave his support at the time of the Catilinarian conspiracy. He was praetor in 58, sided with Pompey in the civil war, was afterward banished, and died in exile. Figulus sought to revive Pythagorean doctrines and combine them with Etruscan and Oriental beliefs, notably a belief in astrology, and apparently he gathered some adherents. Suetonius and Apuleius tell of Figulus' supernatural powers. Jerome calls him *Pythagoricus et magus* ("Pythagorean and magician"). The indifference of the Romans to such abstruse and mystical subjects caused his works to be soon forgotten. His works included *De dis* ("Concerning the Gods"), in at least 19 books, the earliest comprehensive work on Roman religion; *Commentarii grammatici,* in at least 29 books, a loose collection of notes concerned with, among other matters, synonyms, inflection, orthography, word formation, syntax, and etymology; *De extis* ("Concerning Sacrificial Meats"); *Augurium privatum; De ventis* ("Concerning Winds"), in at least four books; *De animalibus,* in at least four books; *De hominum natura,* in at least four books; *Sphaera graecanica et sphaera barbarica;* and a rhetorical treatise, *De gestu* ("Concerning Gesture").

figure, in logic, the classification of syllogisms according to the arrangement of the middle term, namely, the term (subject or predicate of a proposition) that occurs in both premises but not in the conclusion. There are four figures:

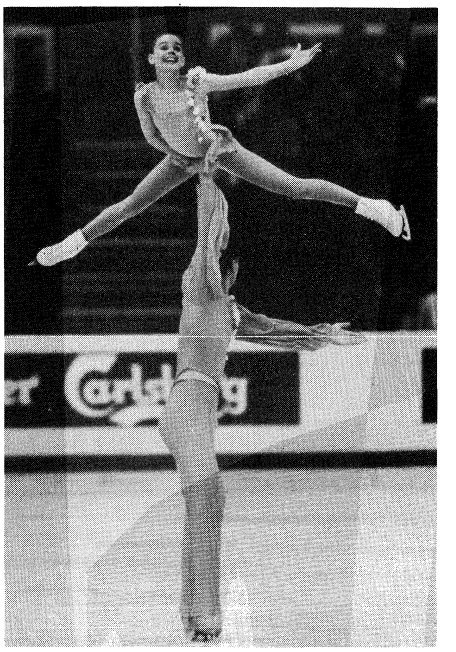
Figure 1	Figure 2
M ... *P*	*P* ... *M*
S ... *M*	*S* ... *M*
S ... *P*	*S* ... *P*

Figure 3	Figure 4
M ... *P*	*P* ... *M*
M ... *S*	*M* ... *S*
S ... *P*	*S* ... *P*

In the first figure the middle term is the subject of the major premise and the predicate of the minor premise; in the second figure the middle term is the predicate of both premises; in the third figure the middle term is the subject of both premises; in the fourth figure the middle term is the predicate of the major premise and the subject of the minor premise.

figure of speech: *see* speech, figure of.

figure skating, sport in which ice skaters, singly and in pairs, inscribe precise figures in a graceful manner. The special figure skate used has a characteristic blade, which is hollow-ground to emphasize its two edges and has a serrated edge near the toe.



Lift in pair figure skating performed by Yekaterina Gordeyeva and Sergey Grinkov (U.S.S.R.) at the world championships, Budapest, 1988

All-Sport USA/Vandystadt

A Treatise of Skating (1772) by Captain Robert Jones is apparently the first account of figure skating, which was done in cramped and formal style until, in 1864, the American dancing master Jackson Haines introduced to Europe his techniques based on dance movement. The International Skating Union (ISU), the world governing body of skating, was founded in 1892. World championships were held independently until the first ISU-supervised contest was held in 1908; that was also the first year in which pair skating was introduced. Figure-skating events for men, women, and pairs were held in the Olympic Games in 1908 but were not staged again until the Winter Olympic Games were inaugurated in 1924.

Competitions for men and women consist of two sections, each equally important in scoring: school figures, in which contestants perform several prescribed movements; and a free-skating, or optional, routine, composed of movements chosen by the skater and performed to music for a specified period of time. The ISU publishes a list of figures recognized in international competition. Each figure is given a difficulty value of from one to five. In singles competition the skater does not know the actual school figures to be skated until a few minutes before the event, when they are drawn by lot from a larger group, which has usually been made known earlier. Each figure is performed three times by each contestant; and, when a skater has completed a particular figure, the performance is given a numerical mark by each judge independently. The correctness of the shape of the figure, the turn, triple repetition, the size of the figure, and the form with which the figure is skated are all elements in the score given. The free-skating

program is given two marks, one for content and the other for performance.

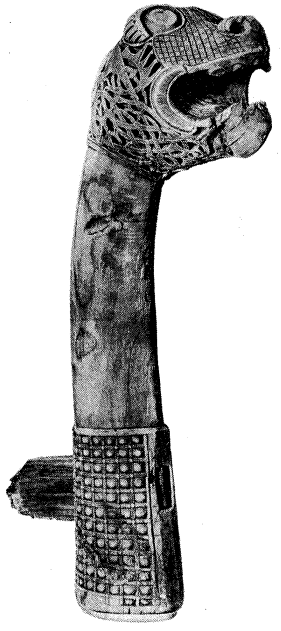
In pair skating a man and a woman skate together and may perform any of the recognized free-skating movements while attempting to convey an impression of harmony in their actions. Pair figure skating bears much resemblance to a later skating development known as ice dancing (*q.v.*) but is distinguished from it chiefly by a movement called the lift. This figure, in which the man lifts his partner completely off the ice, is not allowed in ice dancing.

For Olympic skating champions, *see* Olympic Games; for world champions, *see* Sporting Record: *Ice skating.*

figured bass (music): *see* thorough bass.

figurehead, ornamental symbol or figure formerly placed on some prominent part of a ship, usually at the bow. A figurehead could be a religious symbol, an emblem indicating nationality, or a figure symbolizing the ship's name.

The custom of decorating a vessel probably began in ancient Egypt or India, where an eye was painted on either side of the prow, presumably in the belief that the eyes would help a vessel find its way safely over the water. The custom was followed by the Chinese (who painted eyes on their river junks), the Phoenicians, the Greeks, and the Romans.



Viking figurehead from the Oseberg ship, about 800; in the Universitetets Oldsaksamling, Oslo

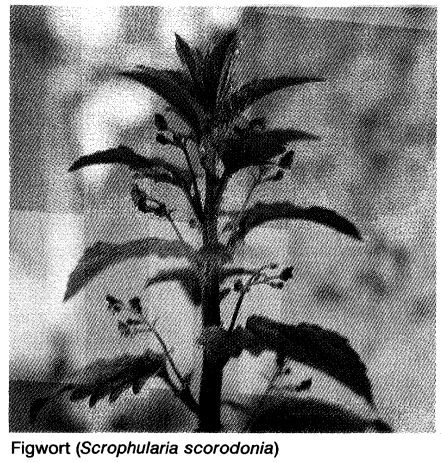
By courtesy of the Universitetets Oldsaksamling, Oslo

The ships of the ancient Egyptians, Phoenicians, Greeks, and early Romans were constructed with heavy vertical timbers at the bow and stern to which the side planking was attached. These stemposts and sternposts protruded well above the hull, and their prominent and semierect position and form created a focal point of interest and a shape obviously suited for decoration. As early as 1000 BC, the stem and sternpost were carved and painted to distinguish one ship from another, and at least one class of vessel used an identifying symbol: a falcon or a falcon's eye generally appeared on the bows of Egyptian funeral barges of the Nile. Although the oculi were the most popular symbols used by early sailors, some figureheads were fashioned for the purpose of terrorizing less civilized tribes. The Egyptians probably originated the practice of using religious symbols; other Mediterranean peoples extended this practice by using carvings and paintings of their principal deity to identify the vessel with its city-state. The Carthaginians, for example, often used a carving of Amon, the Athenians a statue of Athena. When the prow was developed as a weapon for ramming and piercing an enemy vessel, the stem lost its prominence and the so-called ram was decorated instead. One Athenian vessel of about 500 BC had the entire ram carved in the shape of a boar's head. The use of the prow as a battering ram necessarily lowered the prominent bow features of the ship, and so greater emphasis was instead placed on decorating the stern. This trend was carried to an extreme by the Romans at the height of their naval power, when their ships were distinguished by a very high sternpost carved to sweep up and around in graceful curves terminating, for example, in the gilded head of a swan.

Along the more blustery northwest coast of Europe, good seamen such as the Vikings continued to build their ships with high bows and a projecting stem. The figurehead of the Oseberg ship of about AD 800 is a menacing dragon with head upreared. The ships of William I the Conqueror in the Bayeux tapestry are similar to those of his Norse ancestors, but in general the decorative symbols reflect the spread of the Christian church.

In the 13th and 14th centuries, a boarding platform was attached forward and projected out over the stem. With this type of construction the figurehead practically disappeared. Gradually the boarding platform was moved back until it formed the forecastle; when the beakhead was added in the 16th century, it became the natural place for a figurehead. Gradually the beakhead was reduced in size and moved back under the bowsprit until just the figurehead remained. During this period, the fashions in figureheads varied from carvings of saints to national emblems, such as the lion and the unicorn, to a simple scroll and a billethead, and finally to a carving representing the person for whom the vessel was named, or one of that person's female relatives. Historically, figureheads have varied in size from 18 inches (45 cm) for small heads and busts to 8 or 9 feet (2.4 to 2.7 m) for full-length figures. They remained popular until after World War I, when they were discontinued on most ships.

figwort (*Scrophularia*), any of about 200 species of coarse plants of the figwort or snapdragon family (Scrophulariaceae), native to open woodlands in the Northern Hemisphere. The common name refers to an early use of these plants in treating hemorrhoids, an ailment once known as "figs." They are rather tall, frequently fetid plants with purple, greenish, or yellow flowers in large branched spikes. Among the common species widely naturalized in eastern North America is the British *Scrophularia nodosa,* with pea-sized flowers.

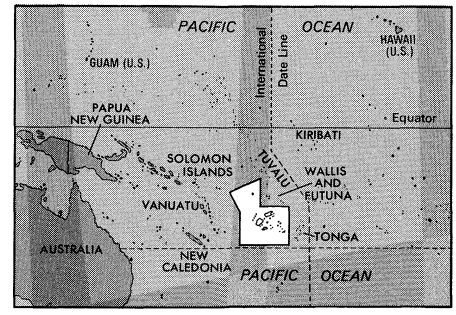


Figwort (*Scrophularia scorodonia*)

A-Z Collection

S. chrysantha, of the Caucasus, with green-yellow flowers, is sometimes grown in flower borders. Maryland figwort (*S. marilandica*), up to 3 m (10 feet) tall, has greenish purple flowers; it is also called carpenter's square because of its four-sided grooved stems.

Fiji, Fijian VITI, nation and archipelago in the South Pacific Ocean. Culturally it forms part of the Melanesian island group. Fiji is situated 1,300 miles (2,100 km) north of Auckland, New Zealand, and covers an area of 7,056 square miles (18,274 square km). The capital is Suva on the island of Viti Levu (Great Fiji). Fiji consists of some 300 islands, of which 100 are inhabited, and 540 islets. The main islands are Viti Levu, Vanua Levu, Taveuni, and Kandavu. Fiji also includes within its borders Rotuma, an island located 440 miles (700 km) north of Suva. The population in 1990 was estimated at 754,000.



Fiji

A brief treatment of Fiji follows. For full treatment, *see* MACROPAEDIA: Pacific Islands.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. The two largest islands, Viti Levu and Vanua Levu, are mountainous and volcanic in origin, rising abruptly from densely populated coasts to generally uninhabited central mountains more than 4,300 feet (1,300 m) above sea level. The smaller islands, which are also volcanic in origin, are formed mostly of either fringing or barrier coral reefs. Mount Tomanivi (4,341 feet [1,323 m]; formerly Mount Victoria) on Viti Levu is the highest point in Fiji. The coastal deltas of the principal rivers—the Sigatoka, Rewa, and Ba on Viti Levu, and the Dreketi on Vanua Levu—contain most of Fiji's fertile arable land.

Fiji's tropical oceanic climate, influenced by the prevalent southeast trade winds, is characterized by high and uniform temperatures, high humidity, heavy rainfall, and occasional hurricanes. Annual average temperature is about 80° F (27° C). The average summer high temperature at Suva is 85° F (29° C), and the average winter low is 68° F (20° C). The mean annual rainfall varies from about 70 inches (1,780 mm) on the leeward (northwestern) sides of the main islands to 120 inches (3,050 mm) on the windward (southeastern) sides. As a result, the eastern sides are covered with dense tropical forests and the western sides with dry grasslands and patches of scrub. Almost half of the nation's total land area is forested, about one-eighth of the total is arable, and a small percentage of the total exists as meadows and permanent pastures.

The people. The people of Fiji are of mixed Melanesian-Polynesian stock; their language, Fijian, is spoken in many dialects. Most Fijians are Methodist. Asian Indians, descendants of labourers who migrated to Fiji to work on sugar estates in 1879, comprise about one-half of the population and slightly outnumber the Fijians. In recent years, more Indians with professional, technical, and commercial skills

have immigrated to Fiji. Most of the Indians are Hindu, but some are Muslim. Intermarriage is rare between Indians and Fijians. A minority of Europeans live on Fiji, and English is the official language. Pacific islanders, notably from Banaba and Tuvalu, and also some Chinese have settled in the archipelago.

Fiji's birth and death rates are lower than those for Micronesia and Polynesia as a whole, and its average annual rate of population growth is somewhat higher than for most other countries in Oceania. Almost two-fifths of Fiji's total population is less than 15 years of age. About two-thirds of the nation's population lives in rural areas.

The economy. Fiji has a market economy based largely on agriculture, sugar production, tourism, and light industries. Economic growth has been hindered by a wide trade deficit that is only partially offset by revenues from tourism. The gross national product (GNP) showed a small decline during the 1980s. The GNP per capita, however, is relatively high for a developing country.

Agriculture accounts for about one-fifth of the GNP and employs more than two-fifths of the work force. Rice, corn (maize), tobacco, yams, cacao, and pineapples are Fiji's chief subsistence crops; sugarcane, copra, and ginger are the chief cash crops. Extensive coconut plantations are found around the coasts of the islands, and parts of Viti Levu are important cattle producing regions. The Native Land Trust Board manages most of Fiji's land on behalf of native landowners. Fiji's timber industry, based on both exotic and indigenous forest resources, has developed for domestic use and export.

Significant quantities of gold, silver, and limestone are mined. Copper, bauxite, and manganese are also found in small quantities. Fossil fuels must be imported.

Manufacturing industries account for about one-tenth of the GNP and employ a slightly smaller fraction of the work force. Light industries predominate and primarily produce processed foods, beverages, small boats, timber, cement, and paint.

Tourism, after sugar, is the country's second largest source of foreign exchange. By either air or sea, Fiji is strategically located for travelers from Australia, New Zealand, Japan, and the United States.

A hydroelectric dam on Viti Levu generates about three-fourths of Fiji's electricity. Imports are dominated by capital and consumer goods, mineral fuels, and food and greatly exceed exports of sugar, gold, fish, and agricultural commodities. The International Monetary Fund has helped to offset Fiji's trade deficit. Chief trading partners include Australia, the United Kingdom, New Zealand, and Japan.

Government and social conditions. Until the coup d'état of September 1987, Fiji was a dominion within the Commonwealth, with a parliamentary form of government. Its 1970 constitution designated the British sovereign, represented by the governor-general, as head of state. Executive power was exercised by the Cabinet under the leadership of the prime minister. Legislative power was vested in the bicameral Parliament, composed of the House of Representatives and the Senate. In October 1987 Fiji was declared a republic, and the country's first president and a prime minister were appointed the following December, formally returning the nation to civilian rule.

Fiji's people enjoy good health conditions; the average life expectancy is about 70 years. Although there are only limited social security provisions, a comprehensive health care system provides medical and dental care to the entire population at nominal cost.

Virtually all school-aged children attend primary school, which is provided free by public and church-run schools. Entry to secondary schools is by competitive examination. Secondary, technical-vocational, and teacher-training education is provided at low cost. The Fiji Institute of Technology and the Fiji School of Medicine are located in Suva, where the main campus of the University of the South Pacific (founded 1968) also is located.

Fiji enjoys a free press and has several daily newspapers; radio broadcasts are in Fijian, English, and Hindi. Virtually all the islands have telephone or radio-telephone service; there is a satellite communications link in Suva, and Fiji's telephone cable link serves the whole Pacific region. The National Archives in Suva contain many historical documents and a fine collection of books about the Pacific region, including the Sir Alport Barker collection.

Cultural life. Fiji's Polynesian-Melanesian culture centres on folk arts and traditions. Long, intricate welcoming ceremonies and the fire-walking ceremony performed on Beqa Island are especially renowned. The Fiji Museum, located in the Thirston Gardens in Suva, contains a fine collection of war canoes and Fijian and other island artifacts. Traditional arts include the weaving of pandanum palm mats, wood carving, pottery making, and the making of *masi* (tapa), a cloth prepared from bark.

History. Archaeological evidence shows that Fiji was settled by Austronesian-speaking peoples in the late 2nd millennium BC; they had developed pottery by about 1300 BC. The Dutch navigator Abel Tasman explored the islands of Vanua Levu and Taveuni in 1643. In the 18th century additional islands were visited by British explorers. The population found by these explorers was mixed Melanesian–Polynesian, the latter dominating the windward sides of the islands and the former the interiors, and there was a complex society with chiefs. The Lau island group was named the Exploring Islands by a U.S. survey expedition in 1840.

The sandalwood trade attracted American ships in the early 19th century, and firearms salvaged from shipwrecks were used by the chiefs of the Mbau in native wars. Traders and the first missionaries arrived in 1835. In 1854 one of the most influential native chiefs, Cakobau, became a Christian and a champion of the missionaries. Cakobau subsequently became the king (*Tui Viti*) of western Fiji, and in 1857 a British consul was appointed at Levuka. In 1874 a deed of unconditional cession was completed between the British and Cakobau, and Fiji was proclaimed a crown colony.

Rotuma was annexed to the colony in 1881. In the 1880s large-scale cultivation of sugarcane began. A plan for federation with New Zealand was rejected in 1900. In 1970 Fiji became independent after 96 years of British colonial rule. Following independence, it became a member of the Commonwealth and the United Nations.

Fiji's constitution and complex electoral system reflect the differences between the Indian and indigenous Fijian racial groups on the island. Most of the country's Indians supported the National Federation Party while the indigenous Fijians were loyal to the Alliance Party, which governed Fiji almost uninterruptedly since independence was achieved in 1970. In the 1980s Fiji underwent a period of racial polarization and political instability. After the Indian-dominated political parties won parliamentary elections in April 1987, Fiji's armed forces staged two successive coups and converted Fiji into a republic in an attempt to insure the indigenous Fijians' future political dominance in the country.

Fijian language, Melanesian language of the Eastern or Oceanic branch of the Austronesian (Malayo-Polynesian) language family. In the late 20th century, it was spoken by about 334,000 persons on the islands of Fiji as either a first or a second language.

Of the several dialects of Fijian, which are divided into Eastern and Western groups, standard Fijian, based on an Eastern dialect (Bauan) and called Bauan Fijian, is known to all indigenous Fijians. Literacy in modern Fiji is high, and Fijian is widely used as a written language and for broadcasting.

Consult the INDEX *first*

Fika, town and traditional emirate, Borno state, northeastern Nigeria. The town lies on the road from Ngala (a settlement opposite Nafada at the head of navigation on the Gongola River) to Potiskum.

Although the Bolewa (Fika, Bole) people settled in the Daniski hills near Fika in the 1440s and subdued the Ngamo (Gamawa) people, it was not until about 1805 that the Bolewa's *moi* ("king"), Buraimah, built the walled town of Lafiya Moi, which shortly thereafter came to be called Fika. The kingdom remained independent throughout the 19th century and survived the attacks in the 1890s by Rābiḥ az-Zubayr (Rabah Zubayr), the Sudanese warrior who destroyed the power of the Bornu kingdom. In 1913 the neighbouring Potiskum chiefdom was placed by the British under Fika's Emir Disa (Idrissa), and in 1924 the emirate headquarters was moved from Fika town to Potiskum, 33 miles (53 km) north-northwest.

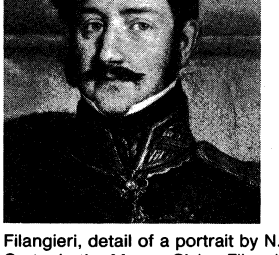
The area is now mainly inhabited by the Ngizim, Bolewa, Ngamo, Karekare, and Bede (Bedde) peoples, who keep cattle and horses and who cultivate peanuts (groundnuts; the only significant export crop), dates, cotton, sorghum, millet, cowpeas, and indigo. Although Fika town has a government health office and a dispensary, Potiskum is larger and is the chief trade centre in the region. Pop. (1972 est.) town, 10,830.

Fikret, Tevfik (Turkish poet): *see* Tevfik Fikret.

Filagato, Giovanni: *see* John XVI (or XVII) *under* John (Papacy).

filament lamp, variety of incandescent lamp (*q.v.*) in which the light source is a fine electrical conductor heated by the passage of current.

Filangieri, Carlo, PRINCIPE (prince) DI SATRIANO, DUCA (duke) DI TAORMINA (b. May 10, 1784, Cava de' Tirreni, Kingdom of Naples [Italy]—d. Nov. 16, 1867, Naples), general in command of the forces of the Kingdom of the Two Sicilies (Naples) during the bloody suppression of the Sicilian revolution of 1848. He also served a brief term as premier of the Two Sicilies (1859).



Filangieri, detail of a portrait by N. Carta, in the Museo Civico Filangieri, Naples

Brogi—Alinari from Art Resource/EB Inc.

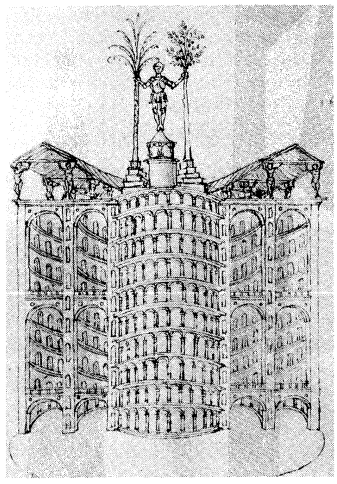
Fleeing the royalist reaction of 1799, when

Napoleon's republican forces were routed from Italy, the 15-year-old Filangieri sought refuge in France, where he entered the military academy in Paris. He joined the French Army in 1803 and was made captain at the Battle of Austerlitz (1805). Recalled into the Neapolitan Army, he fought in Spain, where he distinguished himself as much by his personal duels as by his military success. He played a brilliant role in the Bonapartist Gen. Joachim Murat's unsuccessful campaign against Austria in 1815; he was seriously wounded at Panaro. During the Neapolitan insurrection of 1820 he supported the constitutionalist party and fought the Austrians, who overthrew the revolutionary government and restored the monarchy (March 1821). Filangieri was dismissed, and he retired to Calabria, where in 1819 he had inherited the princely title and estates of Satriano.

In 1831 Ferdinand II, king of the Two Sicilies, recalled him to command the army. In his suppression of the 1848 Sicilian revolution, he bombarded and captured Messina (September) and besieged and took Catania, where his troops committed many atrocities; by May 1849 he had subdued the entire island. Named duke of Taormina, he governed Sicily until 1855.

Filangieri became Neapolitan minister of war and president of the council under Francis II (1859). He soon resigned, however, after Francis' rejection of his proposal to grant a popular constitution and to ally Naples with France and Piedmont against Austria. In 1860 he refused to fight the revolutionary leader Giuseppe Garibaldi in Sicily and retired to private life.

Filarete, original name ANTONIO DI PIETRO AVERLINO, or AVERULINO (b. *c.* 1400, Florence?—d. *c.* 1469, Rome), architect, sculptor, and writer, who is chiefly important for his *Trattato d'architettura* ("Treatise on Architecture"), which described plans for an ideal Renaissance city.



"House of Virtue and Vice," pen drawing from the *Trattato d'architettura* by Filarete, 1460–64; in the Biblioteca Nazionale Centrale, Florence (Magliabecchiana Ms. Book XVIII, f.c.144r)

By courtesy of the Biblioteca Nazionale, Florence

Filarete is thought to have been trained under Lorenzo Ghiberti in Florence. From 1433 to 1445 he was employed by Pope Eugenius IV to execute the bronze central doors of Old St. Peter's in Rome (installed in the new St. Peter's in 1619). By comparison with the contemporary bronze doors of Ghiberti and Donatello in Florence, Filarete's door is less accomplished in composition and technique but is important for its hieratic classicizing style. The first Renaissance monument of a specifically Roman type, it influenced the work of Isaia da Pisa and later Roman sculptors of the 15th century. In 1448 he returned to Florence, entering in 1451 the service of Francesco Sforza, duke of Milan. In Milan he was active principally as an architect and designed the Ospedale Maggiore (1457–65, finished in the 18th century), among the first Renaissance buildings in Lombardy.

Between 1460 and 1464 he wrote his famed *Trattato*. Inspired by Leon Battista Alberti's treatise *De re aedificatoria*, Filarete's work describes a model city called Sforzinda. Among the projects he envisioned for this ideal Renaissance city was the tower of Vice and Virtue—a 10-story structure with a brothel on the first floor and an astronomical observatory on the 10th. An English translation by John R. Spencer was published in two volumes in 1965.

The name Filarete, probably assumed during his Milanese period, was derived from the Greek meaning "lover of virtue."

filarial worm, any of a group of parasitic worms of the class Nematoda (phylum Aschelminthes) that usually require two hosts, an arthropod (the intermediate host) and another animal (the primary host), to complete the life cycle. The larval phase occurs within the body of a biting insect. The mature phase occurs in the body of an animal bitten by the insect.

The female worm produces large numbers of microscopic, active embryos called microfilariae that pass into the bloodstream of the primary host. These then enter the body of an insect as the insect bites the infected animal. The microfilariae grow into larvae in the insect's muscles, then are passed to the primary host when the insect bites an animal, and the cycle repeats. In mammals filarial worms cause a group of infectious disorders known collectively as filariasis.

filariasis, a group of infectious disorders caused by threadlike nematodes of the superfamily Filarioidea, that invade the subcutaneous tissues and lymphatics of mammals, producing reactions varying from acute inflammation to chronic scarring. In the form of heartworm, it may be fatal to dogs and other mammals.

In the human body the female nematode gives birth to elongated embryos, the microfilariae, which migrate through the peripheral blood and skin, from which they are taken by bloodsucking insects. Within the insect carrier, the microfilariae grow into motile, infective larvae that, at the insect's next blood meal, are introduced into the human host, where they reach maturity in about a year. The term filariasis is commonly used to designate bancroftian filariasis, caused by *Wuchereria bancrofti*, organisms that are widely distributed in tropical and subtropical regions of the world and are transmitted to man by mosquitoes, usually *Culex fatigans*. The nematode lives principally in the lymph nodes and lymph vessels, notably those draining the legs and genital area, where the adult worms induce allergic reactions in the sensitized tissues.

The initial inflammatory stage is characterized by granulomatous lesions, swelling, and impaired circulation; this stage is followed by enlargement of the lymph nodes and dilation of the lymph channels, which, over the years, harden and become infiltrated and clogged with fibrous tissue elements, resulting in some of the untreated cases in the condition known as elephantiasis, which is typically associated with the gross expansion of the tissues of the legs and scrotum. The most effective therapeutic drugs are diethylcarbamazine and sodium caparsolate, which kill the adult worms and microfilariae.

The form of filariasis known as filariasis malayi closely resembles bancroftian filariasis in its symptoms and pathological changes; it is caused by *Brugia malayi*, found chiefly in the Far East. Onchocerciasis (river blindness) is caused by *Onchocerca volvulus*, which is transmitted to man by flies of the genus *Simulium*, which breed along fast-moving streams; the condition is widespread in southern Mexico and Guatemala and is common in Central Africa. Characteristic lesions are nodules beneath the skin, usually in the head region; the infection may also invade the eyes, causing blindness in about 5 percent of the infected individuals. Treatment consists of the surgical excision of the nodules and the administration of chemotherapeutics. Loiasis, prevalent in West and Central Africa, especially along the Congo River, is caused by *Loa loa* and transmitted by flies of the genus *Chrysops*. It is characterized by transient areas of allergic inflammation in the tissues beneath the skin, called calabar swellings; adult worms may sometimes be visible beneath the conjunctiva (the delicate membrane lining the eyelids and covering the exposed surface of the eyeball). Loiasis produces irritation but seldom permanent damage. Treatment includes surgical removal of the worms from the conjunctiva and drug therapy. Other forms of filariasis are caused by *Acanthocheilonema perstans* and *Mansonella ozzardi* and are not in most cases associated with specific symptoms. The prevention of filariasis relies heavily on insecticides and insect repellents.

filbert, also called HAZEL, any of about 15 species of shrubs and trees constituting the genus *Corylus* in the birch family (Betulaceae) and the edible nuts they produce. The former common name for the genus was hazel; various species were termed filbert, hazelnut, or cobnut, depending on the relative length of the nut to its husk. This distinction was found to be misleading, and filbert became the common name for the genus in the U.S. The term cobnut is limited to a commercial variety of one species; the Jamaican cobnut has a similar flavour but is an unrelated plant of the family Euphorbiaceae. The terms hazel and hazelnut, however, are still in popular use.

American filbert (*Corylus americana*)

J. Horace McFarland Company

Filberts, native to the North Temperate Zone, are deciduous; their leaves are alternate, serrate, obovate, and hairy. The plants range from 3 to 36 metres (10 to 120 feet) in height. In late winter a profusion of yellow male catkins and smaller, red-centred clusters of female flowers appears on the same tree. The brown, roundish or oblong nut, usually one to four centimetres (½ inch to 1½ inches) long, is partly or wholly enclosed in a husk.

Choice nuts are produced by two Eurasian trees, the European filbert (*Corylus avellana*) and the giant filbert (*C. maxima*), and by hybrids of these species with two American

shrubs, the American filbert (*C. americana*) and the beaked filbert (*C. cornuta*), popularly called hazelnuts. The large cobnut is a variety of the European filbert; Lambert's filbert is a variety of the giant filbert. Nuts produced by the Turkish filbert (*C. colurna*) are sold commercially as Constantinople nuts. Barcelona nuts come from the Spanish, or Barcelona, filbert, usually considered a variety of the giant filbert. Turkey, Italy, and Spain are the leading commercial producers of filberts.

California, Chinese, Japanese, Manchurian, Tibetan, and Turkish filberts are valuable hedgerow and ornamental trees. Both *C. avellana* and *C. americana* are grown for their colourful autumnal foliage. An oil from the European filbert is used in food products, perfumes, and soaps; the tree yields a soft, reddish white timber, useful for small articles such as tool handles and walking sticks.

Filberts are deep-rooted, moderately shade-tolerant trees, which fruit best in well-drained soil and in full sun.

Filchner, Wilhelm (b. Sept. 13, 1877, Munich, Ger.—d. May 7, 1957, Zürich, Switz.), scientist and explorer who led the German Antarctic expedition of 1911–12.

In 1900 Filchner crossed the Pamirs, the mountainous region of central Asia now chiefly within the Tadzhik S.S.R., and he made an expedition to Tibet in 1903–05. Sailing for Antarctica in the *Deutschland* (1911), he penetrated the Weddell Sea at 77°50′ S early in 1912 and charted the Luitpold Coast (which he named for the prince regent of Bavaria) between 29° and 37° W. In March the ship became trapped in the pack ice and drifted until it finally became freed at 63°37′ S, 36°34′ W on Nov. 26, 1912. In Tibet again (1926–28), Filchner conducted cartographic surveys and magnetic observations; he also made a magnetic survey of Nepal (1939–40). His writings include *Das Rätsel des Matschu* (1907; "The Riddle of the Matschu"), *Zum sechsten Erdteil* (1923; "To the Sixth Continent"), and *Ein Forscherleben* (1950; "An Explorer's Life").

Filchner Ice Shelf, large body of floating ice, lying at the head of the Weddell Sea, which is itself an indentation in the Atlantic coastline of Antarctica. It is more than 650 feet (200 m) thick and has an area of 100,400 square miles (260,000 square km). The shelf extends inland on the east side of Berkner Island (opposite Ronne Ice Shelf) for more than 250 miles (400 km) to the escarpment of the Pensacola Mountains. The ice shelf, named for the German explorer Wilhelm Filchner, was claimed by the United Kingdom (1908) and by Argentina (1942). Argentina, the United Kingdom, and the United States have operated research stations along its northern edge.

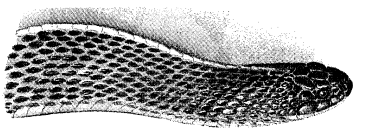
file, in hardware and metalworking, tool of hardened steel in the form of a bar or rod with many small cutting edges raised on its longitudinal surfaces; it is used for smoothing or forming objects, especially of metal. The cutting or abrading action of the file results from rubbing it, usually by hand, against the workpiece.

Files are classified according to their cross-sectional shapes, the form of the cutting edges, and the coarseness of the cut (*i.e.*, the number of teeth per inch or centimetre). There are at least 20 different cross-sectional shapes; the most common are rectangular with various width-to-thickness ratios, square, triangular, round or rattail, and half round. There are three general classifications of tooth form: single-cut, double-cut, and rasp. The single-cut file has rows of parallel teeth cut diagonally across the working surfaces. The double-cut file has rows of teeth crossing each other. Rasp teeth are disconnected and round on top; they are formed by raising small pieces of material from the surface of the file with a punch. Rasp files, or rasps, are usually very coarse and are used primarily on wood and soft materials.

Classification according to coarseness or spacing of the teeth is confined to single- and double-cut files. There are six main classes: rough, coarse, bastard, second-cut, smooth, and dead smooth. The number of teeth per inch varies considerably for different shapes and sizes.

filé, powdered leaves of the sassafras tree, used as a spice and as a thickener for soups and sauces. Its use originated with the Choctaw Indians in the American South. Filé is an essential ingredient of Louisiana gumbo and other Creole dishes. Because cooking makes it stringy, the filé is characteristically added to food after removal from heat and just before serving.

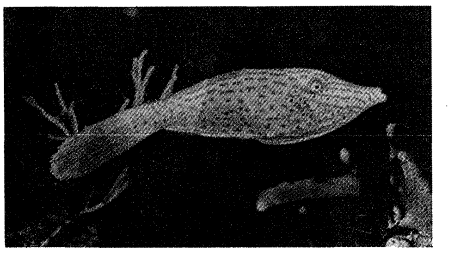
file snake (*Mehelya*), any of about 15 species of snakes belonging to the family Colubridae. They are named for their triangular body cross section and rough-keeled (ridged) scales. All are rather large and plain. They are active by night on the ground. File snakes are nonvenomous; they prey on other snakes, including venomous ones. The Cape file snake (*M. capensis*) of eastern and southern Africa is the enemy of night adders (*Causus*).



File snake (*Mehelya*)
Painting by David M. Dennis

filefish, any of the shore-frequenting marine fishes of the family Monacanthidae, found in warm seas around the world. Close relatives of the triggerfishes, they are sometimes included with them in the family Balistidae.

Filefishes are small-mouthed and flattened from side to side, and they have two dorsal-fin spines, the first of which is large and erectile and can be locked upright by the smaller second spine. Filefishes also have small scales whose small spines give the skin a velvety or sandpapery feel, hence the name filefish. In some species, these scale spines are enlarged on the tail base, only or especially in the males. The small mouths of filefishes bear a few strong incisor-like teeth. The fishes use these teeth to break off pieces of coral on which they feed and to chisel holes into the shells of mollusks in order to extract the soft parts. The scrawled filefish (*Aluterus scriptus*) of worldwide distribution may grow about 100 cm (40 inches) long, but most filefishes are considerably smaller. The members of this family are not generally considered good to eat.



Scrawled filefish (*Aluterus scriptus*)
Carl Roessler

Filene's, in full WILLIAM FILENE'S SONS CO., in Boston, a department store that pioneered a number of retailing innovations. It was founded in 1881 by the Prussian immigrant William Filene and his sons, Edward and Lincoln.

Well-known for its high-quality fashion merchandise, Filene's is probably most famous for its Automatic Bargain Basement. This unique basement store was opened in 1909, selling distress merchandise at bargain prices, as did many other stores' basements, but at Filene's the prices were plainly marked and were automatically reduced by a set percentage after a given number of days if the goods remained unsold—25 percent after 12 selling days, another 25 percent at the end of 18 selling days, and a third 25 percent after 24 selling days; after 30 days, the merchandise was given to charity. The basement operated at a loss for the first three years but subsequently became such a success that its earnings alone were responsible for maintaining the profitability of Filene's during the Great Depression, when every other floor was operating at a loss.

Filene's was the first store to use the charge-plate system and cycle billing and pioneered branch-store operation. In 1929 the store joined F. & R. Lazarus & Co. and Abraham & Straus to form Federated Department Stores, Inc.

Edward Filene, who with his brother Lincoln was responsible for the development and success of Filene's, was a coinventor of the Filene–Finlay simultaneous translator that was later used for the Nuremberg war crime trials and for sessions of the United Nations.

fili (Old Gaelic: "seer"), plural FILI, ancient professional poet in Ireland whose official duties were to know and preserve the tales and genealogies and to compose poems recalling the past and present glory of the ruling class. The fili constituted a large aristocratic class, expensive to support, and were severely censured for their extravagant demands on patrons as early as the assembly of Druim Cetta (575). Their power was not checked, however, since they could enforce their demands by the feared lampoon (*áer*), or poet's curse, which not only could take away a man's reputation but, according to a widely held ancient belief, could cause physical damage or even death. Although by law a fili could be penalized for abuse of the *áer,* belief in its powers was strong and continued to modern times.

After the Christianization of Ireland in the 5th century, fili assumed the poetic function of the outlawed Druids, the powerful class of learned men of the pagan Celts. The fili were often associated with monasteries, which were the centres of learning.

Fili were divided into seven grades. One of the lower and less learned grades was bard. The highest grade was the *ollamh,* achieved after at least 12 years of study, during which the poet mastered more than 300 difficult metres and 250 primary stories and 100 secondary stories. He then could wear a cloak of crimson bird feathers and carry a wand of office. Although at first the fili wrote in a verse form similar to the poetry of Germanic languages (two half-lines linked by alliteration), they later developed minute rules of prosody and rigid and complicated verse forms, the most popular of which was the *debide* (modern Irish *deibide,* "cut in two"), a quatrain composed of two couplets, linked by the rhyme of a stressed syllable with an unstressed one.

After the 6th century, fili were granted land. They were required not only to write official poetry but also to instruct the residents of the area in law, literature, and national history. These seats of learning formed the basis for the later great bardic colleges.

By the 12th century fili were composing lyrical nature poetry and personal poems that praised the human qualities of their patrons, especially their generosity, rather than the patrons' heroic exploits or ancestors. They no longer strictly adhered to set rules of prosody. The distinction between the fili and the bard

gradually broke down; the fili gave way to the supremacy of the bards by the 13th century. *See* bard.

filibuster, in legislative practice, the parliamentary tactic used in the United States Senate by a minority of the senators—sometimes even a single senator—to delay or prevent parliamentary action by talking so long that the majority either grants concessions or withdraws the bill.

Unlike the House of Representatives, in which rules limit speaking time, the Senate allows unlimited debate on a bill. Speeches can be completely irrelevant to the issue.

The word originally described piratical 16th-century privateers and still designates any irregular military adventurer, such as the Americans who took part in mid-19th century Latin-American insurrections. The word was used in the political sense by the mid-1800s. In 1957 Senator Strom Thurmond of South Carolina talked for more than 24 hours, the longest individual filibuster on record, as part of an unsuccessful attempt by Southern senators to obstruct civil-rights legislation.

Invoking cloture on debate (*i.e.,* limiting or ending a debate by calling for a vote) and holding round-the-clock sessions to tire the minority are measures used to defeat a filibuster.

filibustering, originally, in U.S. history, the attempt to take over countries at peace with the United States via privately financed military expeditions, a practice that reached its peak during the 1850s. In U.S. congressional usage, the term refers to obstructive delaying tactics (*see* filibuster).

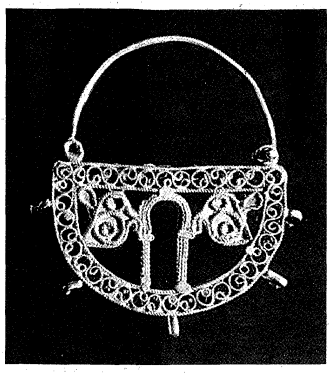
Spurred by land hunger and by the desire of proslavery Southerners to add future slave states to the Union, filibusterers were active during the decade prior to the American Civil War. Starting in 1849, Narcisco López led three unsuccessful expeditions against Cuba. He convinced many prominent Southerners that the island was ripe for revolt against Spain. In his last attempt (1851), López landed in Havana with a contingent of Southern volunteers. The expected popular uprising against Spain failed to materialize, and López, along with about 50 Southerners, was executed by Spanish military authorities.

The high point of American filibustering was reached under William Walker, a Californian who first tried to take Mexican Lower California and then turned his attention to Nicaragua. In 1855 Walker took advantage of a civil war in Nicaragua to take control of the country and set himself up as dictator. In May 1856 President Franklin Pierce recognized the Walker regime.

But Walker was undone when he tried to seize control of the Accessory Transit Company (an American transport company in Nicaragua) from Cornelius Vanderbilt. Vanderbilt formed a coalition of Central American states against Walker, and the dictator of Nicaragua was forced to surrender (May 1, 1857). Walker tried twice more to take Nicaragua. On his last attempt in 1860 he was captured on the coast of Honduras and put before a firing squad.

Filibustering came to an end with the start of the American Civil War. Land hunger was never quite so strong again as the United States turned from an agrarian to an industrial nation. And with the abolition of slavery, Southern support for the conquests disappeared.

filigree, delicate, lacelike ornamental openwork composed of intertwined wire threads of gold or silver, widely used since antiquity for jewelry. The art consists of curling, twisting, or plaiting fine, pliable metal threads and soldering them at their points of contact with each other and, if there is one, with the metal groundwork.



Early Christian filigree gold earring, 7th century; in the Benáki Museum, Athens

By courtesy of the Benaki Museum, Athens

The ancient Greeks used filigree with great elegance; a necklace of pendant flowers and tassels in a trellis of finely plaited ropes is an example of the delicacy filigree work can attain. The use of filigree was widespread during Roman times, extending throughout the empire. Asian filigree work is especially fine. In the Far East, gold and silver filigree are generally surrounded and subdivided by bands of metal.

Filion, Hervé, byname HUSTLING HERVÉ (b. Feb. 1, 1940, Angers, Que., Can.), harness-race driver, trainer, and owner who became the most successful North American harness-racing driver.

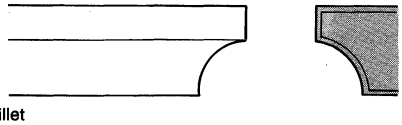
Filion was born on his family's farm, one of 10 children, two sisters and eight brothers, many of the latter also harness drivers, notably his younger brother Henri. Hervé left school after completing the fifth grade and at the age of 13 began driving on the county-fair circuit. He owned his first horse at 17. He came to the United States in 1961 and, by late in the 1960s, had taken over as the annual money- and race-winning driver, leading in eight of nine years by 1976. In that year he also surpassed the total record for races won of Hans Fromming of West Germany (5,296). His Capital Hill Farms, Inc., at Lachute, Que., was a large training farm for horses that he trained, drove, and owned, wholly or in part. Filion drove mainly in the North Atlantic States area and did not take part in many of the harness-racing classic events.

Filioque (Latin: "and from the Son"), phrase added to the text of the Christian creed by the Latin church in the Middle Ages and considered one of the major causes of the schism between the Eastern and Western Churches. *See* Nicene Creed.

Filipe (Portuguese personal name): *see under* Philip.

Filippoi (Greece): *see* Philippi.

fillet (from Latin *filum,* "thread"), in architecture, the characteristically rectangular or square ribbonlike bands that separate mouldings and ornaments. They are very common in classical architecture (in which they also may be found between the flutings of columns) and in Gothic architecture. In the Early English and Decorated styles of the 13th and 14th centuries, respectively, the fillet is frequently worked upon larger moldings and column shafts; in these cases it is not always flat but rather is sometimes cut into two or more narrow faces that have sharp edges between them. *See also* molding.



Fillet

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filling, also called WEFT, or WOOF, in woven fabrics, the widthwise, or horizontal, yarns carried over and under the warp, or lengthwise, yarns and running from selvage to selvage. Filling yarns are generally made with less twist than are warp yarns because they are subjected to less strain in the weaving process and therefore require less strength.

In pile-fabric constructions, such as velvet or velveteen, extra sets of warps are used to form the pile. A single filling yarn is known as a pick, or shot. In textile finishing, filling is a sizing, or weighting, substance added to yarn or fabric to fill in open spaces or increase weight.

Fillmore, city, seat (1851) of Millard county, west-central Utah, U.S. It lies just west of the Pahvant Range (at an elevation of 5,061 feet [1,543 m]), 95 miles (153 km) south-southwest of Provo. Settled in 1851 and named for President Millard Fillmore, it was chosen by Brigham Young, the Mormon leader, as the site for Utah's first territorial capitol building. It was the official, but not actual, capital until it relinquished the position to Salt Lake City in 1856. The uncompleted statehouse, built of red sandstone, now houses pioneer and Indian artifacts and is preserved as a state historic monument. The city is a trading centre for mixed farming (grains, potatoes, alfalfa seed, and livestock); mountain mushrooms are processed there. Fishlake National Forest (site of Big Rock Candy Mountain of folklore fame) is to the east, and the Kanosh Indian Reservation is to the south. Pop. (1986 est.) 2,800.

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

Fillmore, Millard (b. Jan. 7, 1800, Locke Township, N.Y., U.S.—d. March 8, 1874, Buffalo), 13th president of the United States (served 1850–53). Fillmore was a moderate Whig politician whose insistence on federal enforcement of the Fugitive Slave Act of 1850 alienated the North and led to the death of the Whig Party. Elected vice president in 1848, he became chief executive on the death of President Zachary Taylor (July 1850).

Fillmore

By courtesy of the Library of Congress, Washington, D.C.

Fillmore was born in a log cabin to a poor family and was apprenticed to a wool carder at age 15. He received little formal education until he was 18, when he managed to obtain six consecutive months of schooling. Shortly afterward he obtained his release as an indentured apprentice and started work in a law office. He was admitted to the bar in 1823 and entered politics in 1828. Fillmore was identified with the democratic and libertarian Anti-Masonic Party from 1828 until 1834, when he followed his political mentor Thurlow Weed to the Whigs and was soon recognized as an out-

standing leader of the party's Northern wing. Following three terms in the state assembly (1829–32), he was elected to Congress (1833–35, 1837–43), where he became a devoted follower of Sen. Henry Clay. Losing the New York gubernatorial election in 1844, he was easily elected the first state comptroller three years later. At the national Whig convention (1848), the Mexican War hero Zachary Taylor of Virginia was nominated for president and Millard Fillmore—the honest, experienced, dignified Northerner—for vice president, largely through Clay's sponsorship.

Fillmore believed that Whig success at the polls heralded the rise of a truly national party that would occupy a middle ground between extremists of both North and South in the growing sectional controversy over slavery. This philosophy was embodied in Clay's Compromise of 1850, which sought to appease both sides on the slavery issue. When President Taylor died in the middle of the national debate, his successor, Fillmore—much as he personally abhorred slavery—felt it must be endured and given constitutional protection until it could be abolished without destroying the Union in the process. Thus he felt obligated to support the provision requiring the federal government to aid in the capture and return of runaway slaves to their former owners. He publicly announced that, if necessary, he would call upon the military to aid in the enforcement of this statute. Although this section of the compromise assuaged the South and postponed the Civil War for 10 years, it also meant political death for Fillmore because of its extreme unpopularity in the North.

Throughout his career he was a constant advocate of U.S. internal development. He was also an early champion of expansion in the Pacific and in 1853 sent Commo. Matthew C. Perry with a U.S. fleet to Japan, forcing that government to alter its isolationist tradition and to enter into trade and diplomatic relations with the West.

In 1852 Fillmore was one of three presidential candidates of a divided Whig Party in its last national election, which it lost. He also allowed his name to be put forth for president (1856) by the American, or Know-Nothing, Party, which took an ambivalent position on slavery. Overwhelmingly defeated, he retired to Buffalo and never again ran for public office, although he continued to be a civic and cultural leader there.

film: *see* motion picture.

film festival, gathering, usually annual, for the purpose of evaluating outstanding motion pictures. Sponsored by national or local governments, industry, service organizations, experimental film groups, or individual promoters, the festivals provide an opportunity for filmmakers, distributors, critics, and other interested persons to attend film showings and meet to discuss current artistic developments in film. At most of the festivals distributors can purchase films that they think can be marketed successfully in their own countries.

The first festival was held in Venice in 1932. Since World War II, film festivals have contributed significantly to the development of the motion-picture industry in many countries. The popularity of Italian films at the Cannes and Venice film festivals played an important part in the rebirth of the Italian industry and the spread of the postwar Neorealist movement. In 1951 Akira Kurosawa's *Rashomon* won the Grand Prize at Venice, focussing attention on Japanese films. That same year the first American Art Film Festival at Woodstock, N.Y., stimulated the art-film movement in the United States. Scandinavian films gained popularity when top prizes at Venice in 1955 went to two young Danish documentary filmmakers, and the Grand Prize was awarded to *Ordet* (1955; "The Word"), directed by the Dane Carl Dreyer.

Probably the best known and most noteworthy of the hundreds of film festivals is held each spring in Cannes, Fr. Since 1947, people interested in films have gathered in the small resort town to attend official and unofficial showings of films. Other important festivals are held in Berlin, Moscow, Karlovy Vary (Czech.), London, San Francisco, New York City, Chicago, and Venice. Short subjects and documentaries receive special attention at gatherings in Edinburgh, Mannheim and Oberhausen (both in Germany), and Tours, Fr. The Southeast Asia Film Festival considers films that are little known outside Asia. Some festivals feature films of one country, and since the late 1960s there have been special festivals for student filmmakers. Others are highly specialized, such as those that feature only underwater photography or those that deal with specific subjects, such as mountain climbing, or scouting.

Filmer, Sir Robert (b. *c.* 1588—d. May 26, 1653, East Sutton, near Middlestone, Kent, Eng.), English theorist who promoted an absolutist concept of kingship.

He was educated at Trinity College, Cambridge, and at Lincoln's Inn. He was knighted by Charles I and had a brother and a son at court. During the Civil Wars his house in East Sutton was sacked, and he went to prison as a royalist although he never fought for the king.

During the exclusion crisis of 1679–80 Filmer's political tracts (first published between 1648 and 1653) were reissued (1679) and his major work, *Patriarcha,* was published for the first time (1680). John Locke, then writing on politics, attacked his writings as "glib nonsense," but 20th-century scholars have viewed Filmer as a significant and interesting figure in his own right, quite apart from Locke's attention to him. He was the first English absolutist, for *Patriarcha* was written long before the Civil Wars and before Thomas Hobbes was published.

Filmer believed that the state was a family, that the first king was a father, and that submission to patriarchal authority was the key to political obligation. Making a strained interpretation of scripture, typical of his time but ridiculed by Locke, he pronounced that Adam was the first king and that Charles I ruled in England as Adam's eldest heir. Filmer represented that patriarchal social structure which characterized Europe until the Industrial Revolution and which, in one form, persisted longest in the southern United States.

filmsetting (typesetting): *see* photocomposition.

filter, in photography, device used to selectively modify the component wavelengths of mixed (*e.g.*, white) light before it strikes the film. Filters may be made of coloured glass, plastic, gelatin, or sometimes a coloured liquid in a glass cell. They are most often placed over the camera lens but can in some cases be placed over the light source with the same effect.

Black-and-white films are imperfect in their colour sensitivity, and coloured filters are used to modify the light and translate the subject into gray tones that correspond to the tones seen by the human eye. Coloured filters can also brighten or darken the reproduction of coloured objects, permitting local contrast controls at the point of exposure. In colour photography, coloured filters are used to alter the colour quality of the light to match the colour sensitivity of the film.

Some light filters are used in both colour and black-and-white photography. Neutral density filters decrease the intensity of the light without affecting its colour and are used when the light intensity is too great for the correct exposure. Polarizing filters enhance colour vividness by reducing glare from the reflecting surfaces of such substances as glass and water. Colour filters are also used for colour correction in the printing process and for selecting contrast scales of multicontrast black-and-white enlarging paper.

Since filters absorb some of the light that passes through them, an increase in the calculated exposure is usually required. This increase is known as the filter factor. Modern cameras with built-in meters measure the light after the filtration and thus take the decrease in intensity into account.

filter feeding, in zoology, a form of food procurement in which food particles or small organisms are randomly strained from water. Filter feeding is found primarily among the small- to medium-sized invertebrates but occurs in a few large vertebrates (*e.g.*, flamingos, baleen whales).

In bivalves such as the clam, the gills, larger than necessary for respiration, also function to strain suspended material out of the water. Hairlike filaments called cilia produce a water current over the gills and other cilia move the trapped food particles along the gill face and into food grooves. Many bristle-worms, such as the fan worm *Sabella*, have ciliated tentacles near the mouth, which entrap passing food particles. The limbs of certain crustaceans, including the brine shrimp *Artemia*, bear hairlike setae that filter tiny organisms as the animal swims.

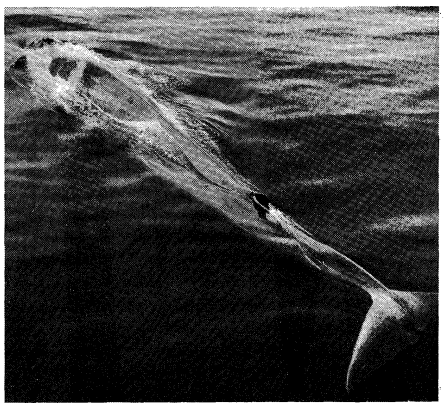
The blue whale has baleen, or whalebone, in place of teeth. These narrow vertical plates, which hang inside the mouth cavity, are fringed on the inner edges to trap the shrimplike krill engulfed by the whale in a mouthful of water.

filter-pressing, process that occurs during the crystallization of intrusive igneous bodies in which the interstitial liquid is separated from the crystals by pressure. As crystals grow and accumulate in a magmatic body, a crystal mesh may be formed, with the remaining liquid distributed in the interstices. This mesh may result from crystals that sink to the floor of the magma chamber or from crystals that accumulate during the advanced stages of crystallization of the body. Pressure applied by the weight of the overlying crystals or by outside forces may force the more mobile liquid out of the crystal mesh and also may fracture or crush the remaining crystals. Filter-pressing has been used to explain the formation of monomineralic rocks or rocks with an apparently unusual mineralogical and chemical composition; *e.g.*, anorthosite.

fin stabilizer, fin or small wing mounted on a ship or aircraft in such a way as to oppose unwanted rolling motions of the vehicle and thus contribute to its stability. The term also refers to the tail protuberances on bombs, artillery shells, and rockets to maintain the stability of these devices in flight. Fins are normally fixed in position but occasionally are made variable. The stabilizing fins on a ship, for example, move in such a manner as to counteract rolling caused by waves; they are usually controlled by a gyroscope.

fin whale, also called FINBACK WHALE, RAZORBACK WHALE, OR COMMON RORQUAL (*Balaenoptera physalus*), slender-bodied baleen whale, belonging to the family Balaenopteridae; its name derives from the ridge on its back. The fin whale is a swift, streamlined whale 18 to 24 metres (60 to 80 feet) long. It has a triangular dorsal fin, short baleen, and 80 or more grooves along its throat and chest. It is gray with white on the underparts and on the right side of the lower jaw.

The fin whale is found in all the world oceans, in groups of a few to several hundred. It lives in polar waters in summer, feeding on



Fin whale (*Balaenoptera physalus*)
Jen and Des Bartlett—Bruce Coleman Inc.

crustaceans and small fishes, and moves to warmer waters in winter to breed. It is a commercially valuable species but has been substantially reduced in numbers by overhunting. It is partially protected (by limits on the size of catches) but is listed as a vulnerable species in the *Red Data Book.*

finale, in music, the last and, as a rule, lively movement of a multimovement instrumental work, or the culminating section of an operatic act or scene, usually involving a vocal ensemble rather than a single singer. During the musical era dominated by Viennese Classicism (*c.* 1770–1820), solo concerti tended to end with movements in rondo form, while the finales of symphonic and chamber works, eventually solo sonatas as well, increasingly complied with the sonata-allegro principle. Beginning with Mozart's last symphony (*Jupiter,* 1788) and reaching its highest expression in numerous works of Beethoven, the finale attained structural significance previously reserved for the opening movement, to the extent that, instead of providing merely an agreeable conclusion, it contained the ultimate thematic resolution of a large-scale instrumental drama.

At times the finale's formal patterning was bound to deviate from that of the Classical sonata-allegro. Beethoven's *Eroica* and Brahms's *Fourth Symphony* end with variation sets, Beethoven's *Piano Sonata* Opus 106, with a monumental fugue. The finale of Beethoven's *Ninth Symphony,* based on Schiller's "Ode to Joy," requires a chorus and a solo quartet as well as an expanded orchestra, an array inspired no doubt by the rousing choral finales of French Revolutionary opera. Mendelssohn, Liszt, and Mahler were among 19th-century composers who emulated Beethoven's example not only with respect to the structural importance they attached to some of their finales but also in their repeated reliance on literary texts and the requisite vocal forces.

finance company, specialized financial institution that supplies credit for the purchase of consumer goods and services by purchasing the time-sales contracts of merchants or by granting small loans directly to consumers. Specialized consumer-finance agencies now operate throughout western Europe, Canada, the United States, Australia, Japan, and some Latin American countries. Although they existed in the early 1900s, the greatest development of finance companies in most countries came after World War II.

Large-sales finance companies, which operate by purchasing unpaid customer accounts at a discount from merchants and collecting payments due from consumers, were a response to the need for installment financing for the purchase of automobiles in the early 1900s. The General Motors Acceptance Corporation, for example, was established in 1919 to purchase automobile accounts receivable from car dealers who were themselves unable to finance time purchases. Many companies in both Europe and America continue to specialize in financing purchases of particular commodities and remain closely associated with specific manufacturers. Some also extend credit for wholesale purchases by retail dealers.

Consumer finance or small-loan companies also arose in the 1900s. Until then, the need for consumer loans had been met primarily by illegal "loan shark" activities because it was unprofitable for banks to make small loans at rates below legally set usury levels. In 1911 several states in the United States began adopting small-loan laws that authorized loans to consumers at rates above usury levels, making it financially practical to operate a consumer-loan business. Today many companies engage both in the sales-finance business and in making loans directly to consumers.

In some countries, including Belgium, Denmark, and Norway, commercial banks have also become important as a direct source of consumer credit. In many other countries, they are important as a source of capital for specialized finance companies. Many finance companies in Great Britain, Australia, and The Netherlands, for example, have become closely affiliated with commercial banks because of the banks' role as capital subscribers. In other cases, commercial banks play an important role in their extension of credit to finance companies.

Financial Corporation of America, major U.S. financial-services holding company whose principal subsidiary, American Savings and Loan Association, is the largest thrift institution in the United States. Corporate headquarters is in Los Angeles.

The holding company was incorporated in 1968 as Budget Industries, Inc., and adopted its present name in 1978. It has interests in savings and loan associations and in commercial finance and banking. The many services offered by Financial Corporation of America include the sale of certificates of deposit, real estate and mortgage financing, personal savings accounting, credit card operations, and real estate brokering.

The late 1970s to early 1980s was a period of rapid growth for the corporation, largely owing to aggressive expansion of subsidiaries' loan portfolios. This expansion was capped in 1983 by the purchase of First Charter Financial Corporation (established 1955), a holding and operating company with financial and real estate interests. The acquisition enabled the corporation to join its savings and loan subsidiary, State Savings and Loan Association, with American Savings and Loan Association, the principal subsidiary of First Charter Financial Corporation. The arrangement that brought the two subsidiaries together under the name of American Savings and Loan Association was the largest merger to date in the history of U.S. thrift institutions and resulted in the creation of the country's largest savings and loan association.

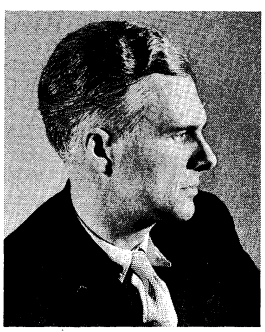
Financial Times, morning daily newspaper published in London that has had strong influence on the financial policies of the British government. It is known as one of England's superior daily newspapers.

Founded in 1888 by Horatio Bottomly, a member of Parliament and a financier, the *Financial Times* competed for many years with four other finance-oriented papers, finally in 1945 absorbing the last of these, the *Financial News* (founded in 1884). The *Financial Times* has specialized in reporting business and financial news while maintaining an independent editorial outlook. On occasion it has attacked the financial policies of the British government. Circulation of the *Financial Times* is said to be one of the world's highest among financial newspapers, second only to that of the *Wall Street Journal.* The *Financial Times* is the only paper in England providing full daily reports on the London Stock Exchange.

finch, any of various small, conical billed, seed-eating songbirds (Passeriformes) belonging to the families Fringillidae, Emberizidae, Estrildidae, Carduelidae, and Ploceidae (*qq.v.*), although authorities disagree as to which finch-like birds should be classified in each family. Well-known or interesting representatives include the bunting, canary, cardinal, chaffinch, crossbill, Galápagos finch, goldfinch, grass finch, grosbeak, junco, mannikin, sparrow, and weaver (*qq.v.*). Many kinds of finches are kept as cage birds.

Finch, Robert (Duer Clayton) (b. May 14, 1900, Freeport, N.Y., U.S.), a leading Canadian poet whose gift for satire finds an outlet in lyrics characterized by irony, metaphysical wit, complex imagery, and a strong sense of form.

He was educated at the University of Toronto, to which he returned as a professor of French after three years in Paris. His first collection, *Poems* (1946), won a Governor General's Award, as did a later work, *Acis in*



Finch

Oxford (1961), a series of meditations inspired by a performance of Handel's dramatic oratorio *Acis and Galatea. Dover Beach Revisited* (1961), treating the World War II evacuation of Dunkirk, is a variation on Matthew Arnold's poem. In another collection, *Variations and Theme* (1980), Finch describes in 14 poem variations the fate of a rare pink water lily.

Findlay, city, seat (1828) of Hancock County, northwestern Ohio, U.S., on the Blanchard River, 47 mi (76 km) south of Toledo. The site was laid out by Joseph Vance and Elnathan Cory in 1821 and named for Col. James Findlay, who had built Ft. Findlay, a local outpost in the War of 1812. In 1860, using the pen name Petroleum V. Nasby, the editor of the Findlay *Jeffersonian,* David Ross Locke, published the first of his satirical letters attacking slavery. Fishing in the Blanchard near old Misamore Mill inspired Tell Taylor to compose "Down by the Old Mill Stream." During the 1880s Findlay was a boom centre of oil and gas production, and its Gas Jubilee of 1887 was one of the most spectacular celebrations ever staged in the area. Manufactures now include rubber tires, photographic supplies, heavy machinery, laundry equipment, petroleum products, solid-state components, and plastics. Findlay College (Churches of God) was founded in 1882. Inc. village, 1838; city, 1887. Pop. (1980) 35,594.

Findlay Arch, north-northeast trending extension of the Cincinnati Arch (*q.v.*) extending into Ontario and the Canadian Shield. In size and plan, the Findlay Arch is similar to the Kankakee Arch and had a similar post-Early Ordovician history, when uplift first occurred. (The Ordovician Period began about 500,000,-

000 years ago and lasted about 70,000,000 years.)

fine art, any of the nonutilitarian visual arts, or arts concerned primarily with the creation of beauty and generally taken to include painting, sculpture, and architecture, with literature, music, and dance sometimes being added. In its strict sense, fine art is to be distinguished from such decorative arts and crafts as wall painting, pottery, weaving, metalworking, and furniture making, all of which have utility as an end (the architect being differentiated from the builder in this respect).

Popular and primitive art, and indeed art up to the end of the Middle Ages in Europe, served without embarrassment some purpose beyond the pure enjoyment of beauty. The distinction between artist and craftsman hardly appears before the Renaissance, and the term fine arts, or beaux-arts in France, does not appear until the mid-18th century. By then the founding of academies had given impetus to the conceiving of fine art as creation on a loftier level untrammeled by secondary considerations, but the most stringent distinction between fine and applied art belongs to the 19th century.

Fine Arts, Museum of, in Boston, Mass., U.S., cultural centre whose balanced collections have made it one of the world's most comprehensive institutions of its kind. Founded in 1870, the museum has a major collection of Asian art dating from the 3rd millennium BC to modern times. It also has the largest collection of paintings by Claude Monet outside France, the world's foremost collection of 19th-century American art, and one of the world's finest collections of Egyptian Old Kingdom objects.

The museum moved to its present location on The Fenway in 1909. A new West Wing designed by I.M. Pei was opened in 1981.

Fine Arts, Museum of, Spanish MUSEO DE BELLAS ARTES, museum in Caracas, Venez., containing a variety of international and Venezuelan art, and also possessing fine gardens. It adjoins the Gallery of National Art (Galería de Arte Nacional), one of the few museums in South America founded to show the national cultural identity of the country; opened in 1976, the gallery contains works by more than 40 Venezuelan painters in the contemporary- and popular-arts sections. Oriental ceramics and carvings of wood and marble, among other exhibits, are in the Museum of Fine Arts, which also contains a representative collection of European art.

Fine Arts, Palace of, Spanish PALACIO DE BELLAS ARTES, in Mexico City, cultural centre built between 1904 and 1934. The palace contains a large theatre, concert hall, museum of popular arts, and halls and galleries for paintings and other works of art. Balcony lobbies display murals by Diego Rivera, José Clemente Orozco, and other Mexican artists. Examples of 19th- and 20th-century Mexican painting and special displays of paintings and sculpture are featured.

A national showplace, the Palace of Fine Arts has interior architectural decorations representing Mexican plant and animal life and masks recalling pre-Hispanic traditions. The stage in the main theatre is fitted with a curtain made of pieces of coloured glass depicting the Valley of Mexico and the two volcanoes outside Mexico City, Iztaccíhuatl and Popocatépetl. The curtain was designed by the Mexican artist Doctor Atl (Gerardo Murillo) and made in New York City by Louis Comfort Tiffany in 1911.

A huge dome surmounts the structure. The whole building sank more than 15 feet (4.6 m) into the ground after its completion.

Fine Gael (Irish: "Gaelic Nation"), byname UNITED IRELAND PARTY, one of the chief political parties in Ireland.

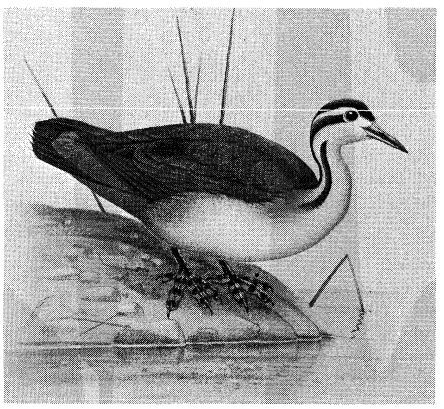
Fine Gael was founded in September 1933 in the amalgamation of William Thomas Cosgrave's Cumann na nGaedheal ("Society of Gaels") and two lesser parties, the Centre Party (formerly the Farmers' Party) and the National Guard (formerly the Army Comrades Association). The Cumann na nGaedheal had been formed by those members of the Dáil (assembly) who had decided to accept the terms of the Anglo-Irish treaty of 1921, which brought the Irish Free State into existence. Identifying itself as the party of peace and stability, Cumann na nGaedheal gained 41 percent of the seats in the Free State's first elections in 1923 and formed a minority government under Cosgrave; it remained in power until defeated by the main opposition, Fianna Fáil, in 1932. In an attempt to recoup his fortunes, Cosgrave tried to create in 1933 a larger and more heterogeneous party in Fine Gael. Not until 1948, however, was Fine Gael able to form a minority government under John A. Costello. Traditionally thought of as the party seeking accommodation and reconciliation with Great Britain, Fine Gael's coalition government caused some surprise by declaring a republic and withdrawing from the Commonwealth (December 1948). Since then, little has separated it from the more nationalist Fianna Fáil, although both parties attempt to present a distinct image and continue to compete for office. Fine Gael may be said to be somewhat more conservative than Fianna Fáil, drawing its support more from the upper economic levels of the middle class. However, from 1973 to 1977 and again from 1981 to 1987, it was the major partner in a coalition government with the Labour Party (except for a short period of Fianna Fáil government in 1982).

fine structure, in spectroscopy, the splitting of a spectral line into two or more components, each representing a slightly different wavelength. The splitting is a result of electron spin, within the radiating atom, which couples (reacts) with the electron's rotation about the atomic nucleus. In atoms of alkali metals such as sodium and potassium, there are two components called doublets, and of alkaline earths, three components called triplets.

Atoms of the alkali metals have only one electron outside a closed core, or shell, of electrons. When such an atom is excited, say by encounter with radiant energy, the atom will absorb the energy and will be raised to a higher energy state. Later, if the atom makes a transition from one energy state to a lower energy state, energy will be emitted, and in a spectrograph the emission is represented by a line. An electron outside a closed core has an angular momentum (a concept dealing with its mass and angular motion) associated with rotation in orbit (in spectral notation denoted by $L = 0, 1, 2, 3$, etc.) and spin about its own axis (denoted by $S = \frac{1}{2}, -\frac{1}{2}$). These two momenta combine (called spin-orbit, or *LS* coupling) to give a total angular momentum (denoted by $J = L + S$); but, because spin can be in either direction, there are actually two slightly different total angular momenta ($J = L + \frac{1}{2}, L - \frac{1}{2}$), or corresponding splitting of the energy state into a double state. Thus, when atoms are in this state they lose energy in two ways, giving rise to doublet lines, or fine structure. Doublet separation for corresponding lines increases with atomic number. In some cases, as with lithium, a doublet may not be resolved by an ordinary spectroscope, whereas in others, as with rubidium, a doublet may be widely separated.

Atoms of the alkaline earths have two electrons outside a closed core of electrons. When the spins of the two electrons are oriented in opposite directions, their spin effects cancel each other ($S = -\frac{1}{2} + \frac{1}{2} = 0$), and the energy states corresponding to the various combinations of the orbital angular momenta are not split (*i.e.*, $J = L + S = L + 0 = 0, 1, 2, 3$, etc.). Thus, only a series of singlet lines are emitted. When the spins of the two electrons are in the same direction, their angular momenta add together ($S = \frac{1}{2} + \frac{1}{2} = 1$) and can combine in three ways with the orbital angular momenta ($J = L - 1, L, L + 1$). In this case, the various energy states ($L = 1, 2, 3$, etc.) are each split three ways into triplet states. Even though one electron may not be excited (the usual case), the other is raised to one of three energy levels in a triplet state. In returning to a less excited state, the electron will radiate energy as a triplet line, and many atoms will give rise to all three triplet lines, or fine structure.

finfoot, also called SUN-GREBE (family Heliornithidae), any of three species of medium-sized, semiaquatic birds of the order Gruiformes. Characteristically, they are brown



American finfoot (*Heliornis fulica*)
Painting by Murrell Butler

above and whitish below, with lobed feet. They are poor flyers, spending most of their time in shady, quiet rivers, half-submerged near overhanging banks. None is more than 60 cm (2 feet) long. The olive-coloured American finfoot (*Heliornis fulica*) is only half that size, with red bill and black-banded yellow toes; it ranges from Veracruz, Mex., to northeastern Argentina.

The African finfoot (*Podica senegalensis*) occurs from Senegal to the Congo and from Ethiopia to the Cape of Good Hope. The Asiatic finfoot (*Heliopais personata*) is found in central and southeastern Asia.

finger grass: *see* crabgrass.

Finger Lakes, group of narrow, glacial lakes in west-central New York state, U.S., in north-south valleys between the vicinity of Syracuse (east) and Geneseo (west). The region, which embraces more than 20 state parks, is noted for its scenery, has many resorts, and produces fruits (especially grapes) and vegetables. It comprises part of the Oswego River watershed of the Lake Ontario drainage system. Primary lakes from east to west are Canandaigua, Keuka, Seneca, Cayuga, Owasco, Skaneateles, and Otisco with possibly four others (Conesus, Hemlock, Honeoye, and Candice) lying to the west included in the term. The main lakes vary in length from 6 miles (10 km) to 40 miles (64 km) and up to 3.5 miles (5.6 km) in width. Seneca Lake is the largest (67 square miles [174 square km]) and also the deepest (maximum depth 618 feet [188 m]).

Finger Lakes stage, division of North American rocks of the Late Devonian epoch (374 to 360 million years ago). It overlies the Taghanic stage (the last stage of the Middle Devonian) and precedes the Chemungian stage. Rocks of the Finger Lakes stage in the northeast grade from red beds in the east to shales in the west,

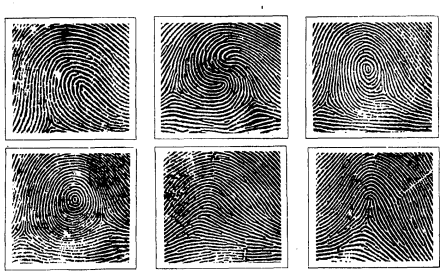
representing the growth of the Catskill Delta and a shift of the shoreline farther to the west. In the central-states region and the Cordilleran region, limestones are predominant and represent open ocean environments. In Ohio and Kentucky, black shales occur.

finger painting, the application of paints with the fingertips. The earliest known examples are the prehistoric decorative and figurative "meanders" traced on walls of the Altamira caves in Spain. Although primarily used by children, the technique has also been used by mature artists, who have experimented with oil pigments and water-miscible paints, particularly in China, Japan, and Korea. The most notable exponent of finger painting was the 18th-century Chinese painter Kao Ch'i-p'ei.

fingerfish, any of the half dozen species of fishes in the family Monodactylidae (order Perciformes), found from western Africa to the Indonesian region and usually inhabiting marine or brackish waters. They have laterally flattened ovate bodies, often greater in height than in length. Because of this shape and the characteristic silvery colour, they are sometimes called moonfishes.

The moonfish, or mono (*Monodactylus argenteus*), a popular aquarium fingerfish found from East Africa to Malaysia, attains lengths of 20 centimetres (8 inches). It epitomizes the euryhaline nature of the group—that is, the young must be raised in fresh water, whereas large adults must remain in salt water. In contrast, the young of the striped fingerfish (*M. sebae*), of West Africa, require saline conditions in aquariums, although adults can survive in fresh water.

fingerprint, impression made by the ridges on the ends of the fingers and thumbs, useful as a means of identification because no two persons have the same pattern of ridges. Any ridged area of the hand or foot may be used as identification, but finger impressions are preferred to those from other parts of the body because they can be taken with a minimum of time and effort, and the ridges in such impressions form patterns that can be readily sorted into groups for ease in filing.



Finger patterns (from top left to bottom right): loop, double loop, central pocket loop, plain whorl, plain arch, and tented arch

By courtesy of the Federal Bureau of Investigation

Fingerprints are classified in a three-way process: by general shapes and contours, by noting the finger positions of the pattern types, and by relative size, determined by counting the ridges in loops and by tracing the ridges in whorls. The information thus obtained is incorporated in a concise formula known as the individual's fingerprint classification.

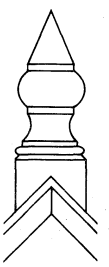
The Galton-Henry system of fingerprint classification, published in June 1900, was officially introduced at Scotland Yard in 1901, displacing the anthropometric (comparative human-body measurement) system of Alphonse Bertillon for criminal-identification records. The system was adopted immediately by scores of law enforcement agencies around the world and is the most widely used method of fingerprint classification.

Juan Vucetich of Argentina, an employee of the police of the province of Buenos Aires in 1888, also devised an original system of fingerprint classification, published in book form under the title *Dactiloscopía Comparada* ("Comparative Fingerprinting").

Dactyloscopy, the technique of fingerprinting, involves cleaning the fingers in benzene or ether, drying them, then rolling the balls of each over a glass surface coated with printer's ink. Each finger is then carefully rolled on prepared cards according to an exact technique designed to obtain a light grey impression with clear spaces showing between each ridge so that the ridges may be counted and traced. Simultaneous impressions are also taken of all fingers and thumbs.

Fingo (people): *see* Mfengu.

finial, in architecture, the decorative upper termination of a pinnacle, gable end, buttress, canopy, or spire, used especially in the Romanesque and Gothic styles. It usually consists of a vertical, pointed central element surrounded by four outcurving leaves or scrolls. When the form it decorates has crockets (*see* crocket), the finial may be formed of four or more crockets surrounding the central upright. Finials in the form of candelabrum shafts occur frequently in early Renaissance work. The term is also applied loosely to any small pinnacle, knob, or other decorative feature terminating a vertical motif.



Finial

From M.S. Briggs, *Everyman's Concise Encyclopaedia of Architecture*; E.P. Dutton & Co., Inc., and J.M. Dent & Sons Ltd.

Finiguerra, Maso, original name TOMMASO FINIGUERRA (b. 1426, Florence—d. 1464, Florence), early Renaissance goldsmith, engraver, draftsman, and designer, known for his work in niello, a type of decorative metalwork, and as one of the first major Italian printmakers.

Finiguerra is believed to have worked as a young man with Lorenzo Ghiberti; he later associated himself with the Florentine artist, Antonio Pollaiuolo. His own style reflects theirs; in fact, it is believed that Finiguerra engraved many of Pollaiuolo's designs during a possible period of collaboration from 1459 to 1464. None of his productions as a goldsmith is known, save perhaps the "Thewalt Cross" (*c.* 1464; Metropolitan Museum of Art, New York City), decorated with niello plaques that may have been designed by him. He had been producing nielli before 1450. Finiguerra frequently preserved his designs for niello by making sulfur casts of the engraved silver ground. He also made niello prints, which are impressions from engraved silver on paper. Examples of his sulfur casts and niello prints are still in existence.

From the niello print it was only a step to the copperplate print, which he produced shortly after 1460. Though he did not invent copperplate engraving, Finiguerra remained the great popularizer of the new medium in Italy.

Finistère, *département,* in Bretagne region, northwestern France, created from the western part of the historic province of Brittany (*q.v.*). Its name is from the Latin *finis terrae* ("land's end"). Occupying 2,620 sq mi (6,785 sq km), it is bounded on the west and south by the Atlantic and on the north by the English Channel. The Aulne Basin separates the heights of Monts d'Arée (1,260 ft [384 m]) in the north and the Montagnes Noires (1,066 ft) in the south, both running east–west. Off the western coast lies the island of Ouessant (Ushant). The main feature of the west coast is the Iroise bay, into which the Presqu'île (peninsula) de Crozen divides the Brest *rade* (roadstead) from the Baie (bay) de Douarnenez. To the south, the low-lying coast traces the most northerly part of the Bay of Biscay.

Finistère has an oceanic climate with abundant rainfall and a dependable climatic regime, favouring agricultural production particularly in the northeast (fruits, vegetables, cereals, and cattle). More than one-third is covered by forest, heath, and wasteland. Commercial fishing is largely a seasonal activity which families combine with working their small holdings. Fishing ports are numerous, the most important being Concarneau and Douarnenez, the former the second-leading fishing port in France. Other industry (agricultural machinery, naval and riverboat shipbuilding, foundries, and engineering works) is not extensive.

Brest (*q.v.*) is primarily a naval base and has an important naval college and port. Perros-Guirec, Tregastel-Plage, and Roscoff are among the northern seaside resorts. In the south, Quimper (*q.v.*), the departmental capital, is a centre for tourism. The region, which was settled by the Celts in the 5th century BC, conquered by the Romans in 56 BC, and invaded by the Anglo-Saxons in the 5th century AD, has preserved its distinctive Breton character, and the language is still spoken in the countryside. The *département* has four *arrondissements*—Quimper, Brest, Châteaulin, and Morlaix—and is in the educational division of Rennes. Pop. (1982) 828,364.

Finisterre Range, mountain range at the base of the Huon Peninsula, northeastern Papua New Guinea, crossing the border of the Morobe and Madang provinces. It comprises a section of the northern boundary of the great Central Depression. Tributaries rising in this range feed the Markham and Ramu rivers, which flow in opposite directions through the depression. The Finisterres rise to 13,454 ft (4,101 m) at Mt. Sarawaket.

Fink, Albert (b. Oct. 27, 1827, Darmstadt, Hesse-Darmstadt—d. April 3, 1897, Ossining, N.Y., U.S.), German-born U.S. railroad engineer and executive who was the first to investigate the economics of railroad operation on a systematic basis; he was also inventor of the Fink truss, used to support bridges and the roofs of buildings.

Educated in Germany, Fink emigrated to the U.S. in 1849 and began to work as a draftsman for the Baltimore and Ohio Railroad Company. He advanced rapidly, soon assuming responsibility for the design and construction of bridges, stations, and shops along a section of the railway. During that period he invented the Fink truss, first used (1852) to support a bridge over the Monongahela River at Fairmont, Va. (now West Virginia), then the longest iron railroad bridge in the U.S. In 1857, for the Louisville and Nashville Railroad, he constructed a bridge over the Green River in Kentucky, in its day the largest iron bridge in the U.S. After the American Civil War (1861–65), in which he played an important role as a railroad executive, he designed and constructed a bridge across the Ohio River at Louisville, Ky., one mile (1,600 metres) in length, the longest truss bridge built up to that time.

Named vice president of the Louisville and Nashville Railroad in 1869, Fink began to analyze the costs and rates of his line, issuing five years later "The Fink Report on Costs of Transportation," the first full investigation of railway economics in the U.S. In 1875 he be-

came commissioner of the Southern Railway & Steamship Association in Atlanta, Ga., and spent two years working to stabilize freight rates for 25 competitive railways and to end destructive rate wars. From 1877 he carried out a similar project for railroads serving New York City. Fink retired in 1889.

Fink, Mike (b. 1770/80, Fort Pitt [Pittsburgh], Pa.—d. 1823, Fort Henry? [North Dakota]), American keelboatman of the Old West, who became the legendary hero of the American tall tale.

As a youth Fink won fame as a marksman and Indian scout around Fort Pitt. Later, when keelboats became the chief vessels of commerce on the Ohio and Mississippi rivers, he became "the king of the keelboatmen," renowned as a marksman, roisterer, and champion rough-and-tumble fighter. In his own time his name became synonymous with the braggadocio of Western frontiersmen. In 1822 he joined General William H. Ashley's first fur-trapping and trading expedition to the upper Missouri River country and was killed in a quarrel the next year.

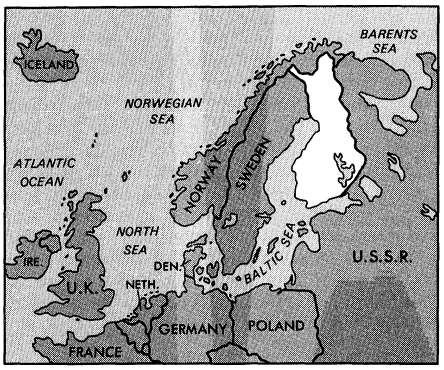
Mythic stories about Mike Fink, told orally and published by many writers of all sorts in greatly varied publications, spread his fame widely between about 1829 and the American Civil War, though thereafter his fame declined. In tall tales, sketches, short stories, romances, plays, and even poems, he was a symbol of the boastfulness, playfulness, might, and violence of frontiersmen. The picturesque nature of his death had imaginative appeal, and greatly varied versions of his death were published.

The best scholarly account is Walter Blair and Franklin J. Meine, eds., *Half Horse Half Alligator: The Growth of the Mike Fink Legend* (1956).

Fink, Theodore (b. July 3, 1855, Channel Islands [U.K.]—d. April 25, 1942, Melbourne), Australian politician and publisher, noted for his interests in education.

Fink was brought to Australia as a child (1861), studied at local schools in Melbourne, and then read law at Melbourne University, becoming a solicitor in 1877. He became prosperous, sat on the Victorian Legislative Council (1894–1904), and chaired several commissions on education, both academic and vocational, in Victoria. He was chairman of *The Herald* of Melbourne and helped make it one of the most influential newspapers in Australia.

Finke River, intermittent but major river of central Australia; it rises south of Mount Ziel in the MacDonnell Ranges of south-central Northern Territory, passes through Glen Helen Gorge and Palm Valley (the only place where the ancient cycad palm, *Livisfona mariae,* grows), and then meanders generally southeast over the Missionary Plain. Entering a 40-mile (65-kilometre) gorge between the Krichauff and James ranges, the river emerges upon mud and sand flats to be joined by the Palmer River and Hugh River. The Finke reaches Lake Eyre in South Australia only during times of flood via the Treuer, when it may spread for hundreds of square miles beyond its poorly delineated banks. The river drains a basin of 44,000 square miles (115,000 square km) but is ungauged in its entire length. The river's 400-mile (640-kilometre) course is studded with permanent waterholes and underground sources. Visited (1860) by John McDouall Stuart, it was named by him after his patron, William Finke. Principal valley settlements are Hermannsburg Mission and Finke.



Finland

Finland, officially REPUBLIC OF FINLAND, Finnish SUOMI, or SUOMEN TASAVALTA, Swedish FINLAND, or REPUBLIKEN FINLAND, northern European country, a third of it lying north of the Arctic Circle, covering an area of 130,559 square miles (338,148 square km). The capital is Helsinki. Bounded by latitudes 60° and 70° N (about 725 miles [1,165 km] from north to south) and by longitudes 20° and 32° E (about 340 miles [550 km] from east to west at its widest extent), Finland is bordered on the north by Norway, on the northwest by Sweden, on the west by the Gulf of Bothnia, on the south by the Gulf of Finland, and on the east by the Soviet Union. The population in 1986 was estimated to be 4,926,000.

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

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. Finland may be divided into three mainland physiographic regions and some near-shore island groups. Except for a small highland region (the fells, or *tunturi*) in the extreme northwestern corner of the country, with rounded summits varying between 1,500 feet (455 m) and 4,357 feet (1,328 m) at its highest peak, Haltiatunturi, the country is a lowland less than 600 feet (180 m) above sea level. The lowest elevations are to be found in the coastal region in a band 20 to 60 miles (32 to 96 km) wide along the western and southern reaches of the country, with elevations generally of less than 60 feet (18 m). The islands comprising the Ahvenanmaa (Åland Islands) a few miles off the southwestern coast are an extension of the coastal lowland. The remaining inland area slopes gradually downward from the fells in the north (at elevations of 150–600 feet (45–180 m) above sea level) to the extensive lake areas in the south (at 60–150 feet [18–45 m]).

Finland's 12,943 square miles (33,522 square km) of inland waters (an area equivalent to that of Belgium) occupy nearly 10 percent of its total area; there are more than 50,000 lakes, mostly smaller than 10 square miles (25 square km). The largest lake, the Saimaa in the southeast, covers some 1,700 square miles (4,400 square km). Much of the country's river system is interconnected with its lakes (Lake Saimaa drains, via the Vuoksi River, toward the much larger Lake Ladoga, lying eastward just across the Soviet border). The Paatsjoki River drains the northern areas to the Arctic; the great Kemijoki (343 miles long), the country's longest river, drains westward into the Gulf of Bothnia; and the Kokemaenjoki drains southwestward.

The region above the Arctic Circle experiences wide extremes in temperature, which can fall to −22° F (−30° C) during the prolonged winter and can reach 80° F (27° C) during Lapland's 73 days of midnight sun (from May to July). Because of the combined moderating effects of the Gulf Stream, the Baltic Sea, and the country's lowland character, Finland is able to support temperate-zone agriculture farther north (above 60° N) than any place else in the world. The average annual temperature in Helsinki is 41° F (5° C), ranging from 21° F (−6° C) to 64° F (18° C); total precipitation amounts to 26 inches (660 mm) annually, about one-third coming as sleet or snow.

More than three-fourths of Finland is forest, dominated by conifers (mainly pine and spruce) in the vast northland but also supporting such deciduous varieties as hazel, aspen, maple, elm, and alder in the extreme south. There are extensive peat bogs in the far northern reaches. The forests support abundant wildlife, including bear, wolf, wolverine, lynx, and Finnish elk. Few reindeer survive in the wild; most are domesticated. The islands and coastal areas support a wide variety of wild birds.

The people. Present-day Finns belong to the Scandinavian and Baltic races. Finland has two official languages, Finnish, spoken in strong regional dialects by most of the population, and Swedish, spoken by a small percent of the population. The Lapps (numbering several thousand), speakers of a Finno-Ugric language, live mostly in the sparsely populated north (Lappland), and some still practice the traditional life of nomadic reindeer herding.

Most of the people belong to the (established) Evangelical Lutheran Church, and only a very small number belong to the Greek Orthodox Church of Finland.

The country's birth and death rates are roughly equivalent to those of Europe as a whole. The low annual growth rate reflects the older, more demographically mature nature of the Finnish people. Less than one-fifth of the population is under 15 years of age. Throughout Finland's modern history emigration has exceeded immigration. Only about two-fifths of the population lives in rural areas.

The economy. Finland has a developed, partly socialized, partly free market economy. Its gross national product (GNP) is growing much more rapidly than the population, making Finland comparable to other developed countries. The sources of the GNP include primarily manufacturing (one-fourth); trade and finance (one-fourth); and administration, social, community, and personal services.

Agriculture accounts for less than one-twelfth of the GNP. Arable land, largely limited to the southern regions, totals about one-twelfth of the total land area. Cereals (barley, oats, wheat, and rye) are the main crop and occupy nearly half of the arable land. Sugar beets, potatoes, rapeseed, strawberries, and currants are also grown. Pastures total only a very small percent of the land area; the principal livestock are cattle (two-fifths dairy cows) and pigs.

Lumbering is a major Finnish industry, and its production (mostly coniferous) is one of Europe's largest. The principal forest products are sawn wood, plywood, paper, and wood pulp.

Finland has good inland and marine fishing. Atlantic herring and European perch are the main species caught.

Minerals account for a very small percent of the GNP, but Finland mines a number of strategic metals. Among them are iron ore, chromite, ilmenite (for titanium), zinc, copper, nickel, cobalt, molybdenum, vanadium, mercury, silver, and gold. Other minerals include limestone, pyrites, talc, quartz, lime, and phosphates. Finland supplies a significant percent of the world's vanadium and cobalt and is a leading supplier of western Europe's copper and nickel. Peat is the only naturally occurring fuel in Finland.

Manufacturing is well developed, and manufactures include refined petroleum products, crude steel, pig iron, rolled steel, cement, raw sugar, fertilizers, textiles, agricultural equipment, construction machinery, television and radio receivers, icebreakers, tankers, passenger vessels, diesel locomotives, and railway car-

riages. About one-fourth of Finland's electric energy is produced by thermal power plants, one-third by hydroelectric plants, and the rest by nuclear power plants.

Natural scenery, winter sports, and fishing draw visitors to Finland, most of whom come from other Scandinavian countries, Germany, and the Soviet Union.

The Finnish government has a controlling interest in most of the basic industries. High government expenditures and trade deficits caused high inflation rates in the early 1970s. A tight money policy, introduced in 1976, and repeated devaluations of the markka, Finland's monetary unit, helped reduce inflation.

The labour force is employed in community, social, and personal services; mining and manufacturing; and trade, restaurants, and hotels. Trade union activity is legal, and there are several trade union federations.

Budgetary revenue primarily originates from taxation. Expenditures are principally for social security, education, health, agriculture and forestry, and transportation.

Finnish State Railways provide internal service as well as connections with the Soviet Union and Sweden. More than half of the country's roads are paved. Inland waterways total 4,100 miles, and Finland has numerous major seaports and minor ports. Malmi, near Helsinki, is the country's international airport.

Exports consist primarily of paper, paperboard, and wood pulp; wood products; machinery and transport equipment; basic metals; chemical products; and textiles and clothing. Principal importers are the Soviet Union, Germany, Sweden, the United Kingdom, and the United States. Imports consist mostly of crude petroleum, machinery and transport equipment, mineral fuels and lubricants, and basic manufactures. Finland's principal sources for imports are the Soviet Union, Germany, and Sweden.

Administration and social conditions. According to the 1919 constitution, the president, elected to six-year terms by electors chosen by popular vote, is the executive head of the Republic of Finland. He appoints the prime minister and cabinet members, the country's administrative officers. Supreme law-making authority is vested in the 200-member unicameral parliament (Eduskunta/Riksdagen), whose members are elected to four-year terms. Coalition governments are usually created from among Finland's four major political parties. The country's highest judicial authorities are the Supreme Court and the Supreme Administrative Court.

Social security in Finland comprises a system of pensions and care for the aged, unemployment benefits, and family welfare plans. The country's excellent health system is reflected in the high life expectancy rates of 70 years for men and 79 years for women.

There is a general housing shortage in Finland, acute in the towns and especially so in Helsinki. Low-income families are eligible to obtain state-subsidized flats, and government loans for mortgages are also obtainable.

Primary education in Finland is free and compulsory and consists of a six-year lower level and a three-year upper level. This education system has helped produce nearly universal literacy in Finland.

Finnish media are free from governmental censorship. *Helsingin Sanomat,* the country's largest daily, is circulated nationally. Radio and television are largely operated by the state-owned Finnish Broadcasting Company.

Cultural life. Finland's national epic, the *Kalevala,* compiled in the 19th century by the scholar Elias Lönnrot from old Finnish ballads, lyrics, and incantations, played a vital part in fostering Finnish national consciousness and pride. Indeed, the development of almost all of Finland's cultural activities and institutions has been involved with and motivated by nationalist enthusiasm. Aleksis Kive's *Seitsemän veljestä* (1870; *Seven Brothers*), the first novel written in Finnish, helped galvanize the Finnish nation-building process.

From the time that the *Kalevala* inspired the paintings of Akseli Gallén-Kallela, there has been a distinctive school of Finnish painters, but the Finnish artistic genius in visual arts has been continually drawn to three-dimensional work. Sculpture is important, highly abstract, and experimental; Elia Hiltanen's Helsinki monument to Jean Sibelius, the country's best known composer, is made of chrome, metal, and steel tubes.

History. Archaeological evidence dates human habitation in Finland to at least 7200 BC. Two distinct Stone Age cultures are evident, both of which may have been of Finno-Ugrian origin. The migration of the Baltic Finns to Finland is usually dated from the beginning of the Christian Era.

In the 12th century the King of Sweden and the Bishop of Uppsala launched a "crusade" into Finland, and by 1323 Sweden had annexed Tavastia and Karelia, Finland's two other original communities. In 1581 Finland became a grand duchy, and in 1634 it was fully incorporated into the Swedish kingdom.

The decline of Sweden as a world power brought Finland closer to Russian control. Russia reasserted its interest in Finland and was ceded part of Finnish territory in 1721 at the conclusion of the Great Northern War. In 1808 Alexander I of Russia invaded Finland, and in 1809 Finland was formally ceded to Russia. The subsequent period saw the growth of Finnish nationalism. The Russian defeat at the hands of the Japanese (1905) and World War I and the Russian Revolution set the stage for Finnish independence, declared Dec. 6, 1917.

When Finland refused Soviet demands in 1939 for certain territorial adjustments, the Soviets invaded Finland. After a brief war the Finns were forced to sue for peace in 1940. When the Russo-Finnish War started, in 1941, the Finns made many advances against the Soviets; but by 1944, when peace was achieved, they were back to the basic settlement of 1939–40.

The indemnity clause of the 1944 settlement wrought immense economic hardship on the Finns, but postwar relations with the Soviet Union have, for the most part, been amicable. The Finnish government has consistently followed a policy of nonalignment with the great powers.

Finland, Church of, Finnish SUOMEN EVANKELIS-LUTERILAINEN-KIRKKO, national church of Finland, which changed from the Roman Catholic to the Lutheran faith during the Protestant Reformation in the 16th century. Christianity was known in Finland as early as the 11th century, and in the 12th century Henry, bishop of Uppsala, Swed., began organizing the church there. He suffered a martyr's death and eventually became Finland's patron saint. Through the influence of Sweden (which ruled in Finland from the 13th century until 1809), Finland gradually accepted Christianity.

When Lutheranism was adopted by Sweden, it was also introduced into Finland and was declared the official religion of the country in 1593. The outstanding Finnish Reformer was Mikael Agricola, who had studied at Wittenberg, where Martin Luther was a professor. Consecrated the first Lutheran bishop of Turku (1554), Agricola wrote several religious works, including a translation of the New Testament (1548).

During the 17th century the Finnish Church, like the German and other Scandinavian Lutheran churches, was influenced primarily by Lutheran orthodoxy. In the 18th century the dominating influence was Pietism, the movement that began in Germany and emphasized personal religious experience and reform. Three revival movements during the 19th century caused many Finns to develop a deeper commitment to the church. In the 20th century a larger percentage of the people took part in church activities than was common in other Scandinavian countries.

The Church of Finland is divided into dioceses, each headed by a bishop, with the archbishop of Turku as the presiding bishop of the church. The church assembly, which meets every five years and is composed of both clergy and lay church members, is the church's highest legislative body. The bishops' council, consisting of the bishops together with representatives of pastors and lay members from each diocese, meets twice annually to conduct the church's business. There are facilities for theological education at the University of Helsinki and at the Swedish University in Turku.

The church's relationship with the state was defined by a church law in 1869. The state gives financial support to the church, and the president of the republic and the Parliament must approve the church laws proposed by the church assembly. Bishops are appointed by the president from candidates proposed by the dioceses.

Since 1922 a Finnish citizen can legally withdraw from the national church and belong to no church or to another church. More than 90 percent of Finns, however, are members of the Church of Finland.

Finland, Gulf of, Finnish SUOMEN LAHTI, Russian FINSKY ZALIV, eastern arm of the Baltic Sea, between Finland (north) and the Soviet Union (east and south). Covering an area of 11,600 square miles (30,000 square km), the gulf extends for 250 miles (400 km) from east to west but only 12 to 80 miles (19–130 km) from north to south. It has a maximum depth of 377 feet (115 m) at its western end. Of low salinity (six parts per thousand), the gulf freezes over three to five months in winter. It receives the Neva and Narva rivers and the Saimaa Canal. Included within the gulf are the islands of Gogland (Sur-sari, or Högland), Lavansari (Moshchnyy), and Kotlin (Kronshtadt). The gulf is an important shipping route for its main ports: Porkkala, Helsinki, and Kotka in Finland and Vyborg, Leningrad, Kronshtadt, and Tallinn in the Soviet Union.

Finlay, Carlos J(uan) (b. Dec. 3, 1833, Puerto Príncipe, Cuba—d. Aug. 20, 1915, Havana), Cuban physician and epidemiologist who discovered that yellow fever is transmitted from infected to healthy humans by a mosquito. Although he published experimen-

Finlay, oil painting by Sulroca; in the Museo Histórico de las Ciencias Médicas "Carlos J. Finlay," Havana

By courtesy of the Centro de Estudios de Historia y Organizacion de la Ciencia "Carlos J. Finlay," Havana

tal evidence of this discovery in 1886, his ideas were ignored for 20 years.

A graduate of Jefferson Medical College, Philadelphia (1855), he returned to Cuba, where he practiced in Matanzas and Havana. In 1879 he was appointed by the Cuban government to work with the North American commission studying the causes of yellow fever, and two years later he was chosen to attend the fifth International Sanitary Conference in Washington, D.C., as the Cuban delegate. At the conference, Finlay urged study of yellow fever vectors, and soon afterward he stated that the carrier was the mosquito *Culex fasciatus*, now known as *Aëdes aegypti*.

In 1900 the U.S. Army Yellow Fever Board, headed by the physician Walter Reed, arrived in Cuba, and Finlay attempted to persuade Reed of his mosquito-vector theory. Although skeptical, Reed decided to investigate the idea, refining Finlay's experimental procedures. Reed's proof of mosquito transmission of yellow fever (1900) and William Gorgas' eradication of the disease in Cuba and Panama followed. Finlay was appointed chief sanitation officer of Cuba (1902–09), and after his death the Finlay Institute for Investigations in Tropical Medicine was created in his honour by the Cuban government.

Finlay, George (b. Dec. 21, 1799, Faversham, Kent, Eng.—d. Jan. 26, 1875, Athens), British historian and participant in the War of Greek Independence (1821–32) who is known principally for his histories of Greece and the Byzantine Empire.

After attending the University of Glasgow, Finlay spent two years studying Roman law at the University of Göttingen but left school in 1823 to follow Lord Byron to Greece. Returning to Scotland briefly to pass his examination in civil law, he again left for Greece in 1825 and remained there the rest of his life.

Although Finlay took part in the war of independence, he lost almost all his possessions after independence was gained; thereafter, he turned from political involvement to farming and the writing of Greek history. He became pessimistic over what he regarded as the new decline of Greece after independence.

Finlay's works praised the high development of administrative sophistication in the medieval Eastern Empire and provided an innovative emphasis on socioeconomic factors and on the role of the general populace in historical change. His contributions were early recognized by German scholars of Greece, particularly his survey of the Byzantine Empire, a period of Greek history left largely untouched by Edward Gibbon. His major books are *The Hellenic Kingdom and the Greek Nation* (1836), *Greece Under the Romans,* 2 vol. (1844), *History of the Byzantine and Greek Empires,* 2 vol. (1854), a number of works on Ottoman and Venetian domination in 1856, and *History of the Greek Revolution,* 2 vol. (1861).

Finley, Charlie, also called CHARLIE O., byname of CHARLES OSCAR FINLEY (b. Feb. 22, 1918, Ensley, Ala., U.S.), U.S. insurance executive and professional baseball club owner, who, though constantly involved in controversy with the commissioner, the American League, managers, and players, had great financial success. His Oakland Athletics won three consecutive World Series (1972–74).

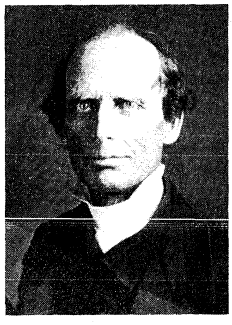
Finley was a farm boy who loved baseball in Alabama, and after he moved with his family to Gary, Ind., and went to work in a steel mill, he organized the Gary Merchants in an Indiana–Michigan industrial league. During World War II, he worked in a defense plant and showed an aptitude for selling, to which occupation he later turned full-time. Hospitalized with tuberculosis (1946–48), he planned a new group insurance coverage for physicians and formed his own company, becoming a millionaire in two years.

Finley started looking for a baseball franchise in 1954, and in 1960 bought the American League Kansas City Athletics. He dressed them in green and gold uniforms and white shoes (1963) and promoted night baseball and weekend series in 1964. After falling out with civic leaders he moved the Athletics to Oakland, Calif., in 1968, where he outraged traditional owners with such promotions as hot pants nights and cow milking contests. Later he introduced a mule, Charlie O., as a mascot. In his ownership career (1960–80) he had 18 managers, some of them twice. After his World Series successes, attendance fell off and the city of Oakland sued him for not promoting the club. Attendance revived with his last manager, Billy Martin, but Finley sold the club in 1980, and retired to his insurance business.

Finn MacCumhaill, also called FINN MACCOOL (Irish hero): *see* Fenian cycle.

Finney, Charles Grandison (b. Aug. 29, 1792, Warren, Conn., U.S.—d. Aug. 16, 1875, Oberlin, Ohio), U.S. lawyer, president of Oberlin College, and a central figure in the religious revival movement of the early 19th century; he is sometimes called the first of the professional evangelists.

After teaching school briefly, Finney studied law privately and entered the law office of



Finney, 1850
By courtesy of Oberlin College, Ohio

Benjamin Wright at Adams, N.Y. References in his law studies to Mosaic institutions drew him to Bible study, and in 1821 he underwent a religious conversion. Finney dropped his law practice to become an evangelist and was licensed by the Presbyterians. Addressing congregations in the manner he had used earlier in pleading with juries, he fomented spirited revivals in the villages of upstate New York. His methods, carried into the Congregational and Presbyterian churches of larger towns, were soon dubbed "new measures" and aroused intense criticism from men such as Lyman Beecher who had been educated in the sterner traditions of eastern schools. Such opposition lessened as Finney's methods became more polished.

His revivals achieved spectacular success in large cities, and in 1832 he began an almost continuous revival in New York City as minister of the Second Free Presbyterian Church. His disaffection with Presbyterian theology and discipline, however, led his supporters to build for him the Broadway Tabernacle in 1834. The following year he became a professor of theology in a newly formed theological school in Oberlin, Ohio, dividing his time between that post and the tabernacle. He left New York in 1837 to become minister of Oberlin's First Congregational Church, closely related to Oberlin College, where he was president from 1851 to 1866.

Finney's theological views, typically revivalist in their emphasis on common sense and humanity's innate ability to reform itself, were given expression in his *Lectures on Revivals* (1835) and *Lectures on Systematic Theology* (1847).

Finnic PEOPLES, descendants of a collection of tribal peoples speaking closely related languages of the Finno-Ugric family who migrated to the area of the eastern Baltic, Finland, and Karelia before AD 400—probably between 100 BC and AD 100, though some authorities place the migration many centuries earlier. The major modern representatives are the Finns and Estonians, who have maintained their languages. Other groups, once independently significant but now largely Russianized, include the Karelians, living mainly in the Karelian Autonomous Soviet Socialist Republic; the Ingrians, Votes, and Veps, scattered around the Gulf of Finland and Lakes Onega and Ladoga; and the Livs, or Livonians, on the Estonian–Latvian border. Native speakers in these groups are fast disappearing; in the 1970s, for example, there were probably fewer than 1,000 speakers of Livonian and fewer than 250 speakers of Votic. Other groups of which there is record have long since disappeared.

Prehistorically, the Finnic peoples evidently came from central Russia, probably bringing with them the art of cereal agriculture. Those migrating to the area of Estonia may have met a numerous population of Balts and Germans, but those going on to Finland entered an almost uninhabited country; the few resident nomadic Lapps withdrew to the north. In the early centuries AD, the Estonians carried on prosperous trade with the south and west and, though suffering reverses during the disruptions of Roman decline and the great migrations, succeeded between about AD 800 and 1200 in becoming the most commercial and progressive of Finnic nations, because of their favourable position in east–west trade and their own handicrafts in textiles and iron. To the north, in the area of Finland and Karelia, on the other hand, the population remained sparse, and no Finnish state emerged, though three loose unities apparently crystallized: the Finns proper, the Tavastlanders (or Tavastians), and the Karelians, each of whom had their own chiefs and all of whom waged war on the others. One offshoot of the Karelians, the Kvaens, moved into far northern Sweden and Norway, where they gained infamy as savage marauders in the Middle Ages.

The independence of the Estonians, Finns, Karelians, and other groups came to an end as they were Christianized and conquered by foreign powers beginning in the 11th and 12th centuries. Estonians were successively ruled by Danes and Teutonic Knights, Swedes, and Russians, enjoying independence only between 1918 and 1940. The Finns, ruled first by the Swedes and then by the Russians, did not achieve independence until 1917. Karelia was divided between Sweden and Russia from 1323 to 1721, when it was wholly incorporated into Finland under Russian rule; western Karelia was part of independent Finland from 1920 to 1940; all Karelia is now Soviet.

Modern Finns are closely tied to the economy of the Scandinavians. Although Finland was originally an agricultural country, only one-third of its people now earn a living from agriculture and forestry. As with the Scandinavian countries, many elements of Finnish society—from housing to businesses and recreational facilities—are owned by cooperatives. In Estonia, agriculture is still the largest employer despite rapid industrialization and an increase in urban population. Many private farms have disappeared, and there are numerous state farms and collectives.

The Finns have a rich folkloric tradition and have successfully transformed their traditional arts and crafts into original designs in wood, stone, glass, and ceramics. The Karelian folklore is similar to the Finns', but the younger

generations tend to identify more with the Soviets. Culturally the Estonians were strongly influenced by the Germans, and only traces of the original Finnic culture have been preserved in folklore. In recent years Estonia has been severely affected by Soviet political control and cultural domination.

Since the Reformation, Lutheranism has been the predominant religion among Finnic peoples.

Finnish language, Finnish SUOMI, member of the Finno-Ugric group of the Uralic language family, spoken in Finland. At the beginning of the 19th century, Finnish had no official status, with Swedish being used in Finnish education, government, and literature. The publication in 1835 of the *Kalevala,* a national epic poem based on Finnish folklore, aroused Finnish national feeling. In the century that followed, Finnish gradually became the predominant language in government and education; it achieved official status in 1863.

Finnish belongs to the Baltic-Finnic branch of the Finno-Ugric languages, being most closely related to Estonian, Livonian, Votic, Karelian, Veps, and Ingrian. Characteristic phonological features include vowel harmony, in which vowels are divided into two contrasting classes such that vowels from opposing classes may not occur together in a word; and consonant gradation, in which stop consonants (such as *p, t, k*) are altered before closed syllables (*e.g., p* is replaced by *v, pp* by *p*). There are also two lengths distinguished in vowels and in consonants. Many words have been borrowed from Indo-European languages, particularly from the Baltic languages, German, and Russian.

Finnish has a written tradition dating from the 16th century, when the Lutheran bishop Mikael Agricola translated the New Testament into Finnish. *See also* Finno-Ugric languages.

Consult the INDEX *first*

Finnish literature, the body of writings in Finland in the Finnish, Swedish, and, in the Middle Ages, Latin languages. The oldest form, folk poetry in Finnish, was transmitted orally until its transcription in the late 18th century. From the mid-12th century until 1809, Finland was ruled by Sweden, and Swedish remained the language of the upper classes until the end of the 19th century, at which time a vigorous movement began to revive Finnish as a cultural medium.

Folk poetry. Finnish folk poetry was rich, with a wide range of forms. The metre, a trochaic four-stress line, was well suited to the Finnish language and to the memorizing of long passages. Most of the poems were epic sequences or short songs. The epics centred upon mythical events or the deeds of a hero. Into this category fell an early poem about the creation of the world and those on the quest of the Sampo, the adventures of Lemminkäinen, and the tragic legend of Kullervo. In many, the central character is Väinämöinen, regarded by some as mythical, by others as historical. These stories also formed part of the national epic, the *Kalevala.* The lyrics, many by women, dealt with everyday griefs and joys; many were love songs or described the moods of a solitary soul, and the setting was rural—a landscape of forests and lakes, with glimpses of a village community.

In oral transmission many poems have changed or become confused with one another. The oldest were mythological, dating from pagan times (lasting in remoter areas till the 12th century), and may be thousands of years old. Many were of medieval origin and contained datable events and persons. Systematic collection of folk poetry began in the second half of the 18th century, and the best known collector, Elias Lönnrot, concluded that the epic poems could be composed as a continuous folk epic. He joined a number together with connective material of his own and imposed a unifying plot; the result was the *Kalevala* (final form, 1849), which was based on folk material but in structure was Lönnrot's creation. Lönnrot also published a selection of the lyrics, *Kanteletar,* and their influence and that of the *Kalevala* as a whole on the Finnish national consciousness, art, and culture has been immense.

Finnish literature in Swedish. Only in the 19th century did a strong literature in Swedish develop in Finland. Previously it had been somewhat sporadic, although there had been several excellent poets, notably Jacob Frese, Gustaf Philip Creutz, and Frans Mikael Franzén. In the work of Johan Ludvig Runeberg, the Finnish people and landscape first came to life in literature, and he became the national poet. Zacharias Topelius wrote historical novels in Scott's manner, as *Fältskärns berättelser* (1853–67; *The King's Ring and the Surgeon's Stories*), poems, and children's stories. Johan Vilhelm Snellman, a disciple of the German philosopher G.W.F. Hegel, developed ideas that emphasized the importance of a local and national culture. He decisively influenced the status of Finnish, which was given parity with Swedish as an official national language in 1863.

Toward the end of the 19th century, Finno-Swedish literature began to draw away from literature in Finnish. Important writers of the transition were Josef Julius Wecksell and Karl August Tavaststjerna. Early in the 20th century a school of prose writers known as Dagdrivarna (Idlers or Saunterers) emerged with a crisp, skeptical, analytical tone. Important among them was Runar Schildt, whose stories and plays dealt with ethical and artistic problems. Among poets, Arvid Mörne and Bertel Gripenberg may be mentioned.

The second flowering of Finno-Swedish literature was in the 1920s, with the development of modernism in poetry, initiated by Edith Södergran, who wrote visionary, dreamlike poems. After her came Elmer Diktonius, whose deliberately rough-edged lyrics had a revolutionary political accent; Gunnar Björling, with a technique of broken-off sentences; Rabbe Enckell, who wrote impressionistic nature poetry; and Hagar Olsson, writer of poetical novels and essays supporting modernism. Poetry became characterized by free rhythms, unrhymed lines, and powerful images. A similar style was adopted by a second generation of modernists: Solveig von Schoultz, Ralf Parland, Eva Wichman, and Bo Carpelan. During the 1960s there was a reaction against modernism by poets who disliked the modernists' aestheticism and individualism and introduced more critical and social discussion. The most prominent advocates of this type of socially committed literature were Lars Huldén and Claes Andersson.

Among 20th-century prose writers, Tito Colliander and Göran Stenius wrote from a religious standpoint. Drama was presented by Walentin Chorell, and the psychological novel by Oscar Parland, while Tove Jansson won international recognition for her imaginative, fairy tale-like stories. Among younger authors Christer Kihlman and Anders Cleve stood out.

Literature in Finnish. The founder of literary Finnish was the religious reformer Mikael Agricola, first Lutheran bishop of Finland, who published a primer (*c.* 1543) and a translation, from the Greek, of the New Testament (1548). The first translation of the whole Bible was published in 1642.

Although a number of talented poets wrote in Finnish in the 17th and 18th centuries, it was only with Aleksis Kivi that a genuine Finnish literature came into being. His *Seitsemän veljestä* (1870; *Seven Brothers,* 1929) was the first Finnish novel. It endowed Finnish with a style (realism spiced with humour) and a theme (the Finnish people) that were to become traditional. Kivi was also a poet, and among his fellow poets were August Ahlqvist-Oksanen; Suonio (Julius Krohn); an austere and powerful poet, Kaarlo Kramsu; and J.H. Erkko, whose style was based on folk song.

In 1872 Kaarlo Bergbom founded the Finnish National Theatre. The 1880s saw the formation of a group of liberal writers known as Nuori Suomi (Young Finland), who founded a paper, *Päivälehti* (from 1904, *Helsingin Sanomat*). Influenced by Norwegian and French writers, they introduced Realism and social criticism to Finland. Similar views were already being put forward by a formidable dramatist, Minna Canth. Among the group's members were Juhani Aho, a master of the lyrical nature novel, and Arvid Järneflet, who attracted attention with *Isänmaa* (1893; "The Fatherland"), a novel of student life. Järneflet tried to apply Tolstoy's teachings to his novels and his life. In *Vanhempieni romaani* (1928–30; "The Novel of My Parents"), he produced a classic portrait of his parents, who had played a part in Finland's cultural life. A younger writer was Eino Leino, one of the major Finnish poets, the scope of whose talent ranged from the visionary and mystical *Helkavirsiä* (1903–16; "Sacred Hymns") to topical novels, pamphlets, and critical journalism.

Finnish writers at about the turn of the century included Teuvo Pakkala, whose stories of childhood became classics, and Johannes Linnankoski, who wrote the best seller *Laulu tulipunaisesta kukasta* (1905; *The Song of the Blood-Red Flower,* 1920), describing the amatory adventures of a Finnish Don Juan, and a well-knit novel of peasant life. Aino Kallas's works had an Estonian setting, and her best were prose ballads, written in an archaic style, about illicit love: *Barbara von Tisenhusen* (1923), *Reigin pappi* (1926; *Eros the Slayer,* 1927), and *Sudenmorsian* (1928; *The Wolf's Bride,* 1930).

Many writers continued the tradition of "folk portrayal" but in a more critical spirit; after the civil war of 1918 an attitude of self-criticism became general. A leading Finnish prose writer was Joel Lehtonen, whose *Putkinotko* (1919–20) was a colourful, humorous, bitterly critical study of the lives of the rural poor. His last novel, *Henkien taistelu* (1933; "Struggle of Souls"), bitterly satirized contemporary conditions. Volter Kilpi, in an important novel, *Alastalon salissa* (1933; "In the Parlour at Alastalo"), used interior monologue, long flashback episodes, and exact detailed description, spreading events of six hours over more than 900 pages. Kilpi was an exponent of the experimental novel; his interest in the problem of time and in re-creation of the past linked him with Marcel Proust and James Joyce. The stories of Heikki Toppila set people's lives against a background of superstition, and his writing was grimly effective. F.E. Sillanpää viewed his characters from a biologist's standpoint, as an integral part of their surroundings; this attitude is especially apparent in his most important novels, *Hurskas kurjuus* (1919; *Meek Heritage,* 1938) and *Nuorena nukkunut* (1931; *The Maid Silja,* 1933). He received the Nobel Prize in 1939. Notable poets of the period include Veikko Antero Koskenniemi, contemplative, pessimistic, and academic; and Otto Manninen, a master of laconic compression and a brilliant translator.

In the mid-1920s a group of young writers emerged called Tulenkantajat (Torchbearers), who took as their slogan "Open the windows to Europe!" Through them, Finns were introduced to free verse, exotic themes, and urban romanticism. The group's original ideals were

realized in the early verse of Katri Vala; at first a prophetess of sensual joys, she later turned to social criticism and socialism. One of the Torchbearers' leaders was an essayist, Olavi Paavolainen, a brilliant travel writer and analyst of the times, who in books published in the 1930s criticized Adolf Hitler's Germany and whose last published work was a war diary, *Synkkä yksinpuhelu* (1946; "Sad Soliloquy"). Mika Waltari's achievements were short stories and a novel, *Sinuhe, egyptiläinen* (1945; *The Egyptian*), set in ancient Egypt but reflecting postwar disillusionment.

Among the chief poets of the years between World Wars I and II were Uuno Kailas and Kaarlo Sarkia, both of whom returned to classical ideals of poetry and traditional metres. The former wrote *Sleep and Death* and upheld a rigid moral code; the latter was a fastidious stylist and sensitive seeker after beauty. Aaro Hellaakoski and P. Mustapää were recognized as major poets only after World War II; both broadened the traditional style, especially in rhythm.

Leading prose writers included Pentti Haanpää and Toivo Pekkanen. In his short stories Haanpää observed the life of the poor, revealing himself as a skillful stylist possessing an individual vein of irony. Pekkanen portrayed the industrial worker; many regarded his account of his own childhood in a working-class family, *Lapsuuteni* (1953; "My Childhood"), as a masterpiece.

In the years immediately before World War II, many literary trends were discernible: colourful romanticism, depth psychology, bitter social criticism. In 1936 a group of left-wing writers known as Kiila (The Wedge) was formed, most of their important work appearing after the war (*e.g.,* Elvi Sinervo's novel *Viljami Vaihdokas* [1946]). Left-wing ideas were also expressed in the work of Haanpää and in that of the period's most notable dramatist, Hella Wuolijoki, who collaborated in 1940 and 1941 with Bertolt Brecht in writing a play, *Herr Puntila und sein Knecht Matti* (performed 1948).

World War II marked a period of transition. The generation that began writing before or during the war suffered a crisis survived by few, among them the poets Aaro Hellaakoski, P. Mustapää (pseudonym of Martti Haavio), Aale Tynni, Viljo Kajava, and Arvo Turtiainen. A school of younger poets soon emerged whose work partook of the free rhythms, lack of rhyme, symbolic imagery, and unpoetical themes of modernism. Its leaders (who included Paavo Haavikko [*Selected Poems,* 1968], also a prose writer and author of experimental and eccentric plays) shared an avoidance of political or religious commitment, an often skeptical outlook, and an interest in problems of lyrical expression. In lyrical poetry the 1950s were a rich and creative period, thanks to such poets as Helvi Juvonen, Eeva-Liisa Manner, Tuomas Anhava (*In the Dark Move Slowly,* 1969), Pentti Holappa, and Lassi Nummi.

A similar development took place, more slowly, in prose. In fiction a restrained, objective style became customary; for example, that of Eila Pennanen and Eeva Joenpelto. Occasionally, as in Antti Hyry's *Kevättä ja syksyä* (1958; "Spring and Autumn") and *Alakoulu* (1965; "Primary School"), this technique resulted in effective prose (Hyry's characters were depicted behavioristically). Other writers explored new paths, notably Veijo Meri in his grotesque, Chaplinesque war novels, as *Manillaköysi* (1957; *Manila Rope*), and Marja-Liisa Vartio, who blended realism and fantasy. A more traditional narrative style was retained by Väinö Linna, author of a war novel, *Tuntematon sotilas* (1954; *The Unknown Soldier*), and of *Täällä Pohjantähden alla* (1959–62; "Here Beneath the Pole-star"), a long novel of social criticism.

Since the early 1960s many poets have adopted a frank, urbane, conversational style and have taken a firm stand on social and political questions. Pentti Saarikoski and Matti Rossi have been among the most notable. In the poems of Anselm Hollo and Väino Kirstinä, emphasis was on linguistic experiment. One of the most outstanding theatrical works of this period has been the *Lapualaisooopera* (1966; "Lapua Opera"), a political musical about the Finnish fascist movement of the 1930s, by Arvo Salo. In prose, intellectual experiment, sexual romanticism, documentary fiction, traditional narrative styles, and naturalistic treatment of everyday life have been obvious features. (K.L.K.L.)

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Finnmark, *fylke* (county), northern Norway, located above the Arctic Circle. Bordered by Finland (south) and the U.S.S.R. (southeast), with the Arctic Ocean to the north and northeast, it encompasses an area of 18,779 square miles (48,637 square km). Long, broad fjords indent the coast; in the west they are protected by islands. North Cape, on the Barents Sea of the Arctic Ocean, is the northernmost point on the European mainland. Vadsø is the county seat, but the tourist trade is centred in Hammerfest (*q.v.*), the northernmost town in Europe. Finnmark contains the important Sør-Varanger iron-ore mines as well as copper deposits along Altefjorden and Varangerfjorden. Crops are grown during the Norwegian summer (approximately May 13 to July 29), when there is continuous sunlight and temperatures are moderate (about 48° F [9° C]). There is year-round commercial fishing along the coast. Finnmark is the homeland of groups of Lapps who live by herding reindeer and fishing. Pop. (1989 est.) 74,045.

Finno-Ugric languages, group of languages constituting much the larger of the two branches of a more comprehensive grouping, the Uralic language family. The Finno-Ugric languages are spoken by several million people distributed discontinuously over an area extending from Norway in the west to the Ob River region in Siberia and south to the lower Danube River in Europe. In this vast territory, the Finno-Ugric peoples constitute enclaves surrounded by speakers of Germanic, Slavic, Romanian, and Turkic languages.

The Ugric division of Finno-Ugric languages is composed of Hungarian and the Ob-Ugric languages Mansi (Vogul) and Khanty (Ostyak). The Finnic division of Finno-Ugric languages is composed of five groups. The Baltic-Finnic group consists of Finnish, Estonian, Karelian (including Olonets), Ludic, Veps, Ingrian, Livonian, and Votic. The Permic group consists of Komi (Zyryan) and Udmurt (Votyak). The three remaining groups are the individual languages Mari (Cheremis), Mordvin (Mordov), and Lapp. Mari and Mordvin, however, are often classified together as the Volga-Finnic group of languages. Also, because the dialects of Lapp are almost mutually unintelligible, they are often classified as separate languages.

The vocabulary of the Finno-Ugric languages reflects a series of contacts with neighbouring non-Uralic peoples at different periods in history. Loanwords from Indo-Iranian seem to be the oldest. Finnish borrowed from Baltic languages in remote times and later from Germanic languages and Russian. Mari, Udmurt, and the Ob-Ugric languages are rich in Turkic loanwords. Hungarian has also borrowed at different times from several Turkic sources, as well as from Iranian, Slavic, German, Latin, and the Romance languages.

The phonologies of the modern Finno-Ugric languages show a variety of forms, and virtually no feature is common to the entire group. For example, vowel harmony (in which vowels are divided into two or three classes, usually a back, front, and neutral category that may not occur together in the same word), which is sometimes thought of as characteristic of Finno-Ugric, is not found in Lapp, Khanty, or the Permic languages. Consonant gradation—an intricate alternation between two classes of stem consonants—occurs in Lapp and the Baltic-Finnic languages. The usual method of marking grammatical categories in these languages is by the addition of suffixes. Some of the group (*e.g.,* Finnish and Hungarian) make use of an elaborate case system. Lapp and the Ob-Ugric languages mark dual number as well as singular and plural.

Finno-Ugric religion, the pre-Christian religious beliefs and practices of the Finno-Ugric peoples, who inhabit regions of northern Scandinavia, Siberia, the Baltic area, and central Europe.

A brief treatment of Finno-Ugric religion follows. For full treatment, see MACROPAEDIA: European Religions, Ancient.

The geographic dispersion of the Finno-Ugric peoples is understood mainly by means of linguistic criteria, since historical and archaeological evidence is scanty. From their ancient home between the Ural Mountains and the Volga River, they began to spread north about 4000–5000 BC and south, east, and west perhaps a millennium later. Prominent among the numerous surviving groups are the Lapps of the Arctic region, the Finns and the Estonians of the Baltic area, the Hungarians (or Magyars) of central Europe, and the Permians and Volga Finns of the central and southern Soviet Union.

Variations in habitat and climate over such a large region have fostered great diversity in economy and social organization, as well as in traditional religion, among the Finno-Ugric peoples. In addition, numerous outside cultures have left their mark. Such heterogeneity renders problematic the concept of a single formula embracing Finno-Ugric religions. The search for a common historical tradition once engaged many scholars, but attention has turned to the nonhistorical study of similarities and differences in Finno-Ugric religious material, revealing a spectrum running from Arctic hunting and fishing cultures to southern agrarians.

Mythology. The most widespread Finno-Ugric account of the creation is the so-called earth-diver myth, found also in North America and Siberia, according to which God commands a being (frequently the devil) to dive into the primeval sea and gather sand, from which God fashions the earth. The myth of the creation of the world from an egg, best known in equatorial regions, finds its most northerly occurrence in Finland and Estonia.

Finno-Ugric descriptions of the cosmos entail a number of widely known themes, the central components of which are the sky, the earth, and the underworld: a stream or sea is said to encircle the round world; the canopy of the heavens pivots on the North Star; a world pole supports the sky; animals carry the earth; and an abyss in the sea swallows ships. Reference to these themes in ritual practices such as incantations or the demarcation of sacred space is not a matter of giving an explanation but of maintaining a connection with the decisive primeval events that gave the world its lasting order.

The tradition of the god of the sky finds many expressions among the Finno-Ugric peoples, reflecting an ancient form altered by cultural contacts and environment. In the southeast, for example, a Turkic influence is evident in the myths of a heavenly court, with servants acting as intermediaries between earthlings

and the god of the sky. Also in the south, the sky god portrayed as "begetter" with the "earth mother" reflects the orientation of agricultural societies, while in the Arctic the corresponding deities promote fishing, hunting, and herding. The high gods are typically distant and invisible, encountered in connection with specific rites.

Beliefs and practices. On a more intimate level, the patterns of daily life are closely tied to a system of guardian spirits and spirits of the dead. The former are supranormal beings that appear in visions, auditory experiences, and other such occurrences, especially when a social norm involving a guardian-spirit sanction is broken. They are believed to "govern" and "own" a particular area, such as a cultural locality (*e.g.,* a household), a natural region (a forest or lake), or a natural element or phenomenon (fire or wind). In addition to propitiating these guardians of the world at large, each family privately venerates the spirits of its own ancestors, which are thought to protect family welfare. This cultic practice, which may represent the oldest form of Finno-Ugric religion, encompasses rites conducted at the moment of death, funeral preparations and committal of the body, celebrations in memory of an individual, annual collective memorials, offerings and prayers to the dead for subsistence, and occasional rites (*e.g.,* upon relocation or illness). In some groups, the memory of outstanding leaders and warriors is venerated in cultic fashion. The realm of the dead consists of the actual graveyard, envisioned as an underground village, and a distant hades, far in the north, behind a burning stream.

Home and family cults were generally supervised by the male head of the family. Religious authorities in the Finno-Ugric communities included shamans or seers, sacrificing priests, guardians of the sanctuary, professional weeping women, and the performers of wedding ceremonies. Cult centres ranged from the home sanctuary, perhaps a log structure near the dwelling house, to a more communal fenced-off area in the forest, to sacrificial stones along the herding route. "Mobile temples" placed on sledges were also used.

Finschhafen, town and port at the tip of Huon Peninsula, eastern Papua New Guinea. The three-basin harbour, an inlet of the Solomon Sea, was charted by the British navigator Captain John Moresby in 1873–74. Named after the German explorer Otto Finsch, the town was claimed by Germany in 1894 and served as German colonial administrative headquarters until virulent fevers forced its abandonment at the close of the 19th century. Finschhafen was subsequently the site of a large Lutheran mission station before World War II and was a Japanese air base in 1942–43. Retaken by Australian forces, it was made a U.S. military base. The many structures erected by those military combatants lie abandoned and neglected. Finschhafen ships some coffee and copra to Lae. Pop. (1980 prelim.) 756.

Finsen, Niels Ryberg (b. Dec. 15, 1860, Tórshavn, Faeroe Islands, Den.—d. Sept. 24, 1904, Copenhagen), Danish physician, founder of modern phototherapy (the treatment of disease by the influence of light), who received the 1903 Nobel Prize for Physiology or Medicine for the application of light in the treatment of skin diseases.

While a student at the University of Copenhagen (M.D., 1890), Finsen became interested in the effects of light on living organisms and in 1893 found that lengthy exposure of smallpox sufferers to the red light formed by exclusion of the violet end of the spectrum prevents the suppuration of the pustules, or formation of characteristic pockmarks. Aware of the bacteria-destroying effects of sunlight, he developed an ultraviolet treatment for lupus vulgaris, a form of skin tuberculosis, which met with great success. Although phototherapy has largely been superseded by other forms of radiation and drug therapy, Finsen's work did much to encourage the radiation therapy then being developed and led to the use of ultraviolet sterilization techniques in bacteriological research. Finsen's Medical Light Institute (now the Finsen Institute) was founded in Copenhagen in 1896.

Finsen
Boyer—H. Roger-Viollet

fiord (inlet): *see* fjord.

Fiordland (region, New Zealand): *see* Southland.

Fiordland National Park, park in the southernmost part of South Island, New Zealand. It was established in 1952 and has an area of 4,834 square miles (12,519 square km), making it one of the largest national parks in the world. It is renowned for the rugged grandeur of its fjords (fiords), mountains, forests, waterfalls, and lakes. The park is bordered by the Humboldt, Livingstone, and Takitimu mountains on the east and by the Tasman Sea on all other sides. Te Anau and Manapouri lakes are used for the generation of hydroelectric power. There are limestone caves, and Sutherland Falls, one of the highest waterfalls in the world, drops 1,904 feet (580 m) in three cascades. The Homer Tunnel gives road access to Milford Sound. On the lower slopes of the mountains a rich cover of dense rain forest is found. Red, silver, and mountain beech are common in the park; other trees include rimu, miro, kahikatea, totara, kamahi, and broadleaf. Birds include the bush robin, tit, fantail, parakeet, warbler, tui, and several other varieties. Opossum and stoat introduced in the park are now a menace to other wildlife. Hunting is encouraged to control red deer and the wapiti. Recreational activities include scenic trips, boating, waterskiing, deer stalking, mountaineering, rock climbing, and fishing. The park headquarters are at Te Anau.

Fiore, Pasquale (b. April 8, 1837, Terlizzi, Kingdom of Naples [Italy]—d. Dec. 17, 1914, Naples), Italian jurist and leading authority on international law.

Fiore studied at Urbino, Pisa, and Turin, and, after a period of teaching philosophy at Cremona, during which he published *Elementi di diritto pubblico constituzionale e amministrativo* (1862; "Elements of Public Constitutional and Administrative Law"), he was appointed professor of constitutional and international law at Urbino in 1863. He then occupied similar chairs at Pisa, Turin, and finally, from 1881, at Naples.

Although he was a prolific writer on a wide range of legal topics, Fiore's international reputation rests on his writings on public and private international law. Since they reflect the spirit and political conditions of his time, they have tended to become out of date. He nonetheless made a lasting contribution by realizing the need to divide international law into new categories, in his *Traité de droit pénal international et de l'extradition* (1880; "Treatise on International Criminal Law and the Law of Extradition"), and by meeting the need for a more precise statement of the law in his *Il diritto internazionale codificato ela sua sanzione giuridica* (1890; *International Law Codified and Its Legal Sanction*).

Fiore's *Elementi di diritto internazionale privato* (1901; "Elements of Private International Law") is one of the principal statements of the doctrines of the so-called Italian, or neostatutist, school, which has exercised profound influence, especially in Latin and Latin-American countries.

Fiorelli, Giuseppe (b. June 8, 1823, Naples, Kingdom of Naples [Italy]—d. Jan. 28, 1896, Naples), Italian archaeologist whose systematic excavation at Pompeii helped to preserve much of the ancient city as nearly intact as possible and contributed significantly to modern archaeological methods.

Fiorelli's initial work at Pompeii was completed in 1848. Then, when he became professor of archaeology at the University of Naples and director of excavations at Pompeii (1860), he pioneered his meticulous method of studying archaeological strata; observation, recording, preservation (including building a museum), and reporting were its fundamental features. In particular he studied the materials and building methods utilized at Pompeii and published *Descrizione di Pompei* (1875; "Description of Pompeii"), among many other works. He was named director of the National Museum, Naples (1863), and director general of Italian antiquities and fine arts (1875–96).

Fiori DA URBINO: *see* Barocci, Federico.

Fiorillo, Tiberio, Fiorillo also spelled FIORILLI, or FIURELLI (b. Nov. 9, 1608?, Naples, Kingdom of Naples [Italy]—d. Dec. 7, 1694, Paris, Fr.), Italian actor of the commedia dell'arte who developed the character Scaramouche.

Perhaps the son of Silvio Fiorillo, a famous Pulcinella, Tiberio Fiorillo quit an undistinguished company of players to gain fame as the braggart captain called Scaramuccia. He was especially popular in France. Playing unmasked, typically in black costume as Scaramouche, he charmed Parisians with his expressive movements, relying little on the spoken word. In 1658 his Italian company alternated with Molière's players at the Petit-Bourbon. He and Molière also shared the stage of the Palais-Royal. In the 1670s he took his character to London, where it was a sensation.

Fiorillo brought to his comedy remarkable dancing and acrobatic agility, which he maintained throughout his long career. In his 80s he was still able deftly to feign kicking another performer in the face.

fipple flute, also called WHISTLE FLUTE, any of several end-blown flutes having a plug ("block," or "fipple") inside the pipe below the mouth hole, forming a flue, duct, or windway that directs the player's breath alternately above and below the sharp edge of a lateral hole. This arrangement causes the enclosed air column to vibrate. Instruments using the fipple-flute principle include one- or two-note whistles, recorders, flageolets, and the organ (in its flue pipes). The flageolet differs from the recorder by having fewer finger holes.

fiqh (Arabic: "understanding"), Muslim jurisprudence, *i.e.,* the science of ascertaining the precise terms of the Sharīʿah, or Islāmic law. The collective sources of Muslim jurisprudence are known as *uṣūl al-fiqh* (*q.v.*).

fir, properly, any of about 40 species of trees constituting the genus *Abies* of the family Pinaceae, although many other coniferous evergreen trees are commonly called firs—*e.g.,* the Douglas fir (*q.v.*), the hemlock fir (see hemlock), and the joint fir (*see* Ephedra). True

firs are native to North and Central America, Europe, Asia, and northern Africa.

The firs are distinguished from other genera in the pine family by their leaves. The needlelike leaves of a true fir grow directly from the branch, and the needles' bases, which are shaped like suction cups, leave conspicuous circular scars when the leaves fall. Each cone is in an upright position, and its spikelike axis remains on the branch after the mature cone falls apart. Each thin, rounded cone scale bears two broadly winged seeds.

In North America there are 10 native species of fir, found chiefly from the Rocky Mountains westward and attaining their fullest development in the Sierra Nevada and Cascade ranges. Several of these fir species attain immense size: the white fir (*A. concolor*), the noble fir (*A. nobilis*), the California red fir (*A. magnifica*), and the Pacific silver fir (*A. amabilis*) all can attain a height of 60 m (200 feet). With the exception of the noble fir, the wood of most western American firs is inferior to that of pine or spruce but is used for lumber and pulpwood.

Of the two fir species that occur in the eastern United States and Canada, the best known is the balsam fir (*Abies balsamea*), which is a popular ornamental and Christmas tree. It may be 12 to 18 m (about 40 to 60 feet) tall at maturity, with cones 5 to 10 cm (about 2 to 4 inches) long. Canada balsam, an oleoresin collected from pitch blisters on the balsam fir's bark, is used to mount specimens on glass slides for microscopic examination.

The silver fir (*A. alba*) is an ornamental and timber species that is native to Europe and Asia. It is a lofty tree, sometimes reaching 45 m (150 feet) in height, with large, spreading, horizontal boughs curving upward toward their extremities. The silver fir is abundant in most of the mountain ranges of southern and central Europe, but it is not found in the northern parts of that continent. Extensive forests of the silver fir are found on the southern Alps, and the tree is plentiful in the Rhineland and on the Apennine and Pyrenees ranges. In Asia it occurs on the Caucasus and Ural mountains and in some parts of the Altai chain. The silver fir has soft wood that is easily worked and is hence much used in carpentry. The tree yields a high-quality turpentine from blisters on its bark. Burgundy pitch and other resin products are also obtained from the silver fir.

Firbank, (Arthur Annesley) Ronald (b. Jan. 17, 1886, London, Eng.—d. May 21, 1926, Rome, Italy), English novelist who was a literary innovator of some importance. Greatly indebted to the literature of the 1890s, his is a peculiarly fantastic and perverse, idiosyncratic humour. His wit largely depends upon the shape and cadence of the sentence and upon an eccentric and personal vocabulary. He influenced later novelists Evelyn Waugh and Ivy Compton-Burnett.

A delicate child, Firbank was educated mainly privately, but he spent some two years at the University of Cambridge. Thereafter, he largely traveled for the sake of his health. He was painfully shy and had a habit of writhing his body and grasping his head. Firbank's eccentricities, drinking, and witty remarks soon made him a well-known, even legendary, figure in London intellectual and bohemian life.

Firbank's most notable novels are *Vainglory* (1915), *Inclinations* (1916), *Caprice* (1917), *Valmouth* (1919), *The Flower Beneath the Foot* (1923), *Sorrow in Sunlight* (1924), and *Concerning the Eccentricities of Cardinal Pirelli* (1926).

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Firdawsī, also spelled FIRDOUSI, or FIRDUSI (poet): *see* Ferdowsī.

fire, rapid burning of combustible material with the evolution of heat and usually accompanied by flame. It is one of the human race's essential tools, control of which helped start it on the path toward civilization.

The original source of fire undoubtedly was lightning, and such fortuitously ignited blazes remained the only source of fire for aeons. For some years Peking man, about 500,000 BC, was believed to be the earliest unquestionable user of fire; evidence uncovered in Kenya in 1981 and in South Africa in 1988, however, suggests that the earliest controlled use of fire by hominids dates from about 1,420,000 years ago. Not until about 7000 BC did Neolithic man acquire reliable fire-making techniques, in the form either of drills, saws, and other friction-producing implements or of flint struck against pyrites. Even then it was more convenient to keep a fire alive permanently than to reignite it.

Original uses of fire. The first human beings to control fire gradually learned its many uses. Not only did they use fire to keep warm and cook their food; they also learned to use it in fire drives in hunting or warfare, to kill insects, to obtain berries, and to clear forests of underbrush so that game could be better seen and hunted. Eventually they learned that the burning of brush produced better grasslands and therefore more game.

With the achievement of agriculture in Neolithic times in the Middle East about 7000 BC, there came a new urgency to clear brush and trees. The first agriculturists made use of fire to clear fields and to produce ash to serve as fertilizer. This practice, called slash-and-burn cultivation, persists in many tropical areas and some temperate zones today.

Manufacture of fire. The step from the control of fire to its manufacture is great and required hundreds of thousands of years. The number and variety of inventions of such manufacture are difficult to imagine. Not until Neolithic times is there evidence that human beings actually knew how to produce fire. Whether a chance spark from striking flint against pyrites or a spark made by friction while drilling a hole in wood gave human beings the idea for producing fire is not known; but flint and pyrites, as well as fire drills, have been recovered from Neolithic sites in Europe.

Most widespread among prehistoric and later primitive peoples is the friction method of producing fire. The simple fire drill, a pointed stick of hard wood twirled between the palms and pressed into a hole on the edge of a stick of softer wood, is almost universal. The fireplow and the fire saw are variations on the friction method common in Oceania, Australia, and Indonesia. Mechanical fire drills were developed by the Eskimo, ancient Egyptians, Asian peoples, and a few American natives. A fire piston that produced heat and fire by the compression of air in a small tube of bamboo was a complex device invented and used in southeastern Asia, Indonesia, and the Philippines. About 1800 a metal fire piston was independently invented in Europe. In 1827 the English chemist John Walker invented the friction match containing phosphorous sulfate, essentially the same as that which is in use today.

Fire in religion and philosophy. The sacred fires and fire drills of religious rituals and the numerous fire-gods of world mythology must be interpreted as additional evidence of both the antiquity and the importance of fire in human history. In the ancient Vedic scriptures, Agni, or Fire, is the messenger between the people and their gods and the personification of the sacrificial fire. Brahman households today are supposed to maintain a sacred fire for the worship of Agni, much as the ancient Romans kept a holy perpetual fire cared for by the vestal virgins and as the Greeks tended and transported the sacred fire of Hestia during migrations. The Zoroastrians of Iran placed fire at the centre of their religion and worshiped it as the most subtle and ethereal principle and the most potent and sacred power, thought to have been presented to man directly from heaven and kindled by the Deity himself. Among the Israelites, Abraham might be viewed as a reformer who resisted the ancient worship of Moloch, the god of fire, by child sacrifice. In Siberia both the primitive Koryak and Chuckchi and the more civilized Buryat honoured the fire-god by keeping all filth and impurities away from their fires and hearths. The need to protect fire from contamination was also a belief in parts of Africa, North and South America, and elsewhere. The Aztec of Mexico and the Inca of Peru worshiped gods of fire with sacred flames, which the Inca ignited by concentrating the Sun's rays with a concave metallic mirror.

The great Greek scientists and philosophers found fire just as significant as did the mystics of religion. Aristotle, for example, declared fire, along with water, earth, and air, to be one of the four general and essential elements of life and of all things. Plato asserted that God used the four elements in the creation of the world. Heraclitus attributed to fire the essential force for creation.

Fire and the growth of civilization. Familiarity with fire, resulting from its easy production by flint and steel, phosphorus matches, or electricity, has led modern civilizations to take fire for granted. Yet, just as the initial control of fire was essential to the development of human beings from Old Stone Age hunters of the tropical forests into the first village-dwelling farmers of the Neolithic, so fire has been essential at every stage of the growth of civilization during the succeeding 10,000 years. From the use of fire to cook food, to clear land, and to furnish warmth and illumination in caves or hovels, fire has been applied to vessels of clay to make pottery and to pieces of ore to obtain copper and tin, to combine these to make bronze (*c.* 3000 BC), and to obtain iron (*c.* 1000 BC). Much of the modern history of technology and science might be characterized as a continual increase in the amount of energy available through fire and brought under human control. Most of the increased available energy has come from ever greater amounts and kinds of fires.

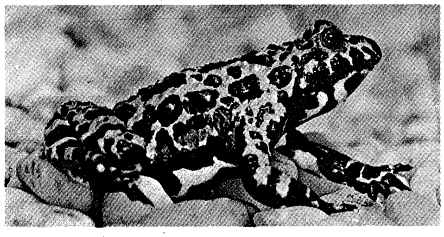
fire, in gems, rapidly changing flashes of colour seen in some gems, such as diamonds. Some minerals show dispersion; that is, they break incident white light into its component colours. The greater the separation between rays of red light (at one end of the visible spectrum) and rays of violet light (at the other end), the greater the dispersion and the greater the fire, because the separate coloured rays produce this phenomenon. In properly cut gemstones with strong dispersion, white light entering through the crown will be reflected and returned through the crown as coloured light; improper cutting, however, reduces reflection and, hence, the stone's fire.

fire alarm, means of warning in case of fire. Originally, watchmen provided the only fire-alarm system, but, with the advent of electric power, boxes wired to fire departments provided a warning system from city streets and such institutional buildings as schools. While some of the latter remain in use, most modern fire-alarm systems are automatic, consisting of thermostat-activated devices that at a certain temperature either sound an alarm or report to a central office, such as a municipal fire station. Some alarms are set to go off whenever the thermostat shows a rapid tem-

perature rise. The thermostat is usually placed at or near the ceiling, where it will be most immediately affected by increase in temperature. Another type of alarm is actuated by a photoelectric cell; when smoke darkens the room slightly, the alarm is activated. One highly sensitive device contains a small amount of radioactive material that ionizes the air in a chamber. With this device a continuously applied voltage causes a small electrical current to flow through the ionized air, and when products of combustion enter, they reduce the current flow and activate the alarm.

fire ant, also called THIEF ANT (*Solenopsis*), any of a genus of insects in the family Formicidae, order Hymenoptera, several species of which are common in North America. The red or yellowish ants are one to five millimetres in length and can inflict a severe sting. The semipermanent nest consists of a loose mound with open craters for ventilation. The workers are notorious for damaging planted grain and attacking poultry.

fire-bellied toad (*Bombina*), small amphibian (family Discoglossidae) characterized by bright orange markings on the undersides of its grayish body and limbs. The common fire-



Fire-bellied toad (*Bombina orientalis*)
Charles Mohr—The National Audubon Society Collection/Photo Researchers

bellied toad (*B. bombina*) is a pond dweller about 5 centimetres (2 inches) long. When disturbed it raises its forearms and arches its head and hindlegs over its back. Resting on the lower part of its tautly curved abdomen, it freezes with the bright colours of its underside on display. This reaction to danger, the "unken reflex," is thought to be a warning signal to indicate to potential predators that the skin of the frog is poisonous.

The genus *Bombina* includes four other species, one European and three Asian. These also have brightly marked undersides.

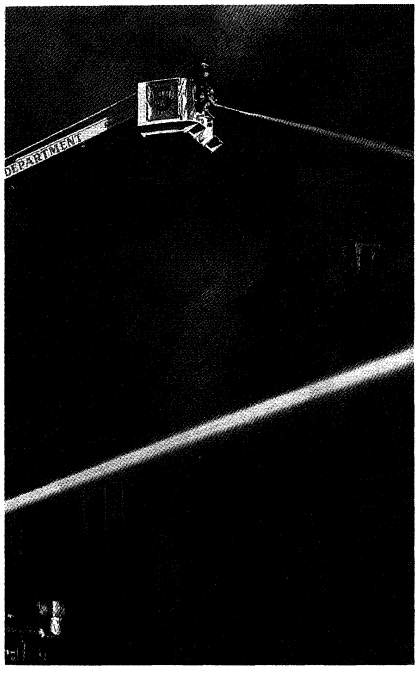
fire blight, plant disease caused by the bacterium *Erwinia amylovora,* which has destroyed pear and apple orchards in much of North America, parts of Europe, New Zealand, and Japan. Other plants affected include almond, *Amelanchier,* apricot, aronia, cherry, *Cotoneaster,* crab apple, hawthorn, *Holodiscus,* Japanese quince, loquat, medlar, mountain ash, *Photinia,* plum, *Potentilla, Pyracantha,* quince, raspberry, rose, spiraea, and other plants in the family Rosaceae. Symptoms include a sudden, brown to black withering and dying of blossoms, fruit spurs, leaves, twigs, and branches. Very susceptible pears, apples, crab apples, and quinces appear as if scorched by fire and may die. Slightly sunken, encircling, dark-brown to purplish-black cankers with a sharp, often cracked margin form on twigs, branches, and trunk, causing a terminal dieback. Fruits are water-soaked, later turning brown or black and shrivelled. In warm, moist spring weather, droplets of bacterial ooze appear on the surface of "holdover" cankers. The oozing bacteria are carried by insects, wind, and rain to infect blossoms, leaves, and twigs. The bacteria spread intercellularly and up to four feet (more than a metre) through vascular tissue in the wood, during late spring and early summer, darkening and killing the tissue. A small percentage of the bacteria overwinter at the margins of branch and trunk cankers

Fire blight on a hawthorn
M.C. Labrum—EB Inc.

ready to repeat the disease cycle starting the following spring about blossoming time.

fire engine, also called FIRE TRUCK, mobile (nowadays self-propelled) piece of equipment used in fire fighting. Early fire engines were hand pumps equipped with reservoirs and were moved to the scene of a fire by human or animal power. In large fires, the reservoir was kept filled by a bucket brigade, but the method was inefficient, and the short range of the stream of water necessitated positioning the apparatus dangerously close to the fire. The introduction of more powerful pumps and flexible hose solved this problem, and a great advance was made with the introduction of the steam-powered pump in many large cities in the 19th century. Steam fire engines were used in the Chicago Fire of 1871. A steam engine remained in use by the New York Fire Department as late as 1932.

Horse traction was replaced early in the 20th century by the internal-combustion engine, which also was used to power the pump. The basic automotive hose carrier quickly assumed its modern form; it carries a powerful pump, a large amount of hose (usually about 1,000 feet, or 300 metres), and a water tank for use where a supply of water is not available. Specialized auxiliary vehicles were also soon developed, including water tank trucks for rural areas. The ladder truck (hook and ladder) mounts a ladder that may be capable of rapid extension to 150 ft, often with a large-capacity nozzle built into the top section. The older type of overlength ladder truck is equipped with steerable rear wheels for negotiating city streets. The main ladder is mounted on the



Firemen fighting fire from the basket at the upper end of the crane on a snorkel truck
Bill Frantz—CLICK/Chicago

truck's body; when it is to be raised into the air, the hinged main ladder and its sliding extensions are moved into place by a hydraulic pump. The ladder truck carries some 200 ft or more of ladders to be used from the ground. The snorkel truck, introduced by the Chicago Fire Department in 1958, is equipped with a hydraulically operated crane mounted on a turntable, for use in either fire fighting or rescue work. The rescue truck carries such specialized equipment as cutting and wrecking tools, gas masks and inhalators, portable lighting and smoke-ejection devices, chemical extinguishers, life nets, shortwave radios, and medical equipment.

fire escape, means of rapid egress from a building, primarily intended for use in case of fire. Several types have been used: a knotted rope or rope ladder secured to an inside wall; an open iron stairway on the building's exterior, an iron balcony; a chute; and an enclosed fire- and smokeproof stairway. The iron stairway is the commonest because it can be added to the outside of nearly any building of modest height, although it has certain drawbacks; unless built against a blank wall it may be rendered useless by smoke from windows, and a means must be provided for keeping it in readiness while denying its use to thieves and prowlers. The iron balcony extends around the exterior of a building to provide a corridor along which persons can flee from fire-imperilled rooms to safety behind a fire wall or in an adjacent building. The chute, or slide escape, is either a curved or a straight incline and may be open or enclosed; it is well suited to such buildings as hospitals, from which patients can be evacuated on their mattresses. The best fire escape, however, is a fully enclosed fireproof stairway in the building or in an adjoining tower. Elevators are not considered safe because fire damage may cause them to fail and heat-sensitive call buttons may stop the car where the fire is hottest.

fire extinguisher, portable or movable apparatus used to put out a small fire by directing onto it a substance that cools the burning material, deprives the flame of oxygen, or interferes with the chemical reactions occurring in the flame. Water performs two of these functions: its conversion to steam absorbs heat, and the steam displaces the air from the vicinity of the flame. Many simple fire extinguishers, therefore, are small tanks equipped with hand pumps or sources of compressed gas to propel water through a nozzle. The water may contain a wetting agent to make it more effective against fires in upholstery, an additive to produce a stable foam that acts as a barrier against oxygen, or an antifreeze. Carbon dioxide is a common propellant, brought into play by puncturing the seal of a cartridge of the liquefied gas; this method has superseded the process, used in the soda-acid fire extinguisher, of generating carbon dioxide by mixing sulfuric acid with a solution of sodium bicarbonate.

Numerous agents besides water are used; the selection of the most appropriate one depends primarily on the nature of the materials that are burning. Secondary considerations include cost, stability, toxicity, ease of cleanup, and the presence of electrical hazard.

Small fires are classified according to the nature of the burning material. Class A fires involve wood, paper, and the like; Class B fires involve flammable liquids, such as cooking fats and paint thinners; Class C fires are those in electrical equipment; Class D fires involve highly reactive metals, such as sodium and magnesium. Water is suitable for putting out fires of only one of these classes (A), though these are the most common. Fires of classes A, B, and C can be controlled by carbon diox-

ide, halogenated hydrocarbons such as halons (*q.v.*), or dry chemicals such as sodium bicarbonate or ammonium dihydrogen phosphate. Class D fires ordinarily are combated with dry chemicals.

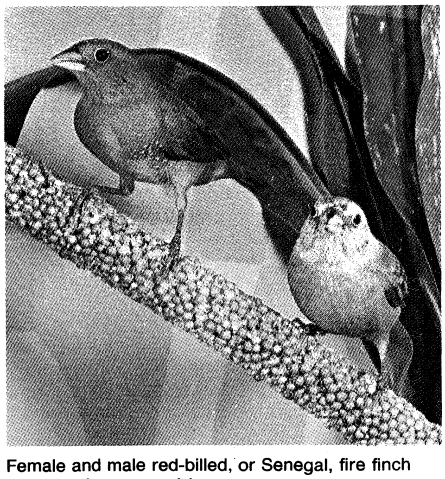
fire fighting, activity directed at limiting the spread of fire and extinguishing it, particularly as performed by members of organizations (fire services or fire departments) trained for the purpose. When it is possible, fire fighters rescue persons endangered by the fire, if necessary, before turning their full attention to putting it out.

Fire fighters, skilled in the use of specific equipment, proceed as rapidly as possible to the site of the fire; in most urban areas, fire stations housing a company of fire fighters and their equipment occur frequently enough that an alarm receives a response within two or three minutes. Most fire services in towns inhabited by 5,000 persons or more will dispatch an engine company (pumper), a truck company (ladder truck), and a rescue vehicle to the scene. If the fire involves a structure occupied by many persons, two or more companies may respond to the first alarm. The first fire fighters arriving will assess the fire to determine the techniques to be used in putting it out, taking into account the construction of the burning building and any fire protection systems within it.

Systematic fire fighting involves four steps: protection of currently uninvolved buildings and areas; confinement of the fire; ventilation of the building; and extinguishment of the fire. Pathways by which the fire could spread are closed off, and the leading edge of the flame is controlled by the application of water or other cooling agents. Openings are made to permit the escape of toxic combustion products and hot air; this step (ventilation) must be conducted with keen judgment so as to permit the fire fighters access to the fire without causing its intensification or risking a smoke explosion (the result of admitting fresh air to a space in which a high concentration of unburned fuel particles is present in a hot, oxygen-depleted atmosphere).

The final stage of fighting a fire is extinguishment. The fire-fighting force uses water streams mixed with appropriate extinguishing agents to quench the remaining flames. When this is accomplished, the fire fighters initiate salvage of the structure by removing smoke and water from the interior and protecting undamaged materials.

fire finch, any of several red-and-brown or red-and-black birds of Africa that usually have fine white dots on their undersides. Fire finches belong to the family Estrildidae (order Passeriformes). Perhaps the commonest and tamest bird in Africa is the 8-centimetre (3-inch) red-billed, or Senegal, fire finch (*Lagonosticta senegala*), found everywhere in scrublands and gardens. The male is mostly light red, the female brown; both are red rumped.



Female and male red-billed, or Senegal, fire finch (*Lagonosticta senegala*)

Joe B. Blossom from The National Audubon Society Collection/Photo Researchers—EB Inc.

fire-fish (fish): *see* lion-fish.

fire insurance, provision against losses caused by fire, lightning, and the removal of property from premises endangered by fire. The insurer agrees, for a fee, to reimburse the insured in the event of such an occurrence. The standard policy limits coverage to the replacement cost of the property destroyed less a depreciation allowance. Indirect loss, such as that resulting from the interruption of business, are excluded but may be covered under a separate contract. Insurance rates are influenced by the quality of fire protection available where the building is located, the type of building construction, the kind of activity conducted within the building, and the degree to which the building is exposed to losses originating outside it.

Certain kinds of property, such as accounting records, currency, deeds, and securities, are frequently excluded from fire-insurance coverage or are declared uninsurable. Loss from such causes as war, invasion, insurrection, revolution, theft, and neglect by the insured are also customarily excluded. Coverage is suspended if the insured does anything that increases the hazard or if the property is vacant beyond a specified period. The policy may be canceled by either party for any reason, but the insurer must give the insured prior notice of cancellation. The policy may specify in addition that the insurer may replace or rebuild the damaged property rather than make a cash settlement.

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Fire Island, also called GREAT SOUTH BEACH, an elongated sandspit, 32 miles (51 km) long and 0.5 mile (1 km) across (at its widest point), in Suffolk county, New York, U.S. It lies off the southern shore of Long Island and shelters Great South Bay and part of Moriches Bay from the Atlantic Ocean. Its name refers to fires that were built there as signals to ships during the War of 1812. Numerous shipwrecks prompted the building of the lighthouse at its western tip in 1858. Now a popular summer resort, it is connected to Long Island by two bridges and by ferry. Fire Island (now Robert Moses) State Park was opened in 1908, and a 19,000-acre (7,700-hectare) section of the island was dedicated as a national seashore in 1964. A county park covers its eastern section. No automobile traffic is allowed. Of particular interest is a 73-acre (30-hectare) "sunken forest," which lies below sea level and is surrounded by sand dunes; when the forest's sassafras, holly, and tupelo trees reach a height of about 35 feet (11 m), they cease to be protected by the dunes and are sheared off by wind and blowing sand.

fire prevention and control, the prevention, detection, and extinguishment of fires, including such secondary activities as research into the causes of fire, education of the public about fire hazards, and the maintenance and improvement of fire-fighting equipment.

Until after World War I little official attention was given to fire prevention, because most fire departments were concerned only with extinguishing fires. Since then most urban areas have established some form of a fire-prevention unit, the staff of which concentrates on such measures as heightening public awareness; incorporating fire-prevention measures in building design and in the design of machinery and the execution of industrial activity; reducing the potential sources of fire; and outfitting structures with such equipment as extinguishers and sprinkler systems to minimize the effects of fire.

The importance of increasing public understanding of the causes of fire and of learning effective reactions in the event of fire is essential to a successful fire-prevention program. To reduce the impact and possibility of fire, the building codes of most cities include fire safety regulations. Buildings are designed to separate and enclose areas, so that a fire will not spread; to incorporate fire-prevention devices, alarms, and exit signs; to isolate equipment and materials that could cause a fire or explode if exposed to fire; and to install fire-extinguishing equipment at regular intervals throughout a structure. Fire-retardant building materials have also been developed, such as the paints and chemicals used to coat and impregnate combustible materials, such as wood and fabric.

In the United States a study conducted over a 10-year period found that the most frequent type of fire was electrical (23 percent of all fires); other causes of fire included tobacco smoking (18 percent), heat caused by friction in industrial machinery (10 percent), overheated materials (8 percent), hot surfaces in such devices as boilers, stoves, and furnaces (7 percent), burner flames (7 percent), and combustion sparks (5 percent).

To reduce the hazardous effects of fire the most basic mechanism is an alarm system, which warns people to leave a building at once, alerts the fire department, and identifies the location of a fire within a structure. Besides the fire alarms that are triggered by people, there are many automatic devices that can detect the presence of fire. These include heat-sensitive devices, which are activated if a specific temperature is reached; a rate-of-rise detector, which is triggered either by a quick or a gradual escalation of temperature; and smoke detectors, which sense changes caused by the presence of smoke, in the intensity of light, in the refraction of light, or in the ionization of air.

Many public buildings are equipped with automatic sprinkler systems, which release a spray of water on an affected area if a fire is detected. The effectiveness of these systems has been proved in data accumulated from throughout the world: in buildings protected by sprinkler systems that had fires, the system extinguished fires in 65 percent of the cases and contained fires until other fire-fighting measures could be taken in 32 percent of the cases. A major problem with sprinkler systems is the potential for water damage, but it has been found that in most cases this threat is minimal compared with the damage that a fire could cause.

There exists a considerable variety of fire-fighting equipment, ranging in sophistication from buckets and extinguishers to the elaborate yet portable apparatus used by fire departments. The most common of these is the fire engine, equipped with hoses, ladders, water tanks, and tools. Ladder and rescue trucks work in conjunction with trucks equipped with platforms that can be elevated by hydraulic lifts to carry out rescue efforts. Fireboats are employed in combating fires on ships and on waterfront property.

Fire-extinguishing agents other than water are used to fight various types of fire. Foaming agents are employed to handle oil fires. "Wet" water, formed by the addition of a chemical that reduces surface tension, can be used in a clinging foam to protect the exterior of a structure near the source of a fire. Ablative water, made by mixing water with additives, forms a dense, heat-absorbing blanket. Carbon

dioxide is employed when water cannot be used and a fire must be fought by suffocation. Dry chemicals are used to extinguish electrical fires or burning liquids, while dry powder is utilized to put out such burning metals as magnesium and phosphorus. Halogenated hydrocarbons, commonly called halons, take the form of liquefied gas or vaporizing liquids at room temperature; they inhibit the flame chain reaction. Steam is used to control fire in confined areas, while inert gas is employed to extinguish gas, dust, and vapour fires.

Fire fighting is a battle against time. The initial priority is rescuing any occupants that may be in a burning building. Precedence is then given to any location from which the fire may spread to a neighbouring structure. A typical method of fire fighting is the over-and-under system. Working from inside the building, if possible, the bulk of the fire fighting takes place from below, while further attack is carried out from above in an effort to prevent the fire from spreading upward.

In rural areas water-tank trucks are usually needed, thus the time factor becomes even more critical. Bush, grass, and forest fires are frequently fought using the same equipment that is used on structural fires. Aircraft are sometimes employed to dump fire-retardant slurries or water mixtures on these blazes.

It has also become necessary to combat fires in pressurized chambers, including spacecraft. The combustion rate in these environments is much higher than it is under normal atmospheric pressure. Strict construction guidelines are followed to keep fire hazards to a minimum, and highly pressurized sprinklers are installed that act immediately upon any combustion.

fire storm, violent convection caused by a continuous area of intense fire and characterized by destructively violent surface indrafts. Sometimes it is accompanied by tornado-like whirls that develop as hot air from the burning fuel rises. Such a fire is beyond human intervention and subsides only upon the consumption of everything combustible in the locality.

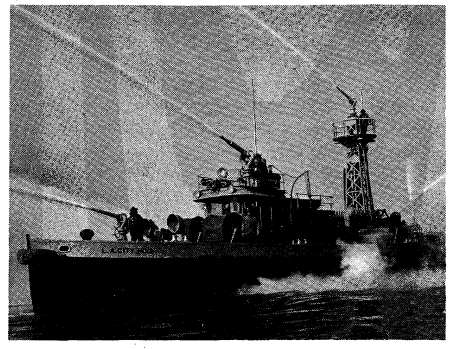
fire walking, religious ceremony practiced in many parts of the world, including the Indian subcontinent, Malaya, Japan, China, Fiji Islands, Tahiti, Society Islands, New Zealand, Mauritius, Bulgaria, and Spain. It was also practiced in classical Greece and in ancient India and China.

Fire walking takes several forms, the most common being the practice of walking swiftly over a layer of embers spread thinly along the bottom of a shallow trench. Sometimes the devotees or priests or oracles have to walk through a blazing log fire. Instead of embers from a wood fire, there may be red-hot stones (Fiji and Mauritius), or embers may be poured over the devotee's head in a "fire bath," or the devotee may lash himself with a flaming torch.

Various explanations are offered for fire walking. Its performance is said sometimes to ensure a good harvest, other times to purify the participants; a man who is accused of a crime or of uttering an untruth may be asked to undergo the ordeal of fire to prove his innocence, and if he emerges unscathed his innocence is proved. Fire walkers believe that only those who lack faith will suffer from injuries from fire, while the faithful are spared. Devotees also undertake fire walking in fulfillment of vows.

Injuries from burns do occur, but they seem on the whole to be much less frequent than would be expected, especially as devotees do not apply any artificial preparation before the ordeal to protect their bodies. This fact has not been completely explained.

fireboat, vessel used in fire fighting in port cities. Basically a large tugboat, the fireboat is equipped with powerful pumps capable of producing streams of up to 12,000 gallons (45,000 litres) per minute. The first fireboats, built in the 19th century, were steam propelled and used steam power to operate their pumps. Modern craft are powered by internal-combustion (usually diesel) engines that also drive the pumps. A typical fireboat is of about 125-foot length by 26-foot beam and 7-foot draft (38 by 8 by 2 metres) and travels at about 14 knots (nautical miles per hour). A high-speed, shallow-draft fireboat introduced in Chicago in 1961 is propelled and steered by underwater hydraulic jets.



Fireboat demonstrating water-throwing capacity of five high-pressure turret nozzles
By courtesy of the Los Angeles City Fire Department

firebrick, also called REFRACTORY BRICK, refractory material consisting of nonmetallic minerals formed in a variety of shapes for use at high temperatures, particularly in structures for metallurgical operations and glass manufacturing. Principal raw materials for firebrick include fireclays, mainly hydrated aluminum silicates; minerals of high aluminum oxide content, such as bauxite, diaspore, and kyanite; sources of silica, including sand and quartzite; magnesia minerals, magnesite, dolomite, forsterite, and olivine; chromite, a solid solution of chromic oxide with the oxides of aluminum, iron, and magnesium; carbon as graphite or coke; and vermiculite mica. Minor raw materials are zirconia, zircon, thoria, beryllia, titania, and ceria, and other minerals containing rare-earth elements.

Firebricks are formed by the dry-press, stiff-mud, soft-mud casting, and hot-pressing processes used in the manufacture of building bricks. Some materials, including magnesite and dolomite, require firing in rotary kilns to bring about sintering and densification before the crushed and sized material can be fabricated into refractory shapes and refired. Raw materials are fused in an electric furnace followed by casting of the melt in special molds.

In glass production, highly siliceous, dense, fireclay bricks, known as flux blocks, are preferred in the portion of the tank that comes in contact with molten glass. Mullite firebricks, prepared from the mineral kyanite, have excellent durability, as do also fused alumina bricks; neither of these allows penetration of the glass and is comparatively inert chemically. Zirconia bricks also have no porosity and great resistance to attack by molten glass.

firebug (insect): *see* red bug.

firecrest, European species of kinglet (*q.v.*).

firefly, also called LIGHTNING BUG, any of the nocturnal luminous insects of the beetle family Lampyridae (order Coleoptera), consisting of about 1,900 species that inhabit tropical and temperate regions. The common glowworm (*Lampyris noctiluca*) is a member of this family (*see* glowworm).

Fireflies are soft-bodied beetles that range from 5 to 25 millimetres (up to 1 inch) in length, and have special light organs on the underside of the abdomen. The flattened, dark brown or black body is often marked with orange or yellow. Some adult fireflies do not eat; others feed on pollen and nectar. Both sexes usually are winged and luminous. Females lacking wings and resembling the long, flat larvae are commonly referred to as glowworms. The larvae, sometimes luminescent before they hatch, live on the ground and feed on snails and slugs. They inject a fluid into their prey and then withdraw the partly digested matter through hollow mouthparts.

Most fireflies produce short, rhythmic flashes in a pattern characteristic of the species; the rhythmic flash is part of a signal system that brings the sexes together. Both the rate of flashing and the amount of time before the female's response to the male are important. Some authorities feel that the flashing is also a protective mechanism, reminding predators of the firefly's bitter taste. Some frogs, however, eat such large numbers of fireflies that they themselves glow.

North American firefly (*Photinus*)
Werner W. Schulz

Firefly light is produced under nervous control within special cells (photocytes) richly supplied with air tubes (tracheae). Only light in the visible spectrum is emitted. Members of the coleopteran family Elateridae are also called fireflies (*see* click beetle).

Firenze (Italy): *see* Florence.

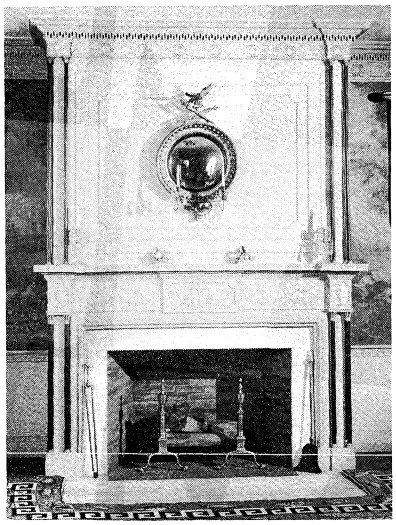
Firenze, Università degli Studi di: *see* Florence, University of.

fireplace, housing for an open fire inside a dwelling, used for heating and often for cooking. The first fireplaces developed when medieval houses and castles were equipped with chimneys to carry away smoke; experience soon showed that the rectangular form was superior, that a certain depth was most favourable, that a grate provided better draft, and that splayed sides increased reflection of heat. Early fireplaces were made of stone; later, brick became more widely used. A medieval discovery revived in modern times is that a thick masonry wall opposite the fireplace is capable of absorbing and re-radiating heat.

From early times fireplace accessories and furnishings have been objects of decoration. Since at least the 15th century a fireback, a slab of cast iron, protected the back wall of the fireplace from the intense heat; these were usually decorated. After the 19th century the fireback gave way to firebrick in fireplace construction.

Andirons, a pair of horizontal iron bars on short legs and placed parallel to the sides of the

fireplace to support burning logs, were used from the Iron Age. A vertical guard bar at the front, placed to prevent logs from rolling into the rooms, is often decorated ornately. (Rear



Early 19th-century fireplace from the Duncan House, Haverhill, Mass.; in the Metropolitan Museum of Art, New York City

By courtesy of the Metropolitan Museum of Art, New York City, Rogers Fund, 1912

guard bars were in use until the 14th century, when the central open hearth as a mode of heating went out of general use.) The grate, a sort of basket of cast-iron grillwork, came into use in the 11th century and was especially useful for holding coal.

Fire tools used to maintain a fire have changed little since the 15th century: tongs are used to handle burning fuel, a fire fork or log fork to maneuver fuel into position, and a long-handled brush to keep the hearth swept. The poker, designed to break burning coal into smaller pieces, did not become common until the 18th century. Coal scuttles appeared early in the 18th century and were later adapted into usually ornamental wood boxes or racks for firelogs. The fire screen was developed early in the 19th century to prevent sparks from flying into the room, and it also has been ornamented and shaped to serve decorative as well as functional purposes.

The fireplace itself was not subject to significant improvement—once the open central hearth was abandoned—until 1624, when Louis Savot, an architect employed in construction in the Louvre, Paris, developed a fireplace in which air was drawn through passages under the hearth and behind the fire grate and discharged into the room through a grill in the mantel. This approach was adapted in the 20th century into a prefabricated double-walled steel fireplace liner with the hollow walls serving as air passages. Some such systems use electric fans to force circulation. In the 1970s, when sharply rising fuel costs had stimulated energy conservation measures, sealed systems were devised in which the air to support combustion is drawn in from outside the house or from an unheated portion; a glass cover, fitted closely over the front of the fireplace, is sealed once fuel has been placed and ignited.

Firestone, Harvey S(amuel) (b. Dec. 20, 1868, Columbiana, Ohio, U.S.—d. Feb. 7, 1938, Miami Beach, Fla.), American industrialist noted for his establishment of the Firestone Tire & Rubber Company, which was for some 80 years a major U.S. tire manufacturer.

Firestone reportedly had driven the first rubber-tired buggy in Detroit, while working as a manager for an uncle's buggy-manufacturing concern. When that business folded, Firestone moved to Chicago (1896) and, with partners, began to operate a retail tire business. In 1900 he moved to Akron, then the centre of tire production, with his patent on a mechanism for applying rubber tires to carriage wheel channels, and formed a company in which he held a half interest. Originally formed to sell rubber carriage tires made by others, the company bought a small factory in 1902 and began manufacturing its own tires; in 1904 it began to make automobile tires. Firestone pioneered the manufacture of pneumatic tires for the Ford Model T automobile, and a sale of thousands of tires to Ford in 1906 propelled Firestone to the top of the American tire industry. The company was innovative in design and manufacturing, pioneering many new tires and treads. Firestone promoted the use of trucks for hauling freight and lobbied for the construction of vast highway systems. In protest over the British-held monopoly over the production of raw rubber in Southeast Asia, he established his own large rubber plantations in Liberia. Firestone was president of the Firestone Tire & Rubber Company until 1932, when his son replaced him at the head of the firm.

firethorn (*Pyracantha*), any of a genus of usually thorny evergreen shrubs, in the rose family (Rosaceae), native to southeastern Europe and Asia. Firethorns are planted as ornamentals for their showy, berrylike fruits; they are

Firethorn (*Pyracantha coccinea*)

Walter Chandoha

also used as hedges and are often espaliered (trained to grow flat against walls and fences). They have small oval leaves on short leafstalks and clusters of small white flowers followed by orange to reddish fruits that cling to the stems well into winter.

The European *Pyracantha coccinea,* up to 4.5 m (15 feet) tall, has provided many varieties of horticultural interest. Of similar height are *P. atalantioides* and *P. fortuneana,* from China, both of which bear clusters of scarlet fruits. *P. koidzumii,* from Taiwan, is densely branched, with red-purple young twigs and orange-scarlet fruit. The Himalyan *P. crenulata,* up to 6 m (19 feet) high, can be trained as a small tree.

fireweed (*Epilobium angustifolium*), also called GREAT WILLOW HERB, or WICKUP, perennial wildflower, in the evening primrose family (Onagraceae), abundant on newly clear and burned areas. Its spikes of whitish to magenta flowers, which grow up to 1.5 m (5 feet) high, can be a spectacular sight on prairies of the temperate zone. Like those of many weedy plants, its seeds can lie dormant for many years, awaiting the warmth necessary for germination. Fireweed is one of the first plants to appear after a forest or brush fire; it also rapidly covers scrub or woodland areas that have been cleared by machine.

Fireweed has limited use in wild gardens, where it must be carefully checked and confined. The willowlike young shoots and leaves can be cooked and eaten.

firework, explosive or combustible used for display. Of ancient Chinese origin, fireworks evidently developed out of military rockets and explosive missiles, and they were (and still are) used in elaborate combinations for celebrations. During the European Middle Ages, fireworks accompanied the spread of military explosives westward, and in Europe the military fireworks expert was pressed into service to conduct pyrotechnic celebrations of victory and peace. In the 19th century, the introduction of new ingredients such as magnesium and aluminum greatly heightened the brilliance of such displays.

There are two main classes of fireworks: force-and-spark and flame. In force-and-spark compositions, potassium nitrate, sulfur, and finely ground charcoal are used, with additional ingredients that produce various types of sparks. In flame compositions, such as the stars that are shot out of rockets, potassium nitrate, salts of antimony, and sulfur may be used. For coloured fire, potassium chlorate or potassium perchlorate is combined with a metal salt that determines the colour.

The most popular form of firework, the rocket, is lifted into the sky by recoil from the jet of fire thrown out by its burning composition; its case is so designed as to produce maximum combustion and, thus, maximum thrust, in its earliest stage.

fireworm, any of certain segmented marine worms of the class Polychaeta (phylum Annelida), including species of the genera *Hermodice* and *Eurythoe.* Fireworms produce a stinging sensation if touched. The body of *H. carunculata,* found in the coral reefs of the Caribbean Sea, is covered with fine, white, brittle bristles that break if touched; they easily become imbedded in human skin and produce a substance that is highly irritating.

The name fireworm is also sometimes applied to the larva of a moth of the insect family Tortricidae (leaf rollers) and to the so-called glowworm—adults and some larvae of the Lampyridae, a family of beetles.

Firishtah, also called MUḤAMMAD QĀSIM HINDŪSHĀH (b. *c.* 1570—d. *c.* 1620), one of Muslim India's most famous writers.

Very little is known about Firishtah's life except that he was captain of the guard to Murtazā Niẓām Shāh, Muslim Indian ruler of Ahmadnagar (1565–88). It was during this period that Firishtah conceived his history of Indo-Muslim rulers and saints, which he wrote under the patronage of Ibrāhīm II, ʿĀdil Shāh, ruler of Bijāpur, in the Deccan (1579–1626), whose service he entered in 1589. Written in Persian, this history is called *Golshan-e Ebrāhīmī* ("The Garden of Ibrāhīm"; Eng. trans., *Mahomedan Power in India*). It is also known under the title *Tārīkh-e Fereshteh* ("Firishtah's Chronicle"). The second of the two versions in which it was written often appears under still another title, the *Nowras-nāmeh* ("New Book"). The history covers the famous Muslim rulers of India from the 10th century to the time of the author and also contains an introduction with information concerning the famous Hindu rulers of the time, Hindu history, and a geography of the lands under Hindu control.

The work lost its status as an authority for early Indo-Muslim history, especially after historical criticism developed and independent copies of the Indo-Persian histories on which it was based became available. Firishtah's chronicle, nevertheless, remains a valuable source

for the history of the Muslim Deccan where he served. He is also known for his medical treatise, which is concerned with pharmacology and therapy techniques and which also contains information on physiology and the humours. It appears under two titles, *Dastūr ol-Aṭebbā'* ("Memorandum for Doctors") and *Ekhtīārāt-e Qāsemī* ("Selections by Qāsim").

firn (German: "of last year"), also called NÉVÉ, partially compacted granular snow that is the intermediate stage between snow and glacial ice. Firn is found under the snow that accumulates at the head of a glacier. It is formed under the pressure of overlying snow by the processes of compaction, recrystallization, localized melting, and the crushing of individual snowflakes. This process is thought to take a period of about one year. Annual layers of firn may often be detected by thin films of dust or ash that accumulate on the surface during each summer.

Further compaction of firn, usually at a depth of 45 to 60 m (150 to 200 feet), results in glacial ice, distinguished by its impermeability to air and water. The density of firn is generally accepted as 0.4 to 0.84 grams per cubic cm, and its grain size ranges from 0.5 to 5 mm.

Fīroz Shāh, Battle of (Dec. 21–22, 1845), conflict between the Sikhs and the British at Fīroz Shāh, in the Punjab, northern India. It was the first of two decisive battles in the First Sikh War, 1845–46.

A British force of about 18,000 men under Sir Hugh Gough attacked a Sikh army of 35,000 under Lāl Singh in late afternoon. After a near repulse and a night of peril, the British achieved victory in the morning at a cost of about 2,400 casualties compared to about 8,000 Sikh casualties. Gough was criticized for his costly frontal attacks but went on to win final victory of the war at Sobrāon on Feb. 10, 1846.

Fīrozpur, also spelled FEROZEPORE, city, southwestern Punjab state, northwestern India, 5 miles (8 km) from the Pakistani border. Fīrozpur was founded by Fīrūz Shāh Tughluq in the 14th century; it fell under British rule in 1835. It became a British outpost and was involved in the First Sikh War (1845–46). The city, lying at a major junction of Indian and Pakistani rail lines, is a trade centre and agricultural market. It is a walled city encompassed by a circular road, with wide, well-paved main streets. Its industries include processing of agricultural products, manufacturing, weaving, and the making of confections. The city has three colleges. A cantonment 2 miles (3.2 km) south contains the district administration and other offices and an airfield.

The area about Fīrozpur consists of level alluvial terrain crisscrossed by irrigation canals, which are necessary because of the semiarid climate. Principal crops are wheat, cotton, gram (chick-pea), oilseed, and millet. Pop. (1981) city, 61,162.

Firozpur Jhirka, also called FEROZEPUR, city, southeastern Haryāna state, northwestern India. The city is said to have been founded by Fīrūz Shāh III as a military outpost and was constituted a municipality in 1867. Connected by road with Alwar, in Rājasthān state, and with Gurgaon city, it is an agricultural market centre. Industries include a distillery and iron and metalware factories. Pop. (1981) 9,400.

First Bank System, Inc., American bank holding company. Its major subsidiary is the First National Bank of Minneapolis. Headquarters for both are in Minneapolis, Minn.

The corporation was originally formed as the First Bank Stock Corporation in 1929 and adopted its present name in 1968. The bank traces its history back to 1864, when it was established as the First National Bank of Minneapolis. After several subsequent mergers and name changes, it merged with First Minneapolis Trust Company in 1933 and adopted the name First National Bank and Trust Company of Minneapolis. The bank changed its name back to the current one in 1943.

Affiliate banks pay fees to the holding company for a number of services including investment advice, marketing, public relations, personnel, and accounting. Besides the First National Bank of Minneapolis, other banks are located in such states as Arizona, Minnesota, Montana, North Dakota, South Dakota, and Wisconsin. Other affiliates include two insurance companies, a computer services company, and a leasing and mortgage bank company.

Consult the INDEX *first*

first cause, in philosophy, the self-created being (*i.e.,* God) to which every chain of causes must ultimately go back. The term was used by Greek thinkers and became an underlying assumption in the Judeo-Christian tradition. Many philosophers and theologians in this tradition have formulated an argument for the existence of God by claiming that the world that man observes with his senses must have been brought into being by God as the first cause. The classic Christian formulation of this argument came from the medieval theologian St. Thomas Aquinas, who was influenced by the thought of the ancient Greek philosopher Aristotle. Aquinas argued that the observable order of causation is not self-explanatory. It can only be accounted for by the existence of a first cause; this first cause, however, must not be considered simply as the first in a series of continuing causes, but rather as first cause in the sense of being the cause for the whole series of observable causes.

The 18th-century German philosopher Immanuel Kant rejected the argument from causality because, according to one of his central theses, causality cannot legitimately be applied beyond the realm of possible experience to a transcendent cause.

Protestantism generally has rejected the validity of the first-cause argument; nevertheless, for most Christians it remains an article of faith that God is the first cause of all that exists. The person who conceives of God in this way is apt to look upon the observable world as contingent—*i.e.,* as something that could not exist by itself.

First Charter Financial Corporation, American holding and operating company that is a major subsidiary of Financial Corporation of America (*q.v.*), a large American financial-services holding company.

First Chicago Corporation, American bank holding company founded in 1969 and overseeing the First National Bank of Chicago. Headquarters for both are in Chicago.

The bank, formed in 1863, operates international banks worldwide. The corporation also owns several Chicago-based nonbank subsidiaries in real estate financing, personal property leasing, student loan profiles, and small business investment.

The corporation provides domestic commercial banking for industrial customers through a variety of credit lines and advisory services, as well as offering commercial banking in other countries through affiliates, correspondent banks, and its own offices. The Chicago bank provides the usual banking services for individuals, including deposit and borrowing services. It also provides trust services in addition to its roles as transfer agent and paying agent. Its bond department deals directly with the Federal Reserve Open Market Committee Trading Desk. In 1982 the corporation acquired the credit card business of Bankers Trust New York Corporation.

First Church of Christ, Scientist, in Boston, The Mother Church of Christian Science, first established by Mary Baker Eddy in 1879, reestablished as an international organization by Eddy in 1892. The church building was constructed in 1895; a domed extension was added later (1903–06).

The Mother Church is the controlling body of Christian Science, and all local Churches of Christ, Scientist are considered branches of The Mother Church. The laws of the church, its organizations, and activities are discussed in the *Manual of The Mother Church,* first prepared by Eddy in 1895 and later revised by her. Eddy also provided for the establishment of a self-perpetuating Board of Directors that administers all the activities of the Mother Church. The board is composed of five members who appoint the other officers: president, first and second reader, clerk, and treasurer. Under the Board of Directors, various agencies and committees carry on the work of the Mother Church.

First City Bancorporation of Texas, Inc., bank holding company, headquartered in Houston and operating primarily in Texas, U.S.

The major subsidiary is the First City National Bank of Houston, established in 1956 with the merger of First National Bank in Houston (established 1866) and City National Bank of Houston (established 1928 under a different name). Other subsidiary banks are located throughout Texas.

First City Bancorporation provides managerial direction, financial resource coordination, and advisory services for its various subsidiary banks. The nonbank subsidiaries are involved in finance: life insurance, credit insurance, health and accident insurance, and financial data processing.

First International (Socialist federation): *see* International, First.

First Interstate Bancorp, formerly (1961–81) WESTERN BANCORPORATION, one of the largest American multibank holding corporations. Headquarters are in Los Angeles.

The corporation was formed in 1957 as Firstamerica Corporation and started operations in 1958 when it acquired all of the directly held shares of Transamerica Corporation's stock in banks in which Transamerica held a majority share of stock. The name Western Bancorporation was adopted in 1961 and the present name in 1981.

The affiliates are guided by corporate goals and advised by corporate specialists in accounting, budgeting, credit, investments, law, operations, and regulations. The corporation monitors the operations and policies of the affiliated banks, which provide a full range of commercial banking including checking, savings, and time accounts. Several of the banks offer international services. Nonbank subsidiaries offer credit, mortgage, and leasing services. In 1982 First Interstate Bancorp began to franchise its name and its services—an innovation which enabled the corporation to create a nationwide banking and financial system without violating laws prohibiting interstate banking.

First National Bank of Boston, major American commercial bank with branch and representative offices in the United States and abroad. It is the principal subsidiary of the Bank of Boston Corporation (*q.v.*).

First National Bank of Chicago, major American commercial bank formed in 1863, leading subsidiary of First Chicago Corporation (*q.v.*), a holding company.

First National Bank of Minneapolis, major U.S. commercial bank founded in 1864,

now the main subsidiary of First Bank System, Inc. (*q.v.*), a bank holding company.

First of June, Battle of the, also called BATTLE OF THE GLORIOUS FIRST OF JUNE (June 1, 1794), naval engagement of the French Revolutionary Wars, fought between the French and the British in the Atlantic Ocean about 430 miles (690 km) west of the Brittany Peninsula. The battle took place when the British fleet with 26 ships of the line, commanded by Earl Howe, attempted to intercept a U.S. grain convoy of 130 merchant ships that was being escorted into Brest by a French fleet of 26 ships of the line (reinforced to 30 before the battle ended). The French, under Louis Villaret de Joyeuse, were trying to lure the British away from the convoy when Howe attacked. Although only seven of Howe's ships broke the French line, he disorganized their fleet and captured six ships. The battle was technically a British victory, but the French fleet had accomplished its task of drawing the British away and enabling the convoy to reach Brest safely.

Firth, Sir Charles (Harding) (b. March 16, 1857, Sheffield, Yorkshire, Eng—d. Feb. 19, 1936, Oxford), English historian notable for his work on English history in the 17th century.

Firth was educated at Clifton and at New College and Balliol College, Oxford. He settled in Oxford in 1883 and lived there for the rest of his life. For many years he worked with S.R. Gardiner and produced many historical studies on the Commonwealth in England under Oliver Cromwell. Several of his books achieved wide popularity, including *Oliver Cromwell* (1900), *Cromwell's Army* (1902), and *The Last Years of the Protectorate* (1909), which was a continuation of Gardiner's work. Firth was regius professor of modern history from 1904 to 1925 and was knighted in 1922. He was active in many fields, helping to launch the *English Historical Review* in 1886 and becoming president of the Royal Historical Society (1913–17) and president of the Historical Association (1906–10 and 1918–20). He also edited Lord Macaulay's *History of England* and gave much help and advice to other historians in their own researches. Most of his works are included in his book *A Bibliography of the Writings of Sir Charles Firth* (1928).

Firth, John R(upert) (b. June 17, 1890, Keighley, Yorkshire, Eng.—d. Dec. 14, 1960, Lindfield, Sussex), British linguist specializing in contextual theories of meaning and prosodic analysis. The originator of the "London school of linguistics," and an inspiring teacher, Firth insisted that meaning be the centre of linguistic study, as opposed to linguists who tried to analyze language without reference to it. In this emphasis he was influenced by Bronisław Malinowski.

After receiving an M.A. in history from the University of Leeds (1913), Firth joined the Indian Education Service in 1915 and served intermittently until 1928. From 1916 to 1919 he also saw military service in Afghanistan, Africa, and India and, from 1919 to 1928, was professor of English at the University of the Punjab at Lahore. In 1928 Firth became a senior lecturer in phonetics at University College, London. He held teaching positions at the London School of Economics and at the Indian Institute, Oxford; in 1944 he was appointed to the first chair of general linguistics in Britain at the University of London, where he taught until his retirement in 1956. Beginning in 1941, Firth gave intensive courses in Japanese to military personnel, for which he was awarded the Order of the British Empire (1946). A collection of Firth's most important articles, *Papers in Linguistics 1934–1951,* appeared in 1957.

Firth, Sir Raymond (William) (b. March 25, 1901, Auckland, N.Z.), New Zealander social anthropologist best known for his research on the Maori and other peoples of Oceania and Southeast Asia.

Firth began his studies at Auckland University College in his native New Zealand and then continued at the London School of Economics, from which he obtained his doctorate. A brief affiliation with the University of Sydney (1929–1932) was thereafter the only break in Firth's association with the London School of Economics; he became a full professor there in 1944 and, in 1968, professor emeritus. He was knighted in 1973.

Firth was strongly influenced by Bronisław Malinowski and edited *Man and Culture: An Evaluation of the Work of Bronislaw Malinowski* (1957), considered one of the best works about this very influential anthropologist. Firth's first major contribution to anthropology was *Primitive Economics of the New Zealand Maori* (1929). The economic organization of primitive societies continued to be one of Firth's primary interests, as indicated by his works on the Kauri gum industry and the fishing industry of Malaysia. Among his other chief interests were social structure and religion, especially of the Tikopia of the Solomon Islands, and the anthropological treatment of symbols.

The work of Firth's that was widest in scope was his influential *Human Types: An Introduction to Social Anthropology* (1938). His other notable works are *We, the Tikopia* (1936), *Essays on Social Organization and Values* (1964), *Malay Fishermen: Their Peasant Economy* (1966), *Rank and Religion in Tikopia* (1970), and *Symbols: Public and Private* (1973).

Fīrūzābād, ancient GŪR, town situated about 55 miles (88 km) south of Shīrāz, in the Fārs region of south-central Iran. The town is said to have been founded by the Sāsānian king Ardashīr I (AD 224–241) in commemoration of his victory over the Parthian king Artabanus. The Sāsānian town was circular in plan and had a high tower topped by a fire altar in the centre. The ruined palace of Ardashīr I in the town is the oldest extant example of Sāsānian architecture. The name of the town was changed in the middle of the 10th century because the citizens felt that *gūr* (Persian: "grave") had unpleasant connotations. Pop. (1986) 34,433.

Fīrūzābādī, al-, in full ABU 'L-ṬĀHIR MUḤAMMAD BEN YA'ḲŪB BEN MUḤAMMAD BEN IBRĀHĪM MAJD AL-DĪN AL-SHĀFI'Ī AL-SHĪRĀZĪ AL-FĪRŪZĀBĀDĪ (b. February or April 1329, Kāzerūn, Iran—d. Jan. 13, 1415, Zabīd, Yemen), lexicographer who compiled an extensive dictionary of Arabic that, in its digest form, *al-Qāmūs* ("The Ocean"), served as the basis of later European dictionaries of Arabic.

After teaching in Jerusalem (1349–59), al-Fīrūzābādī traveled through western Asia and Egypt and settled at Mecca (1368), where he remained for 15 years. Travels to India and another 10 years at Mecca preceded his appointment in 1395 as chief judge (*qāḍī*) of Yemen. Over the course of his lifetime, al-Fīrūzābādī wrote more than 40 works, the best known of which was his dictionary, now lost. A consolidation of two earlier Arabic dictionaries, the work ran to at least 60 volumes. There were early 19th-century publications of the *al-Qāmūs* extract of this work at Calcutta, at Üsküdar (Scutari, opposite Istanbul), and at Cairo. The digest was also translated into Turkish and Persian.

fiscal policy, measures employed by governments to stabilize the economy, specifically by manipulating the levels and allocations of taxes and government expenditures. Fiscal measures are frequently used in tandem with monetary policy (*q.v.*) to achieve certain goals.

The usual goals of both fiscal and monetary policy are to achieve or maintain full employment, to achieve or maintain a high rate of economic growth, and to stabilize prices and wages. The establishment of these ends as proper goals of governmental economic policy and the development of tools with which to achieve them are products of the 20th century.

In taxes and expenditures, fiscal policy has for its field of action matters that are within government's immediate control. The consequences of such actions are generally predictable: a decrease in personal taxation, for example, will lead to an increase in consumption, which will in turn have a stimulating effect on the economy. Similarly, a reduction in the tax burden on the corporate sector will stimulate investment. Steps taken to increase government spending by public works have a similar expansionary effect. Conversely, a reduction in government expenditure or an increase in tax revenues, without compensatory action, has the effect of contracting the economy.

Fiscal policy relates to decisions that determine whether a government will spend more or less than it receives. Until Great Britain's unemployment crisis of the 1920s and the Great Depression of the 1930s, it was generally held that the appropriate fiscal policy for the government was to maintain a balanced budget. The severity of these disturbances gave rise to a new set of ideas, first given formal treatment by the economist John Maynard Keynes, revolving around the notion that fiscal policy should be used "countercyclically," that is, that the government should exercise its economic influence to offset the cycle of expansion and contraction in the economy. Keynes's rule, briefly, was that the budget should be in deficit when the economy was experiencing low levels of activity and in surplus when boom conditions (often accompanied by high inflation) were in force.

Under the balanced-budget regime, personal and business tax rates were raised during periods of declining economic activity to ensure that government revenues were not reduced. The effect of this was to reduce consumption still further, increase surplus industrial capacity, and depress investment, all of which exerted a downward pressure on the economy. Alternatively, if, in order to maintain a balanced budget, taxes remained level but government expenditures were cut back during such a period of declining economic activity, a similar downward pressure was exerted. The Keynesian theory showed that, under certain conditions, the operation of market forces would not automatically generate full employment, and that governments should abandon the balanced-budget concept and adopt active measures to stimulate the economy. Furthermore, to be really effective, these measures should be financed by government borrowing rather than by raising taxes or by cutting other government expenditures. Initial experiments with this new stabilizing technique in the United States during the first term (1933–37) of President Franklin Delano Roosevelt's administration were somewhat disappointing, partly because the amount of deficit financing was not large enough and partly, perhaps, because the expectations of business had been dulled to such an extent by the Great Depression that it was slow to respond to opportunities. With the advent of World War II and soaring government spending, the unemployment problem in the United States disappeared.

In the postwar period the use of fiscal policy changed somewhat. The problem was no longer massive unemployment but a persistent tendency to inflation against a backdrop of fairly rapid economic growth punctuated by short periods of shallow recession. Since

the days of Keynes, fiscal policy has been refined to smooth these cyclical movements. As a counterinflationary tool it has not been particularly effective, partly because of political constraints and partly because of the so-called automatic stabilizers at work. The political constraints arise from the fact that politicians have found it unpopular to raise taxes and cut government expenditure when the economy becomes overheated. The automatic stabilizers in the economy inhibited the use of discretionary fiscal policy. For example, during a recession personal incomes will be shrinking, but owing to the highly progressive tax system (*i.e.,* tax rates that rise disproportionately on higher incomes) the loss of purchasing power of the consumers is cushioned, leaving more spending money in the hands of the consumers than would otherwise have been the case. This will be accompanied by a decline in government tax revenues, and so long as the government does not take steps to reduce expenditures to compensate for the loss of revenue, the net result will be to temper the decline in the level of economic activity. Conversely, during a boom a disproportionate share of the additional income flows into the treasury, keeping the rate of consumption expenditures below the rate which might have otherwise prevailed in the absence of a progressive tax system. Unemployment benefits produce a similar effect. During a recession unemployment benefits rise with the growing numbers of unemployed and prevent disposable incomes from falling by as much as would otherwise have been the case. When the economy begins to expand again and demand for labour picks up, the unemployment pay drops automatically.

Fischart, Johann (b. 1546/47, Strasbourg—d. 1590, Forbach, Lorraine), German satirist, the principal German literary opponent of the Counter-Reformation.

He received a good education and before 1570 travelled widely, visiting the Netherlands and probably England, and studying in Paris, Strasbourg, and Siena, Italy. In 1574 he received a *doctor juris* degree in Basel, but from 1570 to 1580 he lived mostly in Strasbourg. In this decade his main literary works appeared. Three years in Speyer as advocate at the *Reichskammergericht* (imperial court of justice) were followed by appointment in 1583 as magistrate at Forbach, Lorraine.

Of his main works, the earliest are attacks on the papacy, Franciscans, and Dominicans, and two of the latest are polemical satires against the Catholic Church and especially the Jesuits. Beginning as a Lutheran, he came to defend Calvinist doctrines—the only major German writer to do so. His works also ridiculed the fashions of the age.

Fischart's principal work is the *Affentheurliche und ungeheurliche Geschichtsschrift* (1575)—renamed *Geschichtsklitterung* in later editions (1582, 1590)—a greatly expanded prose version of Rabelais's *Gargantua.* Also noteworthy is his *Das glückhafft Schiff von Zürich* (1576), one of the most carefully constructed 16th-century narrative poems, commemorating the boatload of Zürich citizens who brought to Strasbourg a basin of porridge, still warm after a day-long journey.

Fischer, Bobby, byname of ROBERT JAMES FISCHER (b. March 9, 1943, Chicago), U.S. Chess master, youngest player in the world ever to attain the rank of grand master (1958).

Fischer learned the moves of Chess at age 6 and at 16 dropped out of high school to devote himself fully to the game. In 1958 he won the first of many U.S. championships. In World Championship Candidate matches during 1970–71, Fischer won 20 consecutive games before losing once and drawing 3 times to the former world champion Tigran Petrosyan (Soviet Union) in a final match won by Fischer. At Reykjavík, Iceland, in 1972, Fischer became the first U.S. player officially to hold the title of Chess Champion of the World when he defeated the then world champion Boris Spassky of the Soviet Union. In doing so he won the $156,000 victor's share of the $250,000 purse.

Bobby Fischer, 1971
AP/Wide World Photos

When playing White, he invariably opened 1. P-K4. His victories commonly resulted from surprise attacks or counterattacks rather than from the accumulation of small advantages; yet his play remained positionally sound. In 1975, on Fischer's refusing to meet the Soviet challenger, Anatoly Karpov, the Fédération Internationale des Echecs deprived him of his championship and declared Karpov champion by default. Machgielis Euwe's *Bobby Fischer—The Greatest?* was published in 1979.

Fischer, Emil (Hermann) (b. Oct. 9, 1852, Euskirchen, Prussia—d. July 15, 1919, Berlin), German chemist who was awarded the Nobel Prize for Chemistry in 1902 in recognition of his investigations of the sugar and purine groups of substances.

Fischer's work on the purines was instituted in 1881. He demonstrated the relationships of uric acid, xanthine, caffeine, theobromine, and other nitrogenous compounds to the single substance purine. His researches into the sugar group, begun in 1883, are of unparalleled importance to organic chemistry. Despite major complications because of stereochemical relations, he determined the molecular structures of fructose, glucose, and many other sugars and verified his results by synthesizing the compounds. Fischer also made significant contributions to the chemistry of proteins, including enzymes.

Educated at Bonn and Strasbourg, Fischer became professor of chemistry at Berlin in 1892. The Royal Society awarded him the Davy Medal in 1890 and elected him a foreign member in 1899. His autobiography, *Aus meinen Leben,* was published in 1922.

Fischer, Ernst Otto (b. Nov. 10, 1918, Munich), German theoretical chemist and educator who received the Nobel Prize for Chemistry in 1973 for investigations that explain how certain metals and organic substances can merge. He shared the prize with Geoffrey Wilkinson of London University, who had worked independently on the organometallic sandwich compounds.

Fischer served in the German Army before and during World War II. In 1952 he received a doctorate in natural sciences from the Technical University in Munich. He lectured there in 1954–57 and became professor of inorganic chemistry and director of the Inorganic Chemistry Institute in 1964. He served on faculties at Munich University (1957–64) and in Jena (1959) and Marburg (1960 and 1964). He also lectured and was a visiting professor at a number of U.S. universities.

Fischer, Hans (b. July 27, 1881, Höchst, near Frankfurt am Main—d. March 31, 1945, Munich), German biochemist who was awarded the Nobel Prize for Chemistry in 1930 for research into the constitution of hemin, the red blood pigment, and chlorophyll.

After receiving his Ph.D. in chemistry from Marburg (1904) and his M.D. from Munich (1908), Fischer worked as a physician and in medical chemical research, going on to become professor of medical chemistry at the University at Innsbruck, Austria. In 1921 he returned to Munich. Fischer showed that there is a close relationship between hemin and chlorophyll; he synthesized hemin and nearly completed the synthesis of chlorophyll. He also studied the yellow pigment carotene, a precursor of vitamin A, and the porphyrins.

Fischer, Johann Michael (b. 1692, Burglengenfeld, Bavaria—d. May 6, 1766, Munich), German architect, one of the most creative and prolific designers of late Baroque and Rococo churches in Germany.

Fischer was trained by his father, a mason. As an apprentice in Bohemia and Moravia beginning in 1713, he became familiar with the churches of the Dientzenhofer family and returned to Munich in 1718 to become foreman of city architecture. One of his earliest independent projects was the renovation of the Premonstratensian abbey church of Osterhofen (1726–29). The major structural theme in Fischer's churches is the octagon with unequal sides, first employed in the Unering parish church (1730–32). His productivity was astounding; in 1735 alone he planned three outstanding churches—St. Michael's in Berg-am-Laim, the pilgrimage church at Aufhausen, and the Franciscan church at Ingolstadt.

Fischer's greatest work is generally considered to be the Benedictine abbey church at Ottobeuren (1744–66), a vast Rococo structure, centred around a drumless dome and lavishly—but elegantly—decorated with sculpture, stuccowork, and paint. The monastery church of St. Marius and St. Arianus at Rott-am-Inn (1759–62) may be stylistically more significant, as its relative simplicity heralds the approach of Neoclassicism.

Fischer, Kuno, original name ERNST KUNO BERTHOLD (b. July 23, 1824, Sandewalde, Prussia—d. July 5, 1907, Heidelberg), German philosopher and educator who founded Neo-Kantian thought with his *System der Logik und Metaphysik* (1852; "A System of Logic and Metaphysics"). With other writings on Gotthold Lessing, Friedrich Schiller, and Goethe he contributed to the philosophy of aesthetics. Eventually he subscribed to Hegelian thought and in his *Geschichte der neueren Philosophie,* 10 vol. (1852–93; "History of Recent Philosophy") offered new interpretations of thought from René Descartes (17th century) to Arthur Schopenhauer (19th century).

Fischer, (Johann Ignaz) Ludwig (b. Aug. 18, 1745, Mainz, Archbishopric of Mainz—d. July 10, 1825, Berlin), German operatic bass, famed for his vocal range of 2½ octaves.

Although originally a student of the violin and cello, Fischer was discovered at the age of 18 in a church choir and in a student operetta and was given a position at court. With the help of a grant by Elector Karl Theodor he continued vocal studies with the tenor Anton Raaff in Mannheim. By 1775 he became a singing teacher himself and in 1778 moved with the court to Munich, where he was a great success. He married the singer Barbara Strasser, and in 1780 they moved to Vienna where Fischer won the admiration of Wolfgang Amadeus Mozart, who chose him to create the role of Osmin in *Die Entführung aus dem Serail* (1782). In 1783 Fischer appeared successfully in Paris at the Concert Spirituel; he then toured Italy and in 1785 performed in Dresden, Vienna, and Prague. In 1789 he

became a permanent member of the court opera in Berlin, making guest appearances in London, Leipzig, and Hamburg. He retired from the stage in 1812.

Fischer was also a composer, and his drinking song "Im kühlen Keller sitz' ich hier" in the Singspiel *Der Kritikaster und der Trinker* remains well known. A manuscript of his autobiography up to 1790 is in the Berlin Staatsbibliothek. His son and two daughters also became distinguished singers.

Fischer-Dieskau, Dietrich (b. May 28, 1925, Berlin), German operatic baritone and preeminent lieder singer, distinguished for his lyrical voice, commanding presence, and superb artistry.

Fischer-Dieskau studied with Georg Walter before serving in World War II and with Hermann Weissenborn afterward. In 1947 he made his concert debut in Johannes Brahms's *Ein deutsches Requiem* at Freiburg, and the next year his opera debut as Posa in Giuseppe Verdi's *Don Carlos* at the Städtische Oper, Berlin, where he became a leading baritone.

Fischer-Dieskau has performed in principal opera houses and festivals in an exceptional range of classic and modern roles from Wolfgang Amadeus Mozart's Almaviva and Don Giovanni to John the Baptist in Richard Strauss's *Salome.* His Wagnerian roles include the Herald in *Lohengrin,* Wotan in *Das Rheingold,* and Wolfram in *Tannhäuser.* In England he won fame in a concert performance of Frederick Delius' *A Mass of Life* in 1951 and in Franz Schubert's song cycles *Die schöne Müllerin* and *Winterreise* in 1952. His first appearance in the United States was in 1955 in Cincinnati, in a Johann Sebastian Bach cantata and Johannes Brahms's *Ein deutsches Requiem.* In 1962, at Coventry, Warwickshire, he performed notably in the premiere of Benjamin Britten's *A War Requiem,* and in 1965 he introduced at Aldeburgh, Suffolk, Britten's *Songs and Proverbs of William Blake* that had been composed for him. Unexcelled as a lieder singer, he has a vast repertory. He has also conducted since the 1970s, written books on both Schubert and Wagner, and has compiled a volume of lieder.

Fischer–Tropsch reaction, conversion of so-called synthesis gas, composed mainly of carbon monoxide and hydrogen, to hydrocarbons through the influence of elevated temperatures and normal or elevated pressures in the presence of a catalyst of magnetic iron oxide.

The process was first used in Germany about 1940 as a method of producing liquid and gaseous hydrocarbon fuels, such as gasoline or gas oil, and is named after the German chemists Franz Fischer and Hans Tropsch. *See also* coal liquefaction; coal gasification.

Fischer von Erlach, Johann Bernhard (baptized July 20, 1656, Graz, Austria—d. April 5, 1723, Vienna), Austrian architect, sculptor, and architectural historian whose Baroque style, a synthesis of Classical, Renaissance, and southern Baroque elements, shaped the tastes of the Habsburg Empire. Fischer's works include the Dreifaltigkeitskirche (1694–1702) and the Kollegienkirche (1696–1707), both in Salzburg, and the Winter Palace of Prince Eugene of Savoy (1695–1711) in Vienna. His *Entwurf einer historischen Architektur* (1721; *A Plan of Civil and Historical Architecture,* 1730) was the first successful comparative study of architecture.

Early career in Italy and Austria. Son of a provincial sculptor and turner, Fischer was trained in his father's workshop. He went to Rome when he was about 16 years old and had the good fortune to enter the studio of the great Baroque sculptor and architect Gian Lorenzo Bernini, where he learned the art of designing and making medals as well. In 1679 and 1682 he received his first known commissions as a medallist. In Rome he came into close contact with the circle of archaeologists and antiquarians around Queen Christina of Sweden, who had converted to Roman Catholicism, abdicated, and then settled in Rome. From that association he acquired considerable knowledge of ancient art and of the scientific methods then beginning to be used in archaeology—methods that formed the basis for his own later archaeological reconstructions. He also studied ancient Roman, Renaissance, and Baroque art and architecture and the architectural theory of those periods. In about 1684 he went to Naples, then under Spanish rule, probably in the service of the Spanish viceroy. He is reported to have been ambitious and even to have acquired considerable wealth.

After some 16 successful years in Italy, Fischer returned to his homeland at an opportune time; after the imperial victories over the Turks, the Habsburg Empire was emerging as a great European power, and the emperor Leopold I wished to emulate King Louis XIV of France by representing his power as an absolute monarch visibly in magnificent buildings. The aristocracy followed his example by erecting splendid palaces, and the Catholic clergy, too, wanted to glorify, in ecclesiastical architecture, the victory over the infidel as well as that over the Reformation. Moreover, the Turks had destroyed many country seats of the aristocracy and had severely damaged the suburbs of Vienna during the siege of 1683. The need for new buildings as well as the quick economic recovery following the victories brought about a great increase in building and a resultant flowering of art and architecture. In 1687 Fischer embarked on a brilliant career as court architect to three successive emperors, Leopold I, Joseph I, and Charles VI, and also designed buildings for the aristocracy and the Archbishop of Salzburg. In 1689 Leopold I appointed him to teach his elder son, Joseph, perspective and the theory and history of architecture. In 1690 Fischer won public recognition with two temporary triumphal arches erected in Vienna to celebrate Joseph's entry into the city after his coronation as king and future ruler of the Holy Roman Empire in Frankfurt am Main. During the next 10 years, Fischer was much sought after as an architect in Vienna and Salzburg and in the Habsburg lands. In 1693 alone he was commissioned to design 14 important buildings; at the same time, he was also producing sculpture and designing for the decorative arts—notably goldsmiths' work.

During these years he created a new type of country house, combining the most important achievements in suburban architecture since the 16th century. He united the ideas of the French Baroque country palace made up of many joined pavilions with that of the classically inspired Renaissance villa, typical of Andrea Palladio, surrounded by low detached wings. By using the powerful curving forms of the Roman Baroque architects, especially Bernini, he gave his villas a more dynamic form. One of their outstanding features is the spacious oval hall in the centre of the plan, as in Schloss Neuwaldegg, near Vienna, and in Schloss Engelhartstetten, in Lower Austria. Fischer's country house designs had a decisive influence on the architects of his time. In a similar synthesis of Roman and French Baroque seasoned with Palladian elements, he also created a new type of town palace characterized by impressive form, structural clarity, and the dynamic tension of its decoration. The Winter Palace of Prince Eugene of Savoy, begun in 1695, and the palace of the ban of Croatia, Count Batthyány, begun in 1699, both in Vienna, are notable examples of this type.

The most important of Fischer's palace designs, however, remained unexecuted: his first project for Schönbrunn Palace on a hill near Vienna. His plan was for an enormous residence befitting the ruler of the Holy Roman Empire; it would have surpassed all previous palaces, even Versailles, by combining and harmonizing features from all of them. Fischer deeply regretted the fact that he was allowed to build only a much smaller palace in the valley below, the Schönbrunn Palace of today, begun in 1696 and later radically altered under Maria Theresa.

As architect to Johann Ernst, Graf von Thun, the archbishop of Salzburg, Fischer displayed his talent in church architecture and town planning. The domes and towers of his churches changed the whole appearance of Salzburg. In their exquisitely proportioned, lofty interiors he tried to achieve a balance between the longitudinal and central schemes, a problem all great church architects had been faced with since Michelangelo's projects for St. Peter's in Rome. All of Fischer's churches have two-towered facades accented by dynamic curves and elegant decoration, but each has its own special quality, determined by its location and by its particular function, as attached to a seminary, a university, or a nunnery. The elegant concave facade of Holy Trinity Church, for example, contrasts to and heightens the effect of the sober front of the adjoining seminary buildings. The almost geometric forms of the University Church surmounted by the undulating forms of its towers crown the university complex, providing a new architectural and symbolic accent to a city dominated by its massive cathedral, as Salzburg had been. Fischer also designed a new facade for the Archbishop's stables and laid out a square in front of it. He changed an old quarry into a summer riding school and built the Archbishop's Summer Residence, Schloss Klesheim, outside Salzburg.

Foreign travels and change of style. At the turn of the 18th century Fischer was at the height of his career. In a visible sign of his success as a court architect, he was raised to the nobility in 1696. The imperial alliance with Prussia, Holland, and England during the War of the Spanish Succession enabled Fischer, in 1704, to visit those countries and to study their architecture, particularly in relation to Palladio. The result was a remarkable change in his architectural style. In 1707 he went to Venice to study Palladian architecture at its source. The result was his development of a new type of "Palladian" palace facade, classical in its proportions but enlivened with richly sculptured decoration. It consists of a central projection accentuated by a giant order and surmounted by a triangular pediment and of relatively unarticulated lateral sections. Its models were English and North German Baroque interpretations of Palladian architecture as well as the works of Palladio himself and of his Italian followers. Fischer's most important achievements in this field are the facades of the Bohemian Chancellery and Trautson Palace, both in Vienna, and of the Clam-Gallas Palace, in Prague, which were imitated by architects all over the Habsburg Empire.

During the first 10 years of the 18th century, however, Fischer designed fewer buildings than in the years before. His time was taken up by his administrative duties as chief inspector of court buildings and his work on a great history of architecture, *Entwurf einer historischen Architektur.* His book, which reveals the wide range of his learning, was the first comparative history of the architecture of all times and all nations; it included significant specimens of Egyptian, Persian, Greek, Roman, Muslim, Indian, and Chinese architecture, illustrated by engravings with explanatory notes. Some of the archaeological reconstructions that ap-

peared in the book were among the best of Fischer's time. At the end of the historical survey he placed his own achievements, which he saw as a logical continuation of the Roman tradition of architecture. The book was published in 1721.

Final Projects. When his second imperial patron, Joseph I, died in 1711, Fischer's position as the principal architect at the Viennese court was no longer uncontested. Many preferred the more pleasing and less demanding architecture of his rival Johann Lucas von Hildebrandt to Fischer's lofty conceptions. Yet he was also able to gain the favour of Charles VI, to whom he dedicated his history of architecture in manuscript in 1712, and to obtain commissions for the greatest architectural undertakings in Vienna—the rebuilding of the imperial palace and the building of the Karlskirche (Church of St. Charles Borromeo).

Charles had vowed to build the Karlskirche as an offering to his patron saint for the city's deliverance from an epidemic of the plague. In its imperial grandeur the building Fischer conceived not only glorified St. Charles but was also a monument to the Emperor himself. In this church he attempted to incorporate and harmonize the main ideas contained in the most important sacred buildings of past and present, beginning with the Temple of Jerusalem and including the Pantheon and St. Peter's in Rome, the Hagia Sophia in Istanbul, and also the Dôme des Invalides in Paris and St. Paul's in London. The relatively independent parts of the building—a pair of Roman triumphal columns, low towers, a high oval dome, a central portico modelled after a Roman temple facade, a transept and presbytery—are harmonized to form a visual unity from whatever point they are seen. The complex formal and symbolic structure of the building is the result of its twofold function. For example, the most striking feature of the church—the pair of giant triumphal columns on either side of the portico—is decorated with spiral reliefs glorifying the life of St. Charles. The pair of columns, however, also alludes to the Emperor's emblem, the "pillars of Hercules." As the last Habsburg king of Spain, Charles had in vain dreamed of establishing a worldwide monarchy by uniting the crowns of Spain and the Empire. Yet the columns of the Karlskirche bear the crown of Spain at their summits, flanked by eagles, the heraldic bird of the Holy Roman Empire.

Fischer did not live to see his masterpiece completed, but his son Joseph Emanuel Fischer von Erlach completed the church with some alterations. He also completed the Imperial Stables and built, according to his father's designs, the Imperial Library, the interior of which was the most imposing library hall of its time.

Assessment. The form of Fischer's architecture is determined by its function. Each single form conveys not only aesthetic value but also a symbolic meaning. Fischer looked to the already existing great works of similar function to find a new, even unique, solution for each task, the best of all possible solutions. All of his works are composed of several different elements or contrasting features that are harmonized in a unified whole and in reference to their natural and artistic environment.

Fischer's contemporaries admired his genius in inaugurating a new artistic period. His strongly individual architectural solutions, however, could neither be taught nor imitated. Only those works that introduced new general types, such as the country houses and palace facades, had a direct influence on the architecture of the period. The universality of his architectural conceptions has been recognized only recently. (Ha.A.)

MAJOR WORKS. *Architecture.* Hall of the Ancestors, Frain Castle (1688–95; Vranov nad Dyji, Czech.); Stratmann Palace (1692–93; Vienna); Schloss Neuwaldegg (1692–97; Vienna); high altar of Pilgrimage Church (1692–1704; Mariazell, Austria); Summer Riding School, north facade, and horse pond of the Archbishop's stables (1690–94; Salzburg, Austria); Schloss Engelhartstetten (Niederweiden; *c.* 1693; Austria); Dreifaltigkeitskirche (Church of the Holy Trinity and Priests' House; 1694–1702; Salzburg); Johannesspital and Johanneskirche (Hospital and Church of St. John the Baptist; before 1695–1704; Salzburg); Winter Palace of Prince Eugene of Savoy (1695–1700; Vienna); Kollegienkirche (University Church; 1696–1707; Salzburg); Schönbrunn Palace (1696–1711; Vienna); Ursulinenkirche (Ursuline Church; 1699–1705; Salzburg); Batthyány Palace (1699–1706; Vienna); Schloss Klesheim (1700–09; near Salzburg); high altar of Franziskanerkirche (Franciscan Church; 1708–09; Salzburg); Bohemian Chancellery (1708–14; Vienna); Trautson Palace (1710–16; Vienna); Clam-Gallas Palace (begun 1713; Prague); Karlskirche (Church of St. Charles Borromeo; begun 1715; Vienna); Elector's Chapel in Cathedral (1715–21; Wrocław, Pol.); Nationalbibliothek (Imperial Library; designed in 1716, built 1723–37 by Fischer's son in Vienna); Hofstallungen (Imperial Stables; 1719–23; Vienna).

Writings. Entwurf einer historischen Architektur (1721; *A Plan of Civil and Historical Architecture,* 1730).

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Fischhof, Adolf (b. Dec. 8, 1816, Alt-Ofen, Hung.—d. March 23, 1893, Emmersdorf, Austria), Austrian political theorist, one of the principal leaders of the Viennese revolution of 1848.

As a young assistant physician, Fischhof was the first speaker to address the crowd assembled outside the building of the Austrian estates in Vienna on the morning of March 13, 1848—the first day of the revolution. Rising in a few days to a position of leadership in the Vienna student movement, he was subsequently (May 1848) elected president of the Executive Committee of Security, the ruling force in the Austrian capital through the summer of 1848. A leading member of the short-lived parliaments at Vienna and Kremsier (now Kroměříž in Czechoslovakia), he played a major role in the drafting of the ill-fated Kremsier constitution. With the final suppression of the revolution (March 1849), he was arrested and briefly imprisoned. Although his full civil rights were restored by a political amnesty in 1867, he refused to reenter public life, maintaining a voluntary exile at Emmersdorf, where he led the quiet life of a political theoretician. He had sketched a dualistic plan for the Habsburg monarchy six years before the 1867 *Ausgleich* (the compromise allowing the Magyars to dominate Hungary and the German element to rule the rest of the Austrian territories) and later proposed a scheme of federalization for the Austrian half of the empire that included provisions for a national curial system and "international language laws." These theories of imperial reorganization exerted considerable influence in their day, especially in Czech national circles.

fiscus (Latin: "basket"), also called PURSE, the Roman emperor's treasury (where money was stored in baskets), as opposed to the public treasury (*aerarium*). It drew money primarily from revenues of the imperial provinces, forfeited property, and produce of unclaimed lands.

Vespasian created the *fiscus Alexandrinus* and *fiscus Asiaticus* to receive Egyptian and Asian revenues, formerly directed to the *aerarium.* The *fiscus* thereafter became independent of the *aerarium* and controlled most of the income of the empire. The *fiscus* supplied funds for the army and fleet, official salaries, and postal subsidies.

fish, any of a variety of cold-blooded, vertebrate animals found in the fresh and salt waters of the world. Living species range from the primitive, jawless lampreys and hagfishes through the cartilaginous sharks, skates, and rays to the abundant and diverse bony fishes.

A brief treatment of fishes follows. For full treatment, *see* MACROPAEDIA: Fishes.

Fishes are enormously varied in shape, size, and colour. Their bodies are generally fusiform (tapered to each end), and they can range in length from 10 millimetres (0.4 inch) to more than 20 metres (60 feet). Most fishes that inhabit surface or midwater regions are streamlined or flattened side-to-side, while most bottom-dwellers are flattened top-to-bottom. Tropical species are often brightly coloured, and others may have a drab appearance so as to blend in with their surrounding environment. Most fishes have paired fins, and their skins are covered with either bony or toothlike (placoid) scales; some have bony plates embedded in the skin or lack scales. Respiration is generally through gills. Most bony fish have a swim bladder, a gas-filled organ used to adjust swimming depth. In a few species the swim bladder has evolved into a lunglike respiratory organ, enabling these fishes to breathe air. Most fish reproduce by laying eggs, which may be fertilized externally or internally. Some species are hermaphroditic, although examples of fishes that are self-fertilizing are rare. A few fishes bear live young. The mortality rate of eggs and hatching is generally very high; only a few individuals reach adulthood out of a batch of hundreds or even millions of eggs.

The central nervous system of fishes—the brain and spinal cord—controls body activity. Most fishes have a well-developed sense of smell; the olfactory, or nasal, organ is located on the dorsal surface of the snout. Many fishes have taste buds in their mouth cavities. Most can see well, and experiments have shown that many fishes, especially those that swim near the surface, have colour vision. Hearing organs are located within the skull, on either side of the brain. The lateral-line system, consisting of highly innervated fluid-filled canals that run the length of the body, detects vibrations in the water current.

Fish first appeared more than 450,000,000 years ago. Since that time they have evolved to fit almost all freshwater and saltwater habitats.

Fish, Hamilton (b. Aug. 3, 1808, New York City—d. Sept. 6, 1893, New York City), U.S. secretary of state (1869–77) who skillfully promoted peaceful arbitration of explosive situations with Great Britain and Latin America.

A lawyer involved in New York Whig politics, Fish served in the U.S. Senate from 1851 to 1857, when he transferred his allegiance to the newly formed Republican Party. During the Civil War (1861–65) he became chairman of the Union Defense Committee to expedite the supply of arms and troops and later served as a War Department commissioner to investigate and alleviate the allegedly poor conditions of Federal prisoners in the South.

In March 1869 Pres. Ulysses S. Grant appointed Fish head of the State Department, in which position he served for eight years. His entry into office coincided with a crisis between the United States and Great Britain over the "Alabama" claims, which arose from the Civil War depredations of the British-built Confederate cruiser "Alabama." By tactful management of Congress on the one side and

of the British government on the other, Fish calmed the quarrel. Cooperating with British diplomats, he brought about the conference that drafted the Treaty of Washington (May 1871), providing for the first major international arbitration of modern history.

Fish
By courtesy of the Library of Congress, Washington, D.C.

At the same time, Fish conducted a contest with American interventionists who wished to land troops in Cuba in order to help rebels attempting an overthrow of Spanish rule. Their pressure became almost irresistible when in 1873 Spanish authorities seized on the high seas the ship *Virginius,* belonging to the Cuban revolutionary committee in New York, and shot 53 Americans and Britons. Fish managed to maintain peace, however, and Spain restored the *Virginius* with apologies and indemnities.

As the most experienced and most respected member of Grant's Cabinet, Fish helped to counteract the period's low political standards by leading the element of Grant's inner circle who laboured to keep the president vigilant against trickery and graft, to save him from improper appointment of old friends, and to prevent gross violations of the civil liberties of blacks. Returning to private life in New York in 1877, Fish devoted his last years to public-spirited activities, especially to the development of Columbia University.

BIBLIOGRAPHY. An authoritative biography is Allan Nevins, *Hamilton Fish: The Inner History of the Grant Administration,* rev. ed., 2 vol. (1957).

fish duck (bird): *see* merganser.

fish farming: *see* aquaculture.

fish hawk (bird): *see* osprey.

fish louse, also called CARP LOUSE, plural FISH LICE, or CARP LICE, any member of the crustacean subclass Branchiura, a group of parasites of migratory marine and freshwater fishes. Of the approximately 120 known species, most belong to the genus *Argulus.* The fish louse has a very distinctive oval-shaped, flattened body formed by a broad carapace. Other notable physical features include compound eyes, a pair of large suckers, four pairs of branched thoracic swimming limbs, and a tiny unsegmented abdomen. The body measures about 10 to 30 mm (0.4 to 1.2 inches) long. Most fish lice are effective swimmers, but many species tend to move through the water by a somersaulting action. They attach themselves to the skin of the host with their strong suckers, and they feed on its blood or mucus by using modified disklike piercing and sucking mouthparts. Unlike many related parasitic crustaceans, they deposit their eggs rather than carry them attached to the body.

fish meal, coarsely ground powder made from the cooked flesh of fish. Though formerly important as a fertilizer, fish meal is now primarily used in animal feed—especially for poultry, swine, mink, farm-raised fish, and pets. Certain species of oily fish, such as menhaden, anchovy, herring, and pilchard, are the main source of fish meal and its companion product, fish oil.

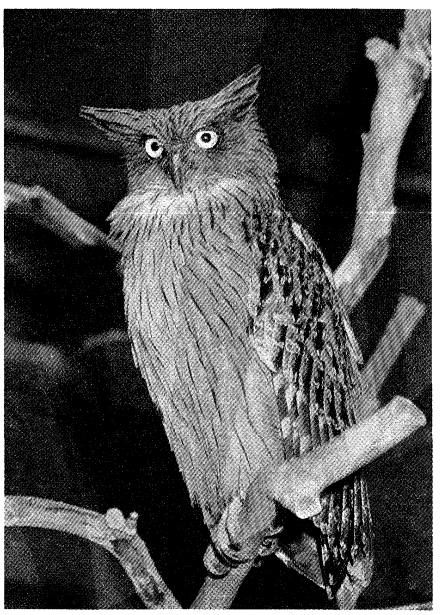
To be processed into meal, chopped fish is forced by screw conveyor through long steam cookers. The cooked mash is then pressed to remove water and oil (which quickly spoils during storage). The pressed fish cakes are dried by hot air, yielding a meal that is high in vitamin B_{12} and contains as much as 50 percent protein.

fish oil, fatty oil from the bodies of fishes, used in the manufacture of many products, such as margarine, cooking oil, cosmetics, caulking compounds, paints, industrial coatings, lubricants, water repellents, soaps, and candles. It is also used in the tanning of leather, the manufacture of rubber, and the production of chemicals used for making synthetic wax. Anchovy, menhaden, herring, and pilchard are the chief sources of fish oil.

Oil and water are pressed from cooked fish during the manufacture of fish meal and are separated by centrifuge. The oil is further purified by centrifuge before storage.

Fish oils are high in unsaturated lipids, which are reported to reduce blood cholesterol levels and help prevent excessive fat deposits in the arteries. Fish liver oils (such as cod-liver oil) were once an important source of vitamins A and D, which are now produced synthetically at lower cost. *See also* cod-liver oil.

fish owl, also called FISHING OWL, any of several species of owls of the family Strigidae (order Strigiformes). They live near water and eat fish as well as small mammals and birds. The several Asian species are of the genus *Ketupa;* the several African species are of the genus *Scotopelia.*



Fish owl (*Ketupa*)
Kenneth W. Fink from Root Resources—EB Inc.

The brown fish owl (*K. zeylonensis*) ranges from the eastern Mediterranean to Taiwan and Japan. Pel's fishing owl (*S. peli*) ranges over most of sub-Saharan Africa. It is about 50 to 60 cm (20 to 24 inches) long, brown above with barring, reddish yellow below with spots and V markings. It has a heavily feathered, round head without ear tufts.

fish poisoning, illness in humans resulting from the eating of varieties of poisonous fishes.

Ciguatera poisoning is one of the most common forms of fish poisoning in the Caribbean. It is caused by fishes that in other parts of the world constitute food items (*e.g.,* sea bass, snapper). The conditions under which these fishes become toxic in the Caribbean waters are not clear. Symptoms, which may develop immediately after eating or may be delayed for as long as 30 hours, include nausea, vomiting, diarrhea, weakness, numbness, muscle pain, and general itchiness. Death (occurring in less than 10 percent of the cases) is usually caused by respiratory paralysis.

Tetraodon poisoning is caused by the ingestion of certain species of pufferlike fish found in Far Eastern waters. These fishes contain a potent, heat-stable toxin that affects the human nervous system, producing symptoms within minutes. Dizziness and tingling about the lips and tongue may soon be followed by muscular incoordination, convulsions, and respiratory paralysis. More than 60 percent of the cases are fatal within a few hours. Survival for more than 24 hours is a good sign of eventual recovery.

Scombroid poisoning comes from consumption of tuna, skipjack, bonito, and other fish in the mackerel family that have lost their freshness; bacteria in the fish act on histidine, an amino acid that is a normal constituent of the fish protein, to produce the substance that is responsible for the symptoms: nausea, vomiting, headache, difficulty in swallowing, thirst, and itchiness. The symptoms usually subside within 12 hours.

Other varieties of fish that may cause poisoning in humans include the moray eel and certain species of sharks and freshwater minnows. *See also* shellfish poisoning.

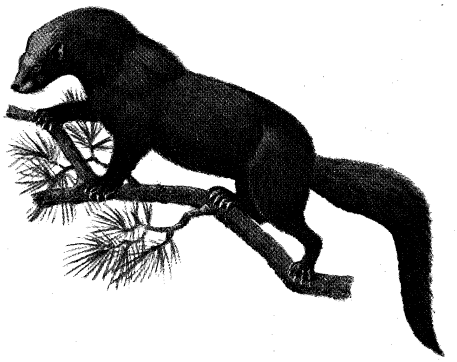
Fish River, Afrikaans VISRIVIER, stream in southern Namibia. It rises in Namaqualand and flows south across the Great Namaqualand plateau, where it cuts a spectacular gorge 1,000 to 2,300 feet (300 to 700 m) deep, to empty into the Orange River. It is about 375 miles (600 km) long and is intermittent.

Fish River, Great (South Africa): *see* Great Fish River.

fish sauce, in Southeast Asian cookery, a liquid seasoning prepared by fermenting freshwater or saltwater fish with salt in large vats. After a few months time, the resulting brownish, protein-rich liquid is drawn off and bottled. It is sometimes allowed to mature in the sun in glass or earthenware bottles before use. Called *nam pla* in Thailand, *nuoc nam* in Vietnam, *patis* in the Philippines, *tuk trey* in Cambodia, *ngan-pya-ye* in Myanmar (Burma), and *ketjap ikan* in Indonesia, fish sauce is as ubiquitious as soy sauce in the region, being especially important in Thailand and Vietnam. The oyster sauce of Chinese cookery is a similar preparation, used especially in Cantonese dishes.

fish-skin disease (human skin disorder): *see* ichthyosis.

fisher, also called FISHER MARTEN, FISHER CAT, PENNANT'S MARTEN, PENNANT'S CAT, BIG MARTEN, BLACK FOX, BLACK CAT, or PEKAN (species *Martes pennanti*), rare North American carnivore of northern forests, trapped for its valuable brownish black fur (especially fine in the female). It is a member of the weasel family (Mustelidae). The fisher has a weaselike body, bushy tail, tapered muzzle, and low, rounded ears. Adults are usually 50–63 cm (20–25 inches) long, excluding the 33–42-centimetre tail, and weigh 1.4–6.8 kg (3–15 pounds). Males are larger and heavier than the females. The fisher hunts both on the ground and in trees, attacking various rodents (including porcupines) and other animals. Its



Fisher (*Martes pennanti*)
Painting by Donald C. Meighan

diet also consists of fruits and sometimes nuts. A litter contains one to five young, born after a gestation period of 338–358 days, including a delay before implantation of the fertilized egg in the wall of the uterus.

Fisher, Andrew (b. Aug. 29, 1862, Crosshouse, Ayrshire, Scot.—d. Oct. 22, 1928, London, Eng.), three-time Labor prime minister of Australia (1908–09, 1910–13, 1914–15) who sponsored important legislation in the fields of social welfare, economic development, labour relations, and defense.

Fisher emigrated from England to Queensland in 1885, worked as a coal miner and union leader, and was elected to the state legislature in 1893. In 1901 he served in the first federal Parliament and, briefly, in the first Labor government in 1904, assuming party leadership in 1907. His second term as prime minister was a fruitful one, advancing on the program of his predecessor, Alfred Deakin. Legislation was passed that created a commonwealth bank and a land tax to break up large estates, extended the Navigation Act to protect Australian shipping, and started a national navy. Fisher also brought about the provision of maternity allowances, the extension of judicial arbitration for labour disputes, and the beginning of a transcontinental railroad.

On reelection in 1914, Fisher led Australia into World War I, having pledged his country's support for Great Britain to "the last man and the last shilling" in a famous election campaign declaration. Strain imposed by the war, however, forced him to resign his ministry in 1915, after which he served as Australian high commissioner in London from 1916 to 1921.

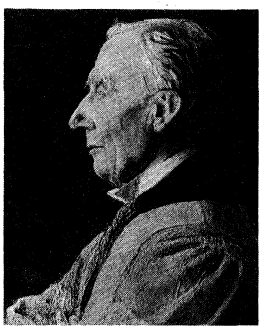
Fisher, Bud, byname of HARRY CONWAY FISHER (b. April 3, 1884/85, Chicago, Ill., U.S.—d. Sept. 7, 1954, New York, N.Y.), American cartoonist and creator of the comic strip "Mutt and Jeff."

After attending the University of Chicago, Fisher worked as a journalist in San Francisco, where for the San Francisco *Chronicle* he originated "Mr. Mutt" in 1907. Soon he added Jeff, the short one of the pair and usually the loser in their encounters. Originally a sports cartoonist, Fisher gave his strip a racetrack flavour, but it soon became a general comic. He moved to New York in 1909. During World War I he was an artist with the Canadian forces in London. A racehorse enthusiast, he at one time owned 50 Thoroughbreds. From 1932 on, the strip was drawn mostly (wholly after Fisher's death) by ghost artist Al Smith (Albert Schmidt; 1902–86).

Fisher, Herbert Albert Laurens (b. March 21, 1865, London, Eng.—d. April 18, 1940, London), British historian, educator, government official, and author who was an influential representative of the historical liberalism of his time.

Fisher became a fellow of New College, Oxford, in 1888 and tutor and lecturer in modern history in 1891. While at New College he wrote his two-volume *Medieval Empire* (1898), a study of the Holy Roman Empire influenced by the legal historian F.W. Maitland. He was appointed vice chancellor of the University of Sheffield, Yorkshire, in 1912.

Between 1912 and 1926, Fisher was active in the government in numerous capacities and as member of Parliament (1916–26) for the Liberal Party. As president of the Board of Education (1916–22), he was responsible for the education bill of 1918, a significant contribution to the development of secondary schools in Britain. Among other measures, it prohibited pupils from leaving school until 14 and abolished the exemptions for the older students that had enabled them to attend school part-time. In 1925 he was elected warden of



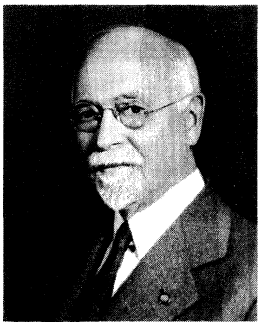
Herbert Albert Laurens Fisher, detail of an oil painting by an unknown artist
By courtesy of the Warden and Fellows, New College, Oxford; photograph, Thomas Photo

New College, Oxford, where he remained until his death. Among Fisher's major works are *The Commonweal* (1924), a statement of the Liberal idea of individual responsibility to the state and a defense of capitalism, and *The History of Europe,* 3 vol. (1935).

Fisher, Irving (b. Feb. 27, 1867, Saugerties, N.Y., U.S.—d. April 29, 1947, New Haven, Conn.), American economist best known for his work in the field of capital theory. He also made considerable contributions to the development of modern monetary theory.

Educated at Yale University (B.A., 1888; Ph.D., 1891), Fisher taught mathematics (1892–95) and economics (1895–1935) there. In *The Purchasing Power of Money* (1911), he developed the modern concept of the relationship between changes in the quantity of money and changes in the general level of prices. Including speeches, letters to newspapers, articles, reports to governmental bodies, circulars, and books, Fisher prepared, from 1912 to 1935, 331 documents expounding his plan for the "compensated dollar"—a dollar of constant purchasing power, sometimes referred to as the commodity dollar. Rather than defining the unit of money in terms of a given weight of gold, Fisher proposed to define the dollar in terms of a given value of gold to be determined by an index number of commodity prices of a given set of goods.

Fisher's crusading spirit led him into many



Irving Fisher
By courtesy of Yale University Archives, Yale University Library

fields of reform, including health, eugenics, conservation, prohibition, and the League of Nations. He also proved himself an able businessman. He devised a card-index file system, put it on the market in 1910, and made a fortune. He was a major figure behind the formation of Remington Rand, Inc. (1926), and served as a director of that corporation until his death.

Among more than two dozen books, his most important, in addition to *Purchasing Power,* were *Mathematical Investigations in the Theory of Value and Prices* (1892), *The Nature of Capital and Income* (1906), *The Making of Index Numbers* (1922), *The Theory of Interest* (1930), and *Booms and Depressions* (1932).

Fisher, Saint John, byname JOHN OF ROCHESTER (b. 1469, Beverley, Yorkshire, Eng.—d. June 22, 1535, London; canonized May 19, 1935; feast day July 9), English humanist, martyr, and prelate, who, devoted to the pope and to the Roman Catholic church, resisted King Henry VIII of England by refusing to recognize royal supremacy and the abolition of papal jurisdiction over the English church.

Ordained priest in 1491, he won the patronage of Lady Margaret Beaufort, mother of

St. John Fisher, drawing by Hans Holbein the Younger; in Windsor Castle
Copyright reserved

King Henry VII of England. He became her confessor in 1497 and persuaded her to found Christ's College (1505) and St. John's College at Cambridge. After her death in 1509, he took over at St. John's, effecting its final establishment in 1511. In 1504 he was appointed chancellor of Cambridge and bishop of Rochester, Kent.

With the advent of Lutheranism in the 1520s, Fisher began his work as a controversialist. His books in Latin against Lutheranism and allied doctrines considered heretical by the Roman Catholic church gave him a European reputation as a theologian. In the House of Lords, he strongly opposed any state interference in church affairs, urging that the church should reform itself. When the validity of the marriage between Henry VIII and Catherine of Aragon was first openly questioned in 1527, Henry and Cardinal Wolsey consulted Fisher; he incurred the king's wrath when he defended Catherine in 1529, later publishing his defense and preaching in London on the queen's behalf. In 1531 he vehemently opposed the granting to Henry of the title "Supreme Head of the Church and Clergy of England" and subsequently repudiated the Supremacy Act of 1534.

In March 1534 the Act of Succession declared Henry's marriage to Catherine void and that with Anne Boleyn valid. On the following April 13 Fisher and Sir Thomas More

jointly refused to take the oath required by the Act on the grounds that, while willing to accept the succession as a proper matter for Parliament, they could not accept the rest of the Act, especially because it repudiated papal authority. They were imprisoned in the Tower of London; Fisher was already seriously ill.

The passing of the Supremacy and Treason acts at the end of the year made denial of the royal titles treasonable. On May 20, 1535, Pope Paul III created Fisher a cardinal, which enraged Henry VIII and destroyed all hope for Fisher. He was called several times before councillors but refused to speak about the supremacy. In a conversation that was disguised as privileged, the solicitor general, Sir Richard Rich, reportedly tricked Fisher into confiding that the king was not and could not be supreme head of the Church of England. He was tried on June 17, condemned for treason, and executed on Tower Hill. Biographies of Fisher include *Saint John Fisher* (1956) by E.E. Reynolds and *The Works and Days of John Fisher* (1967) by Edward Surtz.

Fisher (of Kilverstone), John Arbuthnot Fisher, 1st Baron (b. Jan. 25, 1841, Ceylon [now Sri Lanka]—d. July 10, 1920, London), British admiral and first sea lord whose reforms between 1904 and 1910 ensured the dominance of the Royal Navy during World War I.

Fisher entered the navy at age 13. He was a midshipman in the Crimean War and in China (1859–60), where he took part in the capture of Canton. Promoted to captain (1874), he commanded various ships and the gunnery school and took a prominent part in the bombardment of Alexandria (1882) as commander of the battleship *Inflexible.*

Fisher held the post of director of naval ordnance and torpedoes for five years and was appointed to the Admiralty board as third sea lord and controller of the navy in 1892; in this post he was responsible for the material efficiency of the fleet. Knighted in 1894, he became second sea lord in 1902 and first sea lord in 1904. During his tenure as first sea lord Fisher executed changes in the organization of the fleet, the administration of dockyards, ship construction, the development of submarines, the conversion of the navy's ships from the use of coal to that of oil, and gunnery development. To counter the rapid expansion of the German navy, he reinforced the British naval forces in home waters and, by scrapping obsolete ships, released men to provide the nucleus of crews for ships in reserve. He was also responsible for the creation of the battleship *Dreadnought,* the prototype of the "all-big-gun ship" that revolutionized naval construction and was immediately copied by Germany. When the competition with the German navy became acute, he persuaded the British government to begin the construction of eight new battleships. He also created the lightly armoured *Invincible*-type battle cruisers, which carried heavy armaments but relied on speed for their protection. In war these proved, however, to be outclassed by the heavily armoured German battle cruisers.

Created Baron Fisher of Kilverstone (1909), he retired in January 1910 and remained in retirement until October 1914, when he was recalled as first sea lord to serve under the first lord of the Admiralty, Winston Churchill. After the defeat of a British squadron by the German admiral Graf von Spee's forces at the Battle of Coronel, off the coast of Chile, Fisher sent out the battle cruisers *Invincible* and *Inflexible,* which destroyed Spee's squadron in the Battle of the Falkland Islands (Dec. 8, 1914).

Fisher's career ended over his ambivalent attitude toward the Churchill-backed plan for a naval expedition through the Dardanelles, which was intended to land a force and capture the Turkish capital. When the campaign in the Dardanelles faltered, Fisher urged that it be abandoned, and when his views received no support from the British leadership, he resigned on May 15, 1915, in protest against Churchill's conduct of the Admiralty. He then wrote two volumes of memoirs, *Memories and Records,* published in 1919.

Fisher, Sir R(onald) A(ylmer) (b. Feb. 17, 1890, London—d. July 29, 1962, Adelaide, Australia), British statistician and geneticist who pioneered the application of statistical procedures to the design of scientific experiments.

Fisher graduated from the University of Cambridge in 1912. In 1919 he became statistician for the Rothamsted Experimental Station near Harpenden, Hertfordshire, and did statistical work associated with the plant-breeding experiments there. At Rothamsted he developed the analysis of variance, a technique for varying different factors in an experiment and determining the probability of their causing different experimental results. His *Statistical Methods for Research Workers* (1925) remained in print for more than 50 years. His breeding experiments led to theories about gene dominance and fitness, published in *The Genetical Theory of Natural Selection* (1930). In 1933 Fisher became Galton professor of eugenics at the University of London. From 1943 to 1957 he was Balfour professor of genetics at the University of Cambridge. He investigated the linkage of genes for different traits and developed methods of multivariate analysis to deal with such questions.

At Rothamsted Fisher sought ways of designing plant-breeding experiments so as to provide more amounts of useful information with less investments of time, effort, and money. One major problem he encountered in his work was that of the inadvertently biased selection of materials used in experiments, which resulted in inaccurate or misleading experimental data. To avoid such bias, Fisher introduced the principle of randomization. This principle states that before an effect in an experiment can be ascribed to a given cause or treatment independently of other causes or treatments, the experiment must be repeated on a number of control units of the material and that all units of material used in the experiments must be randomly selected samples from the whole population they are intended to represent. In this way, random, or chance, selection is used to diminish the effects of variability in experimental materials.

An even more important achievement was Fisher's origination of the concept of the analysis of variance. This is a statistical procedure used to design experiments that answer several questions at once, instead of just one. Fisher's principal idea was to arrange an experiment as a set of partititoned subexperiments that differ from each other in one or several of the factors or treatments applied in them. The subexperiments are designed in such a way as to permit differences in their outcome to be attributed to the different factors or combinations of factors by means of statistical analysis. This was a notable advance over the prevailing scientific method of varying only one factor at a time in an experiment, which was a relatively inefficient procedure. It was later found that the problems of bias and multivariate analysis that Fisher had solved in his plant-breeding research are encountered in a great deal of other experimental work in biology, and indeed in many other scientific fields as well.

Fisher summed up his statistical work in *Statistical Methods and Scientific Inference* (1956). He was knighted in 1952 and spent the last years of his life conducting research in Australia.

fisherman's ring, the pope's signet ring; it shows St. Peter as a fisherman and has the reigning pope's name inscribed around the border. Used since the 13th century as a seal for private letters and since the 15th century for papal briefs, it is one of two papal seals, the other being the leaden bull (bulla). The ring, which each newly elected pope receives, is publicly broken after his death.

fishery, harvesting of fish, shellfish, and sea mammals as a commercial enterprise, or the location or season of commercial fishing. Fisheries range from small family operations relying on traditional fishing methods to large corporations using large fleets and the most advanced technology. Small-scale fishery is ordinarily conducted in waters relatively close to a home port, but factory ships that are equipped to process the catch on board often go thousands of miles from home. *See* commercial fishing.

Fish constitutes less than 1 percent of the world's diet, and the various hazards of the industry militate against much growth. Weather, environmental problems such as pollution, the unpredictability and high perishability of the harvest, and the high costs of gear and equipment all discourage the expansion of the industry. Of the world's total sea harvest, about one-fourth is provided by the herring family (sardine, anchovy, menhaden). The cod family (haddock, hake, pollock, cusk, ocean perch) accounts for about one-sixth. Another one-tenth is made up of tuna, bonita, and mackerel; and the rest of the harvest includes salmon, flounder, halibut, sole, the shellfish, and trout and other freshwater fish, including carp and catfish.

Among the nations with the largest harvests are Peru, the United States, the Soviet Union, China, Japan, India, and South Korea.

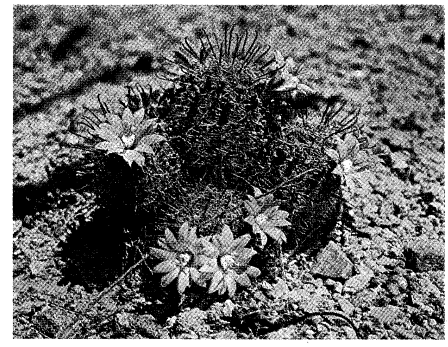
For international statistical data on national fishery industries and trade, *see* BRITANNICA WORLD DATA ANNUAL.

Fishes (constellation): *see* Pisces.

fishhook cactus, any hook-spined species of the family Cactaceae, especially small cacti of the genus *Mammillaria* but also including *Ancistrocactus, Sclerocactus,* and *Ferocactus* (*see* barrel cactus).

Mammillaria, native from southwestern North America to the Caribbean, Colombia, and Venezuela, is a large and complex genus of about 150 species. Its species are favourites for pot culture and are commonly grown outdoors in warmer climates. *Mammillaria* species are small globose to cylindroid plants. The tubercles (projections) are arranged in definite spiral rows and are not connected into ribs. Areoles (specialized buds) on the tips of the tubercles bear spines.

Many small flowers, in many hues, are borne between tubercles in rings around the plant below the tip. In some species the petaloids are striped with a different colour or a darker shade. Some species, such as *M. saboae,* have showy flowers larger than the plant. Several species, including old-woman cactus (*M.*



Fishhook cactus (*Mammillaria microcarpa*)
Jack Dermid

hahniana), are valued for their white woolly appearance. The columnar *M. guerreronis* reaches 70 centimetres (about 28 inches) long and 6 cm wide. The tiny species, as in other genera, shrink into the soil in dry seasons, with only a few spines left visible.

fishing, also called ANGLING, the sport of catching fish, freshwater or saltwater, typically with rod, line, and hook. Like hunting, fishing originated as a means of providing food for survival. Fishing as a sport, however, is of considerable antiquity. An Egyptian angling scene of about 2000 BC shows figures fishing with rod and line and with nets. A Chinese account of about the 4th century BC refers to fishing with a silk line, a hook made from a needle, and a bamboo rod, with cooked rice as bait. References to fishing are also found in ancient Greek, Assyrian, Roman, and Jewish writings.

Today, fishing, often called sport fishing to distinguish it from commercial fishing, is, despite the growth of towns and the increase of pollution in many sources, one of man's principal relaxations and in is many countries the most popular participant sport.

The problems of the modern angler are still those of his ancestor: where to find fish, how to approach them, and what sort of bait to use. The angler must understand wind and weather. Fishing remains what it has always been, a problem in applied natural history.

Early history. The history of angling is in large part the history of tackle, as the equipment for fishing is called.

One of man's earliest tools was the predecessor of the fishhook, a gorge: a piece of wood, bone, or stone an inch (2.5 centimetres) or so in length, pointed at both ends and secured off-centre to the line. The gorge was covered with some kind of bait. When a fish swallowed the gorge, a pull on the line wedged it across the gullet of the fish, which could then be pulled in.

With the coming of the use of metals, a hook was one of the first tools made. This was attached to a handline of animal or vegetable material, a method that is efficient only when used from a boat. The practice of attaching the line in turn to a rod, at first probably a stick or tree branch, made it possible to fish from the bank or shore and even to reach over vegetation bordering the water.

For thousands of years, the fishing rod remained short, not more than a few feet (a metre or so) in length. The earliest reference to a longer, jointed rod is from Roman times, about the 4th century AD. At that time also, Aelian wrote of Macedonians catching trout on artificial flies and described how each fly was dressed (made). The rod they used was only 6 feet (1.8 metres) long and the line the same length, so that the method used was probably dapping, gently laying the bait on the surface of the water.

The history of the sport in England began with the printing by Wynkyn de Worde of the *Treatyse of Fysshynge With an Angle* (1496) as a part of the second edition of *The Boke of St. Albans*, which had originally dealt only with hunting. The book was evidently based on earlier continental treatises dating to the 14th century. The artificial flies described in the *Treatyse* are surprisingly modern (six of the dozen mentioned are still in use). The rods are 18–22 feet long with a line of plaited horsehair tied to one end.

The first period of great improvement came about the mid-17th century, when Izaak Walton and Charles Cotton were writing the classic *The Compleat Angler* and Col. Robert Venables and Thomas Barker were describing new tackle and methods of fishing. About this time some unknown angler attached a wire loop or ring at the tip end of the rod, which allowed a running line, useful for both casting and playing a hooked fish. Barker in 1667 mentions a salmon-fishing line of 26 yards. What was obviously needed was a means of taking up and holding such lengths, and this led to the invention of the reel.

Experiments with material for the line led to the use of a gut string (mentioned by the diarist Samuel Pepys in 1667) and of a lute string (noted by Venables in 1676). The use of a landing hook, now called a gaff, for lifting large hooked fish from the water was noted by Barker in 1667. Improved methods of fishhook making were devised in the 1650s by Charles Kirby, who later invented the Kirby bend, a distinctive shape of hook with offset point that is still in common use worldwide. Kirby and his fellow hook makers, who were also needle makers, were dispersed from their shops near Old London Bridge by the Plague and the Great Fire of London in 1666, and they ultimately established factories in Redditch around 1730.

The first rudimentary reel had consisted of a wooden spool with a metal ring that fitted over the angler's thumb. By 1770 a rod with guides for the line along its length and a reel was in common use. The first true reel was a geared multiplying reel attached under the rod, in which one turn of the handle moved the spool through several revolutions. Never popular in Great Britain, such reels became the prototype of the bait-casting reel as devised by two Kentucky watchmakers in the early 1800s. The predominant British reel was called the Nottingham reel, based on the wooden lace bobbin devised in that ancient lacemaking town. It was a wide-drum, ungeared, very free-running reel, ideal for allowing line and bait or lure to float downstream with the current and suitable for casting lures for predatory fish in various kinds of sea fishing. It was influential on the design of fly-fishing reels.

Rods were also improved as heavy native woods were superseded by straight-grained, tough, elastic woods, such as lancewood and greenheart from South America and the West Indies, and by bamboo. By the end of the 18th century a technique had been developed in which several strips of bamboo were glued together, retaining the strength and pliancy of the cane but greatly reducing the thickness. Between 1865 and 1870 complete hexagonal rods, made by laminating six triangular strips of bamboo, were produced on both sides of the Atlantic.

From 1880 tackle design evolved rapidly. Horsehair for the fishing line was replaced by silk covered with coats of oxidized linseed oil. Such lines were easily cast and sank heavily if ungreased, or floated if greased. The average angler could cast three times farther with these lines, and such methods as dry-fly and wet-fly fishing became possible. In the Nottingham reel, ebonite (a hard rubber) or metal replaced wood, so that it became even more free-spinning. Since the reel revolved faster than the line runoff, a considerable tangle (called an overrun in Britain, a backlash in the U.S.) could result. Governors were devised to prevent this. In 1896 William Shakespeare, of Kalamazoo, Mich., devised the level-wind, which automatically spread the line evenly as it was wound on the reel. In 1880 the firm of Malloch, in Scotland, introduced the first turntable reel, which had one side of the spool open. During casting, the reel was turned 90°, bringing it in line with rod guides, so that the line slipped easily off the end of the spool. For line recovery, the spool was turned back 90°. The reel was used mainly for casting heavy lures for salmon fishing, but it influenced the reel invented by the English textile magnate Holden Illingworth, which the British called a fixed-spool reel and the Americans a spinning reel. In this kind of reel, the spool permanently faces up the rod and the line peels off in the cast as with the Malloch reel.

In the 20th century, rods became shorter and lighter without sacrificing strength. Split bamboo was largely replaced by fibre glass and finally by carbon fibre as rod material. After the 1930s the fixed-spool reel was taken up in Europe and, after World War II, in North America and the rest of the world, creating a boom in spin casting. Nylon monofilament line was developed in the late 1930s and became dominant after World War II, as did braided lines in other synthetic materials. Plastic coverings for fly lines allowed them to float or sink without greasing. Plastic also became the dominant material for artificial casting lures.

Methods. The four basic methods of angling are bait fishing, fly fishing, bait casting or spinning, and trolling. All are used in both freshwater and saltwater angling, but the first and last are most commonly used in saltwater.

Bait fishing, commonly called still fishing in North America and bottom fishing in England, is certainly the oldest and most universally used method. In English freshwater fishing it is used to catch what are called coarse fish: bream, barbel, tench, dace, and grayling (*i.e.*, all fish but game fish, those that provide the angler with sport by the way they fight capture). A bait is impaled on the hook, which is set by the angler when the fish swallows it. Common baits are worms, the maggots of certain flies, small fish, bread paste, and cheese. The bait may be fished on the bottom, weighted down with what is called a ledger in England and a sinker in the United States, usually of lead, or it may be fished at any desired depth. A buoyant object, called a float in England and a bobber in the United States, made of quill, cork, wood, plastic, or a combination, suspends the bait at the desired depth. In order to attract fish, what is called ground bait by the British and chum by Americans may be thrown in the water. Chum is commonly soaked bread or meal, to which some of the bait being used on the hook may be added.

Rods used are usually 10 to 15 feet long, with a fixed-spool reel and monofilament line of 1- to 6-pound (450- to 2,700-gram) strength.

In North America, where most of the fish are predatory, still fishing is practiced with less specialized tackle, the traditional rod being a long cane pole. Freshwater fish taken by this method include bluegills, crappies, perch, and catfish, as well as bass and walleyes.

Ice fishing through holes cut in frozen lakes is particularly popular in the northeastern United States and the Great Lakes–St. Lawrence Valley region of the U.S. and Canada. Equipment is commonly a three-foot rod with a simple reel or a cleatlike device to hold nonfreezing monofilament line and a tilt or tip-up to signal when the fish has taken the bait. Fish taken vary from pan fish (crappies, bluegills, and perch) to larger game fish (pike, walleye, bass, and lake trout). Ice fishing became increasingly popular in the 20th century in Scandinavian and other European countries where heavy freezing permits it.

Fly fishing is considered by those who use the method to be the highest form of angling, and dry-fly fishermen consider themselves to be the true aristocracy of angling. Fly fishing involved originally the use of live flies, and its art was to lay the fly as lightly and obtrusively near a fish, usually trout, as possible. Artificial flies came into use early, however, and live flies are now only used for dapping, in the periods when the winged forms are emerging from their aquatic nymph stage. Wet-fly fishermen present flies underwater. Later variants include nymph fishing, in which the artificial fly resembles the waterborne form of the insect, and streamer fishing, in which the streamer gives to the fly a fishlike look. The rods for both types of fly fishing are 7–10 feet long. The line is tapered toward the end

nearest the fly and is of fairly heavy weight; this makes the casting of the line easier, since the fly itself is virtually weightless. A simple reel is used only to contain the line and to help in tiring a hooked fish. Species fished for were first trout and salmon, but by the second half of the 20th century virtually all game fish from pan fish up were fished for with flies.

Bait casting and spin casting differ essentially only in the type of reel used and the rod length. Spinning rods are generally 7–10 feet long, while the usual length of a bait casting rod is 5–6 feet. As with fly fishing, bait casting originally used live minnows but grew to use lures in imitation of fish (sometimes crippled fish), as well as metal spoons and spinners.

Trolling involves the use of live bait or artificial lures that are drawn through the water behind a slow-moving boat, originally rowed but now generally motor-powered. Trolling is usually done inland on very large lakes and reservoirs, but it is also the primary method for big-game fishing in the oceans. The method has the advantage of covering a large amount of territory where fish might otherwise be difficult to locate. The correct depth and speed are of primary importance in the method. The introduction of sonar equipment in the second half of the 20th century greatly aided trolling, as it did all fishing from boats. Rods are usually 5–7 feet long, and lines are heavy, occasionally of metal, with added weights used to get the lure to greater depths. In inland trolling the rod is held at right angles to the motion of the boat to take advantage of the rod's resilience when a fish strikes. Lures are much like those used in bait casting. Salmon, large trout, and pike are the predominant species fished for.

Saltwater fishing. The methods mentioned so far are all used in saltwater fishing also, fly fishing being perhaps the least used, although it has become increasingly popular in the second half of the 20th century. Fishing for saltwater fish is done from a beach, off rocks, from a pier, or from a boat, which may vary in size from a rowboat, used in inland waters, to ocean-going craft of considerable size. Fish usually caught from shore or by bottom fishing from boats include striped bass, jewfish, snook, and weakfish.

Big-game fishing. Big-game fishing, made feasible by the motorized boat, was pioneered in 1898 by C.F. Holder, who took a 183-pound (83-kilogram) bluefin tuna off Santa Catalina Island, Calif. Fish usually caught include tuna, marlin, swordfish, and shark. Big-game fishing spread to the Atlantic, and catches of increasing size were made on relatively light tackle and line, especially after the invention of a reel with an internal drag by Julius von Hofe of Brooklyn, N.Y., in 1913. Big-game anglers fish from fighting seats into which they can be strapped. Rods are massive, and the butts fit into a socket mounted on the chair. Reels are large, and the line is usually of Dacron or Terylene with a wire leader near the hook.

The establishment of the International Game Fish Association in 1939 did much to promote big-game fishing and to regulate it, supervising marine fishing competitions, establishing various weight categories for lines, and keeping championship records. It also promoted scientific study by encouraging the tagging of released fish to establish fish habitat patterns and working for conservation of endangered species. In 1978 the association also took over the keeping of freshwater records.

Casting is an adjunct sport, much as shooting is for hunting, under the supervision of the International Casting Federation (founded 1955) with member groups in more than 20 countries in the 1980s. It sponsors tournaments and recognizes world records for accuracy and distance.

State of fishing. In the last quarter of the 20th century, fishing was thriving. The growth of air travel after World War II made many areas of North America and elsewhere accessible to anglers and introduced them to new fish, such as the dorado of Argentina and the tigerfish of Central Africa.

Emphasis continued on increasingly lighter tackle for both saltwater and freshwater fishing. Bonefish in shallow coastal waters was a particularly popular quarry with fly-fishing anglers, and fly-fishing records were also established on the open sea. Hardly a species of any size did not have its anglers somewhere; for instance, carp, considered a pest in North American waters, is fished for widely in Europe. Old favourites remained popular, among them salmon and trout in all varieties; and bass fishing became so popular in the United States that boats for bass fishing were specially designed, and professional competitions produced an elite of bass anglers.

Both fishing organizations and individual anglers promoted a catch-and-return policy, so that only fish of trophy or record size were kept by many anglers. *See* Sporting Record: *Fishing.* (F.E.K./T.B.T./Ed.)

BIBLIOGRAPHY. A.J. McClane (ed.), *McClanes's New Standard Fishing Encyclopedia and International Guide* (1974), covers most types of fishing in many parts of the world.

fishing, commercial: *see* commercial fishing.

fishing cat (*Felis viverrina*), tropical cat, family Felidae, found in India and Southeast Asia. The coat of the fishing cat is pale gray to deep brownish gray and marked with dark spots and streaks. The adult animal stands about 40 centimetres (16 inches) at the shoulder, weighs 8–11 kilograms (18–24 pounds) and is from 60 to 85 cm long, excluding the black-ringed tail, which accounts for an additional 25–30 cm. The fishing cat lives near water, and in jungles, reed beds, and marshes. It is reported to fish by scooping its prey out of the water.

Fisk, James (b. April 1, 1834, Bennington, Vt., U.S.—d. Jan. 7, 1872, New York City), flamboyant U.S. financier, known as the "Barnum of Wall Street," who joined Jay Gould in securities manipulations and railroad raiding.

Fisk worked successively as a circus hand, waiter, peddler, dry-goods salesman, stockbroker, and corporate official. In 1866 he formed Fisk and Belden, a brokerage firm, with the support of Daniel Drew. The following year Fisk joined Drew and Gould in protecting their control of the Erie Railroad from Cornelius Vanderbilt by issuing fraudulent stock. As vice president and comptroller, Fisk used corporate funds to corrupt public officials, produce Broadway shows, and support Broadway beauties, especially the well-known Josie Mansfield, to such an extent that he was also called "The Prince of the Erie."

With Drew's help, Fisk aided Gould in an attempt to corner the gold market by inflating the price, a venture that brought them vast sums but led to the panic of "Black Friday," Sept. 24, 1869. Because Gould secretly sold much of his gold before prices fell, Fisk lost a considerable part of his investment. The repercussions of their actions were disastrous for the nation's business and were felt even in Europe. On Jan. 6, 1872, after quarrels over Josie Mansfield and business matters, an associate, Edward Stokes, fatally shot Fisk.

Fisk, Wilbur (b. Aug. 31, 1792, Brattleboro, Vt., U.S.—d. Feb. 22, 1839, Middletown, Conn.), U.S. educator and Methodist clergyman, principal founder of Wesleyan Academy and Wesleyan University in Connecticut.

He studied at Peacham Academy and the University of Vermont and graduated from Brown University in 1815 (he received an M.A. in 1818). Licensed as a local preacher at Lyndon, Vt., in 1818, he was received into the New England Conference of the Methodist Church in June of that year. While stationed at Charlestown, Mass. (1819–20), Fisk attended a camp meeting, where—according to his statement—he experienced "a supernatural work of grace leading him into a higher Christian life." From 1823 to 1826 he was presiding elder of the Vermont district, becoming chaplain of the Vermont legislature in 1826. While in Europe (1835–36) he was elected bishop of the Methodist Episcopal Church (May 1836) but declined consecration.

His high repute as an educator did much to raise the estimate of Methodism in New England. He was a founder and principal of Wesleyan Academy, Wilbraham, Mass. (1825–30); a founder and first president of Wesleyan University, Middletown, Conn. (1831–39); and a member of the Connecticut board of education (1838). Pulmonary hemorrhages, from which he had suffered since childhood, resulted in his death at age 46, at the height of his career.

Fiske, Bradley Allen (b. June 13, 1854, Lyons, N.Y., U.S.—d. April 6, 1942, New York City), U.S. naval officer who invented a number of instruments that revolutionized naval warfare.

Chief among Fiske's inventions were the electric range finder, an electric ammunition hoist, a naval telescope mount and sight, and a special ship-based airplane (torpedo plane)

Bradley Allen Fiske, 1912
By courtesy of the U.S. Navy

capable of carrying a torpedo that greatly extended the tactical range of naval ships at sea. Though he resigned from the navy in May 1915, after years of policy disputes with U.S. Department of the Navy officials over adequate naval preparation, Fiske saw many of his inventions developed and used successfully in World Wars I and II. He wrote *From Midshipman to Rear-Admiral* (1919).

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Fiske, Harrison Grey (b. July 30, 1861, Harrison, N.Y., U.S.—d. Sept. 3, 1942, New York City), U.S. playwright and theatrical manager who with his wife, Minnie Maddern Fiske, produced some of the most significant plays of the emerging realist drama, particularly those of Henrik Ibsen.

In love with the stage, Fiske became a dramatic critic in his teens and became editor at 18 of *The New York Dramatic Mirror.* He married in 1890. Among his own plays were *Hester Crewe* (1893) and *Marie Deloche* (adapted from the French; 1896), both of which starred Mrs. Fiske.

In 1901 Fiske opened the Manhattan Theatre in New York City to oppose Charles Frohman's Theatrical Syndicate, which then dominated the U.S. theatre. Although Fiske lost much money during the six years he operated the theatre, the quality of his shows was

esteemed, and they were considered among the most significant New York productions until the appearance of the Theatre Guild. After selling the *Dramatic Mirror* in 1918, Fiske devoted himself to production until 1931.

Fiske, Helen Maria (writer): *see* Jackson, Helen (Maria) Hunt.

Fiske, John (b. March 30, 1842, Hartford, Conn., U.S.—d. July 4, 1901, East Gloucester, Mass.), U.S. historian and philosopher who popularized European evolutionary theory in the United States and attempted to apply that theory to an optimistic theory of inevitable historical progress. Fiske's idea of the "American segment" of man's larger history as the latest development in humanity's progress provides one of the most optimistic post-Darwinian expressions of an American faith in God, progress, and a moral society.

John Fiske, 1878

By courtesy of the Library of Congress, Washington, D.C.

After graduation from Harvard Law School in 1865, Fiske briefly practiced law in Boston before turning to writing. In 1860 he had encountered Herbert Spencer's adaptation of the evolutionary theory of Charles Darwin to aspects of philosophy. Deeply impressed by their ideas, he attempted to incorporate them into his own writings. A visit to Europe (1873–74) provided him the opportunity to meet and talk at length with Darwin, Spencer, and Thomas Henry Huxley. The result was the publication, in 1874, of Fiske's *Outlines of Cosmic Philosophy,* an exposition of evolutionary doctrine well received both at home and abroad. Around 1880 his interests turned to U.S. history as interpreted in the light of evolutionary theory, and from 1885 to 1900 he lectured and published voluminous works on the U.S. colonial and revolutionary periods.

Although Fiske's contemporaries viewed his ideas as suspiciously irreligious, his purpose in *Outlines of Cosmic Philosophy* was to spiritualize an evolutionary interpretation and to posit a transcendental direction and order in historical evolution, thus reconciling theology and science. The same belief in inevitable progress through evolutionary change prevailed in his interpretation of U.S. history. One of his most important books on early American history, *The Critical Period of American History, 1783–1789* (1888), proposed that evolutionary progress in history, through the development of Anglo-Saxon political federalism, appears as the movement toward an increasingly complex social structure.

Fiske, Minnie Maddern, original name MARIE AUGUSTA DAVEY (b. Dec. 19, 1865, New Orleans—d. Feb. 15, 1932, Hollis, N.Y., U.S.), U.S. actress who became one of the leading exemplars of realism on the American stage, especially through her performances in Ibsen's plays.

Fiske made her New York debut at the age of five and for the next few years played children's roles; *e.g.*, Eva in *Uncle Tom's Cabin.* She made her first appearance as an adult actress in 1882. In 1890 she married the playwright and theatrical manager Harrison Grey Fiske, and in 1893 she enjoyed a modest success in his play *Hester Crewe.* Her performance of Tess in Stoddard's 1897 dramatization of Hardy's novel *Tess of the D'Urbervilles* was her first notable success. At about this time she also began to specialize in the plays of Ibsen and Shakespeare, and her interpretations of Ibsen's heroines were especially acclaimed.

Minnie Maddern Fiske

EB Inc.

Fiske's most important roles during the period in which her husband managed the Manhattan Theatre, New York, were in Ibsen's *Hedda Gabler* (1903) and *Rosmersholm* (1907), Paul Heyse's *Mary of Magdala* (1904), and Langdon Mitchell's *Becky Sharp* (1904) and *The New York Idea* (1906). She was responsible for the first professional production of a play by Edward Sheldon, *Salvation Nell* (1908), in which she starred under her husband's direction. She toured in Ibsen's *Ghosts* in 1927 and in *Becky Sharp* in 1931.

fissile material, also called FISSIONABLE MATERIAL, in nuclear physics, any species of atomic nucleus that can undergo the fission reaction. The principal fissile materials are uranium-235 (0.7 percent of naturally occurring uranium), plutonium-239, and uranium-233, the last two being artificially produced from the fertile materials uranium-238 and thorium-232, respectively. A fertile material, not itself capable of undergoing fission with low-energy neutrons, is one that decays into fissile material after neutron absorption within a reactor. Thorium-232 and uranium-238 are the only two naturally occurring fertile materials.

fission, in biology, the general process of cell division. If two daughter cells are formed, the process is called binary fission. The production of more than two cells is multiple fission. Binary fission represents the major reproductive procedure of unicellular organisms, but it also occurs in the process of embryonic development and tissue growth and repair of higher plants and animals. It generally follows nuclear doubling, whether in mitosis or in meiosis (*qq.v.*).

Certain metazoan animals, *e.g.*, some planarian species, regularly reproduce asexually by a separation of the body into two portions, a method also referred to as fission. Regular transverse fission at the neck region of the tapeworm and at the oral end of the scyphostome polyp is distinguished as strobilation. Commonly, this results in a chain, called a strobilus, of the fission products—the proglottids of tapeworms and the ephyrae of scyphozoan jellyfish; each proglottid or ephyra matures in turn and separates from the end of the strobilus. A few metazoan species regularly undergo a body division into several units simultaneously, a process called fragmentation. Planarian fission and fragmentation generally represent direct reproduction in which each portion regenerates missing parts to become a complete, new animal. Strobilation products, however, are only indirectly reproductive; proglottids are not regenerative and die but carry and release great numbers of eggs; ephyra do not produce new polyps but mature into sexually reproducing medusae, the larvae of which become polyps.

fission, spontaneous (physics): *see* spontaneous fission.

fission product, in physics, any of the lighter atomic nuclei formed by splitting heavier nuclei (nuclear fission), including both the primary nuclei directly produced (fission fragments) and the nuclei subsequently generated by their radioactive decay. The fission fragments are highly unstable because of their abnormally large number of neutrons compared with protons; consequently they undergo successive radioactive decays by emitting neutrons, by converting neutrons into protons, antineutrinos, and ejected electrons (beta decay), and by radiating energy (gamma decay).

One of the many known fission reactions of uranium-235 induced by absorbing a neutron results, for example, in two extremely unstable fission fragments, a barium and a krypton nucleus. These fragments almost instantaneously release three neutrons between themselves, becoming barium-144 and krypton-89. By repeated beta decay, the barium-144 in turn is converted step by step to other fission products, lanthanum-144, cerium-144, praseodymium-144, and eventually relatively stable neodymium-144; and krypton-89 is similarly transformed to stable yttrium-89 by way of rubidium-89 and strontium-89. Fission products, some of which are useful in research and industry, are identified by their chemical properties and by their radioactive properties, such as their half-lives and the kinds of particles they emit.

fission-track dating, method of age determination that makes use of the damage done by the spontaneous fission of uranium-238, the most abundant isotope of uranium. The fission process results in the release of several hundred million electron volts of energy and produces a large amount of radiation damage before its energy is completely absorbed. The radiation damage, or fission tracks, can be made visible by the preferential leaching (removal of material by solution) of the host substance with a suitable chemical reagent; the leaching process allows the etched fission-track pits to be viewed and counted under an ordinary optical microscope. The amount of uranium present can be determined by irradiation to produce thermal fission of uranium-235, which produces another population of tracks, these related to the uranium concentration of the mineral. Thus, the ratio of naturally produced, spontaneous fission tracks to neutron-induced fission tracks is a measure of the age of the sample.

A wide variety of minerals have been fission-track dated, as have natural and artificial glasses. Fission-track dating has been used for very old samples (*e.g.,* meteorites) and also for the dating of very young specimens (*e.g.,* artifacts from archaeological sites). *See also* radiation-damage dating.

fissure, cerebral: *see* cerebral fissure.

FITA Round, in the sport of archery, a form of target shooting competition used in international and world championship events, authorized by the Fédération Internationale de Tir à l'Arc (FITA), world governing body of the sport. World championships are based on scores achieved in two FITA Rounds. Men shoot 36 arrows at each of four distances: 90, 70, 50, and 30 metres (98, 77, 55, and 33 yards). Women shoot 36 arrows at each of 70, 60, 50, and 30 metres. At 50 and 30 metres the target is 80 centimetres (2.6 feet) in diameter instead of the standard 122 centimetres. At all distances the five coloured rings of the

target are divided into two zones, allowing scoring from one to ten for each hit.

fitch, fur trade name for the polecat (*q.v.*), especially the European, or common, polecat.

Fitch, (William) Clyde (b. May 2, 1865, Elmira, N.Y., U.S.—d. Sept. 4, 1909, Châlons-sur-Marne, Fr.), U.S. playwright best known for plays of social satire and character study.

Fitch graduated from Amherst College in 1886. In New York City he began writing short stories for magazines. He was a prolific writer, producing 33 original plays and 22 adaptations. Among the more important were *Beau Brummel* (1890), written for the actor Richard Mansfield, *The Climbers* (1901), *Captain Jinks of the Horse Marines* (1901), *The Girl with the Green Eyes* (1902), *The Truth* (1907), and *The City* (1909). His earlier plays were largely melodramas and historical plays of lesser significance. Fitch excelled in comedy, realistic dialogue, and theatre technique; but the popularity of his plays hardly exceeded his own lifetime.

Fitch, John (b. Jan. 21, 1743, Windsor, Conn., U.S.—d. July 2, 1798, Bardstown, Ky.), pioneer of U.S. steamboat transportation who produced serviceable steamboats before Robert Fulton.

Fitch served in the U.S. War of Independence (1775–83) and later surveyed land along

John Fitch, detail from a mural by Constantino Brumidi, 1873; in a corridor of the Capitol building, Washington, D.C.

By courtesy of the Library of Congress, Washington, D.C.

the Ohio River. Settling in Bucks County, Pa., in 1785, he became interested in building steamboats. He sought and failed to obtain subsidies from the Continental Congress, but he later succeeded in receiving exclusive rights from New Jersey, Pennsylvania, New York, and Delaware to build and operate steamboats on their waters. Backed by Philadelphia financiers, he built a 45-foot (14-metre) craft that had a successful trial on the Delaware River on Aug. 22, 1787, before a group of delegates to the Constitutional Convention. He then built a larger steamboat to carry passengers and freight. Propelled by paddle wheels, it made well-advertised, regularly scheduled trips between Philadelphia and Burlington, N.J. After a battle with James Rumsey over claims to invention, Fitch was granted a U.S. patent for steamboats on Aug. 26, 1791, and a French patent the same year.

He began construction of another steamboat, but its loss in a storm discouraged his backers. He went to France in 1793 in an attempt to interest the government in steam navigation but failed. Returning to the U.S. depressed and in poor health, he died a few years later. Although his vessels were reliable, Fitch ignored building and operating costs and so failed to demonstrate the economic value of steam propulsion. As a result, steam power was sparingly used after his death, and Robert Fulton, who did not launch a boat until after Fitch died, received more credit for originating this type of transportation.

Fitch, Ralph (b. *c.* 1550—d. *c.* Oct. 4, 1611, London), merchant who was among the first Englishmen to travel through India and Southeast Asia and whose eyewitness reports on all that he saw were greatly valued by the founders of the East India Company.

In February 1583, together with John Newberry, John Eldred, William Leedes, and James Story, Fitch embarked in the "Tiger" and reached Syria in late April. (Act I, scene 3 of Shakespeare's *Macbeth* alludes to the trip.) From Aleppo (Syria), they went overland to the Euphrates, which they descended to al-Fallūjah, now in Iraq, and from there crossed over to Baghdad and sailed down the Tigris to Basra (May—July 1583). Eldred remained, but Fitch and the others sailed down the Persian Gulf to the trading centre of Hormuz, where they were arrested at the instigation of Venetian merchants and transported to the island of Goa in Portuguese India. They were jailed until they were released on bond provided by two Jesuits.

Story chose to remain in Goa, but in April 1584 Fitch, Newberry, and Leedes escaped and began their journey across India. They visited the court of the Mughal emperor Akbar at Fatehpur Sīkri, near Āgra, in north central India, where Leedes settled as court jeweller. Newberry began a return journey to England, but he is believed to have died in India.

Fitch descended the Yamuna and Ganges rivers and visited Vārānasi (Benares) and Patna. By land he travelled to Cooch Behār at the base of the Himalayas, where he possibly hoped to learn of Tibetan trade across the mountains. After travelling through East Bengal, he sailed for Burma in November 1586. He visited the Rangoon region; sailed up the Irrawaddy River; stopped at Pegu, fabled for its splendour; and ventured into the Siamese Shan states, now in Burma (1586–87).

Early in 1588 he went to the Malay Peninsula and visited Malacca, now in Malaysia, where he learned much about trade with China and the Spice Islands, now the Moluccas. In the spring he began his journey homeward, reaching London on April 29, 1591.

Fitch, Val Logsdon (b. March 10, 1923, Merriman, Neb., U.S.), U.S. nuclear physicist, co-recipient with James Watson Cronin of the Nobel Prize for Physics in 1980 for an experiment conducted in 1964 that disproved the long-held theory that particle interaction should be indifferent to the direction of time.

Fitch's early interest in chemistry shifted to physics in the mid-1940s when, as a member of the U.S. Army, he was sent to Los Alamos, N.M., to work on the Manhattan Project. He graduated from McGill University in Montreal with a bachelor's degree in electrical engineering in 1948 and was awarded a Ph.D. in physics by Columbia University in 1954. He then joined the faculty of Princeton University, where he was named Cyrus Fogg Brackett professor of physics in 1976.

Fitchburg, city, co-seat (with Worcester city) of Worcester County, northern Massachusetts, U.S., on the Mohawk Trail and a branch of the Nashua River; it forms part of the Fitchburg–Leominster metropolitan area. The site was first settled in 1740; originally known as Turkey Hills, it was later named for John Fitch, who did much to secure the incorporation of the town in 1764. The river furnished power for early textile mills, and the opening of the Boston–Fitchburg stage line stimulated the growth of the town. The arrival in the 1840s of the Boston and Fitchburg and of the Vermont and Massachusetts railroads spurred industrial development. Manufactures now include machinery, paper and metal products, fabricated steel, plastics, leather goods, and textiles. Fitchburg State College was established in 1894. Inc. city, 1872. Pop. (1980) city, 39,580; metropolitan area (SMSA), 99,957.

fitchet (mammal): *see* ferret.

fitnah (Arabic: "trial, test"), in Islāmic usage, a heretical uprising, especially the first major internal struggle within the Muslim community (AD 656–661), which resulted in both civil war and religious schism—between the Sunnīs and Shī'ah, or Shiites.

The third caliph, 'Uthmān (reigned 644–656), a member of the Umayyad family of Mecca, had incurred the opposition of Muḥammad's closest followers, the Muslims of Medina, by favouring his own Meccan family in his official appointments. 'Uthmān's murder by Egyptian soldiers (June 17, 656) elicited Meccan demands for revenge, and when Muḥammad's son-in-law, 'Alī, whom the Medinese had proclaimed fourth caliph, failed to comply, opposition was directed against him. The Battle of the Camel (December 656), pitting the forces of 'Alī against those of 'Ā'ishah, one of Muḥammad's widows, and Ṭalḥah and az-Zubayr, prominent Companions of the Prophet, temporarily secured 'Alī's position but inaugurated civil war. Mu'āwiyah, another Umayyad from Mecca and governor of Syria, took up the demands for vengeance on 'Uthmān's death and questioned the validity of 'Alī's caliphate. Their confrontation in the Battle of Ṣiffīn (657), which the arbitration at Adhruḥ (659) attempted to resolve, was disastrous: it split 'Alī's forces, some of his followers (Khawārij) refusing to acknowledge the validity of human arbitration in a case which they felt could be rightly decided only by God. 'Alī's position was also undermined when the arbitrators would not declare him the rightful caliph; the result was an irrevocable split in Islām by the formation of the *shī'at 'Alī* ("party of 'Alī"), political allies of 'Alī who eventually translated their political demands into a religious conviction that 'Alī and all his descendants were divinely appointed to succeed Muḥammad as caliphs. Strengthened by this outcome, Mu'āwiyah seized Egypt and began raiding 'Alī's stronghold, Iraq. The open warfare finally ended in 661 when 'Alī was assassinated and Mu'āwiyah began his reign as the first Umayyad caliph, but the religious split endured between the Sunnīs and the Shī'ah.

fitness, Darwinian (genetics): *see* Darwinian fitness.

fits root (herb): *see* Indian pipe.

Fittig, Rudolf (b. Dec. 6, 1835, Hamburg—d. Nov. 19, 1910, Strassburg, Ger.), German organic chemist who contributed vigorously to the flowering of structural organic chemistry during the late 19th century.

After studying for his Ph.D. (1856-58) under Friedrich Wöhler at Göttingen, he was assistant to Wöhler, then became professor at Tübingen in 1869 and successor to Adolf von Baeyer at Strasbourg in 1876. He helped to edit *Annalen der Chemie* from 1895 to 1910.

He was one of the first to study the action of sodium on organic compounds, using that element in preparing pinacol, diphenyl, toluene, and many other substances. He discovered several aromatic compounds in coal tar, studied the reactions of unsaturated acids, and proposed the correct structures for the quinones.

Fitton, Mary (baptized June 24, 1578, Gawsworth, Cheshire, Eng.—d. *c.* 1647), English lady considered by some to be the still mysterious "dark lady" of Shakespeare's sonnets, though her authenticated biography does not suggest acquaintance with Shakespeare. Her colouring is represented as dark on the painted monument of the Fitton family in the church at Gawsworth. She became maid of honour to Elizabeth I in about 1595 and

mistress to William Herbert (later earl of Pembroke) and to Sir Richard Leveson. She was twice married and widowed.

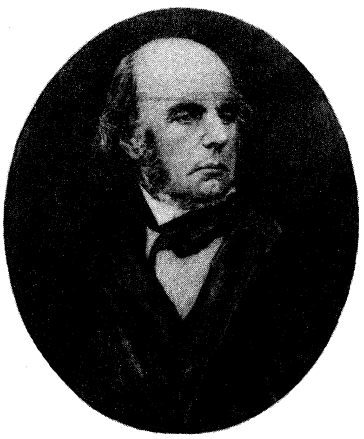
Fitzalan, Henry: *see* Arundel, Henry Fitzalan, 12th earl of.

Fitzalan, Richard: *see* Arundel, Richard Fitzalan, 4th earl of.

Fitzalan, Thomas: *see* Arundel, Thomas Fitzalan, 5th earl of.

Fitzgerald, city, seat of Ben Hill County, south central Georgia, U.S. It originated in 1894 after the governor of Georgia, William J. Northen, sponsored a relief train to Midwesterners suffering from a severe drought. P.H. Fitzgerald of Indianapolis, Ind., in response to the governor, suggested founding a town in Georgia for Civil War, mainly Union, veterans. The American Soldiers Colony Association was organized and purchased land near Swan, a tiny lumber camp. The town was laid out in a symmetrical plan with street names honouring both the North and the South. Fitzgerald is now an agricultural marketing centre (cotton, tobacco, and peanuts [groundnuts]); manufactures include textiles, meat-packing, and steel products. Inc. 1896. Pop. (1982 est.) 10,447.

FitzGerald, Edward (b. March 31, 1809, Bredfield, near Woodbridge, Suffolk, Eng.—d. June 14, 1883, Merton, Norfolk), English writer, best known for his *Rubáiyát of Omar Khayyám*, which, though it is a free adaptation and selection from the 12th-century Persian poet's verses, stands on its own as a classic of English literature. It is one of the most frequently quoted of lyric poems, and many



Edward FitzGerald, miniature portrait by Eva Rivett-Carnac after a photograph of 1873; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

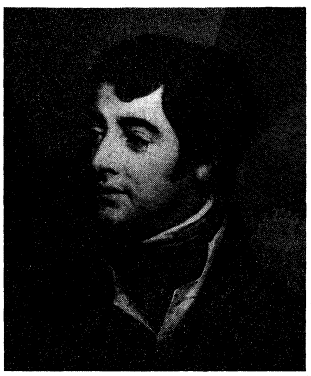
of its images, such as "A jug of wine, a loaf of bread, and thou" and "The moving finger writes," have passed into common currency.

FitzGerald was educated at Trinity College, Cambridge, where he formed a lifelong friendship with William Makepeace Thackeray. Soon after graduating in 1830, he retired to the life of a country gentleman in Woodbridge. Though he lived chiefly in seclusion, he had many intimate friends, including Alfred, Lord Tennyson and Thomas Carlyle, with whom he kept up a steady correspondence.

A slow and diffident writer, FitzGerald published a few works anonymously, then freely translated *Six Dramas of Calderón* (1853) before turning to Oriental studies and mastering Persian. In translating Omar Khayyam, his method was to transmit the essence of the poet's mood and thought, often in his own imagery, in a sequence that would be intelligible to English readers.

In March 1859 the *Rubáiyát* was published in an unpretentious, anonymous little pamphlet. The poem attracted no attention until, in 1860, it was discovered by Dante Gabriel Rossetti, and soon after by Algernon Swinburne. Its appearance in the same year as Darwin's *Origin of Species*, when the sea of faith was at its ebb, lent a timely significance to its philosophy, which combines expressions of outright hedonism ("Ah take the Cash, and let the Credit go") with uneasy ponderings on the mystery of life and death. *See also* Omar Khayyam.

Fitzgerald, Lord Edward (b. Oct. 15, 1763, County Kildare, Ire.—d. June 4, 1798, London), Irish rebel renowned for his gallantry



Lord Edward Fitzgerald, detail of a painting by Hugh Douglas Hamilton; in the National Gallery of Ireland, Dublin

By courtesy of the National Gallery of Ireland, Dublin

and courage, who was a leading conspirator behind the uprising of 1798 against British rule in Ireland.

The son of James Fitzgerald, 1st duke of Leinster, he joined the British Army and in 1781 fought against the colonists in the American Revolutionary War. Fitzgerald was first elected to the Irish Parliament in 1783. His enthusiasm for the French Revolution led to dismissal from the Army in 1792, and four years later he joined the Society of United Irishmen, a nationalist organization that aspired to free Ireland from English control. This group appointed him to head the military committee formed to plan an uprising and obtain aid from the French revolutionary regime. Although the French delayed in supplying arms and troops, Fitzgerald's committee went ahead with its plans for a general rebellion. The insurrection was set for May 23, 1798. In March Fitzgerald's coconspirators were seized by government agents. Fitzgerald himself was arrested in Dublin on May 19, after a fierce struggle during which he was shot in the arm. He died of his wound in prison several weeks later. The rebellion broke out at the appointed time but was ruthlessly suppressed.

Fitzgerald, Ella (b. April 25, 1918, Newport News, Va., U.S.), American singer who became world famous for the wide range and

Ella Fitzgerald

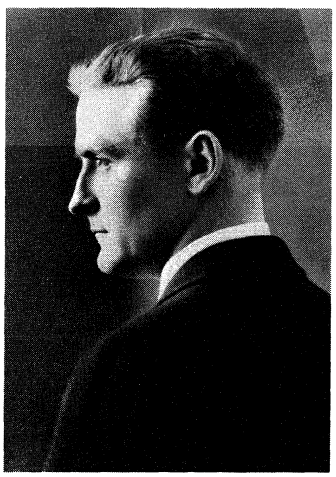
Courtesy of Warner Brothers Records, Inc.

rare sweetness of her voice. She developed a singing style that was much imitated in the 1950s and '60s.

Fitzgerald worked in the Chick Webb orchestra from 1935, and in the 1940s she created a solo cabaret act. Her status rose dramatically in the 1950s when she acquired as manager the jazz impresario Norman Granz, who gave her better material to sing, along with ideal jazz instrumental support. For many years the star attraction of Granz's Jazz at the Philharmonic, she was also one of the best-selling vocal recording artists in history. From 1956 to 1967 she recorded on a 19-volume series of "song books," in which she preserved for posterity nearly 250 outstanding songs composed by Richard Rodgers, Cole Porter, George Gershwin, Duke Ellington, Jerome Kern, Irving Berlin, and Johnny Mercer. Although her diction is excellent, her interpretation of words is intuitive rather than studied.

Fitzgerald's mastery of "scat" singing, a technique in which the singer improvises as a trumpet or saxophone would and uses nonsense syllables, was widely imitated by both male and female jazz vocalists. Her most exciting recorded performances, such as *Mack the Knife: Ella In Berlin*, possess the imagination and skill of a modern jazz horn player translated into scat.

Fitzgerald, F(rancis) Scott (Key) (b. Sept. 24, 1896, St. Paul, Minn., U.S.—d. Dec. 21, 1940, Hollywood), American short-story



F. Scott Fitzgerald

writer and novelist famous for his depictions of the Jazz Age (the 1920s), his most brilliant novel being *The Great Gatsby* (1925). His private life, with his wife, Zelda, in both America and France, became almost as celebrated as his novels.

Fitzgerald was the only son of an unsuccessful, aristocratic father and an energetic, provincial mother. Half the time he thought of himself as the heir of his father's tradition, which included the author of "The Star-Spangled Banner," Francis Scott Key, after whom he was named, and half the time as "straight 1850 potato-famine Irish." As a result he had typically ambivalent American feelings about American life, which seemed to him at once vulgar and dazzlingly promising.

He also had an intensely romantic imagination, what he once called "a heightened sensitivity to the promises of life," and he charged into experience determined to realize those promises. At both St. Paul Academy (1908–10) and Newman School (1911–13) he tried too hard and made himself unpopular, but at Princeton he came close to realizing his dream of a brilliant success. He became a prominent figure in the literary life of the

university and made lifelong friendships with Edmund Wilson and John Peale Bishop. He became a leading figure in the socially important Triangle Club, a dramatic society, and was elected to one of the leading clubs of the university; he fell in love with Ginevra King, one of the beauties of her generation. Then he lost Ginevra and flunked out of Princeton.

He returned to Princeton the next fall, but he had now lost all the positions he coveted, and in November 1917 he left to join the army. In July 1918, while he was stationed near Montgomery, Ala., he met Zelda Sayre, the daughter of an Alabama Supreme Court judge. They fell deeply in love, and, as soon as he could, Fitzgerald headed for New York determined to achieve instant success and to marry Zelda. What he achieved was an advertising job at $90 a month. Zelda broke their engagement, and, after an epic drunk, Fitzgerald retired to St. Paul to rewrite for the second time a novel he had begun at Princeton. In the spring of 1920 it was published, he married Zelda, and

> riding in a taxi one afternoon between very tall buildings under a mauve and rosy sky; I began to bawl because I had everything I wanted and knew I would never be so happy again.

Immature though it seems today, *This Side of Paradise* in 1920 was a revelation of the new morality of the young; it made Fitzgerald famous. This fame opened to him magazines of literary prestige, such as *Scribner's,* and high-paying popular ones, such as *The Saturday Evening Post.* This sudden prosperity made it possible for him and Zelda to play the roles they were so beautifully equipped for, and Ring Lardner called them the prince and princess of their generation. Though they loved these roles, they were frightened by them, too, as the ending of Fitzgerald's second novel, *The Beautiful and Damned* (1922), shows. *The Beautiful and Damned* describes a handsome young man and his beautiful wife, who gradually degenerate into a shopworn middle age while they wait for the young man to inherit a large fortune. Ironically, they finally get it, when there is nothing of them left worth preserving.

To escape the life that they feared might bring them to this end, the Fitzgeralds (together with their daughter, Frances, called "Scottie," born in 1921) moved in 1924 to the Riviera, where they found themselves a part of a group of American expatriates whose style was largely set by Gerald and Sara Murphy; Fitzgerald described this society in his last completed novel, *Tender Is the Night,* and modeled its hero on Gerald Murphy. Shortly after their arrival in France, Fitzgerald completed his most brilliant novel, *The Great Gatsby* (1925). All of his divided nature is in this novel, the naive Midwesterner afire with the possibilities of the "American Dream" in its hero, Jay Gatsby, and the compassionate Princeton gentleman in its narrator, Nick Carraway. *The Great Gatsby* is the most profoundly American novel of its time; at its conclusion, Fitzgerald connects Gatsby's dream, his "Platonic conception of himself," with the dream of the discoverers of America. Some of Fitzgerald's finest short stories appeared in *All the Sad Young Men* (1926), particularly "The Rich Boy" and "Absolution," but it was not until eight years later that another novel appeared.

The next decade of the Fitzgeralds' lives was disorderly and unhappy. Fitzgerald began to drink too much, and Zelda suddenly, ominously, began to practice ballet dancing night and day. In 1930 she had a mental breakdown and in 1932 another, from which she never fully recovered. Through the 1930s they fought to save their life together, and, when the battle was lost, Fitzgerald said, "I left my capacity for hoping on the little roads that led to Zelda's sanitarium." He did not finish his next novel, *Tender Is the Night,* until 1934. It is the story of a psychiatrist who marries one of his patients, who, as she slowly recovers, exhausts his vitality until he is, in Fitzgerald's words, *un homme épuisé* ("a man used up"). Though technically faulty and commercially unsuccessful, this is Fitzgerald's most moving book.

With its failure and his despair over Zelda, Fitzgerald was close to becoming an incurable alcoholic. By 1937, however, he had come back far enough to become a scriptwriter in Hollywood, and there he met and fell in love with Sheilah Graham, a famous Hollywood gossip columnist. For the rest of his life—except for occasional drunken spells when he became bitter and violent—Fitzgerald lived quietly with her. (Occasionally he went east to visit Zelda or his daughter Scottie, who entered Vassar College in 1938.) In October 1939 he began a novel about Hollywood, *The Last Tycoon.* The career of its hero, Monroe Stahr, is based on that of the producer Irving Thalberg. This is Fitzgerald's final attempt to create his dream of the promises of American life and of the kind of man who could realize them. In the intensity with which it is imagined and in the brilliance of its expression, it is the equal of anything Fitzgerald ever wrote, and it is typical of his luck that he died of a heart attack with his novel only half-finished. He was 44 years old. (A.Mi.)

MAJOR WORKS. *Novels. This Side of Paradise* (1920); *The Beautiful and Damned* (1922); *The Great Gatsby* (1925); *Tender Is the Night* (1934); *The Last Tycoon,* unfinished (1941).

Short stories. Flappers and Philosophers (1920); *Tales of the Jazz Age* (1922); *All the Sad Young Men* (1926), includes "The Rich Boy" and "Absolution"; *Taps at Reveille* (1935).

Notebooks and Letters. The Crack-up, ed. by Edmund Wilson (1945); *Letters,* ed. by Andrew Turnbull (1963).

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FitzGerald, Garret (Michael) (b. Feb. 9, 1926, Dublin), prime minister of Ireland (1981–82, 1982–87), as leader of the Fine Gael party in coalition with the Labour Party.

FitzGerald was born into a political family of revolutionary persuasions during the infancy of the Irish Free State. He was educated at University College and King's Inns, Dublin, and in 1959 became an economics lecturer in the department of political economy at University College, Dublin. He was elected to the Dáil (parliament) in 1969; and he later gave up his university lectureship to become minister of foreign affairs in the coalition government of Prime Minister Liam Cosgrave (1973–77). When the coalition government was resoundingly defeated in the general elections of 1977, Cosgrave yielded leadership of Fine Gael to FitzGerald, who proceeded to modernize and strengthen the party at the grass roots. In his prime ministry, FitzGerald pushed for liberalization of Irish laws on divorce, abortion, and contraception and also strove to build bridges to the Protestants in Northern Ireland. In 1985 he and British Prime Minister Margaret Thatcher signed the Hillsborough (or Anglo-Irish) Accord, giving Ireland a consultative role in the governing of Northern Ireland. After his party lost in the election of 1987, he resigned as its leader.

FitzGerald is author of a number of books, including *Planning in Ireland* (1968), *Towards a New Ireland* (1972), and *Unequal Partners* (1979).

FitzGerald, George Francis (b. Aug. 3, 1851, Dublin—d. Feb. 22, 1901, Dublin), physicist who first suggested a method of producing radio waves, thus helping to lay the basis of wireless telegraphy. He also developed a theory, now known as the Lorentz–FitzGerald contraction, which Einstein used in his own special theory of relativity.

FitzGerald became a tutor at Trinity College in Dublin in 1877 and professor of natural and experimental philosophy in 1881. From his studies of radiation he concluded that an oscillating electric current would produce electromagnetic waves. This finding was later verified experimentally by Heinrich R. Hertz of Germany and used in the development of wireless telegraphy.

Independently of Hendrik A. Lorentz of The Netherlands, FitzGerald studied the results of the Michelson–Morley experiment (1887) and arrived at a similar conclusion. The experiment was an attempt to measure the Earth's motion relative to the pervasive luminiferous ether postulated as the medium within which light waves were propagated. The attempt failed to detect any such motion. In 1892 FitzGerald suggested that when in motion, a body is shorter (along its line of motion) than when at rest and that such a shortening, or contraction, affects the instruments used in the experiment. Lorentz arrived at this idea independently in 1895 and developed it considerably. A collection, *The Scientific Writings of the Late George Francis FitzGerald,* was published in 1902.

Fitzgerald, Gerald: *see* Desmond, Gerald Fitzgerald, 14th (or 15th) earl of.

Fitzgerald, James Fitzmaurice (d. Aug. 18, 1579, Munster Province, Ireland), Irish Roman Catholic nobleman who led two unsuccessful uprisings against English rule in the province of Munster in southwest Ireland.

In 1568, following the arrest and imprisonment of his cousin Gerald Fitzgerald, 14th earl of Desmond, on charges of resisting the authority of England's Queen Elizabeth I, Fitzmaurice was proclaimed leader of the Fitzgeralds of Munster. Allying with his family's traditional rivals, the Butlers, he initiated an uprising against the English in 1569, but by 1573 he had given up the struggle and accepted a pardon.

In 1575 Fitzmaurice traveled to the Continent to seek support for the Irish Roman Catholic cause. Philip II of Spain and Pope Gregory XIII both encouraged his plan for a Catholic invasion of Ireland, but offered almost no material aid. Fitzmaurice landed at Dingle in Munster on July 18, 1579, with a small force of Italians and Spaniards, accompanied by the papal legate Nicholas Sanders.

Within a month, however, he was betrayed—at the instigation of the English—by several of his followers and killed in a skirmish. The rebellion was not completely quelled until 1583.

FitzGerald, Robert D(avid) (b. Feb. 22, 1902, Hunter's Hill, N.S.W., Australia), Australian poet known for his technical skill and seriousness.

He studied science at the University of Sydney but left after two years to become a surveyor in Fiji. During World War II he worked on engineering surveys in New South Wales, then with the Department of the Interior (1939–65).

His work steadily progressed from *To Meet the Sun* (1929), now considered rather dated and derivative, to *Moonlight Acre* (1938), which includes a philosophical poem, "Essay on Memory," that won a national prize; *Between Two Tides* (1952) is a long metaphorical narrative; and *Forty Years Poems* (1965) revealed a writer at the height of his powers. He also wrote a book of criticism, *The Elements of Poetry* (1963), and a volume of essays, *Of Places and Poetry* (1976).

Fitzgerald, Thomas: *see* Kildare, Thomas Fitzgerald, 10th earl of.

Fitzgibbon, John: *see* Clare, John Fitzgibbon, 1st earl of.

Fitzherbert, Maria (Anne), *née* MARY ANNE SMYTHE (b. July 1756, Brambridge?, Hampshire, Eng.—d. March 29, 1837, Brighton, Sussex), secret wife of the Prince of Wales, the future George IV of Great Britain.

Of an old Roman Catholic family, she was educated at a French convent. She married first, in 1775, Edward Weld, who died within a year, and married second, in 1778, Thomas Fitzherbert, who died in 1781, leaving her fairly wealthy. Within two years she had become a prominent figure in London society and ultimately attracted the passionate love of the Prince of Wales. For state reasons a regular marriage was impossible: the Act of Settlement (1689) entailed his forfeiture of the succession if he married a Roman Catholic, apart from the fact that the Royal Marriage Act of 1772 made any marriage illegal without the king's consent, which was out of the question. From Mrs. Fitzherbert's Roman Catholic point of view, any formal marriage ceremony would be ecclesiastically and sacramentally binding. The two were thus secretly married by the Rev. R. Burt, a clergyman of the Church of England, on Dec. 15, 1785. The Prince subsequently took up residence near Mrs. Fitzherbert in both Brighton and London.

In 1787, in the course of debates over sums to be granted to alleviate the Prince's debts (the Prince was notoriously extravagant), Charles James Fox declared, as on the Prince's own authority, that the rumour of the marriage was a malicious falsehood. Others contributed to the denial; but Mrs. Fitzherbert, who at first thought of severing her relation with the Prince, forgave him. Seven years later, in June 1794, the Prince brutally broke off with her, partly because of his liaisons with other women and partly because of his forthcoming marriage to Princess Caroline (the marriage with Mrs. Fitzherbert of course being illegal in English law). Some time later, Mrs. Fitzherbert obtained a formal decision from the Pope pronouncing her to be the Prince's wife and sanctioning her to take him back. They drifted together again for what she would later call the happiest years of her life; they broke off the final time in about 1808, as the Prince became more dissolute. Nevertheless, on his death more than a quarter of a century later, her miniature portrait was found around his neck.

Fitzjames, James: *see* Berwick, James Fitzjames, duke of.

Fitzmaurice, William Petty-: *see* Lansdowne, William Petty-Fitzmaurice, 1st marquess of.

Fitzneale, Richard, Fitzneale also spelled FITZNIGEL, also called RICHARD OF ELY (b. *c.* 1130—d. Sept. 10, 1198), bishop of London and treasurer of England under kings Henry II and Richard I and author of the *Dialogus de scaccario* ("Dialogue of the Exchequer").

He was the son of Nigel, bishop of Ely (1133), and the great nephew of Roger, bishop of Salisbury, who had organized the exchequer under Henry I. His father, who was treasurer under Henry I and Stephen, purchased the office (*c.* 1158) for his son, who retained it until his death. Richard's name appears in the lists of itinerant justices for 1179 and 1194; he was also a judge of common pleas. He became archdeacon of Ely (*c.* 1160) and a canon of St. Paul's; he became dean of Lincoln not later than 1184 and bishop of London in 1189.

Richard Fitzneale's *De necessariis observantiis scaccarii dialogus,* commonly called the *Dialogus de scaccario,* is an account in two books of the procedure followed by the exchequer in the author's time, a procedure which was largely the creation of his own family. Soon after the author's death it was already recognized as the standard manual for exchequer officials. It was frequently transcribed and has been used by English antiquarians of every period, for it describes contemporary exchequer practice with detail and accuracy. The text of the *Dialogus* shows that its author also composed a chronicle of the reign of Henry II, arranged in three columns and thus named the *Liber tricolumnis*; the work is not extant.

FitzOsbern, William, 1ST EARL OF HEREFORD, SEIGNEUR (lord) DE BRÉTEUIL, French GUILLAUME D'OBBERN (d. Feb. 20, 1071, Cassel, Flanders), Norman soldier and lord, one of William the Conqueror's closest supporters.

The son of Osbern (or Obbern) de Crépon, seneschal of Normandy, he himself became seneschal of Normandy and in 1060 was given the lordship and castle of Bréteuil. He took a leading part both in the preparations for the Norman invasion of England and in the battle of Hastings (1066) and was rewarded with a grant of the Isle of Wight and the earldom of Hereford, both vitally important for the defense of England.

After the Conquest, FitzOsbern held a position of the highest responsibility. In 1067 he commanded the army in King William I's absence, was put in charge of a new castle at Norwich, and was made the king's special representative in the north. In the critical rebellion of 1068–69 he was governor of York. In 1071, having been sent to Normandy to help Queen Matilda, he became involved in the Flemish succession dispute and was killed at the Battle of Cassel in Flanders in 1071.

He founded the abbeys of Cormeilles and Lire in Normandy and introduced the "laws of Bréteuil" to Hereford, whence they became a model for many western English, Welsh, and Irish boroughs.

On his death, his estates were divided between his two sons—William (or Guillaume), the elder, succeeding to the Norman fiefs and Roger Fitzwilliam, the younger, succeeding to the earldom of Hereford and the English estates. The latter conspired against King William I and in 1075 forfeited his estates and was imprisoned for the remainder of his life.

FitzOsbert, William, byname LONGBEARD (d. April 6, 1196, Smithfield, London), English crusader and populist, a martyr for the poorer classes of London.

A London citizen of good family, he took part in the English expedition against the Moors in Portugal (1190). On his return he made himself leader of the common people of London against the mayor and aldermen, rousing the mob by fiery speeches at St. Paul's cathedral and especially protesting against the assessment of the "aid" to pay Richard I's ransom (1194). Though serving for a time as a member of the city council and claiming acquaintance with the King, he was regarded by his fellow magistrates as a dangerous demagogue, and they persuaded the justiciar Hubert Walter to seize him before he led an armed revolt in the city. He was taken from the sanctuary of St. Mary-le-Bow, Cheapside, to the Tower of London, sentenced to death, and hanged in chains at Smithfield, with nine followers, being at once revered as a martyr by the poorer classes.

Fitzroy, Augustus Henry: *see* Grafton, Augustus Henry Fitzroy, 3rd duke of.

Fitzroy, Henry: *see* Grafton, Henry Fitzroy, 1st duke of.

Fitzroy, James: *see* Monmouth, James Scott, duke of.

Fitzroy, Robert (b. July 5, 1805, Ampton Hall, near Bury St. Edmunds, Suffolk, Eng.—d. April 30, 1865, Norwood, Surrey), British naval officer, hydrographer, and meteorologist who commanded the voyage of HMS "Beagle," which sailed around the world with Charles Darwin aboard as naturalist. The voyage provided Darwin with much of the material on which he based his theory of evolution.

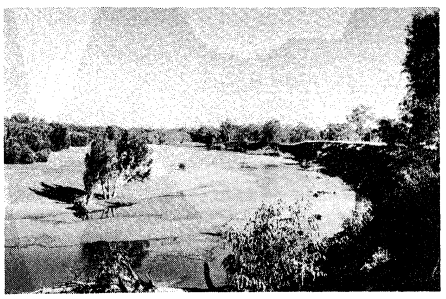
Fitzroy entered the Royal Navy in 1819 and, after service in the Mediterranean and in South American waters, received command of the 240-ton brig "Beagle" in 1828. He surveyed the South American coast around Patagonia and Tierra del Fuego, returning to England in 1830.

On Dec. 27, 1831, Fitzroy sailed from Portsmouth in the "Beagle" with Darwin aboard. The expedition visited the Cape Verde Islands, the South American coast, the Strait of Magellan, the Galápagos Islands, Tahiti, New Zealand, Australia, the Maldives, and Mauritius before returning to England on Oct. 2, 1836. In 1839 Fitzroy published two volumes of *Narrative of the Surveying Voyages of His Majesty's Ships Adventure and Beagle Between the Years 1826 and 1836, Describing Their Examination of the Southern Shores of South America, and the Beagle's Circumnavigation of the Globe.* A third volume, popularly known as *The Voyage of the Beagle,* was published by Darwin in 1839.

A member of Parliament for Durham (1841), Fitzroy became governor of New Zealand in 1843 but was recalled in 1845 largely because he contended that Maori land claims were as valid as those of the settlers. He retired from active duty in 1850 and from 1854 devoted himself to meteorology. He devised a storm warning system that was the prototype of the daily weather forecast, invented a barometer, and published *The Weather Book* (1863). His death was by suicide, during a period of mental turmoil.

Fitzroy River, river in northern Western Australia. It rises in the Durack Range in east Kimberley and traces a 325-mi (525-km) course that flows southwest through the rugged King Leopold Ranges and the Geikie Gorge (where many freshwater crocodiles are found) and turns northwest through rugged country and plains, emptying into the Indian Ocean at King Sound. A tidal rise of 25 ft (8 m) is common at its mouth (6 mi wide). Its chief tributaries are the Hann and Margaret rivers and Christmas Creek. The Fitzroy traverses cattle and sheep country, and rice is grown on floodplains along its lower course. A dam at Camballin controls water for irrigation. There is little navigation because of sandbars and

snags. Fitzroy Crossing, a settlement on the upper river, is in an area of large, permanent waterholes that sustain wildlife. Just above it is the Geikie Gorge National Park. The river



Fitzroy River, sand-clogged along its middle course, in Western Australia

John Brownlie—Bruce Coleman Inc.

was explored in 1838 by Lieut. John Lort Stokes of the HMS "Beagle," who named it in honour of Capt. Robert Fitzroy, a former commander of the ship.

Fitzroy River, river in eastern Queensland, Australia, formed by the confluence of the Dawson and Mackenzie rivers, on the slopes of the Eastern Highlands. The united stream flows northeast across the Broadsound Range and then southeast through distributaries to enter Keppel Bay on the Coral Sea of the Pacific Ocean after a course of 300 mi (480 km). Its catchment area with its main tributary, the 100-mi Margaret River, is 55,000 sq mi (142,000 sq km). The Fitzroy is navigable from Port Alma, at the mouth, 35 mi upstream to Rockhampton. Other towns along the river, which is named after Sir Charles Fitz Roy, governor of New South Wales (1845–55), are Morgan, Clermont, Springsure, and Emerald. Experimental pasturing and rice farming are practiced along the lower floodplain.

Fitzsimmons, Fat Freddie, byname of FREDERICK LANDIS FITZSIMMONS (b. July 28, 1901, Mishawaka, Ind., U.S.—d. Nov. 18, 1979, Yucca Valley, Calif.), U.S. professional National League right-handed baseball pitcher, who was famous for his windup in which he rotated his pitching arm while twisting his body so that he faced second base before turning to deliver the pitch. His best pitch was a knuckle ball.

Fitzsimmons played minor league baseball from 1920 at Muskegon, Mich., and Indianapolis, Ind., before joining the New York Giants in 1925; he pitched for them through the 1937 season, and for the Brooklyn Dodgers (1937–43). His career record was 217 wins and 146 losses. In 1940 he won 16 and lost 2 games for a winning percentage of .889, a record that stood until 1959, when Roy Face had .947. After retiring as a player, he managed the Philadelphia Phillies (1943–45) and coached for the Boston Braves (1948), the New York Giants (1949–55), and the Chicago Cubs (1957–58, 1966).

Fitzsimmons, Robert, byname BOB FITZSIMMONS, or RUBY ROBERT FITZSIMMONS (b. May 26, 1863, Helston, Cornwall, Eng.—d. Oct. 22, 1917, Chicago), world boxing champion in three weight divisions, including heavyweight.

A New Zealand resident as a young man, Fitzsimmons went to the United States in 1890, having already established a reputation as a fighter. He won the world middleweight title by knocking out Nonpareil Jack Dempsey in 13 rounds in New Orleans, Jan. 14, 1891. He resigned this championship on March 17, 1897, when he won the heavyweight title by knocking out Gentleman Jim Corbett in 14 rounds at Carson City, Nev. In this fight he first displayed the solar plexus punch. He lost the heavyweight championship to James J. Jeffries on an 11-round knockout at Coney Island, New York City, June 9, 1899. He won the light-heavyweight championship on Nov. 25, 1903, in San Francisco, when he defeated George Gardner in 20 rounds. He lost this title to Philadelphia Jack O'Brien on a 13-round knockout in San Francisco, Dec. 20, 1905. He continued fighting until 1914. Fitzsimmons weighed only about 170 pounds but had the chest and shoulder development of a much larger man.

Fitzsimmons, Sunny Jim, byname of JAMES E. FITZSIMMONS (b. July 23, 1874, near Brooklyn, N.Y., U.S.—d. March 11, 1966, Miami), U.S. racehorse trainer who, during his 78-year career, trained the winners of 2,275 races, bringing in purses totalling more than $13,000,000. He trained more than 250 winners of stakes events, including two winners of the U.S. Triple Crown (the Kentucky Derby, the Preakness, and the Belmont Stakes): Gallant Fox (1930) and Gallant Fox's colt Omaha (1935). Among the other outstanding horses he trained—victors in most of the leading stakes races in North America—were Fairene, Fenelon, Fighting Fox, Vagrancy, Johnstown, Nashua, Bold Ruler, and Granville.

Fitzsimmons began his career in 1885 as a stable boy at Brannon Brothers stable. After a moderately successful career as jockey (1889–94), which he had to abandon because of increasing weight, he became a trainer and in 1900 produced his first winner, Agnes D. His career of nearly 70 years included lengthy associations with the Belsir Stud and Wheatley stables. He retired in 1963.

Fitzthedmar, Arnold (b. Aug. 9, 1201, London—d. before Feb. 10, 1275), London alderman and merchant who compiled a chronicle of the mayors and sheriffs of London, 1188–1274.

He was the son of German parents from Bremen and Cologne, who had become London citizens (his father's name was Thedmar). He was well educated and connected by marriage with several wealthy London families, and he inherited great wealth and standing in the city. He became an alderman but in February 1258, with many others, was convicted of fraud, amerced, and banned from office; in November 1259 he was declared innocent and reinstated.

At first critical of Henry III's misrule and sympathetic toward the baronial reformers of 1258–59, he was alienated when they allied in June 1263 with the "popular" mayor Thomas FitzThomas and the middle-class revolutionaries. These, with mob support, overthrew the merchant oligarchy that had monopolized power in London. Fitzthedmar probably was implicated in the Royalist plot to trap Simon de Montfort at Southwark in December 1263 and was one of 40 leading citizens who were saved from execution by the arrival, on the morning of their trial, of the news of the victory of Edward (later Edward I) at Evesham (August 1265). As one of the delegation that went, under safe-conduct, to negotiate with Edward at Windsor in October 1265, he was imprisoned for a few days.

As custodian of the city muniments from 1270, he compiled, in the miscellaneous *De antiquis legibus liber,* in addition to an account of his own ancestry and birth, the invaluable *Chronicle of the Mayors and Sheriffs of London, 1188–1274,* the chief authority on the government and politics of London after 1239 and on London's relations with the crown and with the baronial reformers.

Fitzwalter, Robert (d. Nov. 9, 1235), English baronial leader against King John.

He first came into prominence as joint constable, with his cousin Saher de Quency (later earl of Winchester), of the castle of Vaudreuil, which, in mysterious circumstances, they surrendered to the French king Philip II in 1203. They were popularly accused of cowardice; but John issued a written statement that they had acted under his instructions. By 1212, however, Robert was in opposition to John and fled to France. Sentenced to outlawry, his lands were seized and his castles razed. As part of the king's reconciliation settlement with the papacy, Robert's estates were restored in the following year. But he remained active in his opposition to the King, his animosity quickened by John's designs upon Fitzwalter's daughter Maud (Geoffrey de Mandeville's wife). Robert took part in the demonstrations of baronial strength and the negotiations which led to the sealing of Magna Carta in June 1215 and was one of the 25 barons named to see that the King obeyed its provisions. On the outbreak of war, Robert was placed in command of the baronial forces. Again acting with Saher de Quency, he negotiated the intervention of Philip II's son Louis, to whom the barons offered the English throne. At the Battle of Lincoln (May 20, 1217) Robert was taken prisoner but was released in October after the conclusion of peace. In 1219, in company with Saher de Quency, he departed on crusade, returning sick, apparently early in 1221.

His memory long survived in the legend of King John and the fair Matilda (Maud), which became a popular subject of romance.

Fitzwalter, Thomas Radcliffe, Viscount, also called (1553–57) BARON FITZWALTER: *see* Sussex, Thomas Radcliffe, 3rd earl of.

Fitzwilliam Museum, art galleries located in Cambridge, Eng. The museum was erected to house the collection bequeathed in 1816 to Cambridge University by Viscount Fitzwilliam. The original building was completed in 1875 and additions were made after 1924. It houses Egyptian, Greek, and Roman antiquities; the Henderson collection of armour; medieval and Renaissance objects including ivories, enamels, and scientific instruments; and important paintings of the English, French, Italian, Dutch, and Flemish schools. It also has a library of musical manuscripts and literary autographs.

Fiume (Yugoslavia): *see* Rijeka.

Fiume question, post-World War I controversy between Italy and Yugoslavia over the control of the Adriatic port of Fiume (known in Yugoslavia as Rijeka; *q.v.*).

Although the secret Treaty of London (April 26, 1915) had assigned Fiume to Yugoslavia, the Italians claimed it at the Paris Peace Conference on the principle of self-determination. Ignoring the suburb of Susak, which had 11,000 Yugoslavs and 1,500 Italians, they claimed that the rest of Fiume had 22,488 Italians against 13,351 Yugoslavs and certain others. On Sept. 12. 1919, the Italian nationalist poet Gabriele D'Annunzio, who had mustered a body of men near Trieste, occupied Fiume and proclaimed himself the "commandant" of the "Reggenza Italiana del Carnaro." The Italian government, however, on concluding the Treaty of Rapallo (Nov. 12, 1920) with Yugoslavia, resolved to turn D'Annunzio out of Fiume. Giovanni Giolitti, the Italian premier, ordered the battleship "Andrea Doria" to shell D'Annunzio's palace only, predicting that the surprise would cause the "commandant" to escape at once—as indeed it did. Riccardo Zanella, the next premier, supported Count Carlo Sforza's solution of the problem, namely a free state of Fiume-Rijeka with an Italo-Fiuman-Yugoslav consortium for the port; and such a solution was approved by the Fiuman electorate on April 24, 1921. But when the Fascists gained power in Italy, the Rapallo Plan for a free state came to nothing. Pressed by Benito Mussolini, the Yugoslav

government yielded, and a new Italo-Yugoslav treaty, signed in Rome on Jan. 27, 1924, recognized Fiume itself as Italian while Susak became Yugoslav.

After World War II, by the Treaty of Paris (Feb. 10, 1947), all of Fiume became part of Yugoslavia.

Five, The, also called THE RUSSIAN FIVE, or THE MIGHTY FIVE, Russian MOGUCHAYA KUCHKA ("Mighty Group"), group of five composers who, in about 1875, united in their efforts to create a truly national school of Russian music: César Cui, Aleksandr Borodin, Mily Balakirev, Modest Mussorgsky, and Nikolay Rimsky-Korsakov. The original name of the group, Moguchaya Kuchka, was coined in a newspaper article in 1867. Centred in St. Petersburg (now Leningrad), they are often considered to have been a rival faction to the more cosmopolitan, Moscow-centred composers such as Peter Ilich Tchaikovsky, although Tchaikovsky often used actual folk songs in his music and Borodin and Rimsky-Korsakov emphasized traditional European training in their work. Precursors of The Five were Mikhail Glinka and Aleksandr Dargomyzhsky. They were succeeded by a less-energetic generation including Anatoly Lyadov, Sergey Taneyev, and Aleksandr Glazunov.

Five Articles Oath (Japan): *see* Charter Oath.

Five Dynasties, in Chinese history, period of time between the fall of the T'ang dynasty (AD 907) and the founding of the Sung dynasty (960), when five would-be dynasties followed one another in quick succession in North China. The era is also known as the period of the Ten Kingdoms because 10 regimes dominated separate regions of South China during the same period.

The first of the five dynasties was the Later Liang, which was established by the rebel leader Chu Wen after he usurped the T'ang throne in 907. Chu was murdered by his own son in 912, and the Later Liang was overthrown by one of its generals, Chuang-tsung, who established the Later T'ang dynasty in 923. Although Chuang-tsung ruled relatively successfully for 13 years, the Later T'ang was finally terminated when one of its generals, Kao-tsu, overthrew his master with the aid of the Khitan, a seminomadic people of inner Asia, and Kao-tsu established the Later Chin dynasty. When Kao-tsu's son attempted to halt his tribute payments to the Khitan in 946, they reinvaded North China and carried him into captivity, thus ending the Later Chin. The following year a former Later Chin general who also bore the name of Kao-tsu founded the Later Han dynasty and pushed the Khitan back into Inner Asia. But this regime lasted only four years before still another general usurped the throne, founding the Later Chou dynasty. Although progress toward a more stable government began to be made during this time, the emperor died, leaving an infant on the throne. As a result, another general, T'ai-tsu, seized the throne, founding the more long-lived Sung dynasty, thus bringing the Five Dynasties period to an end.

In spite of the unstable political situation under the five dynasties, cultural activity was not greatly disrupted. It was during this period that printing by wooden blocks was fully developed, and the first complete printing of the Confucian classics was completed in 953. The greatest of the painters in the North was Ching Hao, who was working in monastic seclusion in the mountains of Shansi. Hu Huai was a great figure painter doing hunting scenes in the North. Flower painting, until then distinctively Buddhist, became a branch of nonreligious painting during the Five Dynasties. Although the production of some pottery of the T'ang era was disrupted, the white and black glazed wares of the T'ang were produced in the North without disruption during the Five Dynasties.

A form of poetry that had developed during the T'ang was the *tz'u,* lyrical lines of uneven length written to accompany musical tunes. In the Five Dynasties the *tz'u* won enormous popularity. Folktales also won favour as a literary genre at this time, and a liberating trend in prose, relaxing many stylistic restrictions, freed writers to produce new forms of fiction such as tales of romance and adventure.

Five Good Emperors, the ancient Roman imperial succession of Nerva (reigned AD 96–98), Trajan (98–117), Hadrian (117–138), Antoninus Pius (138–161), and Marcus Aurelius (161–180), who presided over the most majestic days of the Roman Empire. It was not a bloodline; Nerva was raised to the principate by the assassins of Domitian, and the others were successively adopted heirs, each only distantly related to his predecessor if at all. The last two—Antoninus Pius and Marcus Aurelius—are often called the Antonines, though the term Antonine is sometimes extended also to the coemperors Lucius Verus (adopted heir of Antoninus Pius) and Commodus (son of Marcus Aurelius).

The period witnessed considerable expansion of the empire, from northern Britain to Dacia and to Arabia and Mesopotamia. The empire was consolidated, its defenses were perfected, and a tolerably uniform provincial system covered the whole area of the empire. The client states had one by one been reconstituted as provinces, and even the government of Italy had been in many respects assimilated to the provincial type.

All this was preceded and accompanied by the Romanizing of the peoples of the empire in language and civilization. Yet, in spite of the internal tranquillity and the good government that have made the age of the Five Good Emperors famous, one can detect signs of weakness. It was in this period that the centralization of authority in the hands of the emperor was completed; the "dual control" established by Augustus, which had been unreal enough in the 1st century, was now, though not formally abolished, systematically ignored in practice. The Senate thus ceased to be an instrument of government and became an imperial peerage, largely composed of men who were not qualified by election to the quaestorship but rather were directly ennobled by the emperor. The restricted sphere of administration left by Augustus to the old magistracies was narrowed still further; their jurisdiction, for example, tended to pass into the hands of the Greek officers appointed by the emperor. The complete organization of the emperor's own administrative service, and its recognition as a state bureaucracy, was chiefly the work of Hadrian, who took the secretaryships out of the hands of freedmen and entrusted them to procurators of equestrian rank.

All these changes, inevitable and, in some degree, beneficial, as they were, brought with them the attendant evils of excessive centralization. Although these were hardly felt while the central authority was wielded by vigorous rulers, even under Trajan, Hadrian, and the Antonines one notices a failure of strength in the empire as a whole and a corresponding increase of pressure on the imperial government itself. Among the symptoms of incipient decline were the growing depopulation, especially of the central districts of the empire, the constant financial difficulties, the deterioration in character of the local governments in the provincial communities, and the increasing reluctance exhibited by all classes to undertake the now onerous burden of municipal office.

After the death of Marcus Aurelius in 180, the empire quickly descended into the chaos of civil war, which was not ended until the assassination of Commodus (193) and the eventual triumph of Septimius Severus.

Five Great Kings, Tibetan SKU LNGA, in Tibetan Buddhism, a group of five deified heroes popularly worshiped as protection against enemies. Some accounts suggest they were five brothers who came to Tibet from northern Mongolia, and they are usually shown wearing broad-rimmed helmets. Diverse traditions exist, but they are generally identified as the following: (1) Pe-har, chief of the Five Great Kings and described as "king of the karma," who resides in the northern quarter, is white in colour and rides a white lion; (2) Brgya-byin, the "king of the mind," who resides in the centre, is dark blue and rides an elephant; (3) Mon-bu-pu-tra, the "king of the body," who resides in the eastern quarter, is black and rides a white lioness; (4) Shing-bya-can, the "king of virtue," who resides in the southern quarter, is black and rides a black horse; (5) Dgra-lha skyes-gcig-bu, the "king of speech," who resides in the western quarter, is red and rides a black mule.

Consult the INDEX *first*

Five Hundred, card game for three players, devised in 1904 by the U.S. Playing Card Company. It most closely resembles Euchre but shares certain elements with Whist, Bridge, and Auction Pinochle. The game was extremely popular until it was surpassed first by Auction Bridge in the 1920s and later by Contract Bridge. A 32-card deck, ace (high) through 7, is used, plus a joker (best bower), which outranks the jack of trump (right bower), which in turn outranks the left bower (jack of the other suit of the same colour). In a no-trump game, the jacks rank in the usual position. The suits rank downward from hearts to diamonds, clubs, and spades.

Ten cards are dealt each player in a three–four–three sequence; a three-card widow is placed in the centre. As the name implies, the object of the game is to win 500 points: high bidder names trump, exchanges through the widow, and tries to make his bid (6 to 10 tricks). The bid called misere is a bid to lose every trick; to open misere is to do so with one's hand exposed on the table. Both are played at no-trumps, except for the joker. Each bid must be for more tricks than the previous one or for a higher score, following the contract valuation table. Normal rules of trick taking apply, with no points given for extra tricks. The value of a failed bid is subtracted from the bidder's score; other players receive 10 points per trick. The winner is the first to score 500. Variations of the game allow for play with two to six players.

Five Knights' case (English law): *see* Darnel's case.

five-note scale (music): *see* pentatonic scale.

Five Pecks of Rice, Chinese (Wade–Giles romanization) WU-TOU-MI, Pinyin WUDOUMI, great Taoist-inspired popular movement that occurred near the end of China's Han dynasty (206 BC–AD 220) and greatly weakened the government. The Five Pecks of Rice movement became a prototype of the religiously inspired popular rebellions that were to periodically erupt throughout China for the next 2,000 years.

The movement was begun early in the 2nd century AD by Chang Ling, considered the founder and first patriarch of the Taoist church in China. Chang began his career as

a faith healer, and his movement took the name of the five pecks of rice a year that clients paid him either for their cure or as dues of the cult. Chang was succeeded as *t'ien shih* ("celestial master") by his son Chang Heng, who was in turn succeeded by his son Chang Lu. By Chang Lu's time, poverty and misery had become endemic to the peasantry of central China. Taking advantage of the resulting discontent, Chang Lu formed his own army and set up an independent theocratic state, which established free wayside inns for travelers, dealt leniently with criminals, and promoted the spread of the Taoist religion. In developing this state, Chang Lu was joined by another Taoist leader, Chang Hsiu (no relation). Together they managed to extend the rebellion until it covered all of present-day Szechwan province. But the two leaders eventually came into conflict with each other, and Chang Lu killed Chang Hsiu. In AD 215 Chang Lu surrendered to the great Han general Ts'ao Ts'ao, who rewarded him with high rank and a princely fief.

Five-Power Constitution, system of government proposed by the Chinese revolutionary leader Sun Yat-sen in 1905 as the means through which democracy could be implemented in China after the overthrow of the imperial regime. It provided for a central government composed of five yuan, or branches, of government. As in the United States, where Sun Yat-sen went to school, there were to be legislative, executive, and judicial yuan. The last two branches, the examination yuan, which was to administer the selection of candidates for the bureaucracy, and the censorate, or control, yuan, which was to check up on the honesty and efficiency of the government, were traditional Chinese administrative components. Sun hoped that these divisions would help safeguard the rights of the people.

Although Sun's Five-Power Constitution was implemented in 1928 by the Kuomintang, or Nationalist, government of Chiang Kai-shek, most of the government funds were absorbed by the parallel military administration and its various agencies. Moreover, the executive yuan and its diverse ministries dominated all the other yuan and allowed them very little independent power.

The five-yuan system is still maintained by the Nationalist government on Taiwan.

Five Principles (Indonesian history): *see* Pancasila.

five-tone scale (music): *see* pentatonic scale.

Five Years Meeting of Friends: *see* Friends United Meeting.

fives, a ball game played by two or four players in a court enclosed on three or four sides, the hard ball being struck with the hand usually protected by a glove. The derivation of the word fives is doubtful. It may be from an old game called Longue Paume, in which five on a side played, or from allusion to the five fingers of the hand or from the fact that winners formerly had to make five points.

The game, played largely in Great Britain in public schools, has three forms that vary from each other in the physical conformation of the court and in slightly different playing rules: Eton fives, Rugby fives, and Winchester fives.

Eton fives. The Eton fives court is a remarkably close copy of the court used by generations of Eton College boys on the steps of the school chapel. It is enclosed on three sides and open at the back. A shallow step divides the court into an upper and lower part, and the court has several physical irregularities, or hazards.

The game is played with four players, two on each side, who wear leather gloves to protect their hands. There is no recognized singles game. When the game starts, the server alone stands in the upper court. To begin the game he throws the ball so that it hits the front wall and then the right-hand sidewall and falls to the lower court.

The opponent who returns the service is said to make the "first cut," and he need not do so until he gets a service to his liking. Serving is only a method of putting the ball in play. The ball must be hit with a single blow of the hand or wrist and must not touch any other part of the striker's person.

After the first cut, the ball is played alternately by a player of each side. Providing the ball is played not later than after the first bound on the floor and is returned above the line, the rally continues.

A game is won by the side that first obtains 12 points. When the server's side wins a rally, a point is won; if the server's side loses a rally, the server's partner serves and no point is scored; if the server's side loses another rally, the service changes to the opponents. A point can only be won if the winners of the rally are the serving side. A match is usually the best of five games.

Governed by the Eton Fives Association, the main competitions are for an amateur championship and a public schools competition.

For the uninitiated spectator, the game is bewildering. The ball rebounds in many unexpected ways off the hazards, and the players seem often to be in each other's way. It involves mental as well as physical exercise, there being a variety of ways to outwit an opponent.

Rugby fives. The Rugby fives court has four plain composition walls and a hard composition floor. The front wall has a board running across its lower portion. The sidewalls decrease in height from the front wall, sloping down from 15 feet (about 4.8 m) to 6 feet (about 1.8 m), the height of the back wall.

The game is played like Eton fives with the exception that the player who makes the first return is called the server. Either he can throw the ball up for himself, and usually does, or he can require his opponent, called the receiver, to do so. The ball must be hit only with the hand or forearm. The receiver is "up," and only a side that is "up" can score points. Matches are usually the best of three games, the first team or player to get 15 points winning the game. Club and school games are won on total points. Both singles and doubles are played.

Competition, regulated by the Rugby Fives Association, includes several regional championships, a universities championship, amateur singles and doubles championships, and schools championships. Rugby fives can be exhausting because of the speed of the ball, the low board, and the use that is made of the back wall. It is the most popular of the three games.

Winchester fives. Winchester fives is a game confined to a few schools, there being no association or championships and few courts. The court is similar to the Rugby one, but a change of direction of the left-hand wall makes the court slightly narrower at the back than at the front. This changes the positioning of players, and Rugby fives players are at a disadvantage. Despite these differences, Winchester players have little difficulty in adapting to the Rugby game, and several schools that play the Winchester game are affiliated with the Rugby Fives Association.

fivestones (game): *see* jackstones.

Fizeau, Armand-Hippolyte-Louis (b. Sept. 23, 1819, Paris—d. Sept. 18, 1896, Nanteuil-le-Haudouin, Fr.), French physicist noted for his experimental determination of the speed of light.

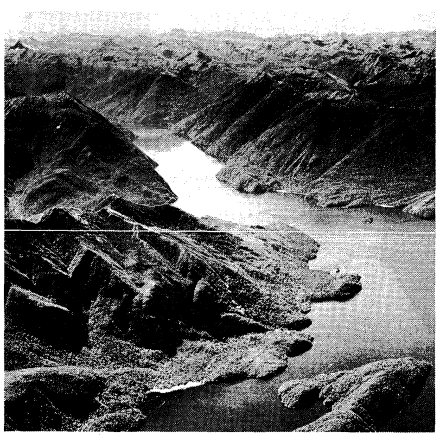
Fizeau worked with Jean-Bernard-Léon Foucault on investigations of the infrared portion of the solar spectrum and made other observations of heat and light. Unaware of Christian Doppler's publication (1842), Fizeau in 1848 gave an explanation of the shift in wavelength in light coming from a star and showed how it could be used to measure the relative velocities of stars that lie in the same line of sight. In 1849 Fizeau found the first reasonably accurate value of the velocity of light obtained in a nonastronomical experiment.

In 1851 he carried out a series of experiments in an attempt to detect the luminiferous ether—a hypothetical material that was thought to occupy all of space and to be necessary for carrying the vibrations of light waves. The experimental results failed to demonstrate the existence of the ether, but his work helped lead to the discarding of the ether theory in the early years of the 20th century.

Fizeau became a member of the French Academy in 1860 and was appointed superintendent of physics at the École Polytechnique, Paris, in 1863.

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

fjord, also spelled FIORD, long narrow arm of the sea, commonly extending far inland, that results from marine inundation of a glaciated valley. Many fjords are astonishingly deep; Sognefjord in Norway is 1,234 m (4,078 feet)



Bradshaw Sound, Fiordland, west coast of South Island, New Zealand

By courtesy of the New Zealand Geological Survey; photograph, T. Ulyatt

deep, and Canal Messier in Chile is 1,270 m (4,167 feet). The great depth of these submerged valleys, extending thousands of feet below sea level, is compatible only with a glacial origin. It is assumed that the enormous, thick glaciers that formed in these valleys were so heavy that they could erode the bottom of the valley far below sea level before they floated in the ocean water. After the glaciers melted, the waters of the sea invaded the valleys.

Fjords commonly are deeper in their middle and upper reaches than at the seaward end. This results from the greater erosive power of the glaciers closer to their source, where they are moving most actively and vigorously. Because of the comparatively shallow thresholds of fjords, the bottoms of many have stagnant water and are rich in black mud containing hydrogen sulfide.

Glacial erosion produces U-shaped valleys, and fjords are characteristically so shaped. Because the lower (and more horizontally inclined) part of the U is far underwater, the visible walls of fjords may rise vertically for hundreds of feet from the water's edge, and close to the shore the water may be many hundreds of feet deep. In some fjords small streams plunge hundreds of feet over the edge of the fjord; some of the world's highest water-

Flags of the World

United Nations

Afghanistan

Albania

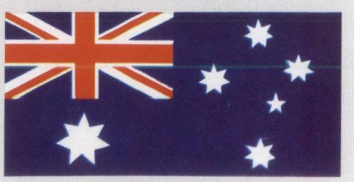
Algeria

Andorra*

Angola

Antigua and Barbuda

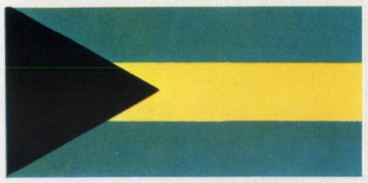
Argentina*



Australia

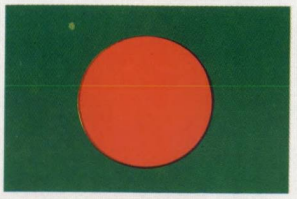
Austria*

*State flag shown; national flag does not carry coat of arms.



The Bahamas

Bahrain

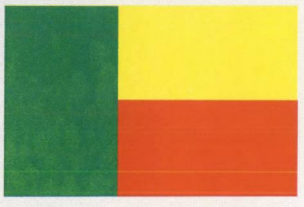


Bangladesh

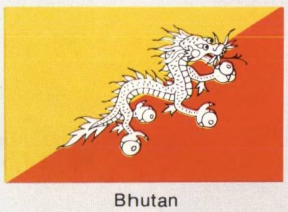
Barbados

Belgium

Belize



Benin



Bhutan

Bolivia*

Botswana

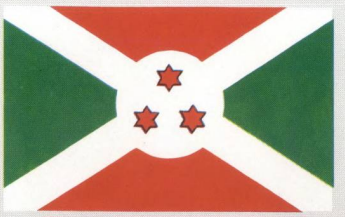
Brazil

Brunei

Bulgaria

Burkina Faso

*State flag shown; national flag does not carry coat of arms.

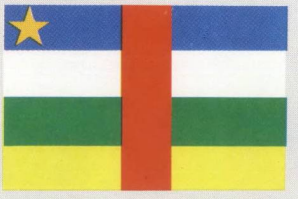


Burundi

Cameroon

Canada

Cape Verde



Central African Republic

Chad

Chile

China

Colombia

Comoros

Congo

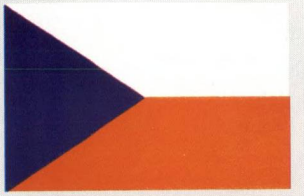
Costa Rica*

Côte d'Ivoire

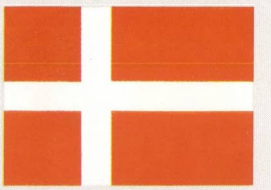
Cuba

*State flag shown; national flag does not carry coat of arms.

Cyprus



Czechoslovakia



Denmark

Djibouti

Dominica

Dominican Republic*

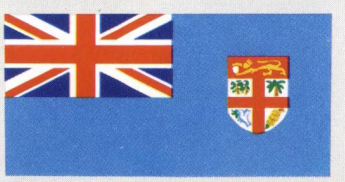
Ecuador*

Egypt

El Salvador

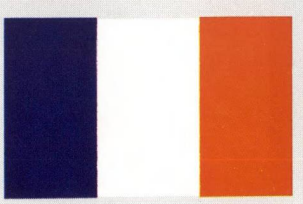
Equatorial Guinea

Ethiopia



Fiji

Finland*



France

Gabon

*State flag shown; national flag does not carry coat of arms.

The Gambia

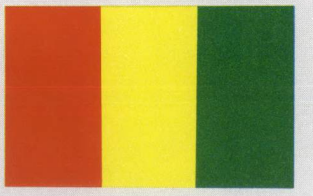
Germany

Ghana

Greece

Grenada

Guatemala*



Guinea

Guinea-Bissau

Guyana

Haiti*

Honduras

Hungary

Iceland

India

*State flag shown; national flag does not carry coat of arms.

Indonesia

Iran

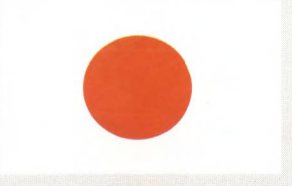
Iraq

Ireland

Israel

Italy

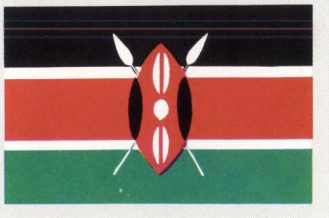
Jamaica



Japan

Jordan

Kampuchea (Cambodia)



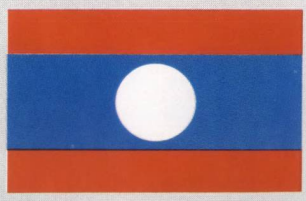
Kenya

Kiribati

North Korea

South Korea

Kuwait



Laos

Lebanon

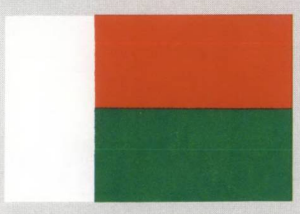
Lesotho

Liberia

Libya

Liechtenstein

Luxembourg



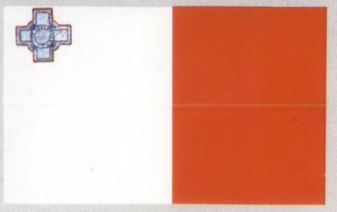
Madagascar

Malawi

Malaysia

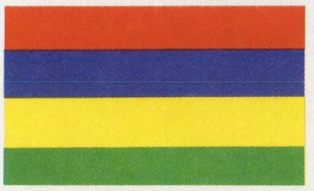
Maldives

Mali



Malta

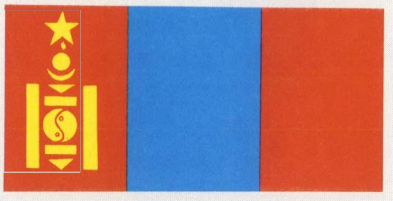
Mauritania



Mauritius

Mexico

Monaco



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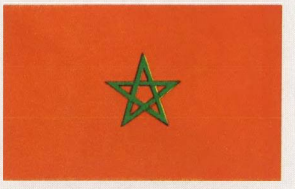
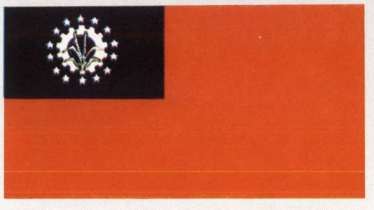


Morocco

Mozambique

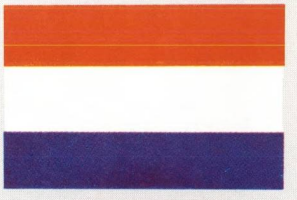


Myanmar

Namibia

Nauru

Nepal

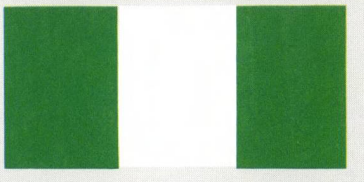


The Netherlands

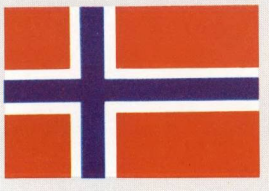
New Zealand

Nicaragua*

Niger



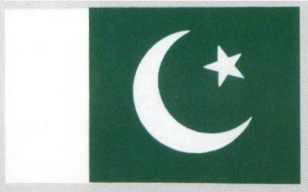
Nigeria



Norway

Oman

*State flag shown; national flag does not carry coat of arms.



Pakistan

Panama

Papua New Guinea

Paraguay

Peru*

Philippines

Poland

Portugal

Qatar

Romania

Rwanda

St. Kitts and Nevis

St. Lucia

St. Vincent and the Grenadines

San Marino*

*State flag shown; national flag does not carry coat ot arms.

São Tomé and Príncipe

Saudi Arabia

Senegal

Seychelles

Sierra Leone

Singapore

Solomon Islands

Somalia

South Africa

Spain

Sri Lanka

The Sudan

Suriname

Swaziland

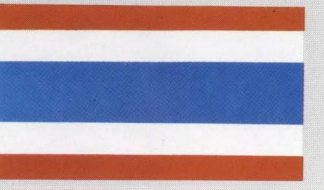
Sweden

Switzerland

Syria

Taiwan

Tanzania



Thailand

Togo

Tonga

Trinidad and Tobago

Tunisia

Turkey

Tuvalu

Uganda

Union of Soviet Socialist Republics

United Arab Emirates

United Kingdom

United States

Uruguay

Vanuatu

Vatican City

Venezuela*

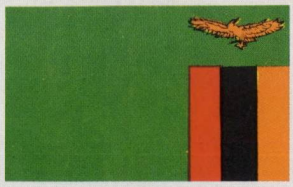
Vietnam

Western Samoa

Yemen

Yugoslavia

Zaire



Zambia

Zimbabwe

*State flag shown; national flag does not carry coat of arms.

Flags of the United States

Alabama

Alaska

Arizona

Arkansas

California

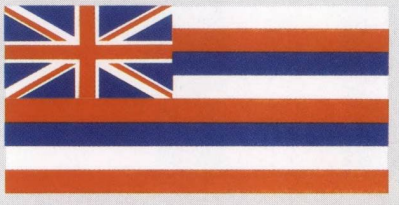
Colorado

Connecticut

Delaware

Florida

Georgia



Hawaii

Idaho

Illinois

Indiana

Iowa

Kansas

Kentucky

Louisiana

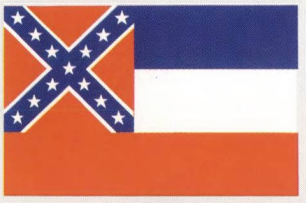
Maine

Maryland

Massachusetts

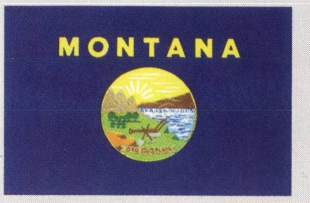
Michigan

Minnesota



Mississippi

Missouri



Montana

Nebraska

Nevada

New Hampshire

New Jersey

New Mexico

New York

North Carolina

North Dakota

Ohio

Oklahoma

Oregon

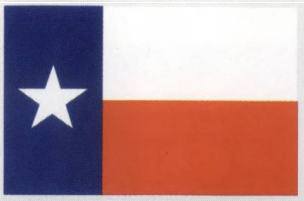
Pennsylvania

Rhode Island

South Carolina

South Dakota

Tennessee



Texas

Utah

Vermont

Virginia

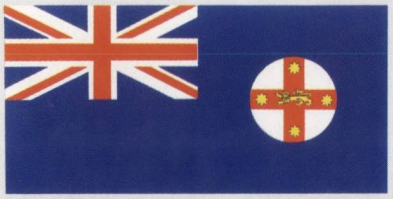
Washington

West Virginia

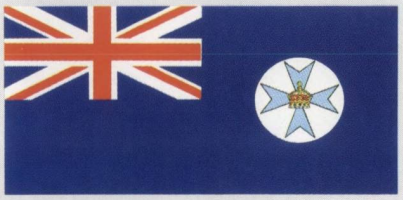
Wisconsin

Wyoming

Flags of Australia



New South Wales



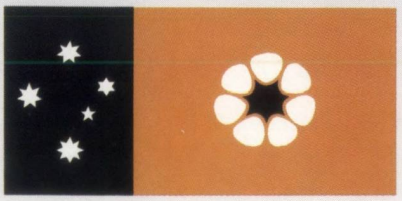
Queensland

South Australia

Tasmania

Victoria

Western Australia



Northern Territory

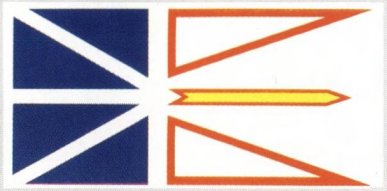
Flags of Canada

Alberta

British Columbia

Manitoba

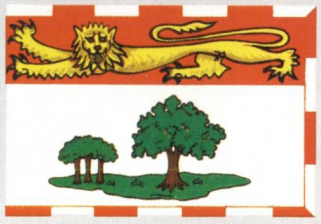
New Brunswick



Newfoundland

Nova Scotia

Ontario



Prince Edward Island

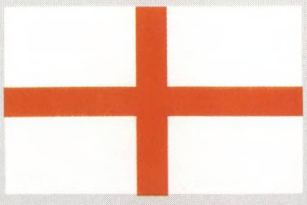
Quebec

Saskatchewan

Northwest Territories

Yukon Territory

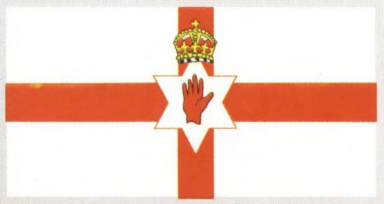
Flags of the United Kingdom and British Crown Possessions



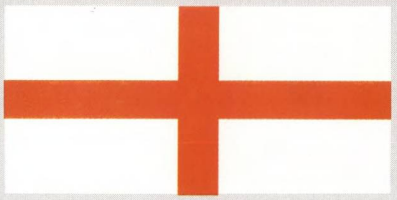
England

Scotland

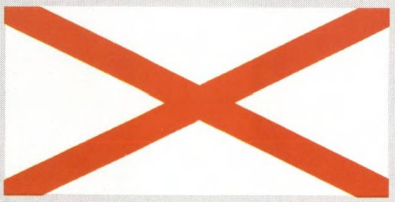
Wales



Northern Ireland



Guernsey



Jersey

Isle of Man

falls are of this type. Fjords commonly have winding channels and occasional sharp corners. In many cases the valley, floored with glacial debris, extends inland into the mountains; sometimes a small glacier remains at the valley's head. The river that formed the original valley commonly reestablishes itself on the upper valley floor after the disappearance of the ice and begins to build a delta at the fjord's head. Often this delta is the only place on the fjord where villages and farms can be established.

Flaccus, Aulus Persius (Roman satirist): *see* Persius.

Flaccus, Gaius Valerius (Roman epic poet): *see* Valerius Flaccus, Gaius.

Flaccus, Marcus Verrius (Roman teacher): *see* Verrius Flaccus, Marcus.

Flaccus, Quintus Horatius (Roman lyric poet): *see* Horace.

Flachsbinder, Jan (Polish Renaissance poet): *see* Dantiscus, Johannes.

Flacius Illyricus, Matthias, Serbo-Croatian MATIJA VLAČIĆ ILIR (b. March 3, 1520, Albona, republic of Venice [now in Yugoslavia]—d. March 11, 1575, Frankfurt am Main), Lutheran Reformer, pioneer in church historical studies, and theological controversialist who created a lasting rift within Lutheranism.

From 1539, after studies in Venice with the humanist Baptista Egnatius, Flacius attended the universities of Basel, Tübingen, and Wittenberg. He was welcomed at Wittenberg in 1541 by Philipp Melanchthon and there came under Martin Luther's influence. Appointed professor of Hebrew at Wittenberg in 1544, Flacius incurred Melanchthon's wrath for opposing the Augsburg Interim (1548) and the Leipzig Interim (1548), which formulated basic Lutheran beliefs. In 1549 he moved to Magdeburg, where his dispute with Melanchthon was resolved.

From 1552 Flacius was occupied with the *Ecclesiastica historia,* his major work in church history. Completed in 1574 and called the *Centuriae Magdeburgenses* ("Magdeburg Centuries") from its third edition (1757), it treats the centuries of church history mechanically as discrete units. Under his supervision it was prepared from manuscripts collected from all accessible European libraries by a group known as the centuriators. Frequently polemical, its intent was to refute Roman Catholic claims to authenticity.

Made professor of the New Testament at the University of Jena in 1557, Flacius was soon involved in a new controversy with Melanchthon over adiaphorism, which holds that certain religious doctrines or practices are matters of indifference because they are neither commanded nor forbidden in the Bible. Melanchthon took the more liberal position that some features of Reformation theology were comparatively minor and therefore open to compromise, but Flacius maintained a strict view of Luther's beliefs and refused to yield to negotiation on any point. Following a series of personal attacks on Melanchthon, Flacius was removed from his post at Jena in 1561 and lived successively in Regensburg, Antwerp, Frankfurt, Strassburg, and again in Frankfurt.

Among other works by Flacius are *Clavis scripturae sacrae* (1566; "Key to Sacred Scripture"); his version (1555) of Luther's writings; and the "Book of Confutation" (1559), in which he detailed his position in the adiaphorist controversy.

Flacourtiaceae, the Indian plum family, belonging to the violet order (Violales) and comprising about 85 genera of widely distributed tropical and subtropical trees and shrubs. Various species yield edible fruit or commercially useful wood.

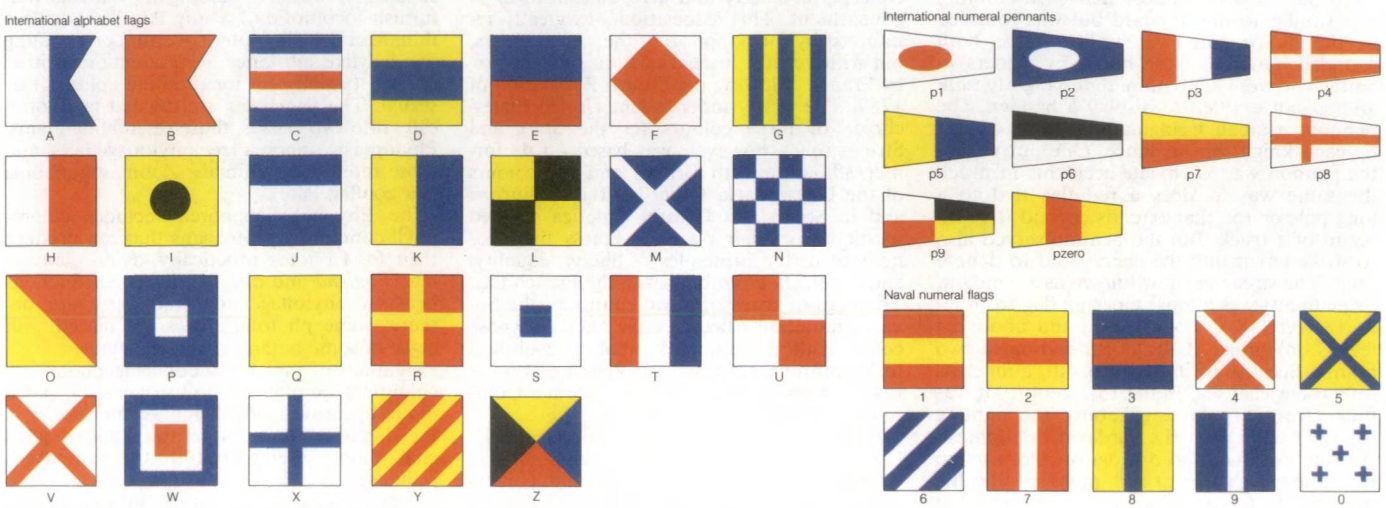
The ramontchi, batoko plum, or governor's plum (*Flacourtia indica* or *F. ramontchi*), native to Southeast Asia and East Africa and commonly cultivated in warm regions of the United States, bears a dark red, astringent fruit, about 12 mm (about 0.5 inch) in diameter, that is of some medicinal use. The tree also yields a wood suitable for tool handles. Other members of the genus *Flacourtia* bear similar fruit. The wood of the wild peach (*Kiggelaria africana*), native to southern Africa, is used for furniture. The kei apple (*Dovyalis caffra*), native to southern Africa, is grown as a hedge and for its fruit, which is pickled or used in preserves. The bright yellow fruit is about 2.5 cm (1 inch) in diameter.

flag, a piece of cloth, bunting, or similar material displaying the insignia of a community, an armed force, an office, or an individual. A flag is usually, but not always, oblong and is attached by one edge to a staff or halyard. The part nearest the staff is called the hoist; the outer part is called the fly. A flag's length (also called the fly) usually exceeds its width (hoist). Flags of various forms and purpose are known as colours, standards, banners, ensigns, pendants (or pennants), pennons, guidons, and burgees.

Originally used mainly in warfare, flags were, and to some extent remain, insignia of leadership, serving for the identification of friend or foe and as rallying points. They are now also extensively employed for signaling, for decoration, and for display. Because the usefulness of a flag for purposes of identification depends on its blowing out freely in the wind, the material that is preferred is usually light and bears a device or pattern identical on both sides. Wording therefore tends to be excluded, and the simpler patterns are favoured. Any colours or devices may be used, but European usage normally follows the practice of heraldry in discouraging the juxtaposition of "metal" and "metal" (*i.e.,* of yellow and white) or of colour and colour without "metal" interposed. The flag of the Vatican City state constitutes an exception to this rule.

Origins. Flags recognizable as such were the invention, almost certainly, of the ancient Indians or the Chinese. It is said that the founder of the Chou dynasty in China (*c.* 1122 BC) had a white flag carried before him, and it is known that in AD 660 a minor prince was punished for failing to lower his standard before his superior. Chinese flags had devices such as a red bird, a white tiger, or a blue dragon. They were carried on chariots and planted upon the walls of captured cities. The royal flag had, however, all the attributes of kingship, being identified with the ruler himself and treated with a similar respect. It was thus a crime even to touch the flag-bearer. The fall of the flag meant defeat; and the king would rarely expose his flag and his person together, the flag being normally entrusted to a general.

Flags had equal importance in ancient India, being carried on chariots and elephants. The flag was the first object of attack in battle, and its fall would mean confusion if not defeat. Indian flags were often triangular in shape and scarlet or green in colour, with a figure embroidered in gold and a gold fringe. If these and the Chinese flags had a common origin in the standards of ancient Egypt and Assyria (standards, in this sense, meaning solid objects, such as metal animals, attached atop poles), then they might have developed from the streamers often attached to the pole. This possibility gains some likelihood from the fact that some Indian flagstaffs were surmounted by a figure similar to that displayed on the flag itself. Mughal royal insignia included, however, other things besides the flag, more especially yaks' tails and the state umbrella. Flags seem also to have been used, in India as in China, for signaling, and there is an instance of a white flag being used as a signal for a truce as early as AD 1542. Indian and Chinese usage spread to Burma, Siam, and southeastern Asia. Flags with a background of white, yellow, or black silk are mentioned, with devices (an elephant, a bull, or a water hen, for example) embroidered on them



Flags used for signal communications between ships
(Left) International alphabet flags; (top right) international numeral pennants for call signs; and (bottom right) naval numeral flags for flag-hoist messages

in gold. A Siamese treatise on war gives the impression that the flags were unfurled as the march began.

Flags were probably transmitted to Europe by the Saracens. But Islām's prohibition of the use of any identifiable image as idolatrous influenced their design. They are often mentioned in the early history of Islām and may have been copied from India. But Islāmic flags are greatly simplified and appear to have been plain black or white or red. Black was supposed to have been the colour of Muḥammad's banner—the colour of vengeance. A black flag was used by the 'Abbāsids in AD 746 (AH 129), the Umayyads choosing white by contrast and the Khawārij red. Green was the colour of the Fāṭimid dynasty and eventually became the colour of Islām. In adopting the crescent sign, however, *c.* 1250, the Ottoman Turks apparently were reverting to an Assyrian sacred symbol of the 9th century BC and probably of greater antiquity than that. The crescent moon, with or without an additional star or stars, has since become the accepted official symbol of Islām.

In Europe the first "national" flags were adopted in the Middle Ages and the Renaissance. Many of the leaders of that time adopted the flag of their patron saint to represent their country. In England, for example, the cross of St. George was adopted in the 13th century. Toward the end of the Middle Ages, flags had become accepted symbols of nations, kings, organizations, cities, and guilds. Guild flags bore obvious devices. For instance, a black flag with three white candles represented the candlemakers of Bayeux, Fr.

Forms and functions. In Europe, flags were subdivided according to their shape and purpose into standards, banners, guidons, pennons, and streamers. There were also many flags of a personal, family, or local significance that were of a different, and usually more complex, pattern. Of the main types, the standard was the largest and was intended, from its size, to be stationary. It marked the position of an important individual before a battle, during a siege, throughout a ceremony, or at a tournament. For the monarch it marked the palace, castle, saluting base, tent, or ship where he was actually present. Standards were also used at first by the greater nobles, whose personal insignia they bore. They were originally long and tapering toward the fly, ending in two points. Banners were square or oblong and were borne in action (as the standard was not) before royal and noble warriors down to the rank of knight banneret. These again bore the personal or family device. The guidon (a word derived from the French *guyd-homme*) was similar to the standard but was rounded in the fly or had two swallow tails, both rounded. Guidons were borne by leaders in battle who were of no more than knightly rank and so not entitled to display a banner. The pennon, a small triangular flag, was carried by each knight on his lance. One purpose of the pennon was to obviate accidents in much the same way as does a red flag tied to a long pole or rod that extends beyond the tailboard of a truck. But the pennon served also to strike terror into the enemy and to denote rank. The streamer (now known as a pendant, or pennant) was a long, tapering flag from 60 to 18 feet (18 to 55 m) long and about 24 feet (7 m) broad at the hoist, ending in two points. Because of its great length, almost its only use was at sea. In the 15th century it was flown from a pole rising above the fighting top, and later from the yardarm or topmast. It came eventually to distinguish the warship from the merchantman and, more specifically, the warship in commission from the warship laid up in harbour. The pennant is white in the British Royal Navy, with a St. George's cross near the hoist, and denotes a warship in commission, being hoisted when the captain assumes his command.

The flag, over the centuries, has developed many special uses. The black flag in days gone by was the symbol of the pirate. All over the world a yellow flag is the signal of infectious illness. A ship hoists it to denote that there are some on board suffering from yellow fever, cholera, or some such infectious malady; and it remains hoisted until the ship has passed quarantine. This flag is also hoisted on quarantine stations. The white flag is universally used as a flag of truce.

At sea, striking, or lowering, the flag denotes surrender. When the flag of one country is placed above that of another, the victory of the former is denoted; hence, in time of peace it would be an insult to hoist the flag of one friendly nation above that of another. Each national flag must be flown from its own flagstaff. To denote honour and respect, a flag is "dipped." Ships at sea salute each other by "dipping," *i.e.,* by running the flag slowly down from the masthead and then smartly replacing it. When troops parade before a sovereign or other reviewing officer, the regimental flags are lowered as they salute him. A flag flying at halfmast is the universal symbol of mourning. A ship's signal of distress is made by hoisting the national ensign reversed, *i.e.,* upside down.

National flags. The colours and designs of national flags are usually not arbitrarily selected but rather stem from the history, culture, or religion of the particular country. Many flags can be traced to a common origin, and such "flag families" are often linked both by common traditions and by geography. The oldest European flags still in use are those that display the Christian cross, which was first extensively used in the Crusades. In addition to the British flag, the Union Jack (*q.v.*), flags with crosses are used by Norway, Sweden, Finland, Denmark, Greece, and Switzerland. Following the introduction of heraldry into Europe in the 12th and 13th centuries, European royalty adopted coats of arms that soon became the basis of their flags. These heraldic devices have largely disappeared from modern national flags, but the colours used in the coats of arms are still the colours of the flags of Poland, Belgium, Germany, Spain, Hungary, Luxembourg, and Monaco. The flags of Austria and the tiny states of San Marino and Liechtenstein still display the heraldic devices themselves.

Among the better-known of Europe's striped flags was the red-white-blue flag of the Netherlands. Because of its use in that country's long war for independence from Spain, the flag and its colours became associated with the concepts of liberty and a republican form of government. This association was greatly reinforced by the adoption of the same colours, but with vertical instead of horizontal stripes, by France following the French Revolution of 1789. The newly independent United States' choice of these colours for the Stars and Stripes (*q.v.*), however, was based on its former affiliation with Britain and the colours of the Union Jack. Other nations in Europe and in South and Central America selected tricolours of their own to express their adherence to the principles of liberty, equality, and fraternity as embodied in the French flag. The flags of two European countries, the Soviet Union and Albania, have red flags whose colour is the traditional symbol of revolution for Communists. China and Vietnam also use red flags on the basis of that colour's Communist associations.

In the Middle East the predominance of Islām has generally limited the choice of flag colours to the four traditional Muslim colours of red, white, green, and black. The flags of most Arab states use one or several of these colours in a tricolour format, although the star and crescent motif is present in the flags of Turkey, Algeria, and Tunisia. Other primarily Muslim countries, such as Pakistan and Malaysia, also use the star and crescent as a sign of their Islāmic faith. Almost all the flags of the sub-Saharan African nations were created in the late 1950s and '60s and bear strong family resemblances to one another. The two major categories are flags of member states of the British Commonwealth and those of nations formerly under French colonial control. The flags of the former French colonies tend to have vertical tricolours and are generally green-yellow-red, while the flags of the Commonwealth members have horizontal tricolours and often include green, blue, black, and white.

The flags of the countries of Asia present a remarkable diversity that is due largely to the development of distinctive national symbols before the era of European colonization. The one general pattern is the use of a religious or political symbol against a background of a solid colour. There are flags featuring the Sun (Japan, Nepal, Taiwan), a wheel (India), the yin-yang symbol (South Korea, Mongolia), a dragon (Bhutan), and a sword (Sri Lanka). Australia and New Zealand use modified versions of a type of British flag, the blue ensign.

In the Western Hemisphere, Canada uses a maple leaf as a distinctive emblem of the nation. The former political union of five of the countries of Central America is commemorated by their retention of the old blue-white-blue Central American flag, which has been modified by each particular country. The common historical heritage of Venezuela, Colombia, and Ecuador is shown by the almost identical yellow-blue-red tricolour flags they use. Some other South American countries were influenced in their choice of flags by those of the United States or France.

Since World War II interest in flags has expanded beyond their creation and use. Political scientists, historians, sociologists, and others recognize them as artifacts expressive of the cultures of certain times and places. The scholarly study of the history, symbolism, etiquette, design, manufacture, and other aspects of flags is known as vexillology (from the Latin *vexillum,* "banner"). Such studies are fostered by many publications as well as by the International Federation of Vexillological Associations and its members.

flagbird, any of the six-plumed birds-of-paradise. *See* bird-of-paradise.

flagellate, any protozoan of the superclass Mastigophora. Mostly uninucleate organisms, flagellates possess, at some time in the life cycle, one to many flagella for locomotion and sensation. (A flagellum is a hairlike structure capable of whiplike lashing movements that furnish locomotion.) Many flagellates have a thin, firm pellicle (outer covering) or a coating of a jellylike substance. Reproduction is either asexual (usually by longitudinal splitting) or sexual. The flagellates are divided taxonomically into two classes, those resembling plants, Phytomastigophorea (*see* phytoflagellate), and those resembling animals, Zoomastigophorea (*see* zooflagellate).

The Phytomastigophorea includes chlorophyll-containing protozoans that can produce their food photosynthetically, as do plants—*e.g., Euglena* and dinoflagellates. Distinctions between phytoflagellates and algae are obscure; some phytoflagellates are placed with algae in some botanical classifications.

Members of the class Zoomastigophorea are colourless, animal-like protozoans—*e.g.,* symbiotic hypermastigids. Zooflagellate species in the digestive tracts of termites and roaches enable these insects to utilize the nutrients in cellulose.

Flagellates may be solitary, colonial (*Volvox*), free-living (*Euglena*), or parasitic (the disease-causing *Trypanosoma*). Parasitic forms

live in the intestine or bloodstream of the host. Many other flagellates (dinoflagellates) live as plankton in both salt- and freshwater.

flagellation, in religion, the disciplinary or devotional practice of beating with whips. Many theories have been offered to explain the phenomenon. It has been interpreted as a driving out of evil spirits, as purification, as a form of sadism, and as an incorporation of the animal power residing in the whip, but none of these hypotheses encompasses the whole range of the custom.

In antiquity and among primitive peoples, ceremonial whippings or beatings were primarily concerned with rites of initiation, purification, and fertility, which often included other forms of physical suffering. Floggings and mutilations might or might not be self-inflicted. Beatings administered by masked impersonators of gods or ancestors are a feature of many North American Indian initiations. Ritual floggings are also known from classical antiquity among the Spartans and in Rome.

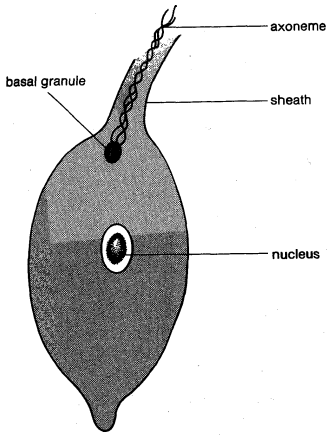
In the primitive Christian Church flagellation apparently was used as punishment for disobedient clergy. From the 4th century, self-inflicted flagellation was practiced by both clergy and laity as the most efficacious means of penance. In the early Middle Ages the laity became especially attracted by this devotional exercise. In the mid-13th century flagellant brotherhoods and processions composed of laymen and women, as well as clergy, began to be organized in Italy, and the practice spread into Germany and the Low Countries.

In the mid-14th century people were fearful because of the plague, but the moral corruption of the church made it impossible for many religiously sensitive persons to find peace within the church. From this religious crisis flagellation arose; the flagellants were seeking by their own efforts to mitigate the divine judgment that was felt to be at hand. They formed groups and travelled about the country on foot. In two daily public ceremonies men whipped their backs and chests with leather thongs, while women chastised themselves in seclusion. The flagellants' piety, fears, and hopes were expressed in processional hymns, fragments of which are preserved in the hymnbooks of later generations. A definite part of their ritual was the reading of a letter that proclaimed flagellation—not the ecclesiastical sacrament of penance—to be the only way to salvation. In 1349 Pope Clement VI condemned flagellation, as did the Council of Constance (1414–18).

In Germany the flagellants became an organized sect and were a target of the Inquisition. The practice gradually subsided, but in the 16th century the Jesuits revived lay interest in self-inflicted flagellation, especially in the southern European countries. Under their guidance the flagellant brotherhoods were introduced into Latin America, where flagellation seems still to be practiced occasionally. In the southwestern U.S. a group of Penitentes have been said to practice flagellation during Lent.

flagellum, plural FLAGELLA, or FLAGELLUMS, hairlike structure capable of whiplike lashing that occurs primarily as an organelle of locomotion in many plants and animals. Flagella, characteristic of the protozoan group Mastigophora, also are locomotory organelles of spermatozoa of many animals. They also occur on the gametes of algae, fungi, mosses, and slime molds. Flagellar motion causes water currents necessary for respiration and circulation in sponges and coelenterates. The simplest flagella, found on some bacteria, consist essentially of a single protein molecule.

Although longer in proportion to the cell and fewer in number, the flagellum closely resembles the cilium (*q.v.*) in structure. The core (axoneme) is a bundle of 11 longitudinal

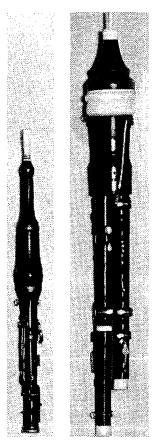


Cell with base of flagellum, showing axoneme and sheath

From P.B. Weisz, *The Science of Zoology*. Copyright 1966. Used with permission of McGraw-Hill Book Co.

fibres—9 fibres surrounding 2 in the centre. This pattern, except in bacteria, is found consistently in plants and animals. The axoneme is covered by a membrane continuous with the outer cell membrane; within the cell, at the base of the flagellum, is located a small basal body (or kinetosome) that is associated with various microfibrillar and microtubular organelles.

flageolet (from Old French *flageol:* "pipe," or "tabor pipe"), wind instrument closely related to the recorder. Like the recorder it is a fipple, or whistle, flute—*i.e.,* one sounded by a stream of breath directed through a duct to strike the sharp edge of a hole cut in the side of the pipe. The name flageolet was applied to such flutes at least from the 13th century, but from the late 16th century it has referred



Single (at left) and double flageolets; in the Museum of Fine Arts, Boston

Leslie Lindsey Mason Collection of Musical Instruments (formerly the Galpin Collection), Museum of Fine Arts, Boston

most specifically to a form of the instrument developed at that time in Paris. Its principal, or French, form has a contracting bore with four front finger holes and two back thumbholes. From the mid-18th century the beaked mouthpiece formerly used was replaced by a narrow tube of bone or ivory that led to a chamber maintaining steady air pressure and holding a sponge to absorb breath moisture.

A popular amateur instrument, it also occupied in the 18th-century orchestra (as the *flauto piccolo*) the role now held by the modern piccolo. With keywork added it became the popular quadrille flageolet of the mid-19th century, made famous by the virtuoso Collinet. A variant is the Catalan *fluviol,* or *flaviol,* a one-handed pipe played to the accompaniment of a tabor drum.

The English flageolet is a late 18th-century adaptation of the French form, with six front finger holes and, sometimes, keywork. Flageolets were often built as double pipes (the English also as triple pipes), all with a single mouthpiece.

The flageolet's compass varied but, in the 19th century, was typically from the second G above middle C to the fourth A above and was notated a 12th below. "Flageolet" sometimes refers generically to any fipple flute.

Flaget, Benedict Joseph (b. Nov. 7, 1763, Contournat, Fr.—d. Feb. 11, 1850, Louisville, Ky., U.S.), an influential figure in the development of the Roman Catholic Church in the United States.

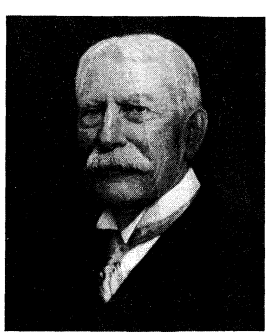
Flaget entered the Sulpician Society (a society of secular priests originating in Paris), was ordained (1786/87), and taught theology. He was one of several Sulpicians sent in 1792 to establish the first Roman Catholic seminary in the United States. During the following 17 years he served as missionary to Vincennes, Ind., and attempted to found a college in Havana.

Bishop John Carroll's diocese of the United States was divided in 1808, and he consecrated Flaget (Nov. 4, 1810) as bishop of Bardstown, Ky.; his diocese extended from Kentucky to the Great Lakes, from the Alleghenies to the Mississippi. Flaget became highly influential in the councils of the U.S. church, and his various religious establishments included St. Thomas Seminary (1812), the Sisters of Loretto and the Sisters of Charity of Nazareth (1812) for the elementary education of girls, and St. Joseph and St. Mary's boys' colleges. He visited Rome in 1835 and, at the request of Pope Gregory XVI, toured France (1837–39). He retired (1848) to ascetic solitude. The see, at his request, was moved to Louisville, where he is entombed in the Cathedral of the Assumption.

Flagg, James Montgomery (b. June 18, 1877, Pelham Manor, N.Y., U.S.—d. May 27, 1960, New York City), U.S. illustrator, poster artist, and portrait painter known for his illustrations of buxom girls and particularly for his World War I recruiting poster of a pointing Uncle Sam with the caption "I Want You" (*see* Uncle Sam). The poster was reissued during World War II.

At the age of 12, Flagg sold his first drawing to the children's magazine *St. Nicholas*; after 1892 he was a regular contributor to other popular periodicals, and his illustrations were collected into books. His dashing line and sure draftsmanship were evident in his portraits in oil and watercolour, the only "serious" art he practiced. These were exhibited in Paris and New York, but most of them were commissioned by the sitters, and Flagg was known to the public mainly through his commercial art. In his autobiography, *Roses and Buckshot* (1946), Flagg represented himself as a bohemian, unfettered by convention.

Flagler, Henry M(orrison) (b. Jan. 2, 1830, Hopewell, N.Y., U.S.—d. May 20, 1913, West Palm Beach, Fla.), U.S. financier and partner of John D. Rockefeller, Sr., in establishing the Standard Oil Company; he pioneered in



Flagler

By courtesy of the Library of Congress, Washington, D.C.

the development of Florida as a U.S. vacation centre.

Around 1850 Flagler became a grain merchant in Bellevue, Ohio, where he met Rockefeller and sold grain through him. With $50,000 capital, Flagler made an unsuccessful attempt to manufacture salt in Michigan and returned to Cleveland, where in 1867 he joined Rockefeller in an oil company that became Standard Oil in 1870. Active in the development of that corporation, he served as director of Standard Oil of New Jersey until 1911.

In 1883 Flagler visited Florida and three years later purchased several railway lines that he combined as the Florida East Coast Railway. During the 1890s he built a chain of luxury hotels along the rail line as well as in Nassau, in the Bahama Islands. He also dredged Miami harbour and established steamship lines to Key West and Nassau.

Flagstad, Kirsten (b. July 12, 1895, Hamar, Nor.—d. Dec. 7, 1962, Oslo), greatest Wagnerian soprano of the mid-20th century.

Flagstad came from a family of professional musicians and studied singing in Oslo, where, after her operatic debut there in 1913, she

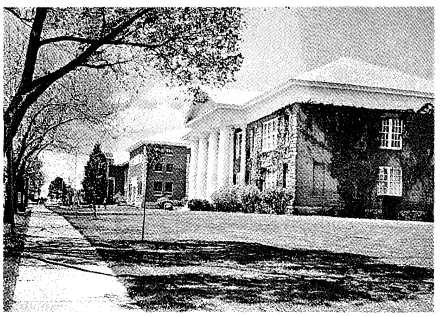
Kirsten Flagstad
Suddeutscher Verlag

worked principally as a light soprano, singing oratorio, opera, and operetta. In 1928 she joined the Storm Theatre in Göteborg, Swed., and added further operatic roles to her repertory.

In 1932, after a period of retirement following her second marriage, she found that her voice had become heavy enough to undertake Wagner's *Tristan und Isolde.* In 1933 and 1934 she sang small roles at Bayreuth, and in 1935 she made her debut at the Metropolitan Opera in New York City as Sieglinde in *Die Walküre.* A year later she appeared at Covent Garden, London, as Isolde. In this role and as Brünnhilde in Wagner's *Ring* cycle her greatness was at once realized. The outbreak of World War II found her in the United States; she returned to Norway in 1941 to join her husband, who was later imprisoned for his associations with the Norwegian traitor Vidkun Quisling. She was exonerated of any offense by a Norwegian court and after her husband's death returned to the United States and England. From 1948 to 1951 she sang at Covent Garden. In 1953 she retired from public singing, but continued to broadcast and make phonograph records. She was the first director of the Royal Norwegian Opera (1958–60).

Besides the great Wagnerian roles, she made memorable appearances in Gluck's *Alceste,* in Beethoven's *Fidelio,* and in Purcell's *Dido and Aeneas.*

Flagstaff, city, seat (1891) of Coconino County, north central Arizona, U.S. The three San Francisco Peaks are immediately north of the city, which is encircled by the Coconino National Forest. Lumberjacks celebrating the 4th of July, 1876, nailed a U.S. flag to the



Northern Arizona University, Flagstaff, Ariz.
Markow Photography

top of a tall ponderosa pine and called the unnamed settlement Flagstaff. In 1882 the Atlantic and Pacific Railroad (now the Santa Fe) arrived and assured the community's growth. A timber-based economy still prevails, but the tourist industry, augmented by the area's scientific developments and the proximity of Glen Canyon Dam, are added economic assets. Nearby are the Arizona Snow Bowl (winter ski resort), Meteor Crater (used as a training ground for astronauts), Painted Desert, Sunset Crater National Monument, Grand Canyon National Park, and major Indian ruins. The city is an astronomical centre with the Perkins and U.S. Naval observatories, and Lowell Observatory, which is used for lunar mapping. It is the site of Northern Arizona University (1966; founded 1899 as Northern Arizona Normal School), and the Museum of Northern Arizona (1928). Inc. 1928. Pop. (1980) 34,641.

Flahaut de la Billarderie, Auguste-(-Charles-Joseph), comte de (count of) (b. April 21, 1785, Paris—d. Sept. 1, 1870, Paris), French army officer and diplomat, better remembered for his exploits in love affairs than for his public service.

At the time of his birth, his mother, Adèle Filleul, was the wife of the Comte de Flahaut, but Charles was generally recognized to be the offspring of her liaison with Talleyrand. During the Revolution, in 1792, his mother took him into exile, and they remained abroad until 1798.

He entered the Army in 1800 and received his commission after the Battle of Marengo. He became aide-de-camp to Joachim Murat (and the lover of Murat's wife, Caroline, Napoleon's sister) and was wounded at Enns, in Austria, in 1805. In Warsaw he met Anna Poniatowska, Countess Potocka, who became his mistress. He served in Portugal (1807), in Spain (1808), and then in Germany. Meanwhile, Countess Potocka had established herself in Paris, but Flahaut was now the lover of Napoleon's daughter-in-law Hortense de Beauharnais, queen of Holland, by whom he had a son, known later as the Duc de Morny. Flahaut fought in the Russian campaign of 1812 and in 1813 became aide-de-camp to Napoleon.

After Napoleon's abdication in 1814 he was placed on the retired list. The Hundred Days brought him into active service again, but his mission to Vienna to secure the return of Marie-Louise failed. He was saved from exile by Talleyrand's influence. Later he settled in England, where in 1819 he married Margaret Elphinstone, afterward Baroness Keith in her own right. The French ambassador opposed the marriage, and Flahaut resigned his commission.

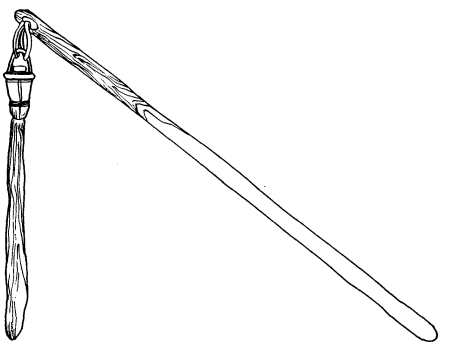
Flahaut returned to France in 1827, and in 1831, under the July Monarchy, he was made a peer of France. He remained intimately associated with Talleyrand's policy and was ambassador in Berlin for a short time in 1831. He was afterward attached to the household of Ferdinand, duc d'Orléans. He was ambassador to Vienna from 1841 to 1848, when he was dismissed and retired from the army. After the coup d'etat of 1851 he was again actively employed and from 1860 to 1862 was ambassador in London.

Flaherty, Robert (Joseph) (b. Feb. 16, 1884, Iron Mountain, Mich., U.S.—d. July 23, 1951, Dummerston, Vt.), U.S. explorer and filmmaker, called the father of the documentary film.

When he was a boy, Flaherty's family moved to Canada, and as he grew up he explored and photographed vast regions of the country's northern territory. His first film, *Nanook of the North* (1922), a dramatic interpretation of the Eskimo way of life, was based on 16 months of living with them and filming their lives. His film was an international success, and its subjective presentation of reality set a model of excellence for nonfiction filmmaking, foreshadowing the documentary movement of the 1930s. John Grierson, the founder of the movement, first used the term documentary in a reference to Flaherty's film, *Moana* (1926), set in the South Seas, a record of a people untouched by the corruption of civilization.

In the 1930s and '40s Flaherty's most famous films were *Tabu* (1931), codirected with the German director F.W. Murnau, *Industrial Britain* (1932), made with John Grierson, *Man of Aran* (1934), *The Land* (1942), and *Louisiana Story* (1948).

flail, ancient hand tool for threshing grain. It consists of two pieces of wood: the handstaff, or helve, and the beater, joined by a thong. The handstaff is a light rod several feet long, the beater a shorter piece. With a flail, one man could thresh 7 bushels of wheat, 8 of rye, 15 of barley, 18 of oats, or 20 of buckwheat in a day (one bushel equals about 35 litres).



Flail

The flail remained the principal method of threshing until the mid-19th century, when mechanical threshers became widespread (*see* thresher.)

flake tool, Stone Age hand tools, usually flint, shaped by flaking off small particles, or by breaking off a large flake which was then used as the tool.

Whenever they were available, prehistoric man preferred to use flint and similar siliceous stones, both because of the ease with which they could be chipped and for the sharp cutting edges characteristic of this type of material. However, in many regions flint does not exist, and man was obliged to use whatever material was easily available, such as sandstones, quartzites, quartz, obsidian and various volcanic rocks.

The basic principle in the manufacture of

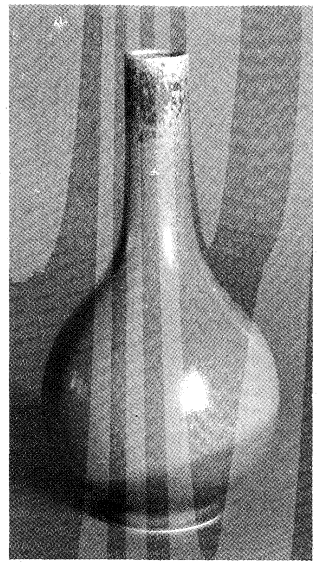
stone tools is the removal of a flake or series of flakes from a stone matrix. It is characteristic of all stone that a blow struck near an edge of a block will detach a chip or flake. Flakes may be removed from blocks by various natural causes such as wave action, pressure in the earth, and soil creep; but those produced intentionally by man exhibit definite characteristics. Their most important attribute is the bulb of percussion which appears on the lower surface of the flake just below the point where the blow was struck. Bulbs of percussion vary in size and shape, depending on the force and direction of the blow, the nature of the stone, and the nature of the object with which the blow was struck. The block from which a flake has been detached, the core or nucleus, bears the imprint of the bulb in the form of a bulbular cavity and also lateral ridges left by the removal of the flake. These ridges often form a definite pattern, showing that a piece has unquestionably been the work of man. Flaking produced by natural causes is usually haphazard, and fractures by frost or heat are characterized by a series of concentric rings as opposed to the ripple marks left by a man-made fracture.

Stone tools were chipped by two principal methods: percussion and pressure. Chipping by percussion may be done either by striking a block of flint with a hammer of stone, wood, or bone held in the hand or by striking the block itself on the edge of a fixed stone; the latter method is called the anvil method. The use of a wooden billet or bar permits the removal of longer, thinner, and flatter flakes; and, because wood is resilient, it does not shatter the edge of the flint, and it leaves smaller and flatter bulbs than those obtained by stone on stone. Pressure flaking, as the name implies, consists of applying pressure by means of a pointed stick or bone near the edge of a flake or blade, to detach small flakes from both sides. This method was used mostly to put the finishing touches on tools or to produce a desired shape.

Flambard, Ranulf (d. Sept. 5, 1128), chief minister of King William II Rufus of England (ruled 1087–1100). Of Norman origin, Ranulf was made keeper of the seal for King William I the Conqueror about 1083, and during the reign of William II he became royal chaplain, chief adviser, and, for a time, chief justiciar. As administrator of the royal finances, he raised vast sums by increasing taxes and by extorting funds from the barons and the church. He delayed for years in making appointments to vacant sees and abbeys in order to obtain their revenues for William's treasury.

In 1099 Ranulf was made bishop of Durham. William died shortly thereafter, and his successor, Henry I (ruled 1100–35), imprisoned Ranulf as a scapegoat for the late king's unpopular policies. Early in 1101 Ranulf escaped to Normandy and incited Duke Robert II Curthose to attempt an invasion of England, which was unsuccessful. Ranulf was restored to royal favour and to his bishopric in 1101, but he never regained his former position as chief minister.

flambé glaze, a rich, deep-red glaze slashed with streaks of purple and turquoise used to decorate pottery, particularly porcelain. The effect results from a particular method of firing a glaze that incorporates copper; the method was first discovered by the Chinese of the Ming dynasty, probably during the reign of Wan-li (1573–1620). Examples of this old flambé work are now extremely rare. The process was at first difficult to control, but by the reign of Ch'ien-lung (1736–96) in the Ch'ing dynasty it had been mastered, and *ch'ui hung*, or blown red glaze ware, as flambé work was called, became very popular. The porcelain factory at Sèvres, Fr., produced a substantial amount of flambé work in the late 19th century. The process was revived in modern times



Porcelain bottle decorated with a flambé glaze, 18th century, Ch'ing dynasty; in the Victoria and Albert Museum, London

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

by individual potters, notably Bernard Moore in England, who worked at the beginning of the 20th century.

Flamborough Head, chalk promontory, county of Humberside, England, where the Yorkshire Wolds project 4 mi (6 km) into the

North landing of Flamborough Head, Humberside

A. Joyce—Bruce Coleman Inc.

North Sea. The northern cliffs, 400 ft (120 m) high, are a breeding ground for seabirds; and their extremity is fretted into bays, caves, and stacks. The lighthouse at the extremity rises 214 ft above the sea.

flamboyant tree: *see* royal poinciana.

flame, rapidly reacting body of gas, commonly a mixture of air and a combustible gas, that gives off heat and, usually, light and is self-propagating. Flame propagation is explained by two theories: heat conduction and diffusion. In heat conduction, heat flows from the flame front, the area in a flame in which combustion occurs, to the inner cone, the area containing the unburned mixture of fuel and air. When the unburned mixture is heated to its ignition temperature, it combusts in the flame front, and heat from that reaction again flows to the inner cone, thus creating a cycle of self-propagation. In diffusion, a similar cycle begins when reactive molecules produced in the flame front diffuse into the inner cone and ignite the mixture. A mixture can support a flame only above some minimum and below some maximum percentage of fuel gas. These percentages are called the lower and upper limits of inflammability. Mixtures of natural gas and air, for example, will not propagate flame if the proportion of gas is less than about 4 percent or more than about 15 percent.

flame-fusion process (synthetic gems): *see* Verneuil process.

flame thrower, military assault weapon that projects a stream of blazing oil or thickened gasoline against enemy positions. As used in World War II and later wars it consisted basically of one or more fuel tanks, a cylinder of compressed gas to supply the propelling force, a flexible hose connected to the tanks, and a trigger-nozzle equipped with some means of igniting the fuel as it was spewed forth. The portable type, carried on the backs of ground troops, had a range of about 45 yards (41 metres) and enough fuel for about 10 seconds of continuous "firing." Larger and heavier units installed in tank turrets could reach out more than 100 yards (90 metres) and carried enough fuel for about 60 seconds of fire. To achieve maximum results, several short bursts were usually fired rather than one long blast.

Modern flame throwers first appeared in the early 1900s when the German army tested two models, one large and one small, submitted by Richard Fiedler. The smaller *Flammenwerfer*, light enough to be carried by one man, used gas pressure to send forth a stream of flaming oil for a distance of about 20 yards (18 metres). The larger model, based on the same principle, was cumbersome to transport but had a range of more than 40 yards (36 metres) and enough fuel for 40 seconds of continuous firing. The German army adopted these weapons and used them with surprise effect against Allied troops in 1915. The British and French soon countered with flame throwers of their own, but all the World War I types had limited range and duration of fire. Their chief effect seems to have been to terrorize the troops that they were used against.

All major powers employed flame throwers in later years, both the back-pack type and the tank-mounted variety. Based on the same principle as Fiedler's early models, they incorporated technical refinements that made them more effective. British and U.S. flame throwers were fuelled with napalm, a type of thickened gasoline that carried much farther than ordinary gasoline, burned with intense heat, and clung like jelly to whatever it touched. These fearsome weapons were valuable for attacking enemy troops, burning away camouflage material, and probing underbrush or the gunports of enemy positions. They were especially effective in World War II against the defensive-type warfare of the Japanese who defended their caves and coconut-log bunkers on Pacific islands. During the 1950s the U.S. army chemical corps developed a lightweight, one-shot portable flame thrower that could be used against fortified positions at close range.

flamen, plural FLAMINES, in ancient Rome, a priest devoted exclusively to the worship of one deity; the name derives from a root meaning "he who burns offerings." Of the 15 *flamines*, the most important were Dialis, Martialis, and Quirinalis, who served Jupiter, Mars, and Quirinus, respectively. Chosen from the patrician class and supervised by the *pontifex maximus*, or chief priest, the *flamines* had a distinctive dress, its outstanding feature being the *apex*, a conical cap. They offered daily sacrifices, and their lives were regulated by strict rules and taboos. The priests' wives, the *flaminicae*, served as their assistants and were also bound by ritual regulations. In imperial times, *flamines Divorum* ("priests of the Gods") were instituted for the worship of deified emperors both in Rome and in the empire's outlying provinces, where they often served as important representatives of the central government.

flamenco, music and dance of the Andalusian Gypsies, or Flamencos. Its roots are in Gypsy,

Andalusian, Arabic, and possibly Spanish Jewish folk song and, according to some scholars, in Byzantine and Indian religious chant. It developed from the 14th century onward

Flamenco, Madrid
Ronny Jaques—Photo Researchers

as Gypsies, Arabs, Jews, and socially outcast Christians mingled on the fringes of society.

The essence of flamenco is *cante,* or song, often accompanied by guitar music and improvised dance. Music and dance fall into three categories: *jondo,* or *grande* ("profound," or "grand"), intensely sad and dealing with themes of death, anguish, despair, or religion; intermediate, less profound, but also moving, often with an oriental cast to the music; and *chico* ("light"), with subjects of love, the countryside, and gaiety. A particular genre of *cante* is distinguished by a characteristic rhythm and chord structure; yet several types of *cante* may share the same rhythm but individualize it in accentuation, subtleties, and emotional content.

The ancestry of many types of song is traceable. Thus the serious *soleares,* a descendant of the much older and serious *cañas,* gave rise to the light *alegrías,* from which developed other light genres such as the *bulerías.* Of pure Gypsy origin are the *alboreás,* traditionally sung only at weddings, being unlucky on other occasions. Other forms, such as the *fandangos grandes,* were adopted from Spanish folk song and dance, the fandangos becoming more serious in character than the original and begetting a series of descendants that includes the *malagueñas* and the Arab-influenced *cartageneras.* Latin-American influence appears in later genres such as the *rumbas gitanas* and the *colombianas.* Most deeply associated with Gypsy tradition are the *cantes grandes,* such as the *siguiriyas gitanas;* the *saetas,* adopted from Spanish religious processions; and the *martinetes,* of Gypsy origin and sung without dance.

In flamenco dance, the men's steps are intricate, with toe and heel clicking (*zapateados*); women's dancing traditionally depends on the grace of the hands and body, rather than on footwork. Particularly in the *baile grande,* or profound dance, the arm, hand, and foot movements closely resemble those of classical Hindu dance.

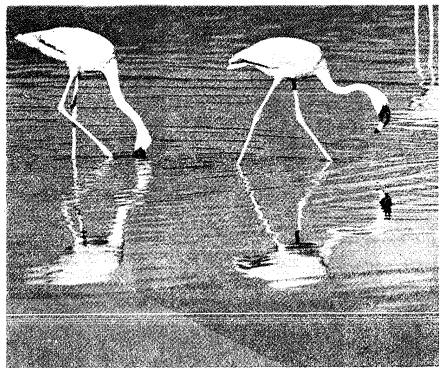
Gypsies began to dance professionally in cafés in the 19th century, and the word flamenco was first applied to their music and dance at this time. Although earlier *cantes* had been sung without guitar—as some varieties still are—in the cafés the guitar became prominent. Ideally the flamenco guitarist is a sensitive accompanist knowledgeable in the song and dance. In the café environment, instrumental solos also became common, often departing from traditional forms.

Essential to traditional flamenco is the *duende,* or possession of the performer by the unhampered emotion of the music or dance. Performances are often accompanied by jaleo—intricate hand clapping, finger snapping, and encouraging shouts. Rhythms appropriate to the songs can also be performed as jaleo solos. Dancers frequently employ finger snapping in complex rhythms; castanets, often associated with flamenco, were not part of the original Gypsy tradition. With the growing number of public performances and the pressures of the commercial stage, rehearsed routines increasingly replaced the spontaneity of flamenco performances.

flamines (in Roman religion): *see* flamen.

flamingo, any of four species of tall wading birds, constituting the family Phoenicopteridae of the order Ciconiiformes, which also includes the herons, bitterns, and storks. They are considered by some authorities to warrant separation as a distinct order, Phoenicopteriformes.

Flamingos have webbed feet, slender bodies, long, thin necks, large wings, and short tails. They range from about 90 centimetres (3 feet) tall to 150 centimetres (5 feet) tall. Their plumage is mainly pink, tinged with light vermillion. They have bare faces.



Lesser flamingo (*Phoeniconaias minor*)
Norman Myers—Bruce Coleman, Inc.

Flamingos are gregarious birds; flocks numbering hundreds may be seen in long, curving flight formations and in wading groups along the shore. In feeding, the flamingo tramps the shallows, stirring up organic matter, especially minute mollusks and crustaceans, which it strains from the muddy water by means of its sievelike lamellated bill. The nest is a truncated cone of clayish mud piled up a few inches in a shallow lagoon; both parents share the month of incubation of the one or two chalky-white eggs that are laid in the hollow of the cone. Downy white young leave the nests in two or three days and are fed by regurgitation of partly digested food of the adults.

The greater flamingo (*Phoenicopterus ruber*) breeds in large colonies on the Atlantic and Gulf coasts of tropical and subtropical America (the American flamingo, *P.r. ruber,* and the Galápagos flamingo, *P.r. galapagosis*) and, in the Old World, in Africa and southern Europe and Asia (*P.r. roseus*). Another American variety, the Chilean flamingo (*P.r. chilensis*), is primarily an inland species.

Two smaller species occurring in the Andes of South America are the Andean flamingo (*Phoenicoparrus andinus*) and James's flamingo (*Phoenicoparrus jamesi*), once thought to have been extinct.

The lesser flamingo (*Phoeniconaias minor*), abundant in the lake district of eastern Africa and also occurring in South Africa, Madagascar, and India, is the most abundant flamingo. It is deep pink in colour and stands about 100 centimetres tall. Large flocks of lesser flamingos sometimes contain several million birds.

Flamininus, Titus Quinctius (b. *c.* 227 BC—d. 174), Roman general and statesman whose skillful diplomacy enabled him to establish a Roman protectorate over Greece. During the

Flamininus, portrait on a Greek gold coin struck after 196 BC; in the British Museum
Peter Clayton

Second Punic War (218–201) he was military tribune under Marcus Claudius Marcellus (208) and propraetor *extra ordinem* at Tarentum (205–204).

As consul in 198 he sought to win Greek support for Rome's struggle against Philip V of Macedonia (Second Macedonian War, 200–196). Arriving in Greece, he realized that future peace depended on breaking Philip's power, not merely humbling him. He secured the backing of the Achaean League and then opened peace negotiations with Philip at Nicaea in Locris. Though proposals were submitted to the Senate, the talks broke down, and fighting resumed until Flamininus' victory at Cynoscephalae (197). The peace terms proposed by the general and adopted by the Senate specified that Philip could retain his throne but must abandon all his dependencies outside Macedonia.

At the Isthmian Games at Corinth in 196, Flamininus proclaimed that all Greeks in Europe and Asia were to be free and governed by their own laws. For this deed he was hailed in many Greek cities as a saviour and accorded homage alongside the gods. After checking the ambitions of the Spartan tyrant Nabis, the Roman forces finally withdrew from Greece in 194.

In 193, Flamininus supported the Roman championship of Greek autonomy in Asia Minor. He attempted to rally the Greeks against the Seleucid king Antiochus III, and to counter the pro-Seleucid policy of the Aetolians. When the Aetolians called on Antiochus for aid, Flamininus persuaded the Achaean League to declare war on both parties. After the defeat of Antiochus by a Roman army at Thermopylae (191), Flamininus helped to re-establish peace in Greece. In 189 he served as censor, and in 183 he was sent to Prusias, king of Bithynia, to demand the surrender of the Carthaginian general Hannibal.

Flaminius, Gaius (d. 217 BC), Roman political leader who repeatedly challenged the authority of the Senate. A plebeian, he held the tribunate in 232. Despite the opposition of the Senate and (according to legend) of his own father, he won passage of a measure to distribute land among the plebeians.

As consul in 223 he defeated the Insubres after disobeying a senatorial order; despite opposition from the Senate, he was granted a triumph by popular vote. Flaminius was the first governor of the Roman province of Sicily. During his censorship (220) he built the Circus Flaminius on the Campus Martius and constructed the Via Flaminia to Ariminum. In 218 he was one of the chief supporters of the Lex Claudia, which barred senators from engaging in commercial activities. His election to a second consulship for 217 reflected pop-

ular criticism of the Senate's conduct of the war against the invading Carthaginians under Hannibal.

Flaminius hastened to cover the western Apennines at Arretium (now Arezzo). When Hannibal slipped past, the Roman commander marched south, probably in an attempt to join his colleague Servilius, who was advancing from Ariminum. On the way Flaminius fell into Hannibal's ambush at Lake Trasimenus (now Trasimeno) and was killed.

Flamsteed, John (b. Aug. 19, 1646, Denby, near Derby, Derbyshire, Eng.—d. Dec. 31, 1719, Greenwich, London), first Astronomer Royal of England. His report to the Royal Society on the need for a new observatory resulted in the founding (1675) of the Royal Greenwich Observatory, of which he was the first director. His star catalog, *Historia Coelestis Britannica* (1725), listed more stars (3,000) and gave their positions much more accurately than any other previous work. Some stars, such as 61 Cygni, are still known by their numbers in his system.

Poor health had forced Flamsteed to drop out of school in 1662. He studied astronomy on his own and later (1670–74) continued his education at Cambridge University. In 1677 he became a member of the Royal Society. Ordained a clergyman in 1675, in 1684 he received the income of the living of Burstow, Surrey. Flamsteed found he himself had to supply all the instruments at Greenwich, apart from a few gifts; he was forced to take private pupils to augment his income. A small inheritance from his father, who died in 1688, provided the means to construct a mural arc, a wall-mounted instrument for measuring the altitudes of stars as they passed the meridian.

The latter part of Flamsteed's life passed in controversy over the publication of his excellent observations. He struggled to withhold them until completed, but they were urgently needed by Newton and Edmond Halley, among others. Newton, through the Royal Society, led the movement for their immediate publication. In 1704 Prince George of Denmark undertook the cost of publication, and, despite the Prince's death in 1708 and Flamsteed's objections, the incomplete observations were edited by Halley, and 400 copies were printed in 1712. Flamsteed later managed to burn 300 of them.

Flanders, French FLANDRE, Flemish VLAANDEREN, medieval principality in the southwest of the Low Countries which included what are now the French *département* of Nord (*q.v.*), the Belgian provinces of East Flanders and West Flanders (*qq.v.*), and the Dutch province of Zeeland (*q.v.*). The name appeared as early as the 8th century and is believed to mean "Lowland," or "Flooded Land."

A brief treatment of Flanders follows. For a full treatment, *see* MACROPAEDIA: Low Countries.

The origin of Flanders lies in the *pagus* Flandrensis, an area composed of Bruges and its immediate environs under the administration of the Frankish empire. Thus, in the early Middle Ages Flanders shared the institutions of the Frankish kingdom. With the decay of these institutions under the later Carolingians, the country became feudalized and was ruled by powerful princes—wealthy landowners—who sought to expand their territory by force of arms and to safeguard it by building castles. The population, though united under a common rule, was far from homogeneous. In the southernmost area it was mainly Gallo-Roman and Romance-speaking; farther north the Frankish settlement had been denser, so that the language was Germanic; and the coastal areas had been settled with people of Saxon and Frisian origin, of a less civilized way of life. The counts effectively united these peoples into one nation. From the 12th century onward, the counts substituted for the old feudal structure an orderly administration and fiscal organization, set up a centralized judicial system (using Roman law), and began extensive legislation. One of the main starting points of this development was the safeguarding of public order by the counts (*pax comitis*). The role of Philip of Alsace was capital in this field. He gave to a great number of towns charters (*keuren*), the contents of which varied little and which all went back to the charter of Arras of 1157–63. At the same time, but quite distinctly, the commune (*q.v.*) movement developed. This led to the establishment in the numerous, wealthy towns of a town government with a considerable measure of independence. The towns were ruled by aldermen who were administrators and judges at the same time. The constitutional history of Flanders is largely that of the struggle for supremacy between comital and communal authority. Finally the central authority was victorious, and in the 16th century monarchical authority was firmly established. Representative institutions (estates) had grown up around the counts, especially from the 14th century onward; they were largely controlled by the three main towns of Ghent, Bruges, and Ypres.

Ecclesiastically, Flanders was divided between three bishoprics, none of which had its seat in an important Flemish city: Thérouanne and Tournai (in the metropolitan province of Reims) and Utrecht (in the metropolitan province of Cologne). In the 14th century Flanders was on the side of Rome against Avignon in the Western Schism of the papacy.

At the outset the Flemish economy was agricultural, but the existence of large herds of sheep are very early signs of clothmaking of more than local importance. Around the 12th century Flemish trade and industry became of real international importance. A crisis in the old manorial organization of agriculture and an expansion of money economy coincided with the rise of towns as centres of trade and industry. The cloth industry, which was soon working mainly with English wool and producing quality goods, had its largest centres at Ghent and at Ypres. International trade, however, was also very important. Until the 13th century the Flemish merchants conducted their trade abroad, especially at the fairs of Champagne, but later merchants of all nations came to Flanders. The seaport of Bruges became a centre of world commerce. Flanders profited from its geographical situation, being an intermediary between the Mediterranean and the Scandinavian and Baltic countries and also between England and the Rhineland (especially Cologne). Toward the end of the Middle Ages the Flemish economy began to suffer for a number of reasons, but even so, Flanders was important to the revenues of the Burgundian dukes.

Flemish architecture found its outstanding expression in civic buildings, belfries, and town halls, though there were also some fine cathedrals. In literature, satire and the didactic genre flourished particularly. The names of the Flemish painters, the Van Eycks, Rogier van der Weyden, Hugo van der Goes, etc., belong to world art history.

The humanities, law, and mathematics also flourished in 16th-century Flanders.

Flandin, Pierre-Étienne (b. April 12, 1889, Paris—d. June 13, 1958, Saint-Jean-Cap-Ferrat, Fr.), lawyer, politician, and several times a minister during the final years of the Third French Republic.

Flandin was the son of a wealthy senator and was closely connected with important industrial and financial interests. He was a deputy from 1914 to 1940 and, in addition, held various ministerial posts; he was also premier from November 1934 to May 1935. When in March 1936 the Germans invaded the Rhineland, Flandin, as foreign minister, suggested the use of French armed forces, but he was supported by only a minority of ministers. His failure to induce the French and British governments to act convinced him that Germany would dominate Europe and that France should accept the inevitable.

In the Vichy regime ill-health prevented Flandin from trying to play as important a part as his ability and sympathies might have allowed. He was associated with the more moderate collaborators. They succeeded in bringing him into the government as foreign minister in Pierre Laval's place, but his inclusion lasted only until February 1941, when Adm. Jean Darlan replaced him. After the liberation the high court of justice, on July 26, 1946, acquitted him of treason and sentenced him to five years of "national unworthiness" but remitted this sentence on account of some services he had rendered to the Résistance.

Flannagan, John Bernard (b. April 7, 1895, Fargo, N.D., U.S.—d. Jan. 6, 1942, New York City), American sculptor notable for his small, primitivistic sculptures of animals, birds, fish, and birth themes.

Trained as a painter at the Minneapolis Institute of Arts, Flannagan was encouraged by Arthur B. Davies to take up wood carving, and

"Triumph of the Egg, I," granite sculpture by John B. Flannagan, 1937; in the Museum of Modern Art, New York City

By courtesy of the Museum of Modern Art, New York

for five years he worked almost exclusively in this medium. While living in upper New York state, he first became attracted to the natural beauty of fieldstone, and he worked for many years in this medium, seeking images that seemed to have evolved from nature rather than from the sculptor's hand. Flannagan defined his sculpture as a species of occult fossil and, with a queer atavistic nostalgia, dredged the subconscious for inspiration.

The traumatic process of becoming was Flannagan's most effective poetic theme; it informed his major works—*e.g.*, "Triumph of the Egg" (1937 and 1941) and perhaps even the tumid "Dragon Motif" (1933), both owned by the Museum of Modern Art, New York City. From them the spirit of the inert material seems to emerge and mingle with the impressions made by the carver. In both formal and philosophical ways, Flannagan was similar to the artists of ancient India. Shortly before he committed suicide, Flannagan had begun to work in wrought bronze.

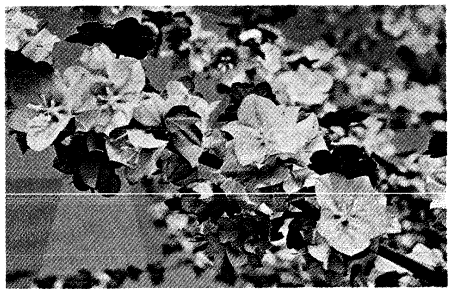
flannel, fabric made in plain or twill weave, usually with carded yarns. It is napped, most often on both sides, the degree of napping ranging from slight to so heavy that the twill weave is obscured. Fibre composition and

amount of napping are dependent on the intended use. Flannel is a relatively warm fabric, since still air is held in the fabric because of the napping. Addition of a man-made fibre to the blend increases the resistance to abrasion and hence may lengthen the life of the fabric. Furthermore, some of these blends help to prevent stretching, so that a better fit is maintained. Crease retention is improved with some blends such as acrylic fibre.

For outerwear, generally wool or blends with wool, or blends of man-made fibres, are used in an even-twill weave. With an all-wool flannel fabric excellent tailored garments can be produced; felting shrinkage can be prevented by blending with various man-made fibres, and washable men's suits are produced through blending wool with acrylic, nylon, or polyester fibres.

Cotton flannels are made with soft-spun filling yarns. There are various types, according to use, with many generic names; for example, flannelette, a lightweight fabric napped on one side only, and suede cloth, which has an extremely short, compact nap treated to give a smooth, flat texture.

flannelbush (*Fremontodendron californicum*), shrub of the cacao, or chocolate, family (Sterculiaceae) of the order Malvales, native to southwestern North America. The lower leaf surfaces have a felty texture. The shrub grows up to 5 metres (16 feet) tall and bears



Flannelbush (*Fremontodendron californicum*)
W.H. Hodge

alternate, lobed leaves about 2.5 centimetres (1 inch) long. The yellow, solitary flowers are about 5 cm across.

Flanner, Janet, pseudonym GENÊT (b. March 13, 1892, Indianapolis, Ind., U.S.—d. Nov. 7, 1978, New York City), U.S. writer and Paris correspondent for *The New Yorker* magazine from 1925 to 1975 (except for the war years 1939–44). Hers was some of the most sophisticated, insightful, and cosmopolitan reportage from Paris during the period.

The child of Quakers, Flanner attended a private school, spent a year in Germany, and then studied at the University of Chicago (1912–14). During World War I she worked for the *Indianapolis Star,* partly as a film critic. After the war and after a sojourn in New York City, she travelled about Europe, ending up in 1922 in Paris (where she resided until the outbreak of World War II). A friend of Harold Ross, she was hired by him in 1925 to write a periodic "Letter from Paris" for his new magazine, *The New Yorker.* Signed by "Genêt," the articles contained observations on politics, art, theatre, and the general quality of French life. In the 1930s she also began writing an occasional "Letter from London." Her first novel, *The Cubical City,* appeared in 1926.

She lived in New York City during the subsequent war years, still writing for *The New Yorker* but also producing translations of novels by Colette. She went back to Paris in 1944 and continued her "Letters" until finally returning to Manhattan in 1975.

Most of her essays were collected in *American in Paris; Profile of an Interlude Between Two Wars* (1940), *Paris Journal, 1944–1965* (1966), *Paris Journal, 1965–1971* (1971), and *Janet Flanner's World: Uncollected Writings 1932–1975* (1979).

flap, in phonetics, a consonant sound produced by a single quick flip of the tongue against the upper part of the mouth, often heard as a short *r* in Spanish (*e.g.,* in *pero,* "but") and similar to the pronunciation of the sound represented by the double letter in American English "Betty" and some forms of British English "berry."

flare, combustible device used to emit a dazzlingly bright light for signalling or illumination on railroads and highways and in military operations; in pyrotechnics the term is applied either to a coloured-fire composition burned in a loose heap or to a similar composition rolled into a paper case to ensure longer and more regular burning.

The flare in its present form dates from the early part of the 19th century, when the introduction of potassium chlorate permitted the development of compositions to produce coloured light. Previous to this the only colour had been the bluish-white light produced by a mixture of sulfur, saltpetre, and orpiment. These blue lights, as they were called, were and still are often used at sea for signalling and illumination. They were also known as Bengal lights, probably because Bengal was the chief source of supply of saltpetre.

The introduction of colours that could readily be recognized at a considerable distance opened up a much wider field for the use of flares at sea. From the middle of the 19th century, many patents were granted, most of them for a means of self-ignition. Subsequent inventions provided for ignition on the same principle as the modern safety match and for the waterproofing of the surface. Lights of this kind are usually fitted with a wooden handle.

Coloured flares of high light intensity are carried as standard equipment in ships' lifeboats; the high intensity is obtained by the incorporation of magnesium, or magnesium alloy, in the composition. Flares are also used to warn motorists of highway obstructions. Commercial highway vehicles carry flares to be used in the event of distress or breakdown.

flare star, also called UV CETI STAR, any star that varies in brightness, sometimes by more than one magnitude, within a few minutes. The cause is thought to be the eruption of flares much larger than, but otherwise similar to, those observed on the Sun. Flare stars are sometimes called UV Ceti stars, from a prototype star in the constellation Cetus. Proxima Centauri, closest star to the Sun, is also a flare star. All known flare stars are red dwarfs; flares in intrinsically brighter stars are not presently detectable. In UV Ceti and a few others, radio flares have been observed corresponding to the optical outbursts.

flash lamp, any of several devices that produce brief, intense emissions of light useful in photography and in the observation of objects in rapid motion.

The first flash lamp used in photography was invented in Germany in 1887; it consisted of a trough filled with *Blitzlichtpulver* ("flashlight powder"), a mixture of magnesium, potassium chlorate, and antimony sulfide. Upon ignition the powder burned quickly, providing a brilliant white light, but it also released a dense cloud of white smoke and was hazardous.

The flashbulb, developed in the 1920s, is a transparent envelope filled with oxygen and a tangle of fine aluminum, magnesium, or zirconium wire ignitable by an electrically heated filament or, rarely, a chemical deflagrator. Luminous combustion of the metal is complete within a few hundredths of a second. Most flashbulbs are coated with tinted lacquer or plastic to prevent shattering and to adjust the colour of the light.

The electronic flash lamp, commonly called a flashtube, consists of a transparent glass or quartz tube filled with xenon (or, occasionally, other noble gases) and fitted with electrodes. High voltage from a capacitor charges the electrodes and causes the gas to ionize; when an ionization path is complete, a pulse of current passes between the electrodes, causing the gas to flash and discharging the capacitor. The duration of the flash can be as short as one microsecond, and circuitry can be arranged to cause the lamp to operate several thousand times per second. The flashtube was invented in 1931 by Harold Edgerton of the Massachusetts Institute of Technology, Cambridge.

flash point, roughly equivalent to the lowest temperature at which a petroleum product will burn. Below this temperature insufficient petroleum vapour is available to support combustion. Before gasoline became important, kerosine was the main petroleum product produced. The tendency to leave as much of the highly volatile gasoline as possible in the kerosine caused numerous fires and explosions in tanks and oil lamps. Legal measures were instituted to curb the danger, and test methods were prescribed and minimum flash points set.

Minimum flash points have been set not only for kerosine and other volatile petroleum products but also for such low-volatility products as lubricating oil, diesel oil, and fuel oil. While such standards might be useful in providing the safety margins for storing, handling, or transporting high-volatility petroleum products, they are superfluous for those of low volatility. Probably this practice is a held-over tradition and is based on the belief that the flash point is a measure of volatility, a fact true only for products that boil over a narrow temperature range.

Consult the INDEX *first*

flash spectrum, array of wavelengths detectable in the light emitted from the limb of the Sun during the flash periods of a few seconds just after the beginning of totality during a solar eclipse or just before the instant of its termination. When the solar photosphere is occulted by the Moon, the layers of the Sun's atmosphere flash into prominence, and the spectrum briefly shows the bright lines produced by tenuous hot luminous gas. Except during eclipses, this part of the spectrum is masked by the glare of the Sun's disk. Study of the flash spectrum gives information about the physical state of the solar chromosphere. The flash spectrum was first observed by the U.S. astronomer Charles Augustus Young in 1870.

flashback, a cinematographic term also used from the 20th century for literature, a narrative technique of interrupting the chronological sequence of a work of dramatic or nondramatic fiction to interject events of earlier occurrence that bear on the immediate situation. The flashback technique, if not the name, is as old as Western literature. In the *Odyssey,* most of the adventures that befell Odysseus on his journey home from Troy are told in flashback by Odysseus when he is at the court of the Phaeacians.

The use of flashback enables the author to start his story from a point of high interest, and to avoid the monotony of chronological exposition. It also enables him to keep the story in the objective, dramatic present because in the flashback the event is not recalled but relived.

In motion pictures, flashback is indicated not only by narrative devices but also by a variety of optical techniques such as fade-in or out (the emergence of a scene from blackness to full definition, or its opposite), dissolves (gradually exposing a second image over the first while it is fading away), or iris-in and out (the expansion or contraction of a circle enclosing the scene).

flashbulb, one-time light bulb giving a single bright burst of light, used in photography. *See* flash lamp.

flashtube, electric discharge lamp giving a very bright, very brief burst of light, useful in photography and engineering. *See* flash lamp.

flat bark beetle, also called CUCUJID BEETLE, any member of the approximately 500 species belonging to the insect family Cucujidae (order Coleoptera). These beetles, easily recognized by their narrow, flattened bodies, occur throughout the world and are usually brown in colour, although some species are red.

Many (*e.g., Cucujus, Catogenus*) live under tree bark and feed on mites and wood-boring insects; a few are stored products pests such as the rust-red grain beetle (*Cryptolestes ferrugineus*), which eats the germ of grains. The larger cucujid beetles are about 12 millimetres (½ inch) long. Sometimes included in the flat bark beetle family is the flat grain beetle (*q.v.*) family Silvanidae.

flat bug, also called FUNGUS BUG, any small, flat, dark-coloured insect of the family Aradidae (order Heteroptera), which numbers about 1,000 species. Members occur in all zoogeographic regions.

Flat bug (*Mezira pacifica*), adults and nymphs
E.S. Ross

Flat bugs, usually found under stones or in crevices, feed on fungi and moisture in decaying wood. Their wings, though well developed, remain quite small.

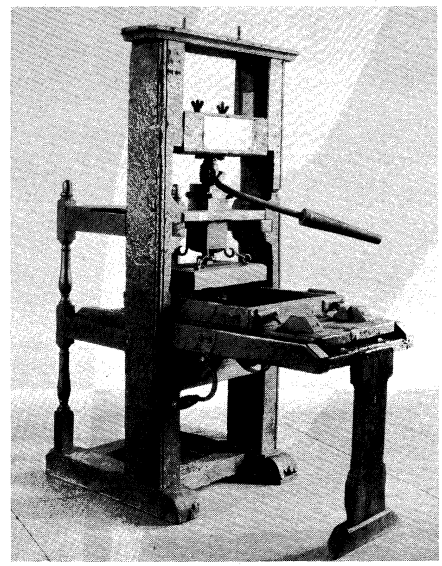
flat grain beetle, any member of the insect family Silvanidae (order Coleoptera), closely related to and sometimes included in the flat bark beetle (*q.v.*) family Cucujidae. These beetles are usually less than 3 millimetres (0.1 inch) in length.

Many species live under the bark of trees. Others (*e.g.,* the saw-toothed grain beetle *Oryzaephilus surinamensis*) feed on grains and have become serious pests wherever grain is stored.

flat-headed cat (*Felis planiceps*), extremely rare Asian cat found in the Malay Peninsula, Sumatra, and Borneo. One of the smallest members of the cat family, Felidae, the adult is from 40 to 60 centimetres (16 to 24 inches) long without the 15–20-cm tail and weighs from 1.5 to 2.5 kilograms (3.3 to 5.5 pounds). Its coat is reddish above and white with red spots below; there are white markings around the eyes. It is the only felid known to include any substantial amount of vegetation in its diet, with a preference for fruit and, when available, sweet potatoes and similar foods. Little else is known about this cat, which is reported to be nocturnal and to hunt fish and frogs along rivers.

flat stitch (knitting): *see* plain stitch.

flatbed press, printing press employing a flat surface for the type or plates against which paper is pressed, either by another flat surface acting reciprocally against it or by a cylinder rolling over it. It may be contrasted to the rotary press (*q.v.*), which has a cylindrical printing surface. The first cylinder flatbed press

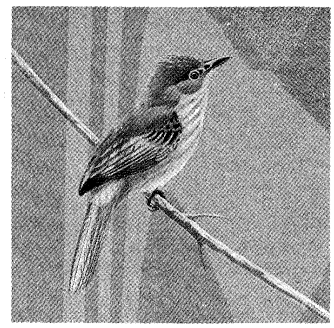


The Franklin press, an early flatbed press for hand printing
The Bettmann Archive

was built by Friedrich Koenig of Germany and used by *The Times* of London in 1814.

In the platen press, a flat surface bearing the paper is pressed against the flat, inked printing plate; the two surfaces come together and part with a jawlike motion. Most small hand presses are platen presses. Both cylinder and platen types of flatbed presses operate at speeds of 1,000 to 4,000 impressions per hour.

flatbill, any of six species of Central and South American birds belonging to the tyrant flycatcher family Tyrannidae (order Passeriformes). Flatbills, which constitute the genera *Rhynchocyclus* and *Ramphotrigon,* are distinguished by their exceptionally broad and flat bill. All are olive, marked with gray, brown, or black above and yellow or brownish below. In length they are 15–17 centimetres (6–7 inches).

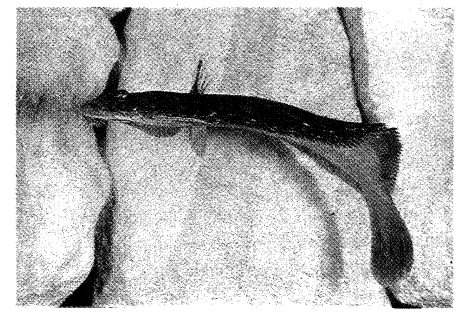


Rufous-tailed flatbill (*Ramphotrigon ruficauda*)
Painting by John P. O'Neill

flatfish, order name PLEURONECTIFORMES, any of about 600 species of bony, oval-shaped, flattened fishes, such as the flounder, halibut, and turbot.

A brief treatment of flatfishes follows. For full treatment *see* MACROPAEDIA: Fishes.

Flatfishes are found from tropical to cold waters. Most are marine and live at moderate depths along the continental shelf, but some enter or live permanently in freshwater. Flatfishes are carnivorous bottom dwellers that habitually rest on one side, often partly buried in the sand or mud. Some are also able to change colour and can blend effectively with a variety of surroundings.



Flatfish (*scophthalmus*)
Jacques Six

One of the most notable features of the flatfish is the location of the eyes—both on one side of the head. Another is the colouring; the eyed side of the fish (uppermost as it lies on the bottom) is pigmented, but the lower, blind side is normally white. Other characteristics include a long dorsal fin on the back and a long anal fin on the belly. The flatfishes of the family Pleuronectidae, including about 100 species, usually have their eyes on the right side of the body. Members of the family Bothidae, about 200 species, are characteristically left-sided—that is, they have their eyes and colouring on the left side of the body. Other important families are the Soleidae (soles) and Cynoglossidae (tongue soles).

Flatfishes vary considerably in size. Small species may reach a length of only about 10 centimetres (4 inches); the largest, the Atlantic halibut (*Hippoglossus hippoglossus*), may reach a length and weight of about 2 metres (7 feet) and 325 kilograms (720 pounds). Many species, such as the halibuts and turbot, are highly valued as food.

For more information on flatfish species and groups, *see* dab; flounder; halibut; plaice; sanddab; sole; tongue sole; turbot.

flatfoot, congenital or acquired flatness of the longitudinal arch of the foot. Usually associated with loss of the arch is a rolling outward of the foot and heel, resulting in a splayfoot position. Normally the arch is maintained by the shape of the bones and by the ligaments and muscles of the foot. Of these three, the muscles are most important. At an early stage the foot may be flexible, and the flatness may result from stretching of the ligaments and weakness of the muscles. At a later stage the shape of the bones may be altered and the deformity become rigid.

Little is known regarding the causation of congenital flatfoot. All infants appear to have flat arches at birth because of the pad of fat

under the instep. The normal arch does not appear until the infant begins to walk and thus develops his muscle power. Failure of development of the arch may be a normal racial or familial characteristic. In general, the problem is a disproportion between the weight to be borne and the muscles to bear it. In a few persons the deformity seems to result from excessive weight or an injury.

Many symptoms have been attributed to flatfoot—pain, swelling, muscular spasm, stiffness, and awkward gait. Other vague symptoms in the extremities and back, sometimes considered to be caused by flatfoot, probably are the result of the generalized muscle weakness that also produced flatfoot. Many persons who have flatfeet are entirely without disability or pain.

The aim of treatment is to secure proper position of the arch and heel by the use of adequate shoes, with or without supports, and to preserve that position by strengthening the muscles maintaining correction of arch and heel. Supports are indicated if pain is severe or fatigue excessive, but their prolonged use may weaken muscles. Few persons have pain severe enough to require surgery.

Flathead, Salish-speaking Indian tribe of what is now western Montana, U.S., whose territory extended from the crest of the Bitterroot Range to the Continental Divide of the Rockies and centred on the upper reaches of the Clark Fork of the Columbia River. Salish was the native name of the tribe, but Flathead is now customary; they themselves did not practice head-flattening, but some of their slaves came from tribes that did. Some early accounts termed all Salish-speaking tribes Flathead (*see* Salish).

The Flatheads were the easternmost tribe of the so-called Plateau culture area but exhibited many of the traits of the Plains Indians just east over the Rockies. The Flatheads had acquired horses in great number and mounted annual fall expeditions to hunt bison on the Plains, often warring with Plains tribes. Furthermore, Plains-type warfare and its honours were emphasized, including staging war dances, killing and scalping enemies, making quick coups (simply touching enemies to shame them), and stealing horses.

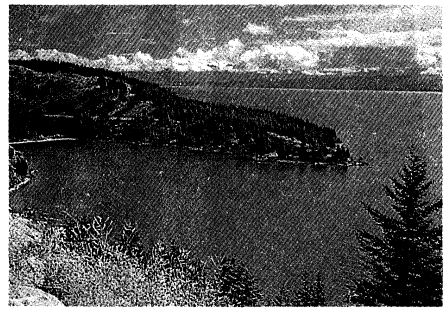
The Plains tepee was the usual dwelling of the Flatheads, though the A-framed, mat-covered lodge, a typical Plateau structure, was also used. Western Flathead groups had bark canoes, but eastern groups had only the makeshift bison-skin tubs known as bullboats, typical of the Plains. Fishing was important among them, as it was among other Plateau Indians.

Flathead religious belief centred on guardian spirits, with whom one communicated in visions. A spirit could bring good fortune or health to the person it guarded or disease and misfortune to others. There were also shamans, or medicine men.

Since 1872 the Flatheads have resided primarily on the Flathead Indian Reservation north of Missoula, Mont.

flathead, any of the flattened marine fish of the family Platycephalidae (order Scorpaeniformes), found in the Indo-Pacific and in tropical regions of the eastern Atlantic. Flatheads are elongated, large-mouthed fish with tapered bodies, two dorsal fins, and rough scales. As their name indicates, the head, which is large and covered with ridges and spines, and the forward part of the body are flattened from top to bottom. The fish are carnivorous and generally live on the ocean bottom, buried beneath the surface. They are commercially valuable food fish and range in size to a maximum of about 1.3 m (50 inches) and 15 kg (33 pounds).

Flathead Lake, lake in the Flathead National Forest of northwestern Montana, U.S., marking the southern limit of the Rocky Mountain Trench, a structural depression extending northward to the Liard Plain. Bordered on the east shore by the Mission Range and on the west by the forested foothills of the Salish Mountains, it is 30 miles (48 km) long, 15 miles (24 km) wide, and 220 feet (67 m) deep and has an area that ranges from about 197 square miles (510 square km) to about 188 square miles (487 square km). Named for the Flathead (Salish) Indians (whose reservation adjoins the lake on the south), it was formed



Flathead Lake, Montana
David Muench—EB Inc.

by glacial damming of the Flathead River, which enters the lake below Kalispell. Power and irrigation facilities are supplied by the Kerr Dam (completed 1958) near Polson at the south end of the lake. The University of Montana Biological Station is on the eastern shore.

Flathead River, river rising in the MacDonald Range in southeastern British Columbia, Can., and flowing south for 240 miles (385 km) across the Canada–United States boundary into Montana. After passing between the Whitefish Range (west) and Glacier National Park and the Lewis Range (east), it enters Flathead Lake and emerges from the lake to join the Clark Fork near Paradise, Mont. Its chief tributaries are the Middle Fork, which rises near the Continental Divide and flows 85 miles (137 km) northwest to join the main stream north of Coram; and the South Fork, which flows 80 miles (129 km) north-northwest from the Flathead National Forest past the Flathead Range to join the main stream via the Hungry Horse Dam and Reservoir. The Flathead Valley is a resort region with diversified farming and fruit growing, lumbering, and mining.

flatulence, the presence of excessive amounts of gas in the stomach or intestine, which sometimes results in the expulsion of the gas through the anus. Healthy individuals produce significant amounts of intestinal gas (flatus) daily; without rectal release, gases trapped within the digestive system produce bloating and abdominal distention. Although a normal occurrence, flatulence sometimes causes embarrassment because of the sound and fetid odour of the gases.

Intestinal gas comes from either swallowed air (nitrogen and oxygen) or the fermentation by bacteria of poorly digested carbohydrates in the colon, yielding a mixture of carbon dioxide, hydrogen, and methane. All the common intestinal gases are odourless; about 1 percent of the flatus consists of a mixture of other gases that causes the distinctive odour. Foods with high proportions of nondigestible carbohydrates, such as beans and other legumes, are associated with excessive flatulence; unusual flatulence not associated with specific dietary causes may indicate intestinal malabsorption or other disease processes.

flatware, spoons, forks, and serving implements used at the table. The term flatware was introduced toward the end of the 19th century. Strictly speaking, it excludes knives, which are classified as cutlery (*q.v.*), although in common American usage knives are generally included.

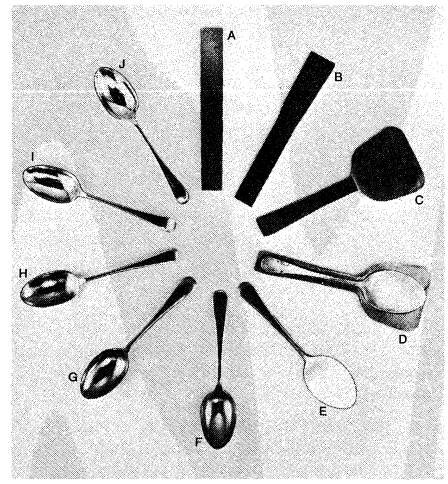
In the earliest spoons, baked clay formed both the bowl-shaped receptacle portion and the supporting stem or handle. Later, spoons were made from suitably shaped bone or wood pieces. The Egyptians fashioned spoons of bronze, some having spiked handles to extract snails from their shells. Elaborate cosmetic spoons had carved handles representing human or animal forms; long incense spoons served ceremonial functions. Both the Greeks and Romans employed bronze and sometimes silver for spoons. Some Roman spoons, made of bone, had small holes in the centres of their bowls; the purpose of these holes is not known. In western Europe the Celts used short bronze spoons with broad shanks formed to fit the hand.

As knowledge of techniques spread, cutlery production was established in areas able to offer plentiful timber to heat furnaces and provide charcoal, in addition to soft water for the hardening and tempering of steel.

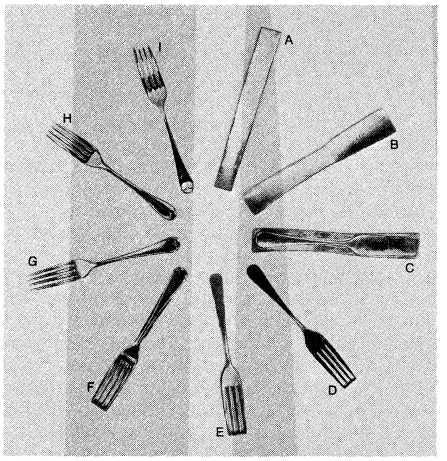
Forks, which originally had a single point, were made with two prongs by the Romans. In the Middle Ages large forks with two flat prongs were used for serving. Smaller eating forks were gradually developed, replacing the traditional pair of pointed table knives that were part of the transition to knife and fork. Handles were sometimes made of precious or semiprecious materials.

Silver spoons originally had long, pointed bowls, but by the later Middle Ages the bowls were frequently fig-shaped, while the stems were often topped with decorative knobs. Matching sets of spoons and forks in standard patterns were common by the mid-18th century. The modern tablespoon, with its stem ending in a rounded curve and turned downward, was adopted about 1760. Although by the late 17th century individual eating knives were no longer carried for ordinary use, sets consisting of knife, fork, spoon, and drinking vessel were still being made for travelers well into the 19th century.

Sheffield plate (*q.v.*) was employed between 1750 and 1880 for such items as knife handles, serving dishes, tea urns, and candelabra; it was manufactured mainly in Sheffield, Eng., but also in Birmingham, Eng. By about 1860 the new process of electroplating (*q.v.*) su-



Stages in the manufacture of a silver-plated spoon
(A) Blank of nickel silver alloy for one spoon; (B) blank cross-rolled to proper thickness and width, which also hardens it; (C) spoon end cross-rolled thinner than handle; (D) shape of spoon blanked; (E) blank handle stamped with pattern; (F) bowl formed; (G) spoon set and buffed; (H) fine buffing; (I) plating; (J) polishing
By courtesy of the Granville College of Further Education, Sheffield, Eng.



Stages in the manufacture of a silver-plated fork
(A) Blank of nickel silver alloy for one fork; (B) blank cross-rolled to increase its width and hardness; (C) shape of fork cut out; (D) fork prongs blanked; (E) fork buffed; (F) handle pattern stamped on and handle bent to shape; (G) prong points dressed and bent to shape; (H) plating; (I) polishing
By courtesy of the Granville College of Further Education, Sheffield, Eng.

perseded the fusion process used in Sheffield plate. The electroplating of silver onto alloys of nickel and copper was soon common and was followed by the plating of nickel onto brass. Sheffield plate ceased to be commercially manufactured, and surviving pieces eventually became valuable antiques.

Though since about 1860 much flatware has been silver-plated by the electroplating method, the use of stainless steel for tableware has grown steadily since 1920. Ferritic stainless steel, containing 12 percent chromium, is used for less costly flatware, particularly in the Far East. The larger spoons and forks intended for use in food preparation are frequently made of stainless steel.

Other flatware materials include gold for luxury services and unplated nickel alloys, aluminum, tin-coated iron, and plastics for inexpensive ones. Wood and natural horn are popular for salad servers. Aluminum is especially useful where lightness and low cost are desired; lightweight plastic eating implements, made in various colours, are produced for picnic sets, ice cream spoons, and airline food service. The least expensive materials for metal flatware are regular steels electroplated with copper, nickel, or chromium.

Silver-plated flatware is manufactured by electroplating silver onto a base metal such as finely buffed nickel silver (an alloy consisting mainly of copper, zinc, and nickel) or stainless steel, its quality being determined by the strength and composition of the base metal, the standard of finish, and the thickness of the silver deposit.

Solid-silver flatware, utilizing essentially pure silver, is a luxury item. Standards for silver purity vary, the principal one being not less than 925 parts of fine silver in 1,000 parts, established by the British assay offices for silver hallmarked as "sterling." The balance is copper or other base metals that add strength to the finished piece. Similar controls exist in many other European countries, although some nations accept a lower standard of 800 parts of silver in 1,000 parts. In Europe silver articles usually bear hallmarks indicating that the metal contains a prescribed amount of silver. Other marks record the year of manufacture and the maker. In the United States the word sterling when used by a reputable supplier is accepted as a sufficient guarantee, and there are no fixed standards.

Modern flatware (Figures 1 and 2) is produced in all the cutlery centres of the world. During the 20th century the processes used in its manufacture reached a high degree of mechanization. The metal, carefully refined, is formed into sheets of proper thickness and is cut into strips of the required width. These processes involve the strictest control of metal behaviour and correct annealing to remove excessive strains. The strips are fed into machine presses that cut out each spoon or fork in its rough shape, one end being at first almost square for a spoon and rectangular for a fork. The ends of these "blanks" are rolled again in a direction at right angles to the centre line, reducing the thickness at this point without altering the thickness of the handle. The bowls of the more expensive spoons are no more than half as thick as their handles.

After being trimmed, the blanks are stamped in alloy-steel dies that hollow the bowls and stamp a pattern on the handles. In the case of forks, slots are cut out to form the prongs, which are then stamped in dies to the required curvature, tapered, and pointed on abrasive belts. These processes are approximately the same whatever metal is used, although in manufacturing cheaper products, made from thinner sheets, cross-rolling can be omitted and the stamping can be performed in one operation.

Subsequent finishing processes vary according to the metal used. In the case of silver, successively finer stages of buffing prepare the surfaces for final polishing or satin finishing. In the case of alloys that are to be electroplated, the articles, after being buffed, are wired individually on frames; quantities of 100 or more can be immersed simultaneously in the series of cleaning baths and plating vats. In most factories the complete frames carrying many articles are transferred automatically from baths to vats and finally to washing and drying. The thickness of the electroplated deposit is increased by some makers at the points of maximum wear; for example, on the centre of the convex surface of spoon bowls. Although the electroplated deposit of silver is specified in grams or pennyweights per dozen pieces and sometimes in actual thickness in millimetres or thousandths of an inch, the more popular method of indication is use of the terms "30 years," "25 years," or "20 years" plate. The designation A1 is considered satisfactory as a guarantee of quality if given by a manufacturer of good repute.

After the pieces have been electroplated, their surfaces are dull and require polishing. Hand polishing is performed by holding the articles upon rapidly rotating mops dressed with an aluminum compound or rouge. The least expensive plating process is "bright plating," in which a very thin coating of silver or chromium is deposited bright, thus eliminating final polishing. Such coatings are of short duration, and the process is therefore restricted to the cheaper grades of flatware. Stainless steel is more difficult to polish than silver, silver plate, or unplated nickel alloys. Techniques have been developed for stamping the cheaper varieties of stainless-steel spoons and forks from prepolished sheet. In some countries stainless steel is polished electrolytically.

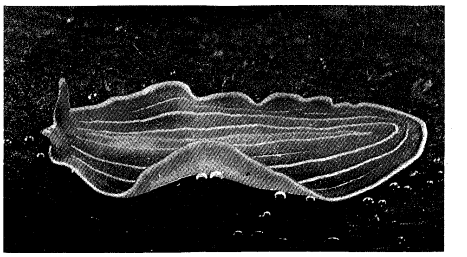
flatworm, phylum name PLATYHELMINTHES, any of various primitive marine invertebrates which include both free-living forms and parasites (*i.e.,* animals that derive nourishment from the body of another living animal).

A brief treatment of flatworms follows. For a full treatment, *see* MACROPAEDIA: Flatworms.

Flatworms occur in a variety of marine, freshwater, and terrestrial habitats and are widely distributed throughout the world. Flatworms, which range in length from a fraction of a millimetre to 15 m (50 feet), are of three main types: turbellarians, which include the planarian (*see* planarian), trematodes (*see* fluke), and cestodes (*see* tapeworm).

Flatworms are bilaterally symmetrical and are usually flattened in appearance; they lack respiratory, skeletal, and circulatory systems and a body cavity (coelom). Spaces between the organs of the nonsegmented body are filled with solid connective tissue (mesenchyme).

Flatworms of the class Turbellaria are mostly free-swimming; some live in or on a host, usually in an aquatic environment. Many are broad and leaflike, but some are cylindrical. All are covered with cilia (tiny hairlike structures) that are in constant motion. All trematodes are parasitic. Fish are the most common



Prostheceraeus, a flatworm of the class Turbellaria
Jacques Six

hosts, but all vertebrate classes are parasitized by them. About 35 species are known to attack man. Some have one host during their lifetime, others two or more. All cestodes are internal parasites. They have no mouth or gut, and food is absorbed through the body wall.

Flaubert, Gustave (b. Dec. 12, 1821, Rouen, Fr.—d. May 8, 1880, Croisset), novelist regarded as the prime mover of the Realist school of French literature and best known for his masterpiece, *Madame Bovary* (1857), a realistic portrayal of bourgeois life, which led to a trial on charges of the novel's alleged immorality.

Early life and works. Flaubert's father, Achille Cléophas Flaubert, who was from Champagne, was chief surgeon and clinical professor at the Hôtel-Dieu hospital in Rouen. His mother, a doctor's daughter from Pont l'Évêque, belonged to a family of distinguished magistrates typical of the great provincial bourgeoisie.

Gustave Flaubert began his literary career at school, his first published work appearing in a little review, *Le Colibri,* in 1837. He early formed a close friendship with the young philosopher Alfred Le Poittevin, whose pessimistic outlook had a strong influence on him. No less strong was the impression made by the company of great surgeons and the environment of hospitals, operating theatres, and anatomy classes, with which his father's profession brought him into contact.

Flaubert, detail of a drawing by E.F. von Liphart, 1880; in the Bibliothèque Municipale, Rouen, Fr.
By courtesy of the Bibliotheque Municipale, Rouen; photograph, Ellebe

Flaubert's intelligence, moreover, was sharpened in a general sense. He conceived a strong dislike of accepted ideas (*idées reçues*), of which he was to compile a "dictionary" for his amusement. He and Le Poittevin invented a grotesque imaginary character, called "le Garçon" (the Boy), to whom they attributed whatever sort of remark seemed to them most degrading. Flaubert came to detest the "bourgeois," by which he meant anyone who "has a low way of thinking."

In November 1841 Flaubert was enrolled as a student at the Faculty of Law in Paris. At the age of 22, however, he was recognized to be suffering from a nervous disease that was taken to be epilepsy, although the essential symptoms were absent. This made him give up the study of law, with the result that henceforth he could devote all his time to literature. His father died in January 1846, and his beloved sister Caroline died in the following March after giving birth to a daughter. Flaubert then retired with his mother and his infant niece to his estate at Croisset, near Rouen, on the Seine. He was to spend nearly all the rest of his life there.

On a visit to Paris in July 1846, at the sculptor James Pradier's studio, Flaubert met the poet Louise Colet. She became his mistress, but their relationship did not run smoothly. His self-protecting independence and her jealousy made separation inevitable, and they parted in 1855.

In 1847 Flaubert went on a walking tour along the Loire and the coast of Brittany with the writer Maxime du Camp, whose acquaintance he had made as a law student. The pages written by Flaubert in their journal of this tour "over fields and shores" were published after his death under that title, *Par les champs et par les grèves.* This book contains some of his best writing—*e.g.,* his description of a visit to Chateaubriand's family estate, Combourg.

Mature career. Some of the works of Flaubert's maturity dealt with subjects on which he had tried to write earlier. At the age of 16, for instance, he completed the manuscript of *Mémoires d'un fou* ("Memoirs of a Mad Man"), which recounted his devastating passion for Elisa Schlésinger, 11 years his senior and the wife of a music publisher, whom he had met in 1836. This passion was only revealed to her 35 years later when she was a widow. Elisa provided the model for the character Marie Arnoux in the novel *L'Education sentimentale.* Before receiving its definitive form, however, this work was to be rewritten in two distinct intermediate versions in manuscript: *Novembre* (1842) and a preliminary draft entitled *L'Éducation sentimentale* (1843–45). Stage by stage it was expanded into a vast panorama of France under the July Monarchy—indispensable reading, according to Georges Sorel, for any historian studying the period that preceded the coup d'etat of 1851.

The composition of *La Tentation de Saint Antoine* provides another example of that tenacity in the pursuit of perfection that made Flaubert go back constantly to work on subjects without ever being satisfied with the results. In 1839 he was writing *Smarh,* the first product of his bold ambition to give French literature its *Faust.* He resumed the task in 1846–49, in 1856, and in 1870, and finally published the book as *La Tentation de Saint Antoine* in 1874. The four versions show how the author's ideas changed in the course of time. The version of 1849, influenced by Spinoza's philosophy, is nihilistic in its conclusion. In the second version the writing is less diffuse, but the substance remains the same. The third version shows a respect for religious feeling that was not present in the earlier ones, since in the interval Flaubert had read Herbert Spencer and reconciled the Spencerian notion of the Unknown with his Spinozism. He had come to believe that science and religion, instead of conflicting, are rather the two poles of thought. The published version incorporated a catalog of errors in the field of the Unknown (just as *Bouvard et Pécuchet* was to contain a list of errors in the field of science).

From November 1849 to April 1851 Flaubert was travelling in Egypt, Palestine, Syria, Turkey, Greece, and Italy with Maxime du Camp. Before leaving, however, he wanted to finish *La Tentation* and to submit it to his friend the poet Louis Bouilhet and to du Camp for their sincere opinion. For three days in September 1849 he read his manuscript to them, and they then condemned it mercilessly. "Throw it all into the fire, and let's never mention it again." Bouilhet gave further advice: "Your Muse must be kept on bread and water or lyricism will kill her. Write a down-to-earth novel like Balzac's *Parents pauvres.* The story of Delamare, for instance. . . ."

Eugène Delamare was a country doctor in Normandy who died of grief after being deceived and ruined by his wife, Delphine (*née* Couturier). The story, in fact that of *Madame Bovary,* is not the only source of that novel. Another was the manuscript *Mémoires de Mme Ludovica,* discovered by Gabrielle Leleu in the library of Rouen in 1946. This is an account of the adventures and misfortunes of Louise Pradier (*née* d'Arcet), the wife of the sculptor James Pradier, as dictated by herself, and, apart from the suicide, it bears a strong resemblance to the story of Emma Bovary. Flaubert, out of kindness as well as out of professional curiosity, had continued to see Louise Pradier when the "bourgeois" were ostracizing her as a fallen woman, and she must have given him her strange document. Even so, when inquisitive people asked him who served as model for his heroine, Flaubert replied, "Madame Bovary is myself." As early as 1837 he had written *Passion et vertu,* a short and pointed story with a heroine, Mazza, resembling Emma Bovary. For *Madame Bovary* he took a commonplace story of adultery and made of it a book that will always be read because of its profound humanity. While working on his novel Flaubert wrote: "My poor Bovary suffers and cries in more than a score of villages in France at this very moment." *Madame Bovary,* with its unrelenting objectivity—by which Flaubert meant the dispassionate recording of every trait or incident that could illuminate the psychology of his characters and their role in the logical development of his story—marks the beginning of a new age in literature.

Madame Bovary cost the author five years of hard work. Du Camp, who had founded the periodical *Revue de Paris,* urged him to make haste, but he would not. The novel, with the subtitle *Moeurs de province* ("Provincial Customs"), eventually appeared in installments in the *Revue* from Oct. 1 to Dec. 15, 1856. The French government then brought the author to trial on the ground of his novel's alleged immorality, and he narrowly escaped conviction (January–February 1857). The same tribunal found the poet Charles Baudelaire guilty on the same charge six months later.

To refresh himself after his long application to the dull world of the bourgeoisie in *Madame Bovary,* Flaubert immediately began work on *Salammbô,* a novel about ancient Carthage, in which he set his sombre story of Hamilcar's daughter Salammbô, an entirely fictitious character, against the authentic historical background of the revolt of the mercenaries against Carthage in 240–237 BC. His transformation of the dry record of Polybius into richly poetic prose is comparable to Shakespeare's treatment of Plutarch's narrative in the lyrical descriptions in *Antony and Cleopatra.* A play, *Le Château des coeurs* (*The Castle of Hearts,* 1904), written in 1863, was not printed until 1880.

Later years. The merits of *L'Éducation sentimentale,* which appeared a few months before the outbreak of the Franco-German War of 1870, were not appreciated, and Flaubert was much disappointed. Two plays, *Le Sexe faible* ("The Feeble Sex") and *Le Candidat* (*The Candidate,* 1904), likewise had no success, though the latter was staged for four performances in March 1874. The last years of his life, moreover, were saddened by financial troubles. In 1875 his niece Caroline's husband, Ernest Commanville, a timber importer, found himself heavily in debt. Flaubert sacrificed his own fortune to save him from bankruptcy. Flaubert sought consolation in his work and in the friendship of George Sand, Ivan Turgenev, and younger novelists—Émile Zola, Alphonse Daudet, and, especially, Guy de Maupassant, who was the son of his friend Alfred Le Poittevin's sister Laure and who regarded himself as Flaubert's disciple.

Flaubert temporarily abandoned work on a long novel, *Bouvard et Pécuchet,* in order to write *Trois Contes,* containing the three short stories "Un Coeur simple," a tale about the drab and simple life of a faithful servant; "La Légende de Saint Julien l'Hospitalier"; and "Hérodias." This book, through the diversity of the stories' themes, shows Flaubert's talent in all its aspects and has often been held to be his masterpiece.

The heroes of *Bouvard et Pécuchet* are two clerks who receive a legacy and retire to the country together. Not knowing how to use their leisure, they busy themselves with one abortive experiment after another and plunge successively into scientific farming, archaeology, chemistry, and historiography, as well as taking an abandoned child into their care. Everything goes wrong because their futile book learning cannot compensate for their lack of judgment.

The profound meaning of *Bouvard et Pécuchet,* which was left unfinished by Flaubert and which was not published until after his death, has been seriously misunderstood by those critics who have regarded it as a denial of the value of science. In fact it is "scientism" (and by analogy the confusion of doctrines) that Flaubert is arraigning—*i.e.,* the practice of taking science out of its own domain, of confusing efficient and final causes, and of convincing oneself that one understands fundamentals when one has not even grasped the superficial phenomena. Intoxicated with empty words, Bouvard and Pécuchet awake from their dream only when catastrophe overtakes all of their efforts.

Flaubert has been accused of presenting them as imbeciles, but in fact he expresses his compassion for them: "They acquire a faculty deserving of pity, they recognize stupidity and can no longer tolerate it. Through their inquisitiveness their understanding grows; having had more ideas, they suffed more." Flaubert's satire is thus to some extent the history of his own experience told with a sad humour.

Flaubert died suddenly of an apoplectic stroke. He left on his table an unfinished page and notes for the second volume of his novel. Bouvard and Pécuchet, tired of experimenting, were to go back to the work of transcribing and copying that they had done as clerks. The matter that they chose to transcribe was the subject of the notes: it was to be a selection of quotations, a *sottisier,* or anthology of foolish remarks. There has been much controversy about this bitter conclusion, as the form that it was to take was left undetermined in the notes Flaubert left, though the materials were gathered and have been published.

Method of composition. Flaubert's aim in art was to create beauty, and this consideration often overrode moral and social issues in his depiction of truth. He worked slowly and carefully, and, as he worked, his idea of his

art became gradually more exact. His letters to Louise Colet, written while he was working on *Madame Bovary,* show how his attitude changed. His ambition was to achieve a style "as rhythmical as verse and as precise as the language of science" (letter of April 24, 1852). In his view "the faster the word sticks to the thought, the more beautiful is the effect." He often repeated that there was no such thing as a synonym and that a writer had to track down *le seul mot juste,* "the unique right word," to convey his thought precisely. But at the same time he always wanted a cadence and a harmony of sounding syllables in his prose, so that it would appeal not only to the reader's intelligence but also to his subconscious mind in the same way as music does and thus have a more penetrating effect than the mere sense of the words at their face value. Composition for him was a real anguish.

Flaubert sought objectivity above all else in his writing: "The author, in his work, must be like God in the Universe, present everywhere and visible nowhere." It is paradoxical, therefore, that his personality should be so clearly discernible in all his work and that his letters, written casually to his intimates and full of disarming sincerity, delicate sensibility, and even exquisite tenderness—side by side with jovial coarseness of expression—should be considered by some critics as his masterpiece. (R.Dum./J.Ba.)

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There have been a great number of studies that deal with the individual works by Flaubert, but among the more modern general criticism are: V.H. Brombert, *The Novels of Flaubert* (1966); Stratton Buck, *Gustave Flaubert* (1966); and B.F. Bart, *Flaubert* (1967). Enid Starkie, *Flaubert: The Making of the Master* (1967), is a penetrating analysis. Jean-Paul Sartre, *L'Idiot de la famille: Gustave Flaubert,* 2 vol. (1971), is a study of the novelist, whom the writer uses as a tool for his own dissection of France's bourgeoisie.

flauto piccolo (musical instrument): *see* piccolo.

Flavian I OF ANTIOCH (b. *c.* 320, probably Antioch, Syria—d. 404), bishop of Antioch from 381 to 404, whose election perpetuated the schism originated by Meletius of Antioch (*q.v.*), a crucial division in the Eastern Church over the nature of the Trinity.

With his friend Diodorus, later bishop of Tarsus (Tur.), Flavian defended the Nicene Creed against Arianism (*q.v.*). In 360 Bishop St. Meletius was appointed to the see of Antioch (whose bishop, St. Eustathius, had been banished for opposing Arianism); there his unexpected profession of Nicaean orthodoxy caused him to be exiled several times. During Meletius' absences, Flavian and Diodorus administered his see. But the churchmen who remained devoted to Eustathius formed a faction—destined to resist Meletius' authority—and made Paulinus their bishop, causing the Meletian Schism.

Flavian succeeded Meletius (381), and Paulinus appointed as his own successor Evagrius, the last bishop of the Eustathian faction. Recognition of Flavian as legitimate bishop of Antioch was at first withheld by Pope St. Siricius, but his position was secured in 398/399 through the intervention of Patriarch St. John Chrysostom of Constantinople and the influence of the Roman emperor Theodosius I the Great. Nevertheless, some Eustathians continued in schism until 414.

Flavian II OF ANTIOCH (d. *c.* 518, Petra, Arabia), patriarch of Antioch probably from 498 to 512. He was chosen patriarch by the emperor Anastasius I after he accepted the evasive Henoticon, the decree of union between the Monophysites (*q.v.*) and the Orthodox. In deference to orthodoxy, however, Flavian would not expressly repudiate the Council of Chalcedon. This equivocal policy only antagonized both sides, particularly the Monophysites. At the synod of Sidon (511) Flavian maintained his position, but soon afterward, under constant harassment by his enemies, he yielded finally to their demand for a rejection of Chalcedon. Forced to abdicate, he was banished to Petra in Arabia.

Flavian DYNASTY (AD 69–96), the ancient Roman imperial dynasty of Vespasian (reigned 69–79) and his sons Titus (79–81) and Domitian (81–96); they belonged to the Flavia gens.

The fall of Nero (AD 68) and the extinction of the Julio-Claudian dynasty had been followed by a war of succession that revealed the military basis of the principate and the weakness of the tie connecting the emperor with Rome. The successive emperors Galba, Otho, Vitellius, and Vespasian represented in turn the legions of Spain, the Praetorian Guard (the household troops), the Army of the Rhine, and a coalition of the armies of the Danube and the Euphrates; and all except Otho were already de facto emperors when they entered Rome. The final survivor in the struggle, Vespasian, was a man of comparatively humble origin; and, because the principate ceased to possess the prestige of high descent, it became necessary to remove, as far as possible, the anomalies of the office and to give it a legitimate and permanent form. There were several results: an elaborate and formal system of titles was substituted for the personal names of the Julio-Claudian emperors; there was an increasing tendency to insist on the inherent prerogatives of the principate (such as the censorial power); and there was an attempt to invest Caesarism with a hereditary character, either by natural descent or by adoption. Moreover, the worship of the *Divi,* or deified Caesars, was made the symbol of imperial continuity and legitimacy.

Vespasian's reign was noted for his reorganization of the army, making it more loyal and professional; for his expansion of the membership of the Senate, bringing in administrators with a sense of service; for his increase and systematization of taxation; and for his strengthening of the frontiers of the empire (though little new territory was added). Titus' brief but popular reign was followed by the autocracy of Domitian, who fought the senatorial class and instituted taxes and confiscations for costly buildings, games, and shows. A final reign of terror (89–96) was ended by his assassination. The Flavian dynasty was succeeded by the era of the Five Good Emperors.

Flavian, SAINT (d. Aug. 11, 449, Hypaepa, Lydia; feast day February 18), patriarch of Constantinople from 446 to 449, who opposed the heretical doctrine of the Monophysites (*q.v.*). He presided at the Synod of Constantinople (448), which condemned the monk Eutyches (*q.v.*), proponent of an extreme form of Monophysitism. Pope St. Leo I the Great approved the synod's action in his famous *Tome* (449). Patriarch Dioscorus of Alexandria, on behalf of Eutyches, influenced the Eastern Roman emperor Theodosius II to summon the Robber Synod of Ephesus (Aug. 8, 449), which exonerated Eutyches and deposed Flavian, whose opponents beat him to death three days later.

The Council of Chalcedon (451) vindicated him, proclaiming him a martyr and saint.

Flavian Amphitheatre: *see* Colosseum.

Flavigny, Marie-Catherine-Sophie de: *see* Agoult, Marie-Catherine-Sophie de Flavigny, comtesse d'.

flavin, also called LYOCHROME, any of a group of pale-yellow, greenly fluorescent biological pigments (biochromes) widely distributed in small quantities in plant and animal tissues. Flavins are synthesized only by bacteria, yeasts, and green plants; for this reason, animals are dependent on plant sources for them, including riboflavin (vitamin B_2), the most prevalent member of the group.

Flavius (ancient Roman personal name, or praenomen): *see under* gens or family name or honorific (*e.g.,* under Severus for Flavius Valerius Severus).

Flavius, Gnaeus (late 4th century BC), Roman legal writer and politician who made public the technical rules of legal procedure, which had been kept secret by the patricians and the pontifices (advisers to the king, dictator, or emperor) so that they could maintain their advantage over the plebeians. Flavius learned procedure while serving as secretary to Appius Claudius Caecus, censor and later consul. In about 304 he published his findings, which became known as the Jus Flavianum. From this work the Roman people for the first time could learn the *legis actiones,* or verbal formulas required to maintain legal proceedings, and the *dies fasti,* or specified days on which proceedings could be instituted.

His resulting popularity caused him to be chosen for several public offices, including that of senator. In 304 he was made curule aedile (magistrate of public buildings and works) over the protests of the nobles, who

despised him because he had weakened their power and because he was lowborn, the son of a freedman.

flavonoid, any of a class of nonnitrogenous biological pigments (biochromes) that includes the anthocyanins and the anthoxanthins. Extensively represented in plants, the flavonoids are of relatively minor and limited occurrence in animals, which derive the pigments from plants. Many members of this group, notably the anthoxanthins, impart yellow colours, often to the petals of flowers. The anthocyanins are largely responsible for the red colouring of buds and young shoots as well as for the purple and purple-red colours of autumn leaves. Although no physiological functions have been definitely established for the flavonoids, it has been suggested that the colour they impart to flowers may be an important factor in attracting bees, butterflies, and other pollen-transporting animals that implement fertilization in plants. Similarly, brightly coloured fruits have improved chances of seed dispersal by animals attracted to them as food.

flavour, also spelled FLAVOR, the sensations perceived when a food or beverage is consumed, not including consistency or temperature. Such sensations help to identify substances and are sources of enjoyment when eating and drinking. The sensory organs involved in flavour perception are those of taste, smell, and touch; involved nerve endings are located in the nose and mouth.

Tasting occurs in the mouth, chiefly on the tongue through the taste buds. The taste buds are stimulated by four fundamental taste sensations—sweet, salty, sour, and bitter. Examples of substances that induce the four basic tastes are sugar (sweet), salt (salty), lemon juice (sour), and quinine (bitter). Substances can be tasted only when they are in water solutions, and if a substance is not in solution when taken into the mouth, it must be dissolved in saliva before it can be detected by the taste buds. The taste buds most sensitive to salty flavours are dispersed along the sides and front of the tongue. Taste buds sensitive to sweet flavours are concentrated on the tip of the tongue. Bitter flavours are detected at the rear of the tongue and sour flavours on the sides.

Smelling involves the olfactory nerve endings in the upper part of the interior of the nose. Aromas can reach these nerves either directly through the nostrils as in breathing or indirectly up the back passageway from the mouth. Because of their remote location, the olfactory nerve endings are best stimulated by "sniffing" through the nose or swallowing if food is in the mouth. Odours are smelled only when the material is in gaseous form—*i.e.*, a dispersion of molecules in air. The thousands of identifiable odours are thought, as in taste, to consist of a combination of a small number of basic odours. The sense of smell is extremely sensitive, requiring only minute quantities for detection; a few parts per million in air is sufficient for detection of many odours. The smell of brewing coffee or the cooking of onions, for instance, can be recognized at considerable distances. The sense of taste requires considerably higher concentrations of substances for detection, as much as several tenths of 1 percent often being necessary to elicit a response.

Touch sensations that contribute to taste originate in the nose, lips, and throughout the entire mouth and throat. The many kinds of touch sensations are based on either the physical or chemical properties of the substance or on a combination of them. Physical properties of foods that produce touch sensations are particle size, texture, consistency, and temperature; reactions induced by chemical properties include the coolness of peppermint, the "bite" of mustard and pepper, the warmth of cloves, and the astringency of spinach.

When a person consumes food, the simultaneous stimulation of the senses of taste, smell, and touch create an immediate impression that causes him to accept the food and continue eating it or to reject and discard it. Many foods such as bananas, berries, and other fruits, nuts, milk, and a few vegetables have flavours that make them highly acceptable in their natural, uncooked state. Other foods derive their flavour through cooking, seasoning, and flavouring or combinations of these. Psychologists have demonstrated that preference for or avoidance of a particular flavour is a learned behaviour, modifiable by conditioning.

Flavour evaluation tests are used by the food-processing industry to determine acceptability of new food products and to assure uniform quality of established products. Many tests rely on panels composed of trained tasters. Flavour tests include ranking and scoring, with panel members ranking samples according to intensity of the flavour characteristic being judged; profile methods, in which trained participants describe sensations produced by food samples; difference tests, with participants reporting differences detected in samples; and consumer acceptance testing, in which trained workers evaluate surveys of reactions of potential consumers to product samples.

In the late 20th century, food scientists were developing objective methods for isolating and measuring the chemicals contributing to flavours. Knowledge of the chemicals involved and the conditions affecting them can lead to improvements in raw materials; quality evaluation and control; processing, storage, and preparation methods; and to new product development.

flavouring, also spelled FLAVORING, any of the liquid extracts, essences, and flavours that are added to foods to enhance their taste and aroma. Flavourings are prepared from essential oils, such as almond and lemon; from vanilla; from fresh fruits by expression; from ginger by extraction; from mixtures of essential oils and synthetic organic chemicals; or entirely from synthetic chemicals, with alcohol, glycerol, propylene glycol, alone or in combination, as solvents. Water is added and sometimes certified food colour as well.

Extracts, essences, and flavours employing only natural flavouring agents are called pure; those employing synthetics (in part or entirely) are called imitation or artificial flavourings.

Essential oils, which are complex substances derived from plants, consist of a number of organic chemical components such as alcohols, aldehydes, ethers, esters, hydrocarbons (terpenes, sesquiterpenes, etc.), ketones, lactones, phenols, and phenol ethers. Nearly all of these organic chemicals have been synthesized, and it is these synthetics that are used in the manufacture of imitation flavourings.

Essential oil extracts. These extracts are prepared by dissolving an essential oil in alcohol of the proper strength, adding water and, where desirable and permitted by law, a small amount of certified food colour. They include almond, anise, celery, cassia or cinnamon, clove, lemon, nutmeg, orange, rosemary, savory, basil, sweet marjoram, thyme, and wintergreen.

Nonalcoholic flavouring extracts. Nonalcoholic flavouring extracts are prepared by employing glycerol or propylene glycol or a combination of these to bring the essential oil into solution, with added water, and sometimes food colour.

True fruit flavours. True fruit flavours are obtained by expression, concentration, or distillation of fresh fruits. The alcoholic content of the finished product is usually between 18 and 22 percent to prevent fermentation.

Imitation, artificial extracts, essences, and flavours. Imitation, artificial extracts, essences, and flavours are prepared by bringing into solution with alcohol, glycerol, or propylene glycol various synthetic flavouring agents to formulate an extract, essence, or flavour with the likeness of the flavour of the fruit, spirit, or liqueur for which it is named. These preparations cover a wide range of flavourings including vanilla, lemon, lime, banana, cherry, butterscotch, brandy, and rum.

Some contain few ingredients, others many. Imitation vanilla extract may be prepared with synthetic vanillin, coumarin (now prohibited in the United States and Canada), heliotropin, glycerol, water, and caramel colouring.

Imitation strawberry flavour may contain 10, 12, or more synthetic organic chemicals including aldehyde C16, aldehyde C14, benzyl acetate, methyl anthranilate, amyl acetate, amyl butyrate, and ethyl propionate, with solvents and added colour, according to the particular manufacturer's art, skill, and experience in bringing out the fullest and most realistic flavour.

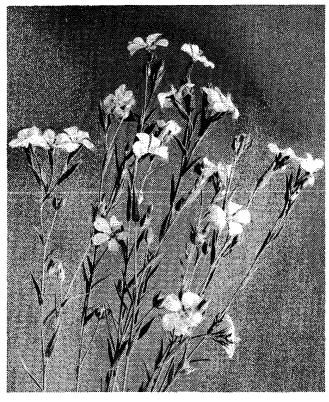
Imitation brandy flavour may contain, with other organic chemicals, ethyl oenanthate, methyl succinate, ethyl acetate, and ethyl propionate.

Certain synthetic organic chemicals lend a distinctive note to imitation flavourings—for example, allyl caproate and ethyl butyrate to pineapple, benzaldehyde to almond, benzyl butyrate to raspberry, and citral to lemon.

Consult the INDEX *first*

flax (*Linum usitatissimum*), plant of the family Linaceae and its fibre, which is second in importance among the bast fibre (*q.v.*) group. The flax plant is cultivated both for its fibre, from which linen yarn and fabric are made, and for its seed, called linseed, from which linseed oil is obtained.

Flax is one of the oldest textile fibres. Evidence of its use has been found in the prehistoric lake dwellings of Switzerland. Fine linen



Flax (*Linum usitatissimum*)
By courtesy of J. Horace McFarland Co.

fabrics, indicating a high degree of skill, have been discovered in ancient Egyptian tombs. Phoenician traders apparently brought linen from the Mediterranean area to Gaul and Britain, and the Romans introduced linen manufacture throughout their empire. In the 17th century the German states and Russia were major sources of raw material, and the linen industry was established in the United Provinces of the Netherlands, Ireland, England, and Scotland. In North America the expansion of the cotton industry reduced the importance of linen. Flax cultivation achieved importance in other areas, including Argentina and Japan, in the first half of the 20th century.

Flax is an herbaceous annual. When densely planted for fibre, plants average 0.9 to 1.2 metres (3 to 4 feet) in height, with slender stalks 2.5 to 4 millimetres (about 0.10 to 0.15 inch) in diameter and with branches concentrated at the top. Plants cultivated for seed are shorter and many-branched. The leaves, alternating on the stalk, are small and lance-shaped. The flowers, borne on stems growing from the branch tips, have five petals, usually blue in colour but sometimes white or pink. Small globular bolls, composed of five lobes, contain the seeds.

The plant, adaptable to a variety of soils and climates, grows best in well-drained, sandy loam and in temperate climates. In most areas planting of the same land with flax is limited to once in six years to avoid soil exhaustion. Cool, moist growing seasons produce the most desirable fibre. Harvesting usually takes place after the lower portion of the stalk has turned yellow but before the fruit is fully mature. The fibre is obtained by subjecting the stalks to a series of operations, including retting, drying, crushing, and beating.

Fibre colour ranges from buff to gray, with the best qualities creamy white. The fibre strands, which measure about 30 to 75 centimetres (12 to 30 inches) long, are made up of individual cylindrically shaped cells with fairly smooth surfaces.

Linen is valued for its strength, lustre, durability, and moisture absorbency. It is resistant to attack by microorganisms, and its smooth surface repels soil. It is stronger than cotton, dries more quickly, and is more slowly affected by exposure to sunlight. It can be bleached to a pure white but dyeing is somewhat difficult because the fibres are not readily penetrated. Although linen increases in strength when wet, the excessive use of alkalies in laundering can weaken the fibres. Low elasticity, imparting hard, smooth texture, also makes linen subject to wrinkling, which can be reduced by chemical treatment. Because linen absorbs and releases moisture quickly and is a good conductor of heat, linen garments have a cooling effect on the wearer.

Fine grades of linen are made into woven fabrics and laces for apparel and household furnishings. Lower grades are used for products requiring strength and ability to withstand moisture—such as canvas, twine, fire hose, bagging, industrial sewing thread, and fishnet. Leading producers include the Soviet Union, Poland, and Romania.

Flaxman, John (b. July 6, 1755, York, Yorkshire, Eng.—d. Dec. 7, 1826, London), sculptor, illustrator, and designer, the leading artist of the Neoclassical style in England.

As a youth, Flaxman worked in his father's plaster-casting studio in London while studying Classical literature, which was to be a continual source of inspiration. In 1770 he entered the Royal Academy schools. After 1775 he began to work for the potter Josiah Wedgwood. The discipline of producing designs, usually based on antique models and executed in wax, which could be translated into the silhouette technique of Wedgwood's jasperware, strengthened Flaxman's innate feeling for line. While at the academy he formed a lifelong friendship with William Blake, who stimulated his interest in Gothic art.

In 1787 he went to Rome and directed the Wedgwood studio there. Intending to stay only two years, he obtained enough commissions to remain until 1794. His artistic creed was formed in these years. He drew assiduously, not only from the antique but also from Italian medieval and Renaissance art, and was determined to give his work a moral purpose. Between 1790 and 1794 he produced ambitious and relatively unsuccessful groups such as "The Fury of Athamas" (Ickworth, Suffolk) and "Cephalus and Aurora" (Lady Lever Art Gallery, Port Sunlight), but his book illustrations had far greater importance. His *Iliad* and *Odyssey* (1793), *Aeschylus* (1795), and Dante's *Divine Comedy* (1802) soon became widely known and, with their clean linear rhythms, contributed much to the spread of Neoclassicism in England. Later in life he designed a *Hesiod*, engraved by William Blake in 1817.

Monument to Agnes Cromwell by Flaxman, 1800; in the Chichester Cathedral, Sussex

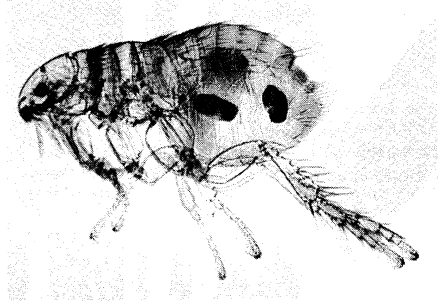
By courtesy of the Courtauld Institute of Art, London; photograph, F.H. Crossley

On his return to London his designs for a large monument to the earl of Mansfield (Westminster Abbey, 1793–1801) established his reputation as a sculptor. He became a member of the Royal Academy in 1800 and its first professor of sculpture in 1810. The number of works produced after 1800 was enormous. They ranged from small monuments in relief to very large commissions in the round (the Nelson monument in St. Paul's Cathedral; 1808–18). He also made some designs for silversmiths, the most famous being "The Shield of Achilles" (1818).

Flaxman's chief strength lies in his sincerity and the remarkable fecundity of his designs, which include figures in the Classical manner and in contemporary dress. In his own day his reputation as a sculptor rivalled those of his great contemporaries Antonio Canova and Bertel Thorvaldsen.

flaxseed: *see* linseed.

flea, a member of one of 1,600 species and subspecies of small, wingless, blood-sucking insects of the order Siphonaptera. The order is divided into three superfamilies. Fleas are found from the Arctic Circle to the Arabian deserts. Specialized anatomical structures allow the flea to attach itself to the skin of mammals or birds and consume their blood. In the process of moving from host to host, fleas may transmit a number of serious human and animal diseases.



Flea (*Ctenocephalides*)

William E. Ferguson

A brief treatment of fleas follows. For full treatment, *see* MACROPAEDIA: Insects.

The adult flea varies in length from 1 to 10 millimetres (0.04 to 0.4 inch) and lives from a few weeks to more than a year. Powerful leg muscles enable fleas to jump distances up to 200 times their body length, developing an acceleration of more than 200 gravities. (This great strength allows fleas to pull miniature carts and perform other stunts in "flea circuses.") Although a detailed life cycle is known for only a few species, in general it is known to consist of four stages. The female flea deposits small white eggs on the host's body or in its nest or other habitat. From these eggs very small, legless larvae emerge. In the larval stage the flea consumes bits of dried excrement or blood, flakes of skin, or a special blood-rich fecal matter provided by its parents. After three, or sometimes two, molts, the larva spins a cocoon and enters the pupal stage. The metamorphosis of pupa to adult occurs in this cocoon over the course of days or months.

On emerging from its cocoon, the adult flea seeks a vertebrate host. The anatomical structures that distinguish Siphonaptera from other groups function primarily as aids to its ectoparasitic feeding habits. Its compressed body and backward-projecting spines ensure swift movement through the hair or feathers of its host, while the mouthparts, modified for piercing and sucking, include barbed stylets that facilitate skin penetration and tenacious attachment to host tissue.

Some fleas, such as the rabbit fleas and the shrew fleas, infest only one particular host species, while others are at home on a wide range of hosts. *Ctenocephalides felis*, the cat flea, feeds on cats, dogs, foxes, civets, mongooses, opposums, and, when these species are not available, even on humans. Related mammals, even if geographically separated, are often parasitized by closely related flea species. The most heavily afflicted mammalian group is the rodents, including rats, mice, and squirrels, while horses and most other ungulates, monkeys, and apes are largely free of flea infestation. The European rabbit flea (*Spilopsyllus cuniculi*) has been discovered to exhibit a life cycle closely matched to the hormonal cycles of its host.

The Siphonaptera are believed to be descended from an ancestor of the Mecoptera, an order of primitive carnivorous insects that includes the scorpionflies. A fossil flea found in Australia has been claimed to be 200,000,000 years old. The known fossil fleas do not differ significantly from modern fleas.

The consequences of flea infestation are of considerable medical and economic importance. The ectoparasitic action of fleas can cause severe inflammation and itching and, in heavy infestation of animals, can lead to serious damage or death through loss of blood. More important than these parasitic effects is the role of fleas as carriers of human and animal diseases. As the principle transmission agent of bubonic plague, the Oriental rat flea (*Xenopsylla cheopis*) and related species were instrumental in the epidemics that caused the death of a fourth of Europe's population in the Middle Ages. As plague-infected rats succumb to the disease, their contaminated parasites seek fresh hosts, which in crowded conditions may include humans. Occasional cases of plague are still reported in tropical regions,

but the disease is well controlled by diagnostic techniques and antibiotics. Murine typhus, a mild fever-producing disease of rodents, is transmitted to humans by *Xenopsylla cheopis* and other fleas. Fleas are also the carriers of myxomatosis, a viral disease of rabbits, deliberately introduced to rabbit populations in Australia and other areas where the animals have become a serious pest. The transmission of some parasitic worms afflicting dogs and cats involves fleas.

flea beetle, any member of the insect subfamily Alticinae (Halticinae) belonging to the leaf beetle family Chrysomelidae (order Coleoptera). These tiny beetles, worldwide in distribution, are usually less than 6 millimetres (0.25 inch) in length and dark or metallic in colour. The enlarged hindlegs are adapted for

Alligatorweed flea beetle (*Agasicles hygrophila*), adult and eggs
William E. Ferguson

jumping. Flea beetles are important pests of cultivated plants: the adults feed on the leaves and the larvae on the roots. Some flea beetles carry plant diseases (*e.g.*, early potato blight).

The grape flea beetle (*Altica chalybea*), 4 to 5 mm long and dark steel-blue in colour, eats grape buds in early spring; both the adults and larvae feed on grape leaves in the summer. They can be controlled by spraying an arsenical poison on the grape leaves.

The striped flea beetle (*Phyllotreta striolata*) infests cabbage and similar plants. The cucumber beetle (*Epitrix cucumeris*) feeds on cucumbers and melon vines, *E. hirtipennis* attacks tobacco plants, and *E. fuscula* eats tomatoes and potatoes.

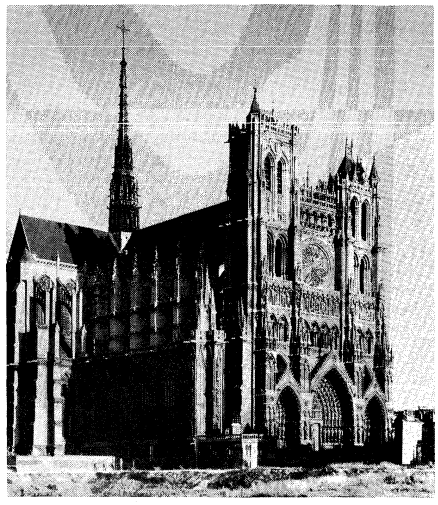
fleabane, any of the plants of the genus *Erigeron* of the family Asteraceae, order Asterales, containing about 200 species of annual, biennial, and perennial herbs native primarily to temperate parts of the world. Some species are cultivated as rock garden or border ornamentals, especially *E. alpinus, E. annuus, E. aurantiacus, E. karvinskianus,* and *E. speciosus.*

Fleabanes resemble plants of the genus *Aster* but have several rows of ray flowers and many overlapping bracts (leaflike structures) below the flower heads. The disk flowers of the solitary or clustered flower heads are yellow; the ray flowers are yellow, purple, pink, or white. Some species have short stems and basal leaves; others are taller, with leaves that

Fleabane (*Erigeron uniflorus*)

alternate along the stem and often are lobed, toothed, or hairy.

flèche, in French architecture, any spire; in English it is an architectural term for a small slender spire placed on the ridge of a church roof. The flèche is usually built of a wood framework covered with lead or occasionally copper and is generally of rich, light, delicate



Flèche at the intersection of the nave and the transepts, Amiens cathedral, France, 1220–*c.* 1270
GEKS

design, in which tracery, miniature buttresses, and crockets have important parts.

Flèches are frequently of great height, that of Notre-Dame, Paris, being nearly 100 feet (30 metres) and that of Amiens 148 feet (45 metres). The flèche is usually placed at the intersection of the nave and transepts.

Flecknoe, Richard (b. *c.* 1600—d. *c.* 1678), English poet, dramatist, and traveller, whose writings are notable for both the praise and the ridicule they evoked.

Flecknoe was possibly a Jesuit of Irish extraction. The most authentic information about him is contained in his *Relation of Ten Years' Travels in Europe, Asia, Affrique, and America* (1654?). Flecknoe's picture of himself as a ladies' man contrasts sharply with Andrew Marvell's account in his poem "Flecknoe, an English Priest at Rome," which ridicules Flecknoe's threadbare asceticism and bad verses. Dryden lampooned him in his hostile *MacFlecknoe* (1682) as being "Through all the realms of Nonsense, absolute." Neither his poems in *Epigrams of all sorts* (1670) nor his prose sketches in *Enigmatical characters* (1658) warrant such an attack. His *The Short Treatise of the English Stage,* appended to a revision of his play *Love's Kingdom* (1664), is of considerable historical interest.

flection (linguistics): *see* inflection.

fleet system: *see* Spanish treasure fleet.

Fleetwood, Charles (b. *c.* 1618, Aldwinkle, Northamptonshire, Eng.—d. Oct. 4, 1692, Stoke Newington, Middlesex), English Parliamentary general, son-in-law and supporter of Oliver Cromwell.

He joined the Parliamentary army at the beginning of the Civil War between Parliament and King Charles I and fought in the major Parliamentary victories at Naseby (June 1645), Dunbar (September 1650), and Worcester (September 1651). By 1650 Fleetwood had become lieutenant general of cavalry, but his major military contribution was in planning the organization of the Parliamentary armies. In 1651 he married Cromwell's daughter, Bridget, and from 1652 to 1655 he was commander in chief and lord deputy in Ireland, where he carried out a policy of repression.

Fleetwood was one of the generals who helped Cromwell govern England from 1655 to 1657, though he opposed the plan to make Cromwell king. After the Lord Protector's death in September 1658, Fleetwood led the group of officers who deposed Cromwell's ineffectual son Richard (May 1659). He had a hand in restoring the Rump Parliament—dissolved in 1653—but when it tried to remove him as commander in chief, he helped dissolve it once again (October 1659). Gen. George Monck then invaded England from Scotland, reinstated Parliament, and replaced Fleetwood as head of the army. When Charles II returned to England in May 1660, Fleetwood was permanently excluded from public office.

Flegel, Eduard Robert (b. Oct. 13, 1855, Vilna, Lithuania, Russian Empire—d. Sept. 11, 1886, Brass, Nigeria), German explorer in Africa who was the first European to reach the source of the Benue River.

In 1879 Flegel travelled about 525 miles (845 kilometres) up the Benue River and in 1880 went by way of the Niger to Sokoto, in northwestern Nigeria, where he obtained permission from the Sultan for an expedition to

Flegel, engraving
Interfoto-Friedrich Rauch, Munich

the Adamawa Plateau. In the course of exploring the Benue Basin (1882–84), he reached the Benue's source, near Ngaoundéré, now in Cameroon. After a short stay in Europe, Flegel returned to Africa in April 1885 with a commission to open up the Niger and Benue basins to German commercial influence and thus prevent British ascendancy in that region.

He was, however, unsuccessful and died the following year. His works include *Lose Blätter aus dem Tagebuch meiner Haussa-Freunde und Reisegefährten* (1885; "Loose Leaves from the Diary of My Hausa Friends and Travel Companions") and *Vom Niger-Benüe* (1890; "Concerning the Niger-Benue").

Fleischer, Nat, byname of NATHANIEL STANLEY FLEISCHER (b. Nov. 3, 1887, New York City—d. June 25, 1972, Atlantic Beach, N.Y., U.S.), U.S. sports journalist, outstanding authority on boxing.

Fleischer, a sportswriter for the New York *Press*, was encouraged by the promoter Tex Rickard to found a monthly magazine, *The Ring*, the first issue of which appeared in February 1922. In 1942 he published the first annual *Ring Record Book and Boxing Encyclopedia*. He was the author of more than 50 books on boxing and wrestling.

Flémalle, Bertholet, also spelled BERTHOLOT FLEMAL, or FLEMAEL (b. May 23, 1614, Liège, Principality of Liège—d. July 10, 1675, Liège), Flemish painter, a pioneer of the classicist movement in his country.

He studied under Henri Trippez and Gerard Douffet. He went to Italy in 1638, returning via Paris, where he decorated the churches of the Grands Augustines and the Carmes Déchaussés. He returned to Liège in 1663. In 1670 he was elected member of the Paris Academy, and he painted the ceiling of the audience chamber in the Tuileries (destroyed in 1871).

Flémalle is one of the most important masters of the later Flemish school. His style is modelled on that of Poussin. Most of his numerous religious pictures in the churches of Liège were destroyed and lost during the French Revolution. However, there are several works still extant in the cathedral, in the churches of Saint-Jean, Saint-Barthelemy, and Sainte-Croix, and in museums. Flémalle was also a distinguished portrait painter. His self-portrait was engraved by Jean Duvivier.

Flémalle, Master of (fl. *c.* 1430), an unknown Flemish painter and leading artist of the northern Renaissance, the work of whom is characterized by naturalistic and sculptural conceptions that signalize the replacement of the decorative International Style of the late Middle Ages. By the late 20th century, after several decades of controversy, a growing number of scholars attributed the works of the Master of Flémalle to the Flemish painter Robert Campin (*q.v.*).

"Virgin and Child," attributed to the Master of Flémalle; in the Städelsches Kunstinstitut, Frankfurt am Main, Ger.

By courtesy of the Stadelsches Kunstinstitut Frankfurt am Main, Ger.; photograph, Verlag Joachim Blauel

Fleming, Sir Alexander (b. Aug. 6, 1881, Lochfield, Ayr, Scot.—d. March 11, 1955, London), Scottish bacteriologist whose discovery of penicillin (1928) prepared the way for the highly effective practice of antibiotic therapy for infectious diseases. Fleming shared the Nobel Prize for Physiology or Medicine in 1945 with Ernst Boris Chain and Howard Walter Florey, who both (from 1939) carried Fleming's basic discovery further in the isolation, purification, testing, and quantity production of penicillin.

Sir Alexander Fleming, pencil drawing by Helen Mcdougall Campbell, 1944; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

After taking his degree at St. Mary's Hospital Medical School, London University (1906), Fleming conducted research on antibacterial substances that would be nontoxic to human tissues. He continued his research while serving with distinction in the Royal Army Medical Corps in World War I. In 1918 he returned to research and teaching at St. Mary's; he became Hunterian professor (1919) and Arris and Gale lecturer (1928) at the Royal College of Surgeons.

In 1921 Fleming identified and isolated lysozyme, an enzyme found in certain animal tissues and secretions, such as tears and saliva, that exhibits antibiotic activity. While working with *Staphyloccus* bacteria in 1928, Fleming noticed a bacteria-free circle around a mold growth (spores of *Penicillium notatum*) that was contaminating a culture of the staphylococci. Investigating, he found a substance in the mold that prevented growth of the bacteria even when it was diluted 800 times. He called it penicillin. A year later he published his results in the *British Journal of Experimental Pathology*. He was elected a fellow of the Royal Society in 1943 and knighted in 1944.

Fleming, Sir Arthur Percy Morris (b. Jan. 16, 1881, Newport, Isle of Wight, Eng.—d. Sept. 14, 1960, Bonchurch, Isle of Wight), English engineer who was a major figure in developing techniques for manufacturing radar components.

In 1900 Fleming went to the United States to undergo training at the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. Upon returning to England in 1902 he joined the British Westinghouse Company, later called the Metropolitan-Vickers Company, Manchester, where he worked as an insulation expert and later as a transformer designer.

During World War I Fleming made important advances in submarine-detection gear, and for this work he was appointed Commander of the Order of the British Empire in 1920. A pioneer in the development of radio, in 1920 he established in Manchester the second British transmitting station to broadcast programs on a daily basis. From 1931 to 1954 he served as director of research and education at Metropolitan-Vickers. He established Metropolitan-Vickers' research department and made sweeping innovations in engineering education. His work on demountable, high-power thermionic tubes made it possible to establish radar stations in Great Britain by the time World War II began in 1939. He was knighted in 1945.

Fleming, Ian (Lancaster) (b. May 28, 1908, London—d. Aug. 12, 1964, Canterbury, Kent, Eng.), internationally popular suspense-fiction novelist whose character James Bond, the stylish, high-living British secret service agent 007, became one of the most successful and widely imitated heroes of 20th-century popular fiction.

Educated in England, Germany, and Switzerland, Fleming was a journalist in Moscow (1929–33), a banker and stockbroker (1935–39), a high-ranking officer in British naval intelligence during World War II, and foreign manager of the London *Sunday Times* after the war.

Casino Royale (1953) was the first of 12 James Bond novels. Packed with violent action, hairbreadth escapes, international espionage, terror, and intrigue, the books sold more than 18,000,000 copies and were translated into 11 languages. Bond, with his propensity for gambling and fast cars, became the prototype of the handsome, clever, playboy-hero of the late 1950s and the '60s. All of the Bond novels, notably *From Russia, with Love* (1957), *Dr. No* (1958), *Goldfinger* (1959), and *Thunderball* (1961), were made into popular motion pictures.

Fleming, Sir John Ambrose (b. Nov. 29, 1849, Lancaster, Lancashire, Eng.—d. April 18, 1945, Sidmouth, Devon), English engineer who made numerous contributions to electronics, photometry, electric measurements, and wireless telegraphy. He is best remembered as the inventor of the two-electrode radio rectifier, which he called the thermionic valve; it is also known as the vacuum diode, kenotron, thermionic tube, and Fleming valve. This device, patented in 1904, was the first electronic rectifier of radio waves, converting alternating-current radio signals into weak direct currents detectable by a telephone receiver. Augmented by the amplifier grid invented in 1906 by Lee De Forest of the U.S., Fleming's invention was the ancestor of the triode and other multielectrode vacuum tubes.

After studying at University College, London, and at Cambridge University under James Clerk Maxwell, Fleming became a consultant to the Edison Electric Light Company in London, an adviser to the Marconi Wireless Telegraph Company, and a popular teacher at University College (1885–1926), where he was the first to hold the title of professor of electrical engineering.

Early in his career he investigated photometry, worked with high-voltage alternating currents, and designed some of the first electric lighting for ships. Fleming was the author of more than a hundred scientific papers and books, including the influential *The Principles of Electric Wave Telegraphy* (1906) and *The Propagation of Electric Currents in Telephone and Telegraph Conductors* (1911). He was knighted in 1929.

Fleming, Paul (b. Oct. 5, 1609, Hartenstein, Saxony—d. April 2, 1640, Hamburg), outstanding lyrical poet of 17th-century Germany. He brought a new immediacy and sincerity to the innovations of metre and stanza introduced by his teacher, Martin Opitz.

The son of a Lutheran pastor, Fleming was studying medicine and composing Latin verse

at Leipzig when he met Opitz and became his ardent disciple. Fleming died after sojourning for years with a trade mission in Russia and Persia and experiencing a disappointing love affair. But he left behind some of the century's finest poetry: love lyrics that were unique for their time in their freshness and depth of feeling and religious hymns distinguished for their fervour and stoical dignity. Some of them—*e.g.*, "In allen meinen Taten" ("In All My Deeds")—appear in hymnals today. Fleming excelled in the sonnet form, which he was the first German to use effectively. His poetry is not free of the allusions to mythology, the piled-up maxims, and the Baroque conceits that were popular during his day, but these artificialities are redeemed by the personal tone of a man who writes convincingly from his own experience. His *Teutsche Poemata* ("German Poems") and *Geist und weltliche Poemata* ("Spiritual and Worldly Poems") appeared posthumously in 1642 and in 1651.

Fleming, Peggy (Gale) (b. July 27, 1948, San Jose, Calif., U.S.), U.S. ice figure skater who dominated world women's amateur competition from 1964 through 1968. At the age of 15 she won the first of five consecutive U.S. Senior Ladies' championships. In the North American title competition, she finished second (1965) and then first (1967). After a third-place performance in her first attempt at the world championship (1965), she won world honours three consecutive years (1966 through 1968). In the 1968 Olympic Winter Games she won a gold medal. After turning professional in 1968, she performed with the *Ice Capades, Holiday on Ice,* and *Ice Follies* skating shows.

Fleming, Richard H(owell) (b. Sept. 21, 1909, Victoria, B.C., Can.), Canadian-born U.S. oceanographer who conducted wide-ranging studies in the areas of chemical and biochemical oceanography, ocean currents (particularly those off the Pacific coast of Central America), and naval uses of oceanography.

Fleming joined the Scripps Institution in La Jolla, Calif., in 1931 and served as assistant director from 1946 to 1950, when he left to become professor of oceanography at the University of Washington.

Fleming measured the amounts of chemical elements in sea water and in marine life. His work on ocean currents included measurement of tidal-current velocities, description of upwelling of seawater, and observations of seasonal variations in currents. He also explored sedimentation in moving and stagnant bodies of water. With H.U. Sverdrup and Martin W. Johnson, Fleming wrote *The Oceans* (1942).

Fleming, Sir Sandford (b. Jan. 7, 1827, Kirkcaldy, Fife, Scot.—d. July 22, 1915, Halifax, Nova Scotia, Can.), civil engineer and scientist who was associated with the development of the railway system in Canada.

Fleming emigrated in 1845 from Scotland to Canada, where he was trained as an engineer. By 1857 he had become chief engineer for the Ontario, Simcoe, and Huron Railway (now part of the Canadian National Railway); and, from 1867 until he retired in 1880, he was chief engineer for the dominion government. In the latter post he constructed the Intercolonial Railway (also part of the Canadian National Railway) and pioneered for a route to the Pacific, eventually constructing much of it.

In retirement he devoted himself to scientific projects and writing; he produced an internationally accepted scheme for standard time (1884) and a telegraph communication system for the British Empire, the first link of which was a Pacific cable between Canada and Australia (1902). He was knighted in 1897.

Fleming, Victor (b. Feb. 23, 1883, Pasadena, Calif., U.S.—d. Jan. 6, 1949, near Cottonwood, Ariz.), one of Hollywood's most popular motion-picture directors during the 1930s, who, with producer David O. Selznick, was responsible for completing *Gone with the Wind* (1939).

Fleming started in the industry as a stunt car driver in 1910, later doing camera work for D.W. Griffith. Serving in the photographic section during World War I, he acted as chief photographer for U.S. Pres. Woodrow Wilson at Versailles, Fr. Later associated with Metro-Goldwyn-Mayer and 20th Century-Fox studios, Fleming made his reputation by guiding such actors as Clark Gable and Spencer Tracy to stardom.

Fleming directed his first feature film, *When the Clouds Roll By*, in 1919, and soon became famous for creating highly charged scenes full of dramatic action. His early popular sound films *Red Dust* (1932) and *Treasure Island* (1934) were followed by the classic *The Wizard of Oz* (1939), in which Fleming artfully combined fantasy and realism. It was hailed as a creation of rare enchantment and catapulted Judy Garland to fame. Fleming's later films included *Dr. Jekyll and Mr. Hyde* (1941), *Tortilla Flat* (1942), *A Guy Named Joe* (1943), *Adventure* (1946), and *Joan of Arc* (1948).

Fleming, Williamina Paton Stevens, née STEVENS (b. May 15, 1857, Dundee, Tayside, Scot.—d. May 21, 1911, Boston), U.S. astronomer who pioneered in the classification of stellar spectra.

Her marriage in 1877 to James Orr Fleming proved to be unhappy by 1879, when Williamina Fleming, who had migrated to Boston in 1878, became the housekeeper of Edward C. Pickering, director of the Harvard College Observatory. She joined his research staff in 1881. For the next 30 years she collaborated on the analysis of stellar spectrum photography, and in 1898 she was appointed Curator of Astronomical Photographs at Harvard.

Fleming is best known for her work on the classification of stellar spectra—the pattern of lines caused by the dispersion of light through a prism placed before a telescope lens. Using a technique that came to be known as the Pickering–Fleming system, she studied the tens of thousands of celestial photographs taken for the Draper Memorial—a project dedicated to the amateur astronomer Henry Draper of New York. In the course of her work she discovered 10 novae, 52 nubulae, and hundreds of variable stars. She also established the first photographic standards of magnitude used to measure the variable brightness of stars.

Her most important works include the *Draper Catalogue of Stellar Spectra* (1890), "A Photographic Study of Variable Stars" (1907), and "Stars Having Peculiar Spectra" (1912).

In 1906 Fleming became the first American woman elected to the Royal Astronomical Society.

Fleming and Walloon, members of the two predominant cultural and linguistic groups of modern Belgium. The Flemings, numbering about 5,500,000 in the early 1980s, speak dialects of Dutch (known as Flemish or, officially, as Vlaams) and live mainly in the north and west. The Walloons, numbering about 3,000,000, speak dialects of French and live in the south and east.

Originally, the area of Belgium, a part of Gaul in Roman times, was inhabited by Celts. Gradually the land was infiltrated by groups of Gothic Germans, until finally in the 3rd and 4th centuries AD, a new wave of Germans, the Salic Franks, began pressing down from the northeast. Eventually they pushed back the Romans and took up a line generally corresponding to the present north–south division between Flemings and Walloons, a natural line of large coal forests. Only later, in the 5th century, after the withdrawal of the Roman frontier garrisons, did many Franks push on southward and settle much of Gaul proper. The northern Franks retained their Germanic language (which became modern Dutch and Flemish), whereas the Franks moving south rapidly adopted the language of the culturally dominant Romanized Gauls, the language that would become French. The language frontier between northern Flemings and southern Walloons has remained virtually unchanged ever since.

Traditionally the Flemings have been characterized as reserved or suspicious and the Walloons as more lively and cheerful, but these attributions may have been propagated by foreign observers who speak French but not Dutch and thus find Walloons more accessible and "open." The paintings of the Flemish Pieter Bruegel the Elder suggest immense vigour. Both groups, since the Renaissance, have contributed finely developed art, music, and literature. The vast majority of both groups are Roman Catholic.

Only about 3 percent of the Belgians engage in agriculture. The Walloons have long been noted for their coal mining and are now much engaged in steel production. The Flemings continue to be primarily engaged in textiles.

Flemish art, art of the 15th, 16th, and early 17th centuries in Flanders, known for its vibrant materialism and unsurpassed technical skill. From the van Eycks through Bruegel to Rubens, the Flemish painters were masters of the oil medium and used it primarily to portray a robust, detailed, and sometimes unsparing vision of the world around them. Their paintings reflect clearly the changes in fortune of this narrow slice of country between France, Germany, and the Low Countries: first come the peaceful, pious, and prosperous 15th-century reigns of the dukes of Burgundy; then a long confused succession of religious crises and civil wars; and finally the imposition of autocratic rule by the kings of France and Spain.

The precursors of the Flemish school are usually placed in Dijon, the first capital of the dukes of Burgundy. Philip the Bold (reigned 1363–1404) established the powerful Flemish-Burgundian alliance that lasted more than a century—until 1482. He also established a tradition of art patronage that was to last nearly as long. Among the artists he attracted to Dijon were the sculptor Claus Sluter (1340–1406) of Haarlem and the painter Melchior Broderlam of Ypres (worked *c.* 1381–1409), in whose richly textured works one can see the first fruits of the attachment to the world of surface appearances that is so characteristic of the Flemish school.

Philip the Good (reigned 1419–67) moved the Burgundian capital to Bruges, centre of the northern wool trade, transforming that commercially minded city into an artistic centre. In 1425 Philip officially employed Jan van Eyck (1390–1441) as "peintre et valet de chambre." The major works of van Eyck—"The Ghent Altarpiece" (1432; St. Bavo, Ghent), "The Madonna of Chancellor Rolin" (1432; Louvre, Paris), and "Giovanni Arnolfini and His Bride" (1434; National Gallery, London)—are astonishing in that they are both the beginning and the culmination of early Flemish painting. Van Eyck is credited by Vasari with the invention of oil painting (using oil varnishes over an opaque white ground), but if so it is an invention that begins at the peak of technical perfection and declines thereafter; for no succeeding painter's works have so well maintained their freshness of surface and brilliance of colour. Van Eyck's artistic vision, static and formal though it is, also has maintained its power, indissolubly imbuing everything he painted with an overwhelming spiritual presence, for all his unbridled love of material appearances.

While continuing to embellish their works with brilliant colour and richly textured surfaces, the following generation of painters wisely did not attempt to imitate van Eyck but looked to Italy for advances in pictorial structure. In his masterpiece, "The Escorial Deposition" (1435; Escorial, Madrid), Rogier van der Weyden (1400–64) focussed on the drama of the scene, eliminating everything extraneous. The linear rhythms of assembled mourners move horizontally across the shallow, crowded composition, preventing the viewer from dwelling on any one detail. Petrus Christus (1410–72) explored the underlying physical structure of his human subjects, giving them a strangely geometric appearance; and Dirck Bouts (1415–75) was the first Flemish painter to accurately use one-point perspective and to proportion his figures to their surroundings. These innovations, however, were extraneous to the spirit of the early Flemish tradition, which inevitably declined along with the self-assurance and religious convictions of the Flemish burghers, caught as they were in the late 15th century by the fall of the house of Burgundy and the economic collapse of Bruges. Of the late masters of early Flemish art, Hugo van der Goes went mad, and Hans Memling and Gerard David produced melancholy, sometimes insipid pastiches of earlier works.

More in tune with the spiritual crisis that racked the continent at century's end were the bizarre allegories painted by Hieronymus Bosch (1450–1516). In his three-panelled "Garden of Earthly Delights" (*c.* 1500; Prado, Madrid), mankind moves in swarms from paradise to perversion to punishment, acting out myriad fantasies of sensual gratification.

The turbulent 16th century in Flanders was not hospitable to art and produced only one great master, Pieter Bruegel (1525–69). Jan Gossaert (1478–1535) cultivated an Italianate style much praised by Vasari, and Joachim Patiner (1475–1524) became the first of a long line of Netherlandish landscape painters; but it is in Bruegel's powerful portrayals of peasant life that one finds best reflected the brutality of the age. Bruegel, influenced by Bosch and educated by a two-year sojourn in Italy, developed a robust style marked by structural solidity, rhythmic sweep, and an ironic moralizing eye for the grotesque. Bruegel left behind two sons, Pieter the Younger, also called Hell Brueghel because of his paintings of damnation, and Jan Brueghel, called Velvet Brueghel, who devoted himself to still-life painting.

In that capacity Jan Brueghel assisted in the flourishing workshop of the great master of the Flemish Baroque, Peter Paul Rubens (1577–1640). Rubens combined the amiability and skills of a diplomat with an unrivalled mastery of the oil medium, creating for the monarchs of France and Spain (with whom he was on intimate terms) fluid, luminous works of great energy and power. The works of his early maturity, such as "The Elevation of the Cross" (1610; Antwerp Cathedral), show evidence of careful study of the Italian masters Michelangelo, Tintoretto, and Caravaggio, but these works also have a rippling, silky surface and an animal vitality wholly Flemish in character. Rubens' mature allegorical style, exemplified by his cycle of paintings memorializing the career of Marie de Médicis, queen of France (1622–25; Louvre, Paris), was ideally suited to the ostentatious tastes of the Baroque age. In these exuberant works, fleshy classical deities, swirling from the air and bounding from the sea, watch over every aspect of the life of this essentially uninteresting woman. At his prime Rubens had more commissions than he could possibly complete himself, and his studio became a training ground for many Flemish painters, among them Sir Anthony van Dyck, a child prodigy who later became famous as a court portrait painter in England; Frans Snyder, a still-life specialist; David Teniers the Elder and Adriaen Brouwer, both known chiefly for their paintings of carousing peasants.

Flemish bond, also called DUTCH BOND, in masonry, method of bonding bricks or stones in courses. *See* bond.

Flemish language: *see* Netherlandic language.

Flemish movement, the 19th- and 20th-century nationalist movement of Flemish-speaking people in Belgium. It has sought political and cultural equality with, or separation from, the less numerous but long-dominant French-speaking Walloons. The movement had its origins in the 1830s; at first, under the leadership of the philologist Jan Frans Willems (1793–1846), it concentrated on the revival of the Flemish literary language. By the 1850s the movement put forth such political demands as separate Flemish and Walloon army units, introduction of Flemish in the administration and courts, and Flemish language instruction in schools and at the University of Ghent.

In the last decades of the century, the movement gained strength by its alliance with the Catholic People's Party. The literary language was well developed; Flemish was introduced into the administration and courts of the Flemish areas; and, in 1898, it became the second official language of the country. In 1930, after a long struggle, Flemish became the sole language of instruction at the University of Ghent. In 1932 separate Flemish army units and a Flemish military academy were instituted. In the same year Flemish became the language of instruction in all primary and secondary schools in Flemish areas.

During both world wars a minority of Flemish activists, favouring the idea of a separate Flemish state, collaborated with the Germans. In the second half of the 20th century, as the industrial base and political control shifted to the Flemings, the movement continued to press for further gains.

Flemish school (music): *see* Franco-Netherlandish school.

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

Flemming, Walther (b. April 21, 1843, Sachsenberg, Mecklenburg—d. Aug. 4, 1905, Kiel, Ger.), German anatomist, a founder of the science of cytogenetics (the study of physical changes in the cell's hereditary material). He was the first to observe and describe systematically the behaviour of chromosomes in the cell nucleus during normal cell division (mitosis).

After serving as a military physician during the Franco-Prussian War, Flemming held positions at the University of Prague (1873–76) and at the University of Kiel (1876–1901). A pioneer in the use of newly discovered aniline dyes to visualize cell structures, he found (1879) that a certain class of dyes revealed a threadlike material in the nucleus. Applying these stains to cells killed at different stages of division, he prepared a series of slides that, upon microscopic examination, clearly established the sequence of changes occurring in the nucleus during cell division. He showed that the threads (later called chromosomes) shortened and seemed to split longitudinally into two halves, each half moving to opposite sides of the cell. He named the entire process mitosis and described it in his historic book *Zellsubstanz, Kern und Zelltheilung* (1882; "Cell-Substance, Nucleus, and Cell-Division"). The implications of Flemming's work for heredity were not fully appreciated until the recognition of Gregor Mendel's principles of heredity 20 years later.

Flensburg, Danish FLENSBORG, city, Schleswig-Holstein *Land* (state), a port at the head of Flensburger Förde (Flensburg Fjord) and Germany's most northerly large city. First mentioned in 1240, it was chartered in 1284 and was frequently pillaged by the Swedes after 1643. It became the capital of Schleswig under Danish rule in 1848 and was occupied by Prussia after the German–Danish War of

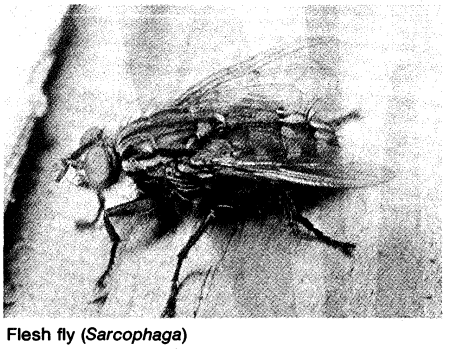
Nicolaikirche (St. Nicholas' Church) at Flensburg, Ger.
Hans Huber

1864. In the plebiscite held in 1920, Flensburg voted to remain in Germany. The site of a naval station and academy before World War II, it again became a naval base after the establishment of the Federal Republic of Germany.

Notable landmarks include the medieval churches of St. Nicholas and St. Mary (1284), the Nordertor (gate; 1595), the municipal museum, the Nordermarkt (North Market; 1595), the German House, and the modern city hall. The adjacent Baltic resort of Glücksburg has a famous castle (1582–87) that was the seat of the ducal house of Schleswig-Holstein-Sonderburg-Glücksburg and was associated with the royal families of Denmark, Great Britain, Norway, and Greece. The German government under Adm. Karl Dönitz capitulated there to the Allies in May 1945.

Flensburg's industries include shipbuilding, metalworking, paper milling, and the production of rum and smoked eels. Pop. (1989 est.) 85,830.

flesh fly, a member of any species of the insect family Sarcophagidae (order Diptera) characterized by blackish stripes on the gray thorax (region behind the head) and a checkered pattern of light and dark gray on the abdomen. Most flesh flies are tropical, although the family is generally widespread. Many species are scavengers with the female depositing immature forms (larvae) on carrion instead of eggs.



Flesh fly (*Sarcophaga*)
E.S. Ross

Other members are insect parasites. One of the best known species (*Sarcophaga kelly*) is a grasshopper parasite. The female deposits larvae, or maggots, on the underside of a grasshopper's wings. The maggots burrow into,

and feed on, its internal organs; they enter a resting stage (pupa) in the soil. Another *Sarcophaga* species develops in the pitcher plant as it feeds on trapped insects. The large gray fly, *Wohlfahrtia vigil*, found in the cooler regions of North America, is usually a mammal parasite and may deposit its young on the skin of infants. Other species deposit eggs in wasp or bee nests.

fleshly school of poetry, a group of late 19th-century English poets associated with Dante Gabriel Rossetti. The term was invented by the Scottish author Robert Williams Buchanan and appeared as the title of an article in the *Contemporary Review* (October 1871) in which he castigated the poetry of Rossetti and his colleagues, notably Algernon Swinburne, for its "... morbid deviation from the healthy forms of life...." In Buchanan's view, these poets exhibited "... weary wasting, yet exquisite sensuality; nothing virile, nothing tender, nothing completely sane; a superfluity of extreme sensibility...." Rossetti replied with "The Stealthy School of Criticism" in *The Athenaeum*, December 1871, and Swinburne with a pamphlet, "Under the Microscope," in 1872. The controversy was prolonged and distressed Rossetti, but it had ended before Rossetti's death in 1882, when Buchanan dedicated his novel *God and the Man* to him.

Fletcher, Alice Cunningham (b. March 15, 1838, Havana—d. April 6, 1923, Washington, D.C.), U.S. anthropologist whose stature as a social scientist, notably for her pioneer study of Indian music, has overshadowed her influence on federal government Indian policies that later were considered to be unfortunate.

Concern for the welfare of American Indians led Fletcher in the 1870s to study archaeology and ethnology at the Peabody Museum, Harvard University. In 1881 she went to Nebraska and began living with the Omaha tribe. Her subsequent efforts to improve the lot of the Indian reflected a missionary zeal and a paternalism toward Indians that was characteristic of the 19th century.

Concerned that the Omaha were about to be dispossessed, Fletcher went to Washington in 1882, drafted a bill to apportion Omaha tribal lands into individual Indian holdings, and successfully lobbied for its passage in Congress. Appointed by Pres. Chester A. Arthur to supervise the apportioning, she completed granting the land parcels in 1884 with the assistance of a young clerk in the Indian Bureau, Francis La Flesche. The son of the principal Omaha chief, La Flesche lived with her as her adoptive son (unlegalized) and collaborated with her in her Indian studies.

Fletcher went to Alaska and the Aleutian Islands to study educational needs in 1886. Her tireless championing of Indian welfare was instrumental in the passage of the Dawes General Allotment Act (1887), which further apportioned remaining tribal lands and provided for eventual citizenship for Indians. Though viewed as humanitarian at the time of its enactment, the Dawes Act came to be regarded by many as a cause of the exploitation and decline of Indian culture.

In the years following, Fletcher conducted land apportionment among the Winnebago and Nez Percé Indians and wrote *Indian Story and Song from North America* (1900) and *The Hako: A Pawnee Ceremony* (1904). Her major work is thought to be *The Omaha Tribe* (1911), an exhaustive study written with Francis La Flesche.

Fletcher, Giles, THE ELDER (b. *c.* 1548, Cranbrook, Kent, Eng.—buried March 11, 1611, London), English poet and author, and father of the poets Phineas and Giles Fletcher; his writings include an interesting account of his visit to Russia.

Educated at Eton and at King's College, Cambridge, Fletcher was employed on diplomatic service in Scotland, Germany, and Holland. In 1588 he was sent to Russia to the court of the tsar, Fyodor I, with instructions to conclude an alliance between England and Russia, to restore English trade, and to obtain better conditions for the English Muscovy Company. He returned to England in 1589 and in 1591 published *Of the Russe Common Wealth*, a comprehensive account of Russian geography, government, law, methods of warfare, church, and manners. In 1610 Fletcher was employed to negotiate with Denmark on behalf of the merchants of the Eastland Company.

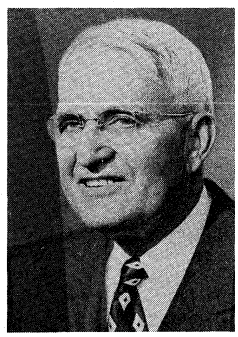
Of the Russe Common Wealth was issued in an abridged form in Richard Hakluyt's *The principal Navigations, Voiages, Traffiques and Discoveries* (2nd ed., 1598); in *Purchas His Pilgrimes* (1625); and also as *History of Russia* in 1643. Modern editions of it appeared in 1964 and 1966.

Fletcher, Giles, THE YOUNGER (b. *c.* 1585, London—d. 1623, Alderton, Suffolk, Eng.), English poet principally known for his great Baroque devotional poem *Christs Victorie.*

He was the younger son of Giles Fletcher, the Elder. He was educated at Westminster School and at Trinity College, Cambridge. After his ordination, he held a college position, and became known for his sermons at the Church of St. Mary the Great. He left Cambridge about 1618 and soon after received the rectory of Alderton, Suffolk.

The theme of Fletcher's masterpiece, *Christs Victorie, and Triumph in Heaven, and Earth, over, and after death* (1610), bears some resemblance to that of the religious epic *Semaine* (1578; Eng. trans., *Devine Weekes and Workes*, 1605) of the French Protestant poet Du Bartas; but the devotion, the passionate lyricism, and the exquisite vision of paradise that critics have praised are Fletcher's own. The poem is written in eight-line stanzas somewhat derivative of Edmund Spenser, of whom, like his brother Phineas, Giles was a disciple.

Fletcher, Harvey (b. Sept. 11, 1884, Provo, Utah, U.S.—d. July 23, 1981, Provo), U.S. physicist, a leading authority in the fields of psychoacoustics and acoustical engineering.



Harvey Fletcher

By courtesy of Brigham Young University, Provo, Utah

Fletcher was graduated from Brigham Young University, Salt Lake City, Utah, in 1907 and received a Ph.D. in physics from the University of Chicago in 1911. In 1916 he joined the staff of Bell Telephone Laboratories, where he worked for 33 years, primarily in the fields of speech, music, and hearing. Much of his work on the fundamentals of psychoacoustics is described in his book *Speech and Hearing* (1922).

Fletcher's research group developed and demonstrated two separate but related methods for reproducing sound: binaural sound reproduction and stereophonic reproduction. He and his team gave the first public demonstration of stereophonic sound in 1934 in New York City. In 1949 he moved to Columbia University, where he established a department of acoustical engineering. In 1952 he was appointed director of research at Brigham Young University, becoming dean of the College of Physical Engineering Sciences (1954) and professor of physics (1958). In 1974 he became professor emeritus, continuing his research in acoustics until a few weeks before his death.

Fletcher, John (baptized Dec. 20, 1579, Rye, Sussex, Eng.—d. Aug. 29, 1625, London), English Jacobean dramatist who collaborated with Francis Beaumont and other dramatists on comedies and tragedies between about 1606 and 1625.

His father, Richard Fletcher, was minister of the parish in which John was born and became afterward queen's chaplain, dean of Peterborough, and bishop successively of Bristol, Worcester, and London, gaining a measure of fame as a tormenting accuser in the trial of Mary, Queen of Scots, and as the chaplain sternly officiating at her execution. When not quite 12, John was apparently admitted pensioner of Bene't (now Corpus Christi) College, Cambridge, and two years later became a Bible clerk. From the time of his father's death (1596) until 1607 nothing is known of him, although the evidence of his later plays indicates that he had not inherited his father's religious bigotry. His name is first linked with Beaumont's in Ben Jonson's *Volpone* (1607 quarto), to which both men contributed encomiums.

Fletcher began to work with Beaumont probably about 1607, at first for the Children

John Fletcher, engraving by George Vertue, 1729

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

of the Queen's Revels and its successor and then (from *c.* 1609 to 1610 until Beaumont's retirement in 1613 or 1614) mainly for the King's Men at the Globe and Blackfriars theatres. From about 1613 he was often assisted, or his plays were revised, by Philip Massinger, who succeeded him in 1625 as chief playwright of the King's Men; other collaborators included Nathaniel Field and William Rowley. Throughout his career he also wrote plays unaided. He died in the great London plague of 1625; he had lingered in the city to be measured for a suit of clothes instead of making his escape to the country.

The canon of the Beaumont and Fletcher plays is approximately represented by the 52 plays in the folio *Fifty Comedies and Tragedies* . . . (1679); but any consideration of the canon must omit one play from the 1679 folio (James Shirley's *Coronation*) and add three not to be found in it (*Henry VIII, Sir John van Olden Barnavelt, A very Woman*). Of these 54 plays not more than 14 are by Beaumont or by Beaumont and Fletcher in collaboration. The other 40 represent Fletcher either unaided or in collaboration with dramatists other than Beaumont, principally Massinger.

The masterpieces of the Beaumont and Fletcher collaboration—*Phylaster, The Maides Tragedy,* and *A King and No King*—show, most clearly in the last, the emergence of most of the features that distinguish the Fletcherian mode from that of Shakespeare, John Chapman, or John Webster: the remote, often pseudohistorical, fairy-tale setting; the clear, smooth speech rising to great emotional arias of declamatory rhetoric; the basically sensational or bizarre plot that faces the characters with wild "either–or" choices between extremes and that can be manipulated toward a sad or a happy ending as the playwrights choose; the sacrifice of consistency and plausibility in characterization so that patterns can be made out of constantly shifting emotional states and piquant situations can be prolonged.

Of Fletcher's unaided plays, six illustrate most completely the middle kind that he had perfected: *The Mad Lover, The Loyall Subject, The Humorous Lieutenant, Women pleas'd, The Island Princesse, A Wife for a Moneth* (all between *c.* 1616 and *c.* 1624). Each of these is a series of extraordinary situations and extreme attitudes, displayed through intense declamations. The best of the six are perhaps *The Loyall Subject* and *A Wife for a Moneth,* the latter a florid and loquacious play, in which a bizarre sexual situation is handled with cunning piquancy, and the personages illustrate clearly Fletcher's tendency to make his men and women personifications of vices and virtues rather than individuals. The best of Fletcher's comedies, for urbanity and consistency of tone, is probably *The Wild-Goose Chase,* a play of episodes rather than of intricate intrigue, but alive with irony and easy wit.

Lastly, there are the Fletcherian plays in which others besides Beaumont had a hand. *Wit at Several Weapons* is a comedy that might have been written wholly by Middleton; and *The Captaine* (to which Beaumont may, however, have contributed) is a lively, complex play of sexual intrigue, with tragic dilemmas too. Of the numerous plays in this group a preference may be expressed for *The False One* and *The Beggars Bush.* The former is an original, incisive, and moderately subtle treatment of the story of Caesar and Cleopatra, which may well have aided John Dryden to compose *All for Love* and for which the greater credit goes to Massinger. The latter is worth reading for its "version of pastoral" which genially persuades the audience that it is better to be a country beggar than a tyrannical king. But neither of these is representative of those features of the canon that modern criticism has most emphasized.

MAJOR WORKS. The dates of composition given here for the individual plays are largely conjectural.

Plays by Fletcher unaided. The Faithfull Shepheardesse (1608–09); *Valentinian* (1610–14); *Monsieur Thomas* (1610–16); *The Womans Prize* (?1611); *Bonduca* (1611–14); *The Mad Lover* (1616); *The Chances* (?1617); *The Loyall Subject* (1618); *Women pleas'd* (?1619); *The Island Princesse* (?1619–21); *The Humorous Lieutenant* (?1619); *The Wild-Goose Chase* (1621); *The Pilgrim* (1621); *Rule a Wife And have a Wife* (1624); *A Wife for a Moneth* (1624).

Plays by Beaumont and Fletcher in collaboration. The Woman Hater (1606); *Phylaster* (1608–10); *The Coxcombe* (1608–10); *The Maides Tragedy* (1609–12); *The Captaine* (1609–12); *King and No King* (1611); *Cupids Revenge* (1611); *The Scornful Ladie* (1613–17); *Loves Pilgrimage* (?1616); *The Noble Gentleman* (*c.* 1625).

Plays by Beaumont, Fletcher, and Philip Massinger. Thierry and Theodoret (date of composition unknown, printed 1621); *The Beggars Bush* (?1622); *Loves Cure* (?revived 1625).

Plays by Fletcher and Massinger. The Little French Lawyer (1619–23); *Sir John van Olden Barnavelt* (1619); *The Custome of the Countrey* (1619); *The False One* (1620); *The double Marriage* (1621); *The Spanish Curat* (1622); *The Sea Voyage* (1622); *The Prophetesse* (1622); *The Lovers Progress* (1623–34); *The Elder Brother* (1625); *A very Woman* (1625–34).

Plays by Fletcher with various other collaborators. Including plays written by Fletcher and Massinger together with a third and sometimes a fourth collaborator—with Shakespeare (no general agreement on these assignments but they probably represent majority opinion), *Henry VIII* (1613); *The Two Noble Kinsmen* (1613); with James Shirley, *The Night-Walker* (1633); with Nathaniel Field, *Foure Playes in One* (?1609–12); with Massinger and Field, *The Honest mans Fortune* (1613); *The Knight of Malta* (1616–18); *The Queene of Corinth* (1616–17); with an unknown reviser, *Wit With-Out Money* (1614); with Thomas Middleton, *The Nice Valour* (?1616); with William Rowley, *The Maid in the Mill* (1623); with John Ford, Massinger, and John Webster, *The Faire Maide of the Inne* (1626); with Massinger, Ben Jonson, and George Chapman, *The Bloody Brother, or, Rollo, Duke of Normandy* (?1617–30).

BIBLIOGRAPHY. *The Works* . . . , ed. by Arnold Glover and A.R. Waller, 10 vol. (1905–12, reprinted 1969), is the standard text, now being superseded by the edition of Fredson Bowers (ed.), *The Dramatic Works in the Beaumont and Fletcher Canon* (1966–). E.M. Waith, *The Pattern of Tragicomedy in Beaumont and Fletcher* (1952), claims that Beaumont and Fletcher significantly stylize experience and relates their work to the Roman art of declamation and to the classical *controversiae;* Ian Fletcher, *Beaumont and Fletcher* (1967), is a brief, appreciative monograph.

Fletcher, Phineas (baptized April 8, 1582, Cranbrook, Kent, Eng.—d. 1650, Hilgay, Norfolk), English poet best known for his religious and scientific poem *The Purple Island.*

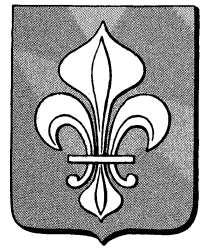
He was the elder son of Giles Fletcher, the Elder, and brother of Giles, the Younger. He was educated at Eton and at King's College, Cambridge. Fletcher became chaplain to Sir Henry Willoughby, who presented him in 1621 to the rectory of Hilgay, Norfolk, where he spent the rest of his life.

His greatest work, *The Purple Island,* was published in 1633. It included the *Piscatorie Eclogs and other Poetical Miscellanies. The Purple Island: or the Isle of Man,* is a poem in 12 cantos describing allegorically the human physiology and soul. The manner of Edmund Spenser is employed throughout, and the chief charm of the poem is considered by critics to be its descriptions of rural scenery. The *Piscatorie Eclogs* are pastorals, the characters of which are represented as fisherboys on the banks of the Cam, and are interesting for the light they cast on the biography of the poet himself (Thyrsil) and his father (Thelgon), and on Phineas' friendship with Cambridge men. Fletcher's poetry has not the sublimity sometimes reached by his brother Giles.

Flettner, Anton (b. Nov. 1, 1885, Eddersheim, Ger.—d. Dec. 29, 1961, New York City), German inventor of the rotor ship, a vessel propelled by revolving cylinders mounted vertically on the deck. He also invented the Flettner trim-tab control for aircraft and the Flettner marine rudder.

Flettner directed an aeronautical and hydrodynamic research institute in Amsterdam following World War I. In 1926 he established in Berlin an aircraft company that produced the Flettner Fl 282 and other helicopters for the German Luftwaffe (Air Force) during World War II. After the war he went to the U.S., where he conducted helicopter research for the U.S. Army and was president of the Flettner Aircraft Corporation, Kew Gardens, Queens, N.Y.

fleur-de-lis, also spelled FLEUR-DE-LYS, or FLEUR-DE-LUCE ("lily flower"), stylized emblem or device much used in ornamentation and, particularly, in heraldry, long associated with the French crown. Strictly, it consists of three petals or leaves—the central one erect, the other two curving right and left away from it—joined by a horizontal band below which the smaller feet of the three petals are visible. Variant forms are the *fleur-de-lis au pied coupé,* or *au pied nourri,* in which the feet are absent or are replaced by a trapezoid pedestal, and the *fleur-de-lis remplie,* or *florencée,* or



Fleur-de-lis

épanouie, with stamens shown between the petals and with the petals themselves divided like flowers at their upper extremities. If a lily is represented naturalistically in heraldry, it is called a *lis-de-jardin* ("garden lily") to distinguish it from the stylized fleur-de-lis.

An emblem similar to the fleur-de-lis is often found in art from the earliest times in many parts of the world and may not always signify a flower. The principal importance of the emblem, however, derives from its long association with the French royal arms. There is a legend that a lily, emblematic of purity, was sent from heaven to the Frankish king Clovis (*c.* 466–511) at his Baptism, and it has been suggested that the name fleur-de-lis is a pun on *fleur de Louis* (Louis-Clovis); but perhaps the figure was derived from that of a dove descending, symbolic of the Holy Spirit. Louis VI of France used the device both as his seal and on coins; Louis VIII wore blue vestments embroidered with gold lilies at his consecration; and soon a blue shield sprinkled with golden fleurs-de-lis was adopted as the royal arms. Charles V of France in 1376 limited the number of fleurs-de-lis to three, in honour of the Holy Trinity. The association of the device with the French crown led to its inclusion in the arms of numerous gentlemen and municipalities in France, and the English kings during the Hundred Years' War began quartering the French arms with their own to represent their claims to French sovereignty; they were to remain until George III's time. The red lily (*fleur-de-lis épanouie*) is the badge of Florence in Italy.

Fleurus, municipality, Hainaut province, south central Belgium, between the industrial region of Charleroi and the hills sloping toward Waterloo. Built on the site of a Gallo-Roman agricultural settlement and first mentioned in 868, it was chartered in 1115 and was the scene of several important battles.

Notable architectural remains include the Romanesque church (*c.* 1150–1200), of which only the tower and central nave stand; the Cistercian Soleilmont Abbey; the Naveau Windmill (1667; Napoleon's observatory during the Waterloo Campaign); and the memorial (1936) to the three French military victories. In 1690 the French under Marshal Luxembourg defeated the Germans and Dutch in Fleurus. A later victory was that of the revolutionary army (led by Marshal Jourdan), over the Austrians in 1794. Then, in 1815, prior to Waterloo, Napoleon defeated the Prussians commanded by Field Marshal Blücher. Fleurus is a junction of several local railways; industries include coal mining and the manufacture of machinery, domestic appliances, and furniture. Pop. (1983 est.) mun., 22,245.

Fleurus, Battle of (June 26, 1794), the most significant battle in the First Coalition phase of the French Revolutionary Wars. Jean-Baptiste Jourdan and Jean-Baptiste Kléber led 73,000 French troops against 52,000 Austri-

ans and Dutch, under Friedrich Josias, prince of Saxe-Coburg, and William V, prince of Orange, stadholder of Holland. Jourdan had taken Charleroi, in the rear of Coburg's main forces, on June 25, after besieging it since June 12. Coburg, unaware that the town had fallen, was marching to relieve it and to protect his rear forces. His five attack columns were successful at first against the French lines and inflicted very heavy casualties. The larger French force was able to endure the casualties and counterattack. Coburg retreated across the Meuse the next day with only half as many losses as the victorious French. Nevertheless, within a month, the Austrians abandoned the southern Netherlands (modern Belgium), which was annexed by France.

Fleury, original name ABRAHAM-JOSEPH BÉNARD (b. Oct. 26, 1750, Chartres, Fr.—d. March 3, 1822, Ménars-le-Château), French actor of the Comédie-Française, one of the greatest comedians of his time.

Fleury, detail from an engraving by Étienne-Frédéric Lignon
By courtesy of the Ashmolean Museum, Oxford

Fleury began his stage apprenticeship at Nancy, Fr., where his father was an actor at the court of Stanisław I, duke of Lorraine and Bar. After encouragement from Voltaire, he acted at the Comédie-Française in 1774 but returned to the provinces for further study, performing chiefly at Lyon.

When Fleury returned to Paris in 1778 he was made a full member of the Comédie-Française, for which he served as doyen, or leader, until his retirement in 1818. During the French Revolution he and many of his fellow players were arrested (1793) for presenting a politically controversial play, *L'Ami des Lois* ("The Friend of Laws"). When liberated, Fleury appeared at various theatres until, in 1799, he rejoined the reconstituted Comédie-Française. A master of comedy, he was especially noted for his brilliant characterization of Alceste in Molière's *Misanthrope.*

Fleury, André-Hercule de (b. June 22, 1653, Lodève, Fr.—d. Jan. 29, 1743, Paris),

André-Hercule de Fleury, engraving by G. Massi after a painting by Hyacinthe Rigaud
By courtesy of the Bibliotheque Nationale, Paris

French cardinal and chief minister who controlled the government of King Louis XV from 1726 to 1743.

The son of a collector of ecclesiastical revenue, Fleury became a priest and eventually almoner to the King in 1683 and bishop of Fréjus in 1698. Shortly before his death in September 1715, Louis XIV appointed Fleury tutor to his five-year-old great-grandson and heir, who succeeded to the throne as Louis XV. In June 1726 Louis XV appointed Fleury minister of state and had him created a cardinal in order to give him precedence in the royal council. Fleury never assumed the title *premier ministre* ("first minister"), but he was in fact the chief minister of the realm. Ruling with an iron hand, he authorized continuation of the codification of civil law that had begun under Louis XIV and the institution of fiscal reforms that enabled French finances to recover from the costly wars of Louis XIV.

Fleury's major achievements were in foreign policy. He at first formed a close working relationship with the British prime minister, Sir Robert Walpole, and strove to reduce the tensions that were mounting between Great Britain and Spain. As a result of his efforts, the hostilities that broke out between Spain and Great Britain in 1727 were prevented from developing into a European conflict. Nevertheless, after 1731 Fleury sought to undermine British influence on the Continent and to reconcile France with Austria. His plans were temporarily upset in 1733, when Russia, Austria's ally, forcibly prevented Louis XV's father-in-law, Stanisław Leszczyński, from claiming the Polish throne. The war party compelled Fleury to support Leszczyński in the ensuing War of the Polish Succession (1733–38) against Austria and Russia. Though French forces occupied Lorraine, Fleury limited the scope of the conflict by securing British neutrality and restricting French military operations in Germany and Italy. In 1738 Fleury concluded a peace treaty by which Leszczyński renounced his claims to the Polish throne and accepted instead the crown of Lorraine. (In accordance with this agreement, Lorraine was annexed by France upon Leszczyński's death in 1766.) Fleury's diplomatic maneuvers had secured closer relations between France and Austria and had broken British dominance in the affairs of the Continent.

Nevertheless, in 1740 the stability of Austria—and the peace of Europe—was threatened by the death of the Holy Roman emperor Charles VI. Fleury recognized the succession of Charles's daughter, Maria Theresa, to the Austrian dominions but sought to secure the election of a French client, Charles Albert, elector of Bavaria (Holy Roman emperor 1742–45), to the imperial throne. The cardinal was, however, too old and feeble to wage a vigorous struggle against the war party, which had fallen under the control of Marshal Charles-Louis de Belle-Isle. Overruling Fleury, Belle-Isle forged an alliance with Prussia in 1741 and entered the war against Austria (War of the Austrian Succession, 1740–48). By the time that Fleury died in early 1743 it was evident that France could gain little from the conflict.

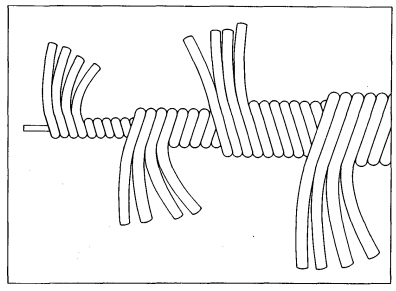
Flevoland, *provincie* (province), central Netherlands, consisting of three polders reclaimed from the eastern side of Lake IJssel (IJsselmeer), part of the former Zuiderzee. Flevoland province, which covers an area of 548 square miles (1,420 square km), was established in 1986 and includes the municipalities of Almere and Zeewolde on South (Zuidelijk) Flevoland Polder, Dronten and Lelystad on East (Oostelijk) Flevoland Polder, and Noordoostpolder and Urk on Northeast (Noordoost) Polder. The South and East Flevoland polders form a continuous expanse of rich marine clay separated from the Northeast Polder to the north by the 1- to 3-mile- (1.6- to 5-kilometre-) wide Lake Ketel, from Overijssel and Gelderland provinces to the east and southeast by the narrow Lake Veluwe, and from Utrecht and Noordholland provinces to the south and southwest by the narrow Gooi and Eem lakes. The Northeast, the East Flevoland, and the South Flevoland polders were completed in 1942, 1957, and 1968, respectively.

The province produces apples, cereals, and flowers and contains dairy cattle. It also functions as a residential area for the "overspill" from the northern Randstad and is used for light industrial and recreational purposes. The major population centre and provincial capital is Lelystad on Lake IJssel in East Flevoland Polder. Pop. (1986 est.) 177,334.

Flewelling, Ralph Tyler (b. Nov. 23, 1871, De Witt, Mich., U.S.—d. March 31, 1960, Glendale, Calif.), American Idealist philosopher whose writings and teaching established the University of Southern California, Los Angeles, as one of the strongholds of Personalism.

Flewelling studied at Boston University (Ph.D., 1909) with Bordon Parker Bowne, founder of Personalism in the United States. After moving to the University of Southern California in 1917, Flewelling founded (1920) *The Personalist*, an international review of philosophy, religion, and literature. *The Person* (1952), written after his retirement in 1945, contains a comprehensive exposition of his views.

flexible shaft, in practical mechanics, a number of superimposed, tightly wound, helical coil springs wrapped around a centre wire, or mandrel. Because of its construction, the shaft can be bent, without fracture, to a much smaller radius than a solid shaft of the same outside diameter. The shaft is connected to the power source and the driven member by special fittings that are soldered or swaged on



Flexible-shaft construction

the ends of the shaft. For transmitting power around corners and for considerable distances, flexible shafts are usually cheaper and more convenient than belts, chains, or gears. Automobile speedometers are driven by flexible shafts, and such shafts are useful for portable tools such as sanders and grinders.

Flexner, Abraham (b. Nov. 13, 1866, Louisville, Ky., U.S.—d. Sept. 21, 1959, Falls Church, Va.), educator who played a major role in the introduction of modern medical and science education to American colleges and universities.

Founder and director of a progressive college-preparatory school in Louisville (1890–1904), Flexner issued an appraisal of American educational institutions (*The American College: A Criticism;* 1908) that earned him a Carnegie Foundation commission to survey the quality of the 155 medical colleges in the United States and Canada. His report (1910) had an immediate and sensational impact on American medical education. Many of the colleges that were severely criticized by Flexner closed soon after publication of the report; others initiated extensive revisions of their policies and curricula.

As secretary to the Rockefeller Foundation's

General Education Board (1913–28), he actively channeled more than half a billion dollars from private donors into the improvement of American medical education. In 1930 he realized his ambition to create a model centre for higher learning when he founded the Institute for Advanced Study, Princeton, N.J. As the institute's first director (1930–39), Flexner gathered together several of the world's most distinguished scientists, highlighted by the arrival there in 1933 of Albert Einstein.

Flexner, Simon (b. March 25, 1863, Louisville, Ky., U.S.—d. May 2, 1946, New York, N.Y.), American pathologist and bacteriologist who isolated (1899) a common strain (*Shigella dysenteriae*) of dysentery bacillus and developed a curative serum for cerebrospinal meningitis (1907).

Simon Flexner was the brother of the educator Abraham Flexner. After teaching at Johns Hopkins University, Baltimore (1895–99), and at the University of Pennsylvania (1899–1903), he helped organize the Rockefeller Institute for Medical Research (now Rockefeller University; 1903), New York City, which, under his leadership, became the world's leading centre for virus disease research.

As director of the Rockefeller laboratories (1903–35) and institute (1920–35), Flexner led the research team that was able to produce in monkeys a nonfatal form of poliomyelitis and pass it from monkey to monkey, thus trapping a polio virus for laboratory study.

flexography, form of rotary printing in which ink is applied to various surfaces by means of flexible rubber (or other elastomeric) printing plates. The inks used in flexography dry quickly by evaporation and are safe for use on wrappers that come directly in contact with foods.

In flexography, the desired imagery or lettering is engraved in the form of tiny indentations, or cells, onto a flexible rubber plate by means of plastic-molding techniques. Liquid ink is flooded onto a rotating ink-metering roller while a blade inclined at a reverse angle to the direction of rotation shaves any surplus ink from the ink-metering roller. The remaining ink is rolled onto the rubber printing plate, which is affixed to a rotary letterpress cylinder, and the plate's tiny indentations receive and hold the ink. The inked plate then transfers the image or type to paper (or some other material) that is held on an impression cylinder.

Flexography has been widely used as a quick and economical way of applying simple designs and areas of colour to a wide variety of packaging materials, such as paper and plastic containers (including waxed-paper ones), corrugated-cardboard boxes, tape, envelopes, and metal foil. The inks used can be overlaid to achieve brilliant colours and special effects. Among the fluid inks used in flexography are aniline inks (aniline dyes dissolved in alcohol or some other volatile solvent), polyamide inks, acrylic inks, and water-based inks. These are superior to oil-based printing inks because they adhere to the surface of the material, while oil-based inks must be absorbed into the material.

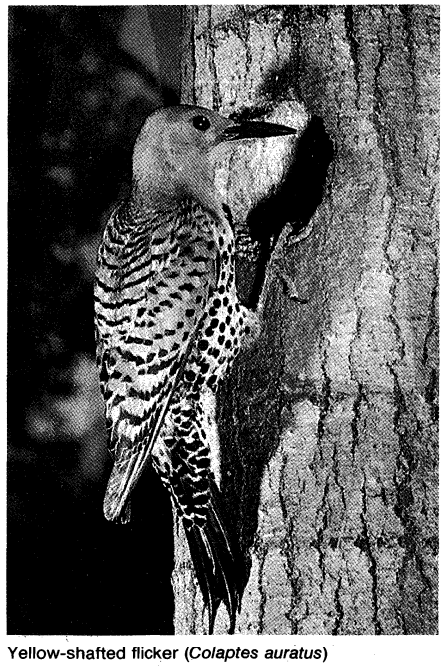
In the late 20th century flexography began to find new and significant applications as an alternative process used in newspaper printing presses. This was because of the simplicity and ease of the flexographic ink-distribution system, which only requires a single roller to determine the thickness of the ink applied, in contrast to the 10 or so rollers needed in conventional newspaper presses using oil-based inks. New water-based flexographic inks promised further advantages in newspaper printing, since such inks do not transfer to the hands of newspaper readers (a familiar problem with newspapers) and do not present the toxic-waste disposal problems associated with oil-based inks.

flexor muscle, any of the muscles that decrease the angle between bones on two sides of a joint, as in bending the elbow or knee. Several of the muscles of the hands and feet are named for this function. The flexor carpi radialis and flexor carpi ulnaris stretch from the humerus (upper-arm bone) along the inside of the forearm to the metacarpal bones of the hand and flex the wrist. The flexor digitorum profundus is a deep muscle that originates at the ulna (bone of the forearm) and acts to bend the fingers near their tips. The flexor digitorum superficialis is closer to the surface; it originates at two points, one at the junction of the humerus and ulna and the other along the radius (bone of the forearm), and acts upon the midsections of the fingers. Also in the hand are the flexor pollicis longus and flexor pollicis brevis, long and short flexors of the thumb, originating in the forearm and base of the hand, respectively. The flexor digiti minimi brevis manus acts upon the little finger.

In the foot are the flexor digitorum longus and flexor digitorum brevis, originating at the tibia (shinbone) and calcaneus (heel bone), respectively, and acting upon the four smaller toes. The flexor hallucis longus and flexor hallucis brevis originate in the calf and near the heel, respectively, and flex the great toe. The flexor digiti minimi brevis pedis acts upon the smallest toe. *Compare* extensor muscle.

Flick Group (German corporation): *see* Feldmuehle Nobel AG.

flicker, any of several New World woodpeckers of the genus *Colaptes,* family Picidae (*q.v.*), that are noted for spending much time on the ground eating ants. The flicker's sticky saliva is alkaline, perhaps to counteract the formic acid that ants secrete. Its bill is slenderer than in most woodpeckers and is slightly downcurved. The six species—most with a white rump, black breastband, and varied head markings—include the yellow-shafted flicker (*C. auratus*) of eastern North America, which has more than 100 local names. This golden-winged form, which measures about 33 cm (13 inches) in length, is replaced in the West (to Alaska) by the red-shafted flicker (*C. cafer*), considered by many authorities to represent the same species as the yellow-shafted because the two forms hybridize frequently. The campos, or pampas, flicker (*C. campestris*) and the field flicker (*C. campestroides*)—sometimes considered to be a single species—are common in east-central South America; they are darker birds with yellow faces and breasts.



Yellow-shafted flicker (*Colaptes auratus*)
B.M. Shaub

flight, in animals, locomotion of either of two basic types—powered, or true, flight and gliding. Winged (true) flight is found only in insects (most orders), most birds, and bats. The evolutionary modifications necessary for true flight in warm-blooded animals include those of the forelimbs into wings; lightening and fusion of bones; shortening of the torso; enlargement of the heart and thoracic muscles; and improved vision. Similar modifications in insects have occurred through different evolutionary pathways. The advantages conferred by flight are also great: in terms of numbers of species as well as numbers of individuals, insects, birds, and bats are among the most successful animal groups.

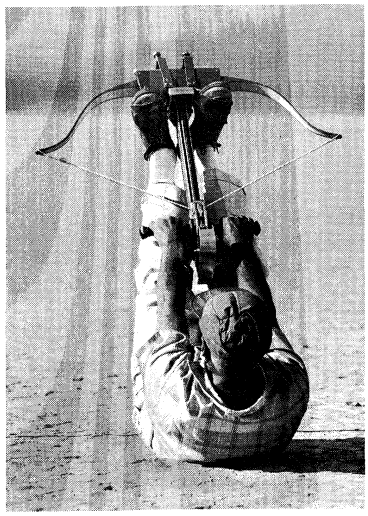
Gliding flight may be of two types: gravitational gliding and soaring. Gravitational gliding may be directed, in which case the animal launches itself toward a definite target, or passive (parachuting), in which case the organism slows its descent, relying on wind for horizontal motion. Adaptations for directed gliding serve primarily to enhance the glide ratio (the amount of horizontal distance covered per unit descent) and include wing-like modifications of fins (several fish groups), webs between digits (a frog, *Rhacophorus;* several lizards), distensible rib-supported vanes (lizards of the genus *Draco;* several snakes), and a fold of skin between the forelimbs and hind limbs (marsupial gliders; colugo; sciurid and anomalurid flying squirrels).

Soaring is sustained gliding without power input. It is attained by many birds (especially large forms, such as condors and albatrosses) and a few insects (*e.g.,* monarch butterfly). In order to remain airborne, the soarer must glide in a column of air that is rising at a rate exceeding the relative rate of descent of the gliding animal.

flight recorder, byname BLACK BOX, instrument that records the performance and condition of an aircraft in flight. Governmental regulatory agencies require these devices on commercial aircraft to make possible the analysis of crashes or other unusual occurrences. Flight recorders are housed in heavy steel within layers of insulating materials, protecting them against impacts of 100 *G*'s and fires of 2,000° F (1,093° C). The recording tape is also protected against inadvertent erasure and contact with seawater. These precautions provide that the recorders will survive extreme climatic conditions as well as even the most serious accidents.

The device records several variables, including airspeed, altitude, heading, vertical acceleration, and aircraft pitch. The recorder also includes a separate device that records voice communication within the aircraft and voice transmissions by radio. Both the flight recorder and the cockpit voice recorder are carried in the tail of the aircraft.

flight shooting, in archery, a form of competition in which shooting for maximum distance is the object, with little or no regard for accuracy. Bows used may be heavy-draw, conventional handbows or even heavier foot bows, which are strapped to the feet and drawn with both hands while the archer lies on the ground. Crossbows are also used. Contestants are grouped in classes according to the pulling weight of their bows. Modern flight bows are composite (made of more than one material—*e.g.,* wood and fibreglass). Arrows are as light as possible, usually made of wood or aluminum with a barreled shape (tapered at the ends, thicker in the middle) and fitted with small plastic vanes. Modern flight shoot-



Flight shooting using a footbow
C.R. Learn

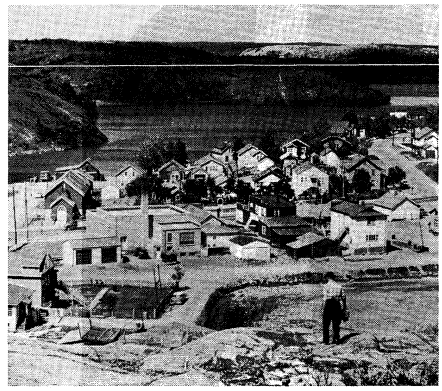
ers, whose records advance with technological improvements of bows and arrows, have shot beyond the mile mark (1.6 kilometres).

flight simulator, any electronic or mechanical systemfor training airplane and spacecraft pilots and crew members by simulating flight conditions. The purpose of simulation is not to completely substitute for actual flight training, but to thoroughly familiarize a student with the vehicle concerned before expensive and possibly dangerous actual flight training occurs. Simulation is useful for review and for familiarizing pilots with new modifications to existing craft.

Two early flight simulators appeared in England within a decade after the first flight of the Wright Brothers. They were designed to enable pilots to simulate simple aircraft manoeuvres in three dimensions: nose up or down; left wing high and right low, or vice versa; and yawing to left or right. It was not until 1929, however, that the first really effective simulator, the Link Trainer, was devised by Edwin A. Link, a self-educated aviator and inventor from Binghamton, New York. By then, airplane instruments had been developed sufficiently to permit "blind" flying on instruments alone, and training pilots to do so involved considerable risk. Link built a model of an airplane cockpit equipped with instrument panel and controls that could realistically simulate all the movements of an airplane. Pilots could use the device for instrument training, manipulating the controls on the basis of instrument readings so as to maintain straight and level flight or controlled climb or descent with no visual reference to any horizon except for the artificial one on the instrument panel. The trainer was modified as aircraft technology advanced. Commercial airlines began to use the Link Trainer for pilot training, and the U.S. government bought six of them in 1934 and thousands more as World War II approached.

Technological advances, particularly in electronics, during the war helped to make the flight simulator increasingly more realistic. The use of efficient analogue computers in the early 1950s led to further improvements. Airplane cockpits, controls, and instrument displays had by then become so individualized that it was no longer feasible to use a generalized trainer to prepare pilots to fly anything but the simplest light planes. By the 1950s the U.S. Air Force was using simulators that precisely replicated the cockpits of the A-4D attack plane and F-4 fighter. During the early 1960s electronic digital and hybrid computers were adopted, and their speed and flexibility revolutionized simulation systems. The application of such computers has made it possible to reproduce complex real-life conditions such as those encountered on space flights.

Flin Flon, city, astride the western Manitoba–Saskatchewan border, Canada, north of Athapapuskow Lake. The name was derived (1915) from a fictional prospector, Professor Josiah *Flin*tabbatey *Flon*atin, hero of the dime novel *The Sunless City,* by J.E. Preston-Muddock, a copy of which was reputedly found in the wilderness of northern Manitoba. A grotesque statue of the professor, designed by cartoonist Al Capp, now stands on the town's outskirts. The community was established around Ross Lake and other small lakes in 1928, the year a railroad line was completed from The Pas (97 mi [156 km] south-southeast) and shortly after a Hudson Bay Mining and Smelting Company plant was built on the site. Flin Flon's economy depends largely on the mining and smelting of copper and zinc, but lumbering, fishing, and tourism are also significant. A



Flin Flon, Man.
Charles R. Meyer—Photo Researchers

municipal district was established in 1933, and the town was incorporated in 1946. Pop. (1981) 8,261.

Flinck, Govert (b. Jan. 25, 1615, Kleve, Brandenburg—d. Feb. 2, 1660, Amsterdam), Baroque painter of portraits, genre, and narrative subjects who was one of the most accomplished followers of Rembrandt.

He first studied in Leeuwarden and later entered Rembrandt's studio. As a painter of biblical and allegorical subjects, he at first modelled his style closely on Rembrandt's, as, for example, in his "Crucifixion" (1643?; Basel), but later he developed a more florid and oratorical manner, in which he appears to have been influenced by Rubens, as in the "Allegory in Memory of Prince Frederick Henry" (1654; Rijksmuseum, Amsterdam). Flinck's most successful works were portraits, and he is especially successful in his group portraits; *e.g.,* "A Goldsmith and His Family" (Brussels), and "Celebration of the Civic Guard at the Signing of the Peace of Münster" (1648; Rijksmuseum, Amsterdam).

Flinders, Matthew (b. March 16, 1774, Donington, Lincolnshire, Eng.—d. July 19, 1814, London), English navigator who charted much of the Australian coast.

Flinders entered the Royal Navy in 1789 and became a navigator. In 1795 he sailed to Australia, where he explored and charted its southeast coast and circumnavigated the island of Tasmania. As commander of the "Investigator," he again sailed from England for Australia in 1801. On this visit he surveyed the entire southern coast, from Cape Leeuwin, in the southwest, to the Bass Strait, which separates mainland Australia from Tasmania. On July 22, 1802, he sailed from Sydney (on Port Jackson) and charted the eastern Australian coast as well as the Gulf of Carpentaria

Flinders, miniature by H.G. de C. Jones, after an oil painting by an unknown artist; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

on the north coast. Continuing westward and southward, he circumnavigated Australia and again reached Port Jackson on June 9, 1803.

In October, on the voyage back to England, the condition of his ship required him to stop at the Île de France, now Mauritius, in the western Indian Ocean. There he was interned by the French authorities and was not allowed to leave for England until 1810. His *Voyage to Terra Australis* appeared shortly before his death.

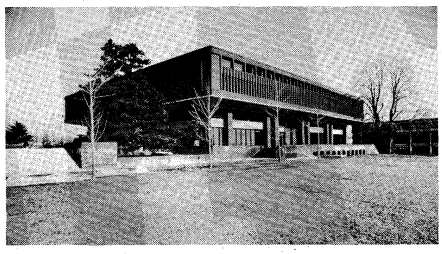
Flinders Island, northernmost and largest island of the Furneaux Group, Tasmania, Australia, with an area of about 800 sq mi (2,080 sq km). It lies in eastern Bass Strait, between Tasmania and the Australian mainland, and is named for Matthew Flinders, an English navigator who surveyed its coasts in 1798. The island is hilly, rising to Strzelecki Peaks, 2,552 ft (778 m), in the south. It is indented with numerous bays; those on the west coast are rimmed with terra rossa (red earth) soils and support cattle and sheep. The principal settlement is at Whitemark, on the west coast. A fish-processing works was opened on the island in 1977 and a sanctuary for Cape Barren geese in 1980. Pop. (1981) 1,039.

Flinders Ranges, mountain region in South Australia, extending 500 mi (800 km) northward from Cape Jervis (at the southeastern tip of Gulf St. Vincent) to a point between Marree and Lake Callabonna, where it falls away to flat grazing land. Northeastward beyond Peterborough, the highland region continues as the Mt. Lofty Ranges. The Flinders rise above 3,000 ft (900 m) at several points and ultimately to 3,825 ft at St. Mary Peak, the state's second highest peak. The ranges contain the Ediacara fauna, an assemblage of fossilized Precambrian animals. They feature scenic landscapes, such as the Germein and Alligator gorges, the Wilpena Pound Depression, and the Arkaba Hills. The region contains two major national parks, Flinders Ranges National Park and Gammon Ranges National Park. Named for Matthew Flinders, the English navigator who sighted the peaks in 1802 from Spencer Gulf, the ranges have been mined for gold, silver, copper, lead, barite, and coal; uranium deposits exist at Mt. Painter.

Flinders River, longest river in Queensland, Australia, rising on the southwestern slopes of the Gregory Range (Eastern Highlands) in the northern section of the state, 100 mi (160 km) west of Charters Towers, and flowing west past Hughenden and Richmond; it then curves northwest and north to enter the Gulf of Carpentaria through two mouths, the second known as the Bynoe River, after a course of 520 mi. Fed by the Saxby and Cloncurry rivers, the Flinders seasonally drains a 41,600-sq-mi (107,700-sq-km) basin, with only its lowest 70 mi usually perennial. It was named

for the English navigator Matthew Flinders by Captain John Stokes of HMS *Beagle*. The river's valley was first settled in 1864. The riverine lands, particularly nearer the gulf, are used in part for raising cattle and sheep.

Flint, city, seat (1836) of Genesee county, eastern Michigan, U.S. It lies along the Flint River, 60 miles (97 km) northwest of Detroit. It originated in 1819 as a trading post (opened by Jacob Smith). Laid out in 1836



General Motors Institute, Flint, Mich.
Milt and Joan Mann from CameraMann

and named for the river (which the Indians called Pawanunling, "river of flint"), the settlement progressed as a fur-trading, lumbering, and agricultural centre. Abundant supplies of timber led to the development in 1886 of the Durant-Dort Carriage Company, and by 1900 more than 100,000 horse-drawn vehicles a year were being produced. The body, spring, and wheel companies of the carriage industry became suppliers for the Buick Motor Company, organized in 1903 by W.C. Durant, who in 1908 consolidated Flint's major manufacturing resources into the General Motors Company. The city's growth paralleled the success of the automotive industry, and it became second to Detroit in the manufacture of automobiles, auto parts, and supplies in the United States.

The General Motors Institute, a cooperative engineering college (founded 1919), Charles Stewart Mott Community College (founded as Flint Community Junior College, 1923), the University of Michigan–Flint (1954), and the Michigan School for the Deaf (1848) are located there. The Flint Institute of Arts, the Robert T. Longway Planetarium, and the Sloan Museum (displaying carriages and antique autos) form part of a university-college cultural complex. The Mott Foundation pioneered the concept of the "community school" through experimental programs in the Flint public schools. Inc. city, 1855. Pop. (1970) 193,317; (1988 est.) 147,247.

Flint, Welsh Y FFLINT, town, Delyn district, Clwyd county, Wales. In his conquest of Wales, Edward I built a castle there in 1277, using an isolated rocky site beside the Dee estuary, on the coastal route into North Wales. Outside the castle a new, walled borough was founded (first charter, 1284) on the grid plan characteristic of the bastide town. The castle was destroyed in 1647. By the 20th century the town had become a coal-mining and industrial centre; mining has now ceased, and the present major industry is rayon manufacture. Pop. (1981) 16,476.

flint (mineral): *see* chert and flint.

Flint, Austin (b. Oct. 20, 1812, Petersham, Mass., U.S.—d. March 13, 1886, New York, N.Y.), one of the most eminent of 19th-century physicians, and a pioneer of heart research in the United States who discovered (1862) a disorder—now known as the Austin Flint murmur—characterized by regurgitation of blood from the aorta into the heart before contraction of the ventricles.

As professor of medicine at the Bellevue Hospital Medical College, New York City (1861–86), and president of the American Medical Association (1883–84), Flint had a great influence on the early course of medicine in the United States. A proponent of improved European diagnostic methods, he popularized the binaural stethoscope in the United States. His *Treatise on the Principles and Practice of Medicine* (1866) is a medical classic.

Flint, F(rank) S(tuart) (b. Dec. 19, 1885, London, Eng.—d. Feb. 28, 1960, Berkshire), English poet and translator, prominent in the Imagist movement (expression of precise images in free verse), whose best poems reflect the disciplined economy of that school.

The son of a commercial traveler, Flint left school at 13 and worked at a variety of jobs. At the age of 17 his reading of a volume by the 19th-century Romantic poet John Keats fired his enthusiasm for poetry. Two years later he became a civil service typist and enrolled in a workingman's night school. He learned French and Latin (eventually he mastered 10 languages) and after World War I rose to become a high official in the Ministry of Labour.

Flint's first volume of poetry, *In the Net of the Stars* (1909), was a collection of love lyrics, clearly showing the influence of Keats and his contemporary Percy Bysshe Shelley. The same year he and a group of young poets, all dissatisfied with the state of English poetry, began working to overthrow conventional versification and to replace strict metre with unrhymed cadence (a term he invented). His friendship with the English poet T.E. Hulme and the American poet Ezra Pound helped him to develop further his own distinctive poetic style. *Cadences* (1915) and *Otherworld* (1925) established him as a leading member of the Imagists.

After the death of his wife in 1920 Flint suddenly stopped writing. He did, however, continue to produce translations, mostly of French works.

flint glass, also called CRYSTAL, or LEAD CRYSTAL, heavy and durable glass characterized by its brilliance, clarity, and highly refractive quality. Developed by George Ravenscroft (*q.v.*) in 1675, it ushered in a new style in glassmaking and eventually made England the leading glass producer of the world. Ravenscroft's experimentation was supported by the Worshipful Company of Glass Sellers, a body of English retailers long dissatisfied with the quality of glass from Isola (island) di Murano, Venice.

The first clear crystal Ravenscroft produced, called flint glass because calcined flint was used as a base, decayed after a period of time. This fault was overcome by adding lead oxide to produce lead crystal. ("Flint glass" is still a synonymous term for lead crystal, though flint is no longer part of its composition.) The Glass Sellers furnished the designs and set exacting standards for the product. Their earliest examples bear the seal of a raven's head. In time, the adaptation of European traditional styling to the new glass produced a genuine native English style of glassware.

Flint glass is also used to make lenses and prisms. Because it absorbs most ultraviolet light but comparatively little visible light, it is used for telescope lenses. The light-dispersive power of flint glass can be made twice as high as that of crown glass (of soda-lime composition), and the two complementary types of glass are cemented together to make lenses corrected for chromatic aberration.

Flint Island, southernmost coral atoll in the Southern Line Islands, part of Kiribati, southwestern Pacific Ocean, 400 miles (640 km) northwest of Tahiti. With a land area of 1 square mile (3 square km) surrounding a lagoon 3 miles by 0.5 mile, the formation rises to a level height of 25 feet (8 m). The atoll is well wooded and once produced guano and, more recently, copra. Sighted by Europeans in 1801, it was claimed by the United States in 1856 under the Guano Act. It became a part of the Gilbert and Ellice Islands Colony in 1972 and a part of independent Kiribati in 1979. There are no permanent inhabitants.

Flint Ridge Cave System, a complex of caves and underground rivers in west-central Kentucky, U.S. The surveyed areas of the system are entirely within Mammoth Cave National Park (*q.v.*). The caverns are interconnected to a great extent, and some of them have been explored. Flint Ridge is a plateau capped by resistant sandstone and shale layers, underlain by hundreds of feet of limestone. Acidic water has eaten into the limestone without affecting the overlying sandstone and shale, producing the underground caves.

Prominent features within the caverns include extensive sulfate mineral formations, stalactites, stalagmites, and archaeological artifacts. The system's hub and gateway is Floyd Collins' Crystal Cave, named after its discoverer (1917). In 1972 a connection was discovered between the Mammoth and Flint Ridge cave systems, making them by far the longest continuous cave system in the world.

flintlock, ignition system for firearms, developed in the early 16th century. It superseded the matchlock and wheel lock and was itself outmoded by the percussion lock in the first half of the 19th century. The best-developed form, the true flintlock, was invented in France in the early 17th century, probably by Marin le Bourgeoys. It had a frizzen (striker) and pan cover made in one piece. When the trigger was pulled, a spring action caused the frizzen to strike the flint, showering sparks onto the gunpowder in the priming pan; the ignited powder, in turn, fired the main charge in the bore, propelling the ball.

Flintshire, also called FLINT, former county of Wales that became the eastern part of Clwyd county in the administrative reorganization of 1974. Flintshire occupied the northeastern corner of Wales and was bounded on the east by the River Dee.

A Celtic tribe known as the Deceangli held the region before they were overrun by the Romans in the 1st century AD. Roman remains in the area are quite sparse, however. The county was traversed by both Offa's and Watt's dykes, which demarcated England on the east from Wales on the west. The area was the scene of protracted fighting in the 12th and 13th centuries as its Welsh inhabitants tardily resisted Anglo-Norman domination of their land. Tightening their hold on the region, the English built great castles at Dyserth, Rhuddlan, and Flint, and King Edward I of England achieved a final conquest of the area in 1284. That same year he formed the county of Flint out of three detached portions of land, and Henry VIII increased the county's territory in the mid-16th century, leaving it in two main portions. In the English Civil Wars of the mid-17th century Flintshire was solidly royalist.

Flintshire was the site of a Cistercian abbey at Basingwerk (1131), near Holywell, and a Dominican priory at Rhuddlan (1258). In addition to the remains of castles at Flint and Rhuddlan, there is a castle at Ewloe that was built by Welsh princes in imitation of Norman work. The town of Mold was the administrative seat of the county.

FLN (Algerian political party): *see* National Liberation Front.

Flodden, Battle of (Sept. 9, 1513), English victory over the Scots, fought near Branxton, Northumberland. To honour his alliance with France (1512) and divert troops from the main English army, then in France under Henry VIII, James IV of Scotland crossed the border (August 22, 1513) with an army of about 30,000 men supported by artillery. Thomas

Howard, earl of Surrey, Henry's lieutenant in the north, gathered an army of about 20,000 to oppose him. Fearing that the Scots would retreat to the border, Surrey issued a challenge to James, who agreed to wait until September 9 to fight. The battle began in the late afternoon. The Scots fought stubbornly, but the English eight-foot-long bill (a staff ending in a hooked-shaped blade) proved superior to the Scottish 15-foot spear; and English archers proved decisive on the Scottish right. By nightfall the Scottish army was annihilated. James was killed, together with at least 10,000 of his subjects, including high officers of church and state and many nobles.

Flodoard (b. 893 or 894, probably at Épernay, Champagne—d. March 28 or May 17, 966, probably at Reims), chronicler whose two major works, the *Annales,* a chronicle covering the period 919 to 966, and the *Historia ecclesiae Remensis*, a history of the church of Reims, provide the essential documentation for this period.

After returning from a visit to Pope Leo VII in Rome, Flodoard became involved in a dispute between Herbert, count of Vermandois, who wanted his son Hugh as archbishop of Reims, and Artauld, Flodoard's patron. Herbert had Flodoard imprisoned for a time in 940–941. After the meeting of a synod at Ingelheim in 948, at which Pope Agapetus II reinstated Artauld, Flodoard was made keeper of the records at Reims. In 951 Flodoard failed in an attempt to become bishop of Noyon.

flogging, formerly a common method of punishing criminals and of preserving discipline in the home, school, armed forces, and prisons. In the Mosaic code flogging was a punishment for crime. Slaves in the ancient world were frequently flogged to death when they were sufficiently numerous to be of little value. Negro slaves in the southern states before the U.S. Civil War were frequently flogged, but rarely to the point of death because they were too valuable.

During the 19th century, imprisonment gradually took the place of corporal penalties as a punishment for crime. The courts, however, retained the power of sentencing a prisoner to be whipped when convicted of crimes of violence. In England, Scotland, and Wales the Criminal Justice Act of 1948 deprived the courts of the power to sentence a person to a whipping in most cases. Except in Scotland, however, the power to inflict corporal punishment was retained in cases of mutiny, incitement to mutiny, and gross personal violence to an officer of a prison when committed by a male person. In the second half of the 20th century the flogging of certain criminals was still prescribed by law in Canada, some European and Asiatic countries, and in the state of Delaware in the United States, where public whippings might be administered at the discretion of the court for 25 different crimes.

The instruments and methods of flogging have varied. In maintaining discipline in the home and school, sticks, rods, straps, whips, and other objects are used. Elsewhere the lash has been widely used, usually elaborated, as in the cat-o'-nine-tails. This is constructed of nine knotted cords or thongs of rawhide attached to a handle. The Russian knout, consisting of a number of dried and hardened thongs of rawhide interwoven with wire, the wires often being hooked and sharpened so that they tear the flesh, is even more painful and deadly. A particularly painful, though not so deadly, type of flogging is the Oriental bastinado, or blows delivered on the soles of the feet with a light rod or knotted cord or lash. Flogging was formerly executed with great brutality. The backs of the condemned were frequently lacerated, and salt was poured into the wounds to increase the pain.

Fløgstad, Kjartan (b. June 7, 1941, Sauda, Nor.), Norwegian poet, novelist, and essayist. He won the Nordic Council's literary prize for his novel *Dalen Portland* (1977; "Portland Valley"), a work that recounts the lives of small-town factory workers and sailors with lyrical realism. In this book, political commitment, documentary material, and fantasy are brought together with a humour and verve reminiscent of the contemporary Latin-American novel.

Some of Fløgstad's deepest affinities were with Latin-American writers. He translated the Chilean poet Pablo Neruda in *Dikt i utval* (1972; "Selected Poems"), as well as various Cuban poets in *Dikt frå Cuba* (1973; "Poems from Cuba").

Fløgstad's own poetry, published in *Valfart* (1968; "Pilgrimage") and *Seremoniar* (1969; "Ceremonies"), represented a skillful mixture of symbolism, wide and eclectic reading, humour, and a responsiveness both to city and village life. In his collection of essays and short fictions, *Den hemmelege jubel* (1970; "The Secret Ecstasy"), Fløgstad defended literature, art, and the imagination against their opponents both on the political right and the left. *Fangliner* (1972; "Prison Lines") is a collection of short stories which take a hard and unsentimental look at the lives of fishermen and factory workers. His first novel was the semi-autobiographical *Rasmus* (1974).

Floire et Blancheflor, French metrical romance known in two versions from the 12th and 13th centuries and thought to be of Byzantine or Arab origin. Its theme of separation and reunion of young lovers is the same as that treated in *Aucassin et Nicolette,* though the roles and religion of the two main characters are reversed. Floire is the son of a Saracen king; Blancheflor, his beloved, is a Christian. The tale was popular throughout western Europe, and versions exist in most European languages. The English account, *Floris and Blancheflur,* was composed in the East Midlands dialect *c.* 1250 and is commonly held to be one of the most charming romances in Middle English.

flood, high-water stage in which water overflows its natural or artificial banks onto normally dry land, such as a river inundating its floodplain. The effects of floods on human well-being range from unqualified blessings to catastrophes. The regular seasonal spring floods of the Nile River prior to construction of the Aswān High Dam, for example, were depended upon to provide moisture for the fertile floodplains of its delta. The uncontrolled floods of the Yangtze and Huang rivers, however, have repeatedly wrought disaster when these rivers habitually rechart their courses. Uncontrollable floods likely to cause considerable damage commonly result from excessive rainfall over brief periods of time as, for example, the floods of Paris (1658 and 1910), of Warsaw (1861 and 1964), of Frankfurt am Main (1854 and 1930), and of Rome (1530 and 1557). Potentially disastrous floods may, however, also result from ice jams during the spring rise, as in the case of the Danube (1342, 1402, 1501, and 1830) and of the Neva (in the Soviet Union, 1824); from storm tides such as those of 1099 and 1953 that flooded the coasts of England, Belgium, and The Netherlands; and from tsunamis, the mountainous sea waves caused by earthquakes, as in Lisbon (1755) and Hawaii (Hilo, 1946).

Floods can be measured for height, peak discharge, area inundated, and volume of flow. These factors are important to judicious land use, construction of bridges and dams, and prediction and control of floods. Common measures of flood control include the improvement of channels, the construction of protective levees and storage reservoirs, and, indirectly, the implementation of programs of soil and forest conservation to retard and absorb runoff from storms.

The discharge volume of an individual stream is often highly variable from month to month and year to year. A particularly striking example of this variability is the flashflood, a sudden, unexpected torrent of muddy and turbulent water rushing down a canyon or gulch. It is uncommon, of relatively brief duration, and generally the result of summer thunderstorms in mountains. A flashflood can take place in a single tributary while the rest of the drainage basin remains dry. The suddenness of its occurrence causes a flashflood to be extremely dangerous.

A flood of such magnitude that it might be expected to occur only once in 100 years is called a 100-year flood. The magnitudes of 100-, 500-, and 1,000-year floods are calculated by extrapolating existing records of stream flow, and the results are used in the design engineering of many water resources projects, including dams and reservoirs, and other structures that may be affected by catastrophic floods.

Flood, Curt, byname of CURTIS CHARLES FLOOD (b. Jan. 18, 1938, Houston, Texas, U.S.), U.S. professional baseball player whose antitrust litigation challenging the major leagues' reserve clause was unsuccessful but led ultimately to its demise.

Flood began playing baseball as a youth and was signed in 1956 by the National League Cincinnati Reds and played for their minor league teams and a few games (1956–57) for the Reds as an infielder. He was traded to the St. Louis Cardinals in 1958 and played for them through the 1969 season as an outfielder. When he was traded to the Philadelphia Phillies, Flood, with the backing of the Major League Baseball Players Association (MLBPA), challenged the reserve clause, which gave St. Louis the right to trade him without his permission, as violating federal anti-trust laws. (Earlier attempts to overthrow the reserve clause had resulted in U.S. Supreme Court decisions in 1922 and 1953 that held the Sherman anti-trust law did not apply to baseball.)

Flood lost his case in 1970 but refiled it in 1971; the decision went against him. Later strike actions by the MLBPA and the consequent establishment of free agency for players with 10 years of service with the same club made the reserve clause inoperative.

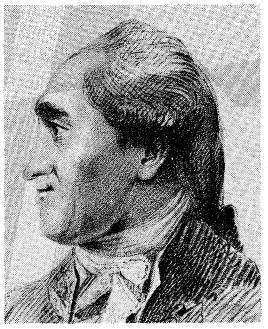
Flood, who had become an accomplished painter, spent some time in Europe (Majorca, 1971–76) but returned to the United States, where he became a broadcaster for the Oakland Athletics and later worked for the Oakland Department of Sports and Aquatics as commissioner of a sandlot baseball league.

His *The Way It Is*, recounting his struggle against the reserve clause, was published in 1971.

Flood, Henry (b. 1732—d. Dec. 2, 1791, Farmley, County Kilkenny, Ire.), Anglo-Irish statesman, founder of the movement that in 1782 forced Great Britain to grant legislative independence to Ireland.

The illegitimate son of Warden Flood, chief justice of the King's Bench in Ireland, Henry entered the Irish Parliament in 1759. His outstanding oratorical powers soon made him the leader of a small but effective group demanding shorter parliaments and establishment of an Irish national militia. Their long-range goal was legislative independence. In 1768 Flood's patriots engineered passage of a bill limiting the duration of Parliament to eight years, and in 1769 and 1771 they defeated measures to grant funds for the British administration in Ireland.

Although Flood had become the first in-

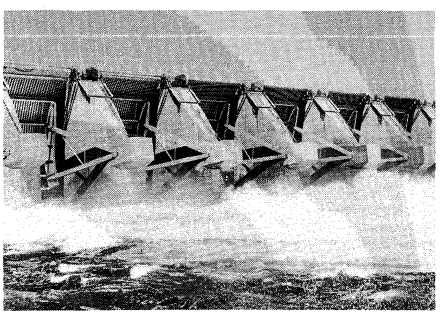


Henry Flood, engraving by James Heath from a drawing by J. Comerford, published 1811

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

dependent Irish statesman, he sacrificed this position in 1775 by accepting the office of vice treasurer under the British viceroy, Lord Harcourt. Henry Grattan, an even greater orator than Flood, replaced him as leader of the patriots. (Grattan described Flood as a man "with a metaphor in his mouth and a bribe in his pocket.") Flood had, however, left the patriot cause at the wrong time; the movement grew rapidly as more and more Irishmen were influenced by the North American colonists who were rebelling (1775–83) against the British. In 1779 Flood rejoined his old party, and two years later he was officially dismissed from his government post. Although Flood had lost his following, he helped Grattan force the British government to renounce its restrictions on Irish trade (1779) and grant legislative independence to Ireland (1782). Flood then decided to challenge Grattan's leadership. Charging that Grattan had not gone far enough in his reforms, Flood obtained passage of a measure requiring the English Parliament to renounce all claims to control of Irish legislation. Nevertheless, Flood's newly acquired popularity was destroyed upon the defeat of his attempt to reform the Irish Parliament in 1784. From 1783 until his retirement in 1790 he was a member of both the British and the Irish parliaments, though in England he failed to achieve the kind of political successes that characterized his Irish parliamentary career.

floodgate, gate for shutting out or releasing the flow of water over spillways, in connection with the operation of a dam. Vertical lift, or radial, gates rise to permit flow under the gate but over the spillway crest. Drum gates



Floodgates of the Wanapum Dam on the Columbia River, Washington

Bob and Ira Spring

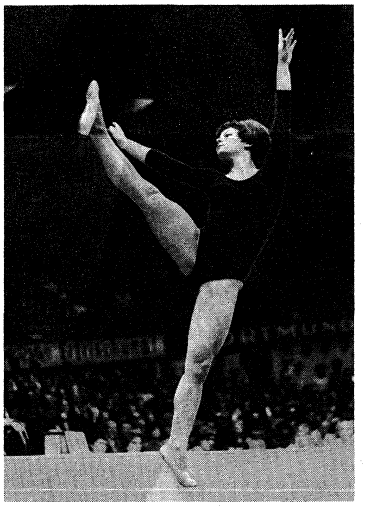
rotate backward, lowering their tops and permitting a measured flow over the top of the gate. Drum gates present the fewest problems in the passage of ice or drift over the spillway.

floodplain, also called ALLUVIAL PLAIN, flat land area adjacent to a stream, composed of unconsolidated sedimentary deposits (alluvium) and subject to periodic inundation by the stream. Floodplains are produced by lateral movement of a stream and by overbank deposition; therefore they are absent where downcutting is dominant. Any erosional widening of one bank is approximately equalled by deposition on the opposite side of the channel in the form of bar development along the inside of meander bends. Thus, the simplest floodplain is made up of a strip of sinuous scrolls immediately adjacent to the stream.

As meander curves enlarge, the alluvium is constantly reworked and the floodplain widened. The minimum width for a completely developed floodplain is equal to meander amplitude, but some floodplains are developed on deep and wide valley fills and are many times wider than the meander belt. The floodplain of the Mississippi River below its confluence with the Ohio has an occasional width of 80 miles (130 kilometres), with a total area estimated as 50,000 square miles (130,000 square kilometres).

During inundation, silt drops from the retreating floodwater and, trapped by vegetation, tends to build up and level the floodplain surface. Buildup is greatest near the stream, forming natural levees in areas of stable banks. Floodplain deposits may show vertical size-graded stratification (sorting), tending to be coarser near the stream. The floodplain is an integral part of the stream system and is affected by the adjustments that the system makes to its sediment load and variable flow.

floor exercise, gymnastics event in which movements are performed on the floor in an area 12 m (39 ft 4½ in.) square, usually covered by cloth. No other apparatus is used. Men's routines are 50 to 70 seconds in duration. The type of exercise required is a



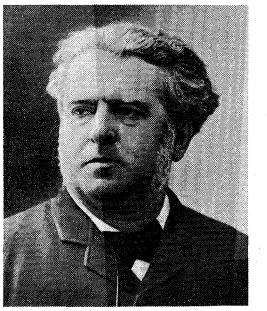
Floor exercise competition (Hana Liskova, Czechoslovakia, 1966)

CTK Feature Service

series of movements combining elements of flexibility, strength, jumps, holding of poses, and balance, as well as other manoeuvres. The whole routine must be performed with rhythm and harmony, and the gymnast must move in different directions, using a major portion of the allotted area. The exercise usually starts and finishes with a series of tumbling movements, such as a cartwheel with a half-turn (roundoff), continuing with handsprings and somersaults (in the air), backward or forward. Between start and finish, balances are held on one leg, handstands are achieved by placing the hands on the floor and kicking to the stand, and movements resembling ballet, tumbling movements, and jumps are interposed.

The women's event is similar to the men's, except that it is performed to music and lasts 60 to 90 seconds. For world champions, *see* Sporting Record: *Gymnastics.* For Olympic champions, *see* Olympic Games.

Floquet, Charles (-Thomas) (b. Oct. 2, 1828, Saint-Jean-Pied-de-Port, Fr.—d. Jan. 18, 1896, Paris), French politician whose deep attachment to the republic led him to become an antagonist of the political aspirations of Gen. Georges Boulanger.



Floquet, *c.* 1880

H. Roger-Viollet—Harlingue

Floquet strongly opposed the Second Empire and rapidly made a name for himself as a republican lawyer and journalist. In 1870–71 he participated in the formation of the new republic and helped form the Ligue d'Union Républicaine de Droits de Paris in hopes of bridging the gap between the new government and the members of the Paris Commune, who had rebelled against it.

Floquet served as president of the Paris municipal council and in 1876 moved to the Chamber of Deputies as a Radical Party member. After a term as president of the Chamber, he formed his own Cabinet in April 1888. Faced with the rising tide of Boulangism, a political movement centred on General Boulanger which threatened an anti-republican coup d'etat, he openly attacked the General himself. On July 13 Floquet and Boulanger met in a duel, and, although much older, the Prime Minister severely wounded his opponent. Still, the Floquet government was overturned in February 1889, when a proposal for constitutional reform was defeated.

Floquet returned to the presidency of the Chamber of Deputies (November 1889) but was forced to resign in 1892 when he was implicated in the Panama Scandal, which involved fraudulent fiscal manipulations over a proposed canal project. In 1894 he was elected to the Senate, where he served until his death. He was noted for his fiery oratory, a prime example of which is his famous retort to Boulanger in the Chamber of Deputies, "At your age, General Boulanger, Napoleon was dead." *Discours et opinions* (1885) was published in two volumes.

Flor, Roger de (b. 1280, Brindisi, Kingdom of the Two Sicilies—d. April 4, 1305, Adrianople, Byzantine Empire), Sicilian-born military adventurer and mercenary captain whose service to the Byzantine emperor Andronicus II had disastrous consequences.

As a boy he went to sea and became a Knight Templar. When Acre in Palestine fell to the Saracens (1291), he made his fortune by blackmailing refugees. Denounced by his grand master, he fled to Genoa and became commander of a force of *almogávares* (Spanish mercenaries) in service to the Aragonese king of Sicily, Frederick III, who was warring with the House of Anjou.

In 1303, with 6,500 *almogávares* known as the Grand Catalan Company, he entered the service of Andronicus II and fought with some success against the Turks. His evident intention, however, to found a principality of his own, combined with the predatory activities of his army, led to his recall at the end of 1304 and to his subsequent assassination. In revenge, the mercenaries ravaged Thrace, the hinterland of the Byzantine capital.

Flora, in Roman religion, the goddess of the flowering of plants. Titus Tatius (according to tradition, the Sabine king who ruled with Romulus) is said to have introduced her cult to Rome; her temple stood near the Circus Maximus. Her festival, called the Floralia, was instituted in 238 BC. A representation of Flora's head, distinguished only by a floral crown, appeared on coins of the republic. Her name survives in the botanical term for vegetation of a particular environment.

Flora, classical sculpture; in the Capitoline Museum, Rome

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floral decoration, the art of arranging living or dried plant material for adornment of the body or home, or as a part of public ceremonies, festivals, and religious rituals.

A brief treatment of floral decoration follows. For full treatment, *see* MACROPAEDIA: Decorative Arts and Furnishings.

Floral arrangement is more complex than simply putting fresh flowers into a tall vase, although such arrangements are naturally one of the more familiar aspects of the art. Line, form, colour, texture, balance, proportion, and scale are all important aspects of floral arrangement, and many design principles appropriate for this art form have evolved over the centuries. The container in which the arrangement is made and the base on which it will stand are also major considerations.

Floral decoration is a three-dimensional art. Sculptural quality is produced by allowing some of the materials to project forward while others recede. Formal arrangements generally emphasize an outline, often a triangle, pyramid, or linear form, which is then filled by using contrasting colours, textures, and weights of floral materials. A visual centre is also important. Frequently, the floral artist adheres to the traditional Japanese rule, which dictates that the arrangement should be at least one and a half times higher than the height of its container.

Different techniques create different styles of arrangement. A bouquet of flowers may be arranged in a tall vase with no need for artificial aids, but frequently a pinholder, wire netting, or plastic foam is required to hold the flowers in place. Florist's wire is used to extend the stems of certain flowers or to support the heads of others. Special tape can bind the stems for corsages and wreaths. Flowers can also be treated to last longer by soaking the stems in water and by cutting or crushing the stems before arranging.

Artificial floral arrangements include the delicate porcelain flowers made in France and England in the 18th and 19th centuries and the festive paper flowers of Mexico and Japan. Swags and wreaths were popular in antiquity. A Roman mosaic of the 2nd century AD from Hadrian's villa at Tivoli shows a basket of cut flowers, thought to be the first such depiction in art. In the 17th and 18th centuries in western Europe, particularly in Holland and France, still-life paintings of flowers show the popularity and fashion of floral arrangements.

China and Japan have a long history of floral arrangement, often linked to religious beliefs and philosophies. Ono Imoko in the early 7th century founded the oldest school of floral arranging in Japan, known as the Ikenobō, which spawned numerous descendants. Other important Japanese styles were the *tatebana* ("standing flowers") and the *rikka,* introduced by Senkei in the mid-15th century; the latter introduced the unequal triangular outline, which was to set the pattern for later Japanese floral styles. The simple uncluttered forms of Japanese floral arrangement have become influential in Western nations, particularly in the United States.

floral kingdom: *see* floristic region.

Florence, Italian FIRENZE, Latin FLORENTIA, city, capital of Firenze province and Toscana (Tuscany) region, central Italy. The city, located about 145 mi (230 km) northwest of Rome has been during its long history a republic, a seat of the duchy of Tuscany, and a capital (1865–71) of Italy. Florence was founded as a Roman military colony about the 1st century BC and during the 14th to 16th centuries achieved preeminence in commerce and finance, learning, and, especially, the arts. Florence's splendours reflect the genius of those who flourished there; among the most famous were Leonardo da Vinci, Michelangelo, Brunelleschi, Dante, Machiavelli, Galileo, and the Medici family.

The following article treats briefly the modern city of Florence. Fuller treatment is provided in the following MACROPAEDIA articles. For history and contemporary life, *see* Florence; for additional perspective on the city in its national context, *see* Italy.

Florence is built on both sides of the Fiume Arno (Arno River), which is subject to occasional flooding. The climate is temperate, its pleasant weather marred only briefly by extreme seasonal temperatures.

The city's economy is based primarily on tourism and is supported by the manufacture of traditional handicrafts—glassware and ceramics, wares of precious metals, leatherwork, art reproductions, wrought iron and straw work, and high-fashion clothing and shoes. The city is not a major manufacturing centre, however, and most industrial activity occurs in the suburbs.

The inner city of Florence is still structured on the lines of the Roman *municipium.* The old mercantile centre is now the Piazza della Repubblica, the core of modern public life. Craftwork is sold througout the city, but traditional marketplaces still exist; among these is the Ponte Vecchio (Old Bridge), which is a commercial centre for goldsmiths, silversmiths, and jewelers.

The historic religious centre of Florence is the site of the Battistero S. Giovanni (Baptistery of St. John) and the Gothic Duomo. The baptistery, believed to be the oldest surviving building (*c.* 1000) in Florence, has huge sculptured bronze doors depicting biblical scenes. The city's fresco-lined churches include many fine examples of Renaissance architecture.

The Uffizi gallery, designed by Giorgio Vasari, is the best known of Florence's art museums. Its elegant Mannerist wings house the world's finest collection of Italian Renaissance painting, in addition to notable masterpieces of French, Dutch, Flemish, and German origin. The palaces and parks throughout the city are epitomized by the Palazzo Pitti and its richly landscaped Boboli gardens. The University of Florence and many other institutions of higher learning, including an increasing number of foreign-based universities, are located in and around the city.

Florence and the surrounding province are served by buses and trolley cars. The main highway, Autostrada del Sole, passes west and south of the city. Florence lies on the most direct railway route between northern and southern Italy, and is also connected with towns to the east and west. Area city, 40 sq mi (102 sq km). Pop. (1981 est.) 460,924.

Florence, city, seat of Lauderdale County, northwestern Alabama, U.S., on the Tennessee River, forming with Sheffield, Tuscumbia, and Muscle Shoals a four-city metropolitan area in the Muscle Shoals region. Founded in 1818, it was named for Florence, Italy, by its Italian surveyor, Ferdinand Sanona. An early property holder was Andrew Jackson, later U.S. president. Industrial development was stimulated by construction of Wilson Dam and state dock installations. Florence State University (1872) became the University of North Alabama in 1974. Indian Mound within the city is the largest in the Tennessee Valley (42 ft [13 m] high; base diameter, 310 ft); artifacts are in the adjacent museum. Inc. town, 1826; city, 1889. Pop. (1980) 37,029.

Florence, city, seat (1875) of Pinal County, central Arizona, U.S., 50 mi (80 km) southeast of Phoenix. It lies on the Gila River in a farming area (mainly cotton) irrigated through the Ashurst-Hayden Diversion Dam. One of the oldest white settlements in the state, it was founded in 1866 and named for the sister of Gov. Richard McCormick. The community developed as a copper-mining trade centre and stage stop, and was incorporated in 1908. Many early adobe buildings still stand including the home (1866) of Levi Ruggles, the first settler, which housed the first land office (1873) in the Gadsen Purchase territory. Nearby are Indian ruins and natural desert gardens. Pop. (1980) 3,391.

Florence, city, seat (1889) of Florence County, northeastern South Carolina, U.S. Established in the 1850s as a rail junction and transfer point for the Wilmington and Manchester, the Northwestern, and the Cheraw and Darlington railroads, it was called Wilds for a judge in the town but later renamed (*c.* 1859) for the daughter of William Harlee, head of the Wilmington and Manchester line.

The city developed as a retail and wholesale distribution centre, balanced between railroads, industry, and agriculture. Manufactures include film, electronic components, fabricated steel, welding equipment, furniture, textiles, and paper. The main crops are tobacco and cotton.

Florence is the site of Florence-Darlington Technical College (1962), Francis Marion College (1970), Clemson University–Pee Dee Experiment Station, and a U.S. Department of Agriculture Boll-Weevil Laboratory. A National Civil War Cemetery is nearby. At the airport is the Air and Missile Museum. The one-room school in which Henry Timrod, poet laureate of the Confederacy, taught is in the city's Timrod Park. The Florence Museum exhibits classical, Oriental, primitive, and American Indian art, as well as historical items. Inc. 1890. Pop. (1980) city, 30,062; metropolitan area (SMSA), 110,163.

Florence OF WORCESTER (d. 1118), English monk, usually accepted as the author of *Chronicon ex chronicis,* which is valuable

for late Anglo-Saxon and early post-Conquest history. Its basis is the universal history (from the creation to 1082) compiled by Marianus Scotus, an Irish recluse at Mainz. The author of the *Chronicon,* like Marianus, was a careful annalist with a marked interest in chronology. He supplements Marianus' scanty treatment of English affairs by drawing on Bede, Asser, lives of English saints, laws, the Anglo-Saxon Chronicles, and also on local records and traditions.

Under the year 1118 the *Chronicon* records the death of Florence (July 7), but it is continued without break to 1131 by a John of Worcester, who, later, added material up to 1140. On the interpretation of the notice under 1118 depends Florence's claim to authorship, but what Orderic Vitalis has to say of John's historical work at Worcester suggests that John's part in the whole *Chronicon* is more substantial than has been traditionally allowed. After 1131, the *Chronicon* was copied at other monasteries, in several cases continued and frequently used by chroniclers.

The standard edition is *Florentii Wigorniensis monachi Chronicon ex chronicis,* edited by Benjamin Thorpe, English Historical Society, 2 vol. (1848–49), which excludes Marianus' text where possible, follows the *editio princeps* of 1592 by William Howard in printing the continuation to 1141, and adds a second continuation to 1295. There is a translation of English material to 1295 by R. Forester in Bohn's *Antiquarian Library* (1854).

Florence, Council of: *see* Ferrara-Florence, Council of.

Florence, University of, Italian UNIVERSITÀ DEGLI STUDI DI FIRENZE, university that originated in Florence in 1321 and became later in the century, through the activities of the writer Giovanni Boccaccio, an early centre of Renaissance Humanism. Boccaccio secured a post there for Leonzio Pilato, whose rough Latin translations of the *Iliad* and the *Odyssey* introduced Homer to Italian scholars. In 1396 the first university chair in Greek was established there for the scholar Manuel Chrysoloras. The university later declined and in 1473 was transferred to Pisa. The large, modern University of Florence dates from 1859.

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

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Florence, William Jermyn, original name BERNARD CONLIN (b. July 26, 1831, Albany, N.Y., U.S.—d. Nov. 19, 1891, Philadelphia), U.S. actor, songwriter, and popular playwright, one of the most popular actors of his day. He was one of a select number of Americans to win the ribbon of the French Société Histoire Dramatique.

Born of Irish parents and reared on the Lower East Side of New York City, Florence worked at various jobs before becoming a call boy at the Old Bowery Theatre. While working to support his widowed mother and her seven younger children, he rehearsed plays at night, and in 1850 he began to do dialect impersonations. In 1853 he married Malvina Pray, and thereafter the two generally appeared together on the stage—he usually as an Irishman and she as a Yankee.

Florence's first success was in *A Row at the Lyceum* (1851); following this, he established his reputation as Captain Cuttle in *Dombey and Son,* Bob Brierly in *The Ticket-of-Leave Man,* and Sir Lucius O'Trigger in *The Rivals.* His last appearance was with Joseph Jefferson, with whom he had maintained a successful partnership.

Florencia, capital of Caquetá department, southeastern Colombia, in the eastern slopes of the Andean Cordillera (mountains) Oriental, on the Río Orteguaza, a tributary of the Caquetá. It was founded in 1908 by Capuchin missionaries. Cattle raising and rice cultivation are widespread around Florencia. The city also serves as a trading centre for the densely forested lowlands to the south and east. Florencia is linked by road to Neiva, capital of Huila department, 95 mi (153 km) to the north-northeast in the Andes. Pop. (1973) 28,056.

Florencio Varela, *cabecera* (principal built-up area) and *partido* (political subdivision), at the southeastern limits of Gran (Greater) Buenos Aires, Argentina, in Buenos Aires province. Founded as the town of San Juan in 1873, Florencio Varela was declared a city in 1953. The *partido* was established in 1893, out of the existing *partidos* of Quilmes, San Vicente, and Almirante Brown.

The *partido* of Florencio Varela covers 80 sq mi (206 sq km) and is bordered by the *partidos* of Berazategui (northeast), La Plata (southeast), San Vicente and Almirante Brown (southwest), and Quilmes (northwest). Other major localities within the *partido* are Gobernador Monteverde and Bosques.

With the growth of the national capital, Florencio Varela has been absorbed into the southeastern suburban area of Gran Buenos Aires. Less than half of it lies within the Gran Buenos Aires urban area, and its population density is lower than most of the other *partidos.* Railway service and the national highway system connect the *cabecera* to Buenos Aires. Pop. (1980) *partido,* 173,452.

Florensky, Pavel Alexandrovich (b. Jan. 21 [Jan. 9, old style], 1882, Yevlakh, Yelizavetpolskaya Province, Russian Empire—d. Dec. 15, 1943, Siberia), Russian Orthodox theologian, philosopher, and mathematician.

Florensky concentrated on philosophy and mathematics at Moscow University, moving on to graduate study at the Moscow Theological Academy, where he eventually taught. Ordained a priest in 1911, he went into exile during the Russian Revolution. When he returned to Moscow in 1919 to resume his work, he refused to renounce or conceal his priesthood in the face of official atheism. During the reign of Stalin in the 1930s, he was imprisoned several times and was banished to Siberia.

Florensky's chief contribution to Russian Orthodox theology is his 1940 essay on theodicy entitled "The Pillar and the Ground of Truth," in which he argued that only through nonrational, intuitive experience could a person become consubstantial with all of creation and thus encounter God's reality and understand God's truth. According to Florensky, rationalistic analysis separates man from creation because it objectifies the external world rather than unifying it.

Florentia (Italy): *see* Florence.

Florentine canvas work: *see* bargello work.

Florentine diamond, clear, pale-yellow stone weighing 137 carats; of Indian origin, it was cut as a double rose with 126 facets. Once owned by Charles the Bold, duke of Burgundy, who lost it when he fell in battle in 1477, the stone came into the possession of Pope Julius II and the Medici family early in the 16th century. Maria Theresa of Austria acquired it through her marriage (1736) to the Duke of Tuscany, and it subsequently became part of the Austrian crown jewels. Seized by the Germans when they took over Austria just before World War II, it was recovered by the U.S. 3rd Army and returned to the Viennese by Gen. Mark Clark.

Florentine mosaic: *see* commesso.

Florentius, Georgius: *see* Gregory of Tours, Saint.

Flores, capital, Petén department, northern Guatemala, built on San Andrés island in the southern part of Lake Petén Itzá, only 449 ft (137 m) above sea level. Once capital of the Itzá Indians (Mayas who successfully resisted Spanish attempts to conquer them until 1697), Flores is a major trade centre for the Petén region. Chicle, timber, rubber, sugarcane, and cacao are the principal products of the hinterland. Access to the town was very difficult until the opening of an airport on the mainland and the building of a causeway for road traffic. Roads lead from Flores across Petén north and northwest to Mexico, east to Belize, and south to the Guatemalan highlands. It is the point of departure for expeditions to the many Mayan sites in the department. Pop. (1981 prelim.) mun., 13,376.

Flores, one of the Lesser Sunda Islands in Nusa Tenggara Timur *propinsi* (East Nusa Tenggara province), Indonesia. The last major island in the chain, which extends eastward from Java, it is long and narrow, 5,500 sq mi (14,250 sq km) in area, and has numerous inlets and bays. The island was named after the Portuguese name for the island's eastern cape, Capo de Flores (Cape of Flowers), after the flamboyants (*Poinciana regia*) found in profusion there. It is very mountainous, especially in the west, where Poco (peak) Mandasawu reaches 7,900 ft (2,400 m). Several active volcanoes are in the centre and east. Near Ende, historically the main city and once a mission centre, is Mt. Kelimutu, the "mountain of the three coloured lakes." In May 1974 a volcanic eruption on nearby Mt. Iya caused one of the lakes—the blue-white one—to change to a reddish colour, similar to the other two. The island's interior has been little explored. The rivers are unnavigable. Most of the vegetation consists of either tropical deciduous forest or savanna, and the western end was formerly a haunt of a giant lizard.

The indigenous people are mainly mixed Malay–Papuan, more Malay in the west, more Papuan elsewhere, making the island a transitional area. Coastal settlers reflect immigration from many areas: there are Bimanese, Sumbanese, Sumbawanese, Buginese, Makasarese, Solorese, Minangkabau, and Javanese-Chinese at different sites on the coast of Flores. Although there are Muslims, primarily in coastal areas around Manggarai and Ende, and Christians, descendants of people converted by the Portuguese in the 16th century, the majority of the population still practice traditional animist religions. In the west, houses are built on terraces, often on piles; neat and regular in arrangement and surrounded by a bamboo hedge, they are divided into separate rooms for different families, with a sleeping passage for unmarried men and strangers. In the east, houses are smaller and inhabited by only one family, while in Ende they are square, roomy, and well built. Land generally is owned communally by the tribe, and the headman has great power.

Agriculture is mainly by shifting cultivation; sticks are used to turn over the soil. The chief food crop is corn (maize); there is commercial production of coconuts in coastal regions and of coffee in the hills. Frequent burning for field plots and for hunting, together with the semi-arid climate, account for the small area—only 3 percent—of genuine forest, the remainder being scrub and savanna. About 5 percent of Flores is in temporary fields, while less than 1 percent is in permanent wet rice fields. Most inhabitants are chronically underfed.

Flores was once tributary to the princes of Celebes (Sulawesi); though their power was broken by the Dutch in 1667, the latter did not firmly establish civil government on the island until 1909. A fair-weather road (still more

heavily utilized by horsedrawn carts than by motor vehicles) was completed in 1926 and traverses the island in a west–east direction; there is airline service to Ende on the southern coast and to Maumere on the northern coast. Pop. (1980), including Adonara, Lomblen, and other smaller adjacent islands, 1,249,052.

Flores, department, south central Uruguay. The rolling hills of the territory of 1,986 sq mi (5,144 sq km) culminate in the east–west-trending Cuchilla (hills) Grande Inferior and are drained by the Río Yi and the Arroyo (stream) Chapicuy Grande. Economic activity centres around livestock raising and agriculture. Sheep ranching is widespread, and wool is a leading product of the department; wheat, corn (maize), linseed, oats, and fruits are cultivated. Flores is traversed south–north by the highway linking Montevideo and Paysandú. A branch railroad from Durazno leads to Trinidad (*q.v.*), the capital. Pop. (1975) 24,745.

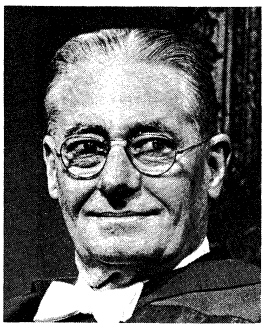
Flores, Isabel de: *see* Rose of Lima, Saint.

Flores Island, Portuguese ILHA DAS FLORES, westernmost island of the Portuguese Azores archipelago, in the North Atlantic. It lies within Horta administrative district and forms, together with the Ilha do Corvo, the Santa Cruz group. The island has an area of 55 sq mi (142 sq km), is volcanic in origin, and rises from sea level to 3,087 ft (941 m) at Morro Grande in its centre. It has numerous crater lakes that offer good fishing and is noted for its lush flora (whence its name). The economy is based on cattle raising and dairying. The French government has established a space-aeronautics base near the island capital, Santa Cruz. Pop. (1981) 4,352.

Flores Sea, Bahasa Indonesia LAUT FLORES, portion of the western South Pacific Ocean, bounded on the north by the island of Celebes (Sulawesi) and on the south by the Lesser Sunda Islands of Flores and Sumbawa. Occupying a total surface area of 93,000 sq mi (240,000 sq km), it opens northwest through Makassar Strait to the Celebes Sea, west to the Java Sea, and east to the Banda Sea. Teluk (gulf of) Bone cuts deeply into the Celebes coast. The sea's basin is divided into four distinct regions. One, in the west, is a broad plateau with a general depth of 1,650 ft (500 m). Submarine mounts rising from this bank are often capped by coral atolls. Two deeper channels cross this region, leading southeast to the Flores Basin (just north of the island of Flores). There the sea plunges to its greatest depth, 16,860 ft (5,140 m). Extending north of the trough, two ridges (the western reaching above water as Selayar Island), flanking a shallower trough (maximum 11,060 ft [3,370 m]), stretch to the island of Celebes. The last region, south of Teluk Bone, is on the east, bordering the Banda Sea. In the winter, surface currents trend southwest only to reverse themselves during the summer.

Florey, Howard Walter Florey, Baron (b. Sept. 24, 1898, Adelaide, Australia—d. Feb. 21, 1968, Oxford), Australian pathologist who, with Ernst Boris Chain, isolated and purified penicillin (discovered in 1928 by Sir Alexander Fleming) for general clinical use. For this research Florey, Chain, and Fleming shared the Nobel Prize for Physiology or Medicine of 1945.

Florey studied medicine at Adelaide and Oxford universities until 1924. After holding teaching and research posts at Cambridge and Sheffield universities, he was professor of pathology at Oxford (1935–62). He was appointed provost of Queen's College, Oxford (1962), and chancellor of the Australian National University, Canberra (1965), positions



Florey
Camera Press

he held until his death. He was knighted in 1944 and made life peer in 1965.

Florey investigated tissue inflammation and secretion of mucous membranes. He succeeded in purifying lysozyme, a bacteria-destroying enzyme found in tears and saliva, and characterized the substances acted upon by the enzyme. In 1939 he surveyed other naturally occurring antibacterial substances, concentrating on penicillin. With Chain, he demonstrated its curative properties in human studies and developed methods for production. Following World War II and the work of his research team in North Africa, penicillin came into widespread clinical use.

Flórez (de Setién y Huidobro), Enrique (b. July 21, 1702, Villadiego, Spain—d. May 5, 1773, Madrid), Spanish historian and representative figure in the movement to reform education under Charles III; he was the major scholar behind the 51-volume *España sagrada* ("Sacred Spain"), a monument of 18th-century historiography.

In 1718 Flórez entered the Augustinian order and studied philosophy with the priests of Piedrahita, moving a year later to teach in the Augustinian college of Salamanca. After earning his doctorate from the universities of Santo Tomás, Avila, and Alcalá, he moved further from strictly theological studies and dedicated himself to historical scholarship. Named rector of the Colegio de Alcalá in 1739 and supported by a pension from Charles III, he undertook a series of expeditions around the Iberian peninsula in 1754 to acquire additional information for his studies. Out of these journeys came much of the material for his *España sagrada* (1754–1879), of which he himself completed 29 volumes. An encyclopaedic collection of ecclesiastical manuscripts, charters, and documents contained in Spanish archives, the work is endowed with a critical sense and methodological strictness. Twenty-two subsequent volumes were completed by his successors.

In addition to the *España sagrada,* Flórez wrote the *Clave historial* (1743; "Key to Historical Methodology"), a discourse on methods of writing history; the *Memorias de las reynas católicas* (1761; "Memoirs of the Catholic Queens"), a genealogical account of Catholic queens in the Castilian line from the Goths until the reign of Charles III; and several memoranda on the conservation of books and publication of ancient manuscripts.

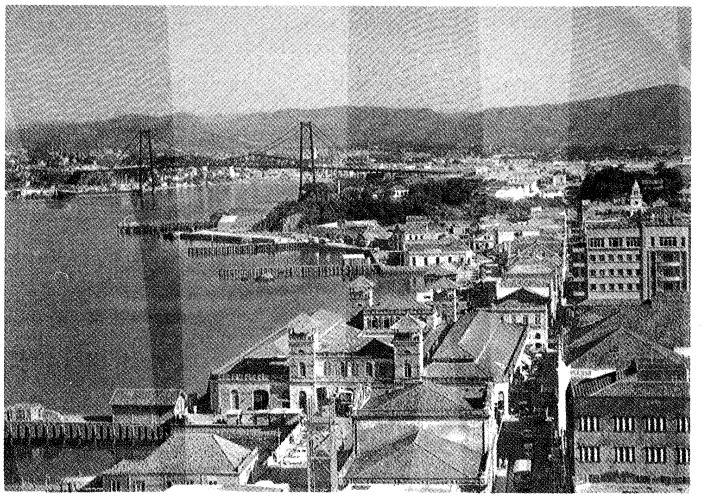
Florian, Latin in full MARCUS ANNIUS FLORIANUS (b. Aug. 19, 232—d. Sept. 9, 276), Roman emperor from June to September 276. The brother, by a different father, of the emperor Tacitus, he at once seized power on the death of his brother. Although his action was tolerated by the Senate and the armies of the West, the legions in Syria promoted their own general, Probus. A civil war broke out but ended in the sudden death of Florian, either at the hands of his own soldiers or by suicide.

Floriano, city, west central Piauí state, northeastern Brazil, on the Rio Parnaíba, at 280 ft (85 m) above sea level. Floriano was elevated to city status in 1897. It is a trade centre with livestock raising and the extraction of carnauba wax as the principal economic activities. Chemicals and textiles are also produced there. Floriano is bridged to Barão de Grajaú, just across the river in Maranhão state, and is linked by road to other urban centres. It serves as a river port 115 mi (185 km) south of Teresina, the state capital, and has an airport. Pop. (1980 prelim.) 35,761.

Florianópolis, port city and capital, Santa Catarina state, southern Brazil, lying on the west coast of the Ilha (island) de Santa Catarina and linked to the mainland by the longest bridge in Brazil, the Hercilio Luz Bridge.

The first European settlement on the island was made in 1542 by Spaniards, but in 1675 control passed to the Portuguese, who established Desterro on the present city site in 1700. The settlement was given town status in 1726 and was raised to city rank in 1823. In 1893 the island was captured by revolutionaries who opposed the government of Brazilian president Floriano Piexto. When the revolution collapsed, the city was renamed to honour the president.

Central Florianópolis consists mainly of wharves, warehouses, and business establishments. This older harbour district is encircled by a modern residential section known as Praia de Fora, built on hill slopes. Florianópolis is the seat of the Universidade Federal de Santa Catarina (1960) and the Universi-



Old harbour district, Florianópolis, Braz., on Santa Catarina Island, with the Hercilio Luz Bridge in the background
Plessner International

dade Para o Desenvolvimento do Estado de Santa Catarina (1966). Museums include the Anthropological Museum and the San Jaqui Museum. The city serves as the state administrative and commercial centre despite the problems of access to the interior caused by the unusually steep escarpment at the edge of the Serra do Paraná on the mainland. Industries produce metallurgical and electrical communications equipment, pharmaceuticals, plastics, and perfume. Florianópolis is linked with other coastal towns, such as Curitiba and Pôrto Alegre, by all-weather highways and steamers. There is air service to São Paulo, Rio de Janeiro, and Pôrto Alegre. Pop. (1980 prelim.) 153,547.

Florida, city, central Camagüey *provincia,* east-central Cuba. Lying just north of the Muñoz River, Florida is a rail junction and manufacturing centre for the surrounding agricultural and pastoral lands. The principal agricultural products of the area are sugarcane and oranges. Cattle also are raised. Large sugar refineries are located on the outskirts of Florida, which is on the central highway and a major railroad. Pop. (1987 est.) 48,732.

Florida, constituent state of the United States of America, the southeasternmost state of the United States, comprising a peninsula and adjoining mainland areas protruding southeastward from the North American continent. It is bounded on the north by Alabama and Georgia; on the east by the Atlantic Ocean; on the south by the Straits of Florida; and on the west by the Gulf of Mexico. The capital is Tallahassee.

A brief treatment of Florida follows. For full treatment, *see* MACROPAEDIA: United States of America: *Florida.*

Indian groups entered Florida from the north as early as 10,000 years ago. Florida was explored by Juan Ponce de León in about 1513. In 1565, after wiping out a settlement of French Huguenots, the Spaniards founded St. Augustine, the oldest city in the United States. By 1750 virtually all of the descendants of the earliest known inhabitants had been wiped out. Florida became a British possession in 1763 after the British victory in the French and Indian Wars. The area reverted to Spanish control after the American Revolution (1783) but was used by the British as a base of operations against the United States during the War of 1812. Andrew Jackson's capture of Pensacola during that war led to the cession of Florida to the United States in 1819. A war with the Seminole Indians followed (1835–42) during which most Seminoles were forcibly removed to Oklahoma. Florida became a state in 1845.

Florida is a low-lying plain, mostly less than 100 feet (30 m) above sea level, with its highest point a mere 345 feet (105 m) in elevation. Sedimentary deposits of sand and limestone cover most of the state, with areas of peat and muck marking where freshwater bodies once stood. Almost two-thirds of the state is covered by trees, and there are more than 1,700 streams and some 30,000 lakes. The contemporary topography has been largely molded by running water, waves, ocean currents, winds, changes in sea level, and the wearing away of limestone rocks by solution. The rich and distinctive tropical and subtropical environment is inhabited by a huge and varied wildlife population.

Climatically, Florida is divided into tropical and subtropical zones. Average annual temperatures show little variation, ranging from 68° F (20° C) in the north to 77° F (25° C) in the south. Rainfall is heaviest in summer. The average annual rainfall ranges from 40 inches (1,000 mm) around Key West to 62 inches (1,575 mm) in West Palm Beach. On the average, hurricanes occur about once a year, usually in September.

Florida is one of the fastest-growing states in the United States. Its 1970–85 growth rate was almost four times the national average. When it became a state, Florida was sparsely populated and had equal numbers of whites and blacks; at the end of the 19th century, the incidence of the blacks began a steady decline. In the late 1980s it was less than 15 percent. Immigrants from Cuba have been significant throughout the 20th century. Sizable Jewish communities have also developed, as have recent communities of Haitian refugees. The death rate is high mainly because of the large number of older people who have retired there.

Florida's farmland covers less than two-fifths of the state, and about one-third of this total is in either pasture or timber. Yet on this land Florida produces about 75 percent of the nation's citrus fruits, and the state is second only to California in vegetable production. It also is important in cattle rearing. Phosphate is the state's main mineral; titanium and zircon are also found, and there is some petroleum.

Tourism is the leading industry. The electronics industry is the leading manufacturing activity. The aerospace industry, centred on the John F. Kennedy Space Center at Cape Canaveral (Kennedy), is a further buttress to the economy, employing many thousands of people.

Florida has three international airports and eight major deepwater ports and is well-served by highways and railways. It maintains more than 800 parks and recreation areas, while counties and municipalities support another 1,300. The Everglades National Park occupies some 1,400,500 acres (567,000 hectares). Sporting events, particularly the Orange Bowl and Gator Bowl football games, are especially popular. Walt Disney World and the accompanying Epcot Center (Experimental Prototype Community of Tomorrow; opened 1982) are huge tourist attractions. Sarasota is a centre for both visual and theatre arts. The John and Mable Ringling Museum of Art possesses an internationally famous fine-art collection, and the city also supports a circus museum and hall of fame. Area 58,664 sq mi (151,939 sq km). Pop. (1990 est.) 12,818,000.

Florida, city, south-central Uruguay, on the Santa Lucía Chico River. Founded in 1809, the city processes the wheat, corn (maize), oats, sugar beets, linseed, and other products of the agricultural hinterland. Lumber mills and factories manufacturing textiles, mosaics, and hosiery also are located in the city.

The surrounding region is characterized by rolling hills. In addition to its agricultural activities, the area is noted for cattle and sheep ranching. Viticulture, dairying, and quarrying of granite, limestone, marble, and iron are also economically important.

The city of Florida has a poultry-farming school. Florida is situated on the main highway and railroad linking Montevideo and Rivera, and it has an airport. Pop. (1985 prelim.) 26,200.

Florida, Purchase of: *see* Transcontinental Treaty.

Florida, Straits of, passage connecting the Gulf of Mexico with the Atlantic Ocean, extending for about 110 miles (180 km) between the Florida Keys, U.S., on the north and Cuba and the Bahamas on the south and southeast. The straits mark the area where the Florida Current, the initial part of the Gulf Stream, flows eastward out of the Gulf of Mexico with a mean surface velocity of 4 to 6 miles (6.5 to 9.5 km) per hour and a width of up to 95 miles (153 km). The Spanish explorer Juan Ponce de León first recorded sailing through the straits in 1513.

Florida Bay, triangular-shaped shallow body of water between the Gulf of Mexico and Biscayne Bay at the southern end of Florida, U.S. The bay is partially sheltered from the Atlantic Ocean on the south and east by the Florida Keys. Its depth is generally less than 11 feet (3 m), and many of the mudbanks are high enough to form small islands. Navigation channels have been dredged through the bay to accommodate the Atlantic Intracoastal Waterway. Most of the bay is included within the Everglades National Park.

Florida Current, swift surface oceanic current flowing northward, following the shallow continental slope between the Straits of Florida and Cape Hatteras. Emerging from the Caribbean Sea, carrying about 880,000,000 cubic feet (25,000,000 cubic m) of water per second, the Florida Current is joined by the Antilles Current, which transports approximately 420,000,000 cubic feet (approximately 11,893,000 cubic m) per second. Florida Current water is recognized by its low salinity and temperatures above 44° F (6.5° C).

Florida Keys, island chain, in Monroe and Dade counties, southern Florida, U.S. Composed of coral and limestone, the islands curve southwesterly for about 192 miles (309 km) into the Gulf of Mexico from Virginia Key, just south of Miami Beach, to Loggerhead Key in the Dry Tortugas (*q.v.*). Waters between the keys and the mainland include Biscayne and Florida bays. The western terminus of the Florida Keys is sometimes considered

One of the Florida Keys, viewed from Stock Island, near Key West, Fla.

David Muench—EB Inc.

to be Key West (*q.v.*), the most important of the islands. The Overseas Highway, running from the mainland to Key West, is the longest overwater road in the world, with 42 bridges, including one 7-mile (11-kilometre) span; completed in 1938, the highway was built over the route of the Florida East Coast Railroad, begun in 1912 by Henry M. Flagler and destroyed by the 1935 hurricane. Largest of the keys is Key Largo, about 30 miles (50 km) long and known for its lime plantations. The John Pennekamp Coral Reef State Park, which contains the largest living coral formations in North America, is the first underseas park in the United States. It is 21 miles (34 km) long and 6.5 miles (about 10 km) wide and lies along Key Largo's east coast. Islamorada, on Upper Matecumbe Key, has a monument to World War I veterans and victims of the 1935 hurricane. The largest town of the middle keys is Marathon, a centre of extensive resort development. Nearby is the Southeast Museum of the North American Indian and a porpoise-training school. Bahia Honda State Park, on Bahia Honda Key, has 77 acres (31 hectares) of tropical palms and beach recreation facilities. The northern shores of the lower keys have been designated the Great White Heron National Wildlife Refuge. The 7,700-acre (3,116-hectare) Big Pine Key, largest of the lower keys, is a refuge for the tiny key deer and has unusual displays of cacti. More than 600 varieties of fish are found in the waters of the keys.

Florida torreya (tree): *see* stinking yew.

Floridablanca, José Moñino y Redondo, conde de (count of) (b. Oct. 21, 1728, Murcia, Spain—d. Dec. 28?, 1808, Seville), Spanish statesman and minister who became identified with the reform program of King Charles III.

He was a leading advocate in Madrid when he was appointed fiscal of the council of Castile in 1766. Having cooperated in the expulsion of the Jesuits from Spain in 1767 and being known as a convinced regalist, he was sent as ambassador to Rome in 1772 with the purpose of procuring the general dissolution of the Society of Jesus. As a reward for his success in this mission, Charles III gave him the title of conde de Floridablanca in 1773.

He replaced Jerónimo Grimaldi as first secretary of state in 1776. In office he attacked the problem of mendicity, sponsored vocational schools and workhouses, established public credit agencies to lend capital to farmers, and was involved in most of the reforming efforts of the government in trade, industry, agriculture, and public works. Wishing to create a more efficient instrument of government, Floridablanca persuaded the king to establish (July 8, 1787) a *junta de estado*, or type of cabinet, which began regular joint meetings of all the royal ministers in order to discuss and coordinate policy and for which he himself drew up a program of action.

Charles IV retained Floridablanca in office upon his accession (1789) but the minister's policy now changed. The growing horror of the French Revolution transformed him from a progressive into an authoritarian, leading him to resuscitate the Inquisition, to impose a rigorous censorship, and to disavow the ministers and institutions of the late king. Aristocratic resentment of his power and humble origin, together with his intransigent policy toward France which was thought to endanger the royal family there, led to his being replaced by the Conde de Aranda in February 1792. At first Floridablanca was allowed to return to his native Murcia, but he was arrested in July and confined in the fortress of Pamplona, where he remained until permitted to retire to Murcia. During the French invasion of 1808 he was nominated president of the supreme central junta but died soon after.

Floridor, original name JOSIAS DE SOULAS, SIEUR (lord) DE PRINEFOSSE (b. 1608?, the Brie district, Fr.—d. August 1671, Paris), French leading actor who headed the important troupe of the Théâtre de l'Hôtel de Bourgogne, in Paris, where he created many roles in plays by the French masters Pierre Corneille and Jean Racine.

The son of a German father, he entered the French army and was promoted to ensign but later resigned to become an actor under the name of Floridor. He joined a group of players that performed in London in 1635 before the English court and at the French Players' Theatre, a playhouse temporarily set up in Drury Lane, London. For a brief time he was affiliated with Filandre (Jean-Baptiste de Mouchaingre), an influential French actor-manager, who was reputed to have been his teacher and with whom he made provincial tours. During that period, he joined the troupe at the Théâtre du Marais, with whom he made his Parisian debut in 1640.

Floridor was called (around 1643) to the Hôtel de Bourgogne, a move that possibly influenced Corneille to give that theatre his later plays instead of giving them to the Marais. He succeeded the French actor Bellerose (Pierre le Messier) as head of the Bourgogne, where he played all the leading parts in tragedy and comedy, becoming one of France's finest actors. His company was unrivalled in Paris until Molière's arrival there in 1658. Molière's play *L'Impromptu de Versailles* (1663), which ridiculed the Bourgogne troupe, spared only Floridor from mockery. He retired, because of illness, shortly before his death.

Flórina, also spelled PHLÓRINA, historically CHLOROS, city, capital of the *nomós* (department) of Flórina, western Macedonia, Greece. Originally a Byzantine foundation, it later passed to Ottoman control; by the 18th century, its population was chiefly Turkish and Albanian. In the 19th century, Flórina was a centre of Bulgarian irredentist agitation in Macedonia. It passed to Greece after the Balkan Wars (1912–13). Located in a fertile agricultural area, Flórina markets grain, wine grapes, and vegetables. It has textile mills and is known for fine leather handicrafts.

The *nomós* of Flórina extends along the Yugoslav and Albanian frontiers; it includes the Greek portions of Lake Prespa and Límni (lake) Mikrá Préspa. Kaolin, marble, lignite, and bauxite are mined. Pop. (1981) city, 12,573; *nomós*, 52,430.

Florio, John, also called GIOVANNI FLORIO (b. *c.* 1553, London—d. *c.* 1625, Fulham, near London), English lexicographer and translator of Montaigne.

Florio, engraving by William Hole, 1611

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Son of a Protestant refugee of Tuscan origin, Florio studied at Oxford. From 1604 to 1619 Florio was groom of the privy chamber to Queen Anne.

In 1580 he translated, as *Navigations and Discoveries* (1580), Giovanni Battista Ramusio's account of the voyages of Jacques Cartier. *Florio His Firste Fruites* (1578), a grammar and a series of dialogues in Italian and English, was followed by *Florio's Second Frutes* and a collection of proverbs in *Giardino di Ricreatione* in 1591. His Italian-English dictionary, *A Worlde of Wordes* (1598), for which he drew heavily upon the works of Giordano Bruno, contains about 46,000 definitions. The second edition, *Queen Anna's New World of Words* (1611), was greatly enlarged.

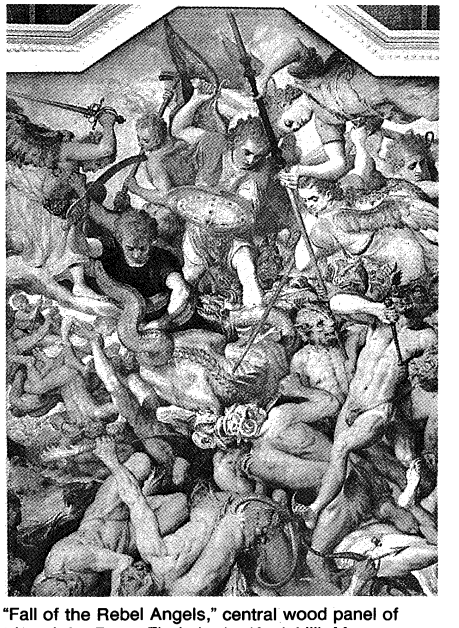
In 1603 Florio produced his major translation, *The Essayes . . . of . . . Montaigne.* The freedom of this version is questionable by modern standards of accuracy, and the style is elaborate where Montaigne is subtle and terse, but the book is nevertheless thoroughly good reading. Florio revised it in 1613.

Floris V, byname FLORIS THE GOD OF THE COMMONERS, Dutch FLORIS DER KEERLEN GOD (b. July 1254, Leiden, Holland—d. June 27, 1296, Muiderberg), count of Holland (1256–96) and Zeeland, son of the German king William of Holland. Under him the territory of Holland greatly expanded and prospered. Floris succeeded his father as count of Holland when he was less than two years old and did not come of age until 1266.

The county was enlarged by the final subjugation of the West Frisians in 1289 and by the acquisition of Waterland, West Frisia, the diocese of Utrecht, and Gooi and by forcing several feudal lords in the borderlands to recognize Floris as their overlord (Amstel, Woerden). The county became more or less coextensive with the later provinces of North and South Holland. Careful maintenance of waterways and dikes increased the agrarian importance of the country. Before his successes on his frontiers, Floris V had had to suppress a revolt of the peasants in the north of Holland (1273–74).

His active interest in affairs was not limited to the Netherlands. He allied himself closely with Edward I of England in his strife with France and secured from the English king great trading advantages for his people; the staple of wool was placed at Dort (Dordrecht), and the Hollanders and Zeelanders got fishing rights on the English coast. So intimate did their relations become that Floris sent his son John to be educated at the court of Edward with a view to his marriage with an English princess. However, Floris in 1296 transferred his alliance to Philip IV of France, probably at the prompting of his cousin John of Avesnes, count of Hainaut, since John and Philip were both hostile to the count of Flanders, Guy of Dampierre, who was also Floris' adversary. This tergiversation was the cause of Floris V's death; discontented nobles, encouraged by the English king, took him prisoner, and, when the peasantry prevented them from taking him to England, killed him in the castle of Muiden. The tragic event has been immortalized in dramas from the pens of some of Holland's most famous writers.

Floris, Cornelis II and Frans, original names CORNELIS DE VRIENDT II and FRANS DE VRIENDT (respectively b. 1514, Antwerp—d. Oct. 20, 1575, Antwerp; b. *c.* 1516, Antwerp—d. Oct. 1, 1570, Antwerp), the most distinguished members of a family of Flemish artists;



"Fall of the Rebel Angels," central wood panel of triptych by Frans Floris in the Koninklijk Museum voor Schone Kunsten, Antwerp

By courtesy of the Koninklijk Museum voor Schone Kunsten, Antwerp, Belgium

their Antwerp workshops contributed significantly to the Northern Renaissance. Cornelis was an architect, sculptor, and medalist; Frans, a painter.

Both brothers studied in Rome in the 1540s and were soon at the head of flourishing workshops in Antwerp. Cornelis supplied the

choir screen of Tournai cathedral and the tombs of Danish kings Frederick I (Schleswig, Ger.) and Christian II (Roskilde, Den.). He designed the Antwerp town hall (1561–65); its amalgamation of a Gothic gable front with a Florentine palace facade became the model for Netherlandic town halls. Frans's success was even more phenomenal, thanks to his ability to organize an efficient picture-producing factory. His life-style was extravagant, and he died overwhelmed with debts.

Florissant, city, St. Louis County, east central Missouri, U.S., northern suburb of St. Louis, near the Missouri River. Settled by the French in about 1785, it was called St. Ferdinand by the Spanish and was officially renamed Florissant (from the French *fleurissant*, "flowering") in 1939. The Old St. Ferdinand's Shrine was built in 1821, St. Stanislaus Seminary was founded by the Jesuits in 1831, and St. Louis Christian College was opened in 1956. Casa Alverez (*c.* 1790) survives as an example of Missouri French architecture. Inc. 1857. Pop. (1982 est.) 55,310.

Florissant Formation, division of middle and upper Oligocene rocks in the United States (the Oligocene Epoch began about 38,000,000 years ago and lasted about 12,000,000 years). The Florissant Formation occurs in central Colorado, where it overlies the White River Group; it was named for exposures studied near Florissant, Colo. The Florissant consists of shales that contain a rich and varied fossil assemblage. Many kinds of Oligocene plants are represented in the Florissant, including the leaves and twigs of redwoods, hackberries, and sycamores. These remains represent a temperate upland forest that existed in the region during the Oligocene. Well-preserved fish skeletons have been found in the fine-grained Florissant sediments, as have freshwater mollusks and an excellently documented record of Oligocene insects and spiders. The Florissant contains the earliest record of the tsetse fly and some mammalian fossils.

floristic region, also called FLORISTIC KINGDOM, or FLORAL KINGDOM, any of six areas of the world recognized by plant geographers for their distinctive plant life. These regions, which coincide closely with the faunal regions (*q.v.*) as mapped by animal geographers, are often considered with them as biogeographic regions. The chief difference is the recognition by plant geographers of the Cape region of South Africa as a distinct major unit because of its rich flora, which includes more than 1,500 genera, 30 percent of which are native nowhere else in the world.

The regions are: Boreal (North America, Europe, northern and central Asia, and North Africa), Palaeotropical (including African, Indo-Malaysian, and Polynesian subregions), Neotropical (South and Central America), South African, Australian, and Antarctic.

The Australian region is the most isolated, followed closely by the South American portion of the Neotropical region. Both of these areas contain a large number of unique plant species. Madagascar, long separated from Africa, is sometimes considered a separate region because of its unusual flora.

Florus, Publius Annius (fl. late 1st and early 2nd century AD, b. Africa—d. Rome?), historian of Rome and poet, important as the first of a number of African writers who, in the 2nd century, exercised considerable influence on Latin literature. He was also the first of the "new-fashioned" poets of Hadrian's reign, whose special characteristic was the use of lighter and more graceful metres than those of the poets they displaced.

Florus compiled a brief sketch of the history of Rome from its founding to the time of Augustus, based chiefly on Livy. The work, called in some manuscripts *Epitome de T. Livio bellorum omnium annorum DCC libri duo,* is a rhetorical panegyric of the greatness of Rome. Almost valueless historically, it was much used in the Middle Ages. In the manuscripts the writer is variously identified, but stylistic similarity to a dialogue *Vergilius orator an poeta* known to be the work of Publius Annius Florus, of which a fragment is preserved, authenticates his authorship of the history. The *Vergilius* states that he took part in the contest of poets instituted by Domitian in honour of Capitoline Jove. Having been refused a prize because of the prejudice against African provincials, he went to Tarraco, Spain, where he taught rhetoric. At some time he must have returned, because it is generally agreed that he is the Florus said to have addressed the well-known lines to Hadrian beginning, "I do not wish to be a Caesar," which provoked Hadrian's satirical parody, "I do not wish to be a Florus," quoted by Spartianus. Twenty-six trochaic tetrameters, *De qualitate vitae,* and five graceful hexameters, *De rosis,* are also attributed to him.

Flory, Paul J(ohn) (b. June 19, 1910, Sterling, Ill., U.S.—d. Sept. 9, 1985, Big Sur, Calif.), American physical chemist, recipient of the Nobel Prize for Chemistry in 1974 for his investigations of synthetic and natural macromolecules.

Flory attended Manchester College, North Manchester, Indiana and Ohio State University (Ph.D., 1934). Thereafter he worked at the University of Cincinnati, Cornell University in Ithaca, N.Y., Standard Oil Development Company, and Goodyear Tire & Rubber Company. His scientific activities ranged from research and development that led to the introduction of commercially successful polymers (nylon and synthetic rubber) to studies of processes by which polymers form and of their properties in bulk and in solution. His research demonstrated the importance of understanding the sizes and shapes of these flexible molecules in establishing relationships between their chemical structures and their physical properties. From 1961 to 1976 he was a professor of chemistry at Stanford University, becoming emeritus in 1976.

floss-silk tree (*Chorisia speciosa*), thorny flowering tree, of the bombax family (Bombacaceae), native to South America but cultivated as an ornamental in other regions. It grows to a height of about 15 metres (50 feet). The large pink flowers yield a vegetable silk used in upholstery.

Floss-silk tree (*Chorisia speciosa*)
G.R. Roberts

Flossenbürg, German Nazi concentration camp, established in 1937 in the market town of Flossenbürg, in the Neustadt district of the Upper Palatinate of Bavaria (Bayern). It was originally used for political prisoners but, by World War II, had become an important forced-labour centre, housing 30,000 to 40,000 worker-prisoners in the main camp and 15 satellite camps. From 1942 on, it was also a transit camp for Jews destined for the extermination camps in Poland.

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flotation, in mining, method used to separate minerals in ore processing. The technique dates to ancient times when the Greeks reportedly used feathers dipped in pitch to recover gold from the mud of a lake, but large-scale modern use of flotation did not come about until after 1924, when the use of salts of xanthic acids, to collect metal sulfides in a froth, was patented.

Fine particles of certain minerals, such as graphite, talc, and sulfur, float on water because they resist wetting, but most minerals require coating with a water repellent to make them float. The finely ground mineral particles are coated by agitating the mixture of ore, water, and suitable chemicals; the chemicals become bound to the surface of certain particles to make them water repellent. These particles then adhere to air bubbles and rise with them to the surface, where they are removed in the froth. Minerals that naturally resist wetting may be treated so that their surfaces will be wetted and they will sink.

This ability of the ore dresser to modify the floatability of minerals made possible many otherwise difficult separations that are common practice in modern mills. Flotation is widely used to concentrate copper, lead, and zinc minerals, which commonly accompany one another in their ores.

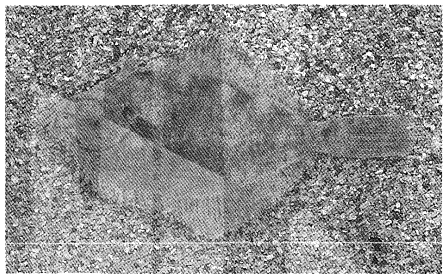
Flotow, Friedrich, Freiherr von (baron of) (b. April 26, 1812, Teutendorf, near Lübeck, French Empire—d. Jan. 24, 1883, Darmstadt, Ger.), German-born French composer best known for his opera *Martha.*

Originally intended for a diplomatic career, Flotow studied music in Paris with Anton Reicha from the age of 16. Forced to leave Paris during the July Revolution of 1830, he went home but returned to Paris in 1831. In 1837 he produced a first, brief version of the opera *Alessandro Stradella,* which later, in its complete form, enjoyed great success. In 1839 he

Flotow, detail of a lithograph by J. Kriehuber, 1847
By courtesy of the Osterreichische Nationalbibliothek, Vienna

collaborated with Albert Grisar and Auguste Pilati on *Le Naufrage de la Méduse*. Between 1840 and 1878 he produced 19 light operas, including *Martha* (1847). Originally a ballet, the opera *Lady Henriette* (1844) contained the Irish song "The Last Rose of Summer." Flotow also wrote ballets for the court theatre at Schwerin, of which he was director (1855–63), and incidental music for Shakespeare's *Winter's Tale*.

flounder, any of numerous species of flatfishes belonging to the families Pleuronectidae and Bothidae (order Pleuronectiformes). The



Flounder (*Platichthys*)
F. Greenaway from Natural History Photographic Agency—EB Inc.

flounder is morphogenetically unusual. When born it is bilaterally symmetrical as are most other fish. After a few days, however, it begins to lean to one side, and the eye on that side begins to migrate to what eventually becomes the top side of the fish. With this development a number of other complex changes in bones, nerves, and muscles occur, and the underside of the bottom-living flatfish loses its colour.

Included among the approximately 100 species of the family Pleuronectidae are the European flounder (*Platichthys flesus*), a marine and freshwater food and sport fish of Europe that grows to a length of 50 centimetres (20 inches) and weight of 2.7 kilograms (6 pounds); the starry flounder (*Platichthys stellatus*), a North Pacific species that averages about 9 kg in weight; and the winter flounder (*Pseudopleuronectes americanus*), an American Atlantic food fish, growing to about 60 cm in length. Flounders in this family typically have the eyes and colouring on the right side.

In the family Bothidae, containing about 200 species, the better known flounders include the summer flounder (*Paralichthys dentatus*), an American Atlantic food fish growing to about 90 cm; the peacock flounder (*Bothus lunatus*), a tropical American Atlantic species attractively marked with many pale-blue spots and rings; and the brill (*Scophthalmus rhombus*), a relatively large commercial European species, reaching a length of 75 cm. Flounders in the family Bothidae typically have eyes and colouring on the left side.

flour, finely ground grains or other starchy portions of plants, used in various food products and as a basic ingredient of baked goods. Flour made from wheat grains is the most satisfactory type for baked products that require spongy structure. In modern usage, the word flour alone usually refers to wheat flour, the major type in Western countries.

Wheat grains, or kernels, are composed of the starchy endosperm, or food-storage portion, comprising about 85 percent; several outer layers that make up the bran, constituting about 13 percent; and the oily germ, or embryo plant, comprising approximately 2 percent. In the production of refined flour, the milling process usually separates the endosperm from the other kernel portions. Extraction of completely pure endosperm has not been possible, as the bran and germ cannot be entirely removed. In the production of whole wheat flour, all parts of the kernel are used.

In modern milling of refined flours the wheat kernels are cleaned and tempered by the addition or removal of moisture and then split open, allowing the endosperm to be scraped from the bran. The coarsest particles are called sizings; medium-sized particles are called middlings; and the finest particles are called break flour. The flour is usually bleached and treated to obtain the improved bread-making qualities formerly achieved by natural aging.

Flour grades are frequently based on the percentage of extraction, or the weight of the flour produced from 100 pounds of wheat. Extractions of about 75 percent are common for white flours; higher extractions produce darker flours. Some of the germ and bran remaining after flour extraction is used as animal feed; oil may be extracted from the germ for use as a nutritional supplement for human diets; and bran and oil-free germ are commonly used as a breakfast-food ingredient.

When flour is mixed with water to make dough, its protein content is converted to gluten, an elastic substance that forms a continuous network throughout the dough and is capable of retaining gas, thus causing the baked product to expand, or rise. The strength of the gluten depends upon the protein content of the flour. Soft wheats, low in protein, produce flours with protein content of 7.5–10 percent, suitable for products requiring light structure, such as cakes, cookies (sweet biscuits), piecrusts, and crackers. Hard wheats, high in protein, produce flours with protein content of 12.5–15.5 percent, suitable for products requiring stronger structure, such as breads, buns, hard rolls, and yeast-raised sweet rolls.

The wide variety of wheat flours generally available includes whole wheat, or graham, flour, made from the entire wheat kernel and often unbleached; gluten flour, a starch-free, high-protein, whole wheat flour; all-purpose flour, refined (separated from bran and germ), bleached or unbleached, and suitable for any recipe not requiring a special flour; cake flour, refined and bleached, with very fine texture; self-rising flour, refined and bleached, with added leavening and salt; and enriched flour, refined and bleached, with added nutrients.

Flours are also made from other starchy plant materials including barley, buckwheat, lima beans, oats, peanuts, potatoes, soy beans, rice, and rye.

flour moth, also called MEDITERRANEAN FLOUR MOTH (*Ephestia kuehniella*), species of insect belonging to the family Phycitidae (order Lepidoptera), a cosmopolitan pest of cereal products and other stored foods. Because they require vitamins A and B, the larvae cannot live on pure starch. They spin a web in flour, grain, or seeds, causing problems in milling or sorting. After the small, white maggot-like larvae grow to a length of nearly 2 centimetres, they crawl into a crevice to pupate; infestations therefore tend to persist in contaminated warehouses. The adult moths have gray mottled forewings, with a span of about 3 cm, and pale hindwings. They shun light and fly in brief zigzags. Each female flour moth lays 200 to 500 eggs, producing as many as four generations per year, or more in warmer environments.

Flourens, Gustave (b. Aug. 4, 1838, Paris—d. April 3, 1871, Chatou, Fr.), French radical intellectual and a leader of the Paris Commune revolt of 1871.

Flourens was the son of a famous physiologist, Marie-Jean-Pierre Flourens, and was a promising young scientist. As an academic he wrote such distinguished works as *Histoire de l'homme* (1863; "History of Man"), *Ce qui est possible* (1864; "What Is Possible"), and *Science de l'homme* (1865; "Science of Man"). In 1867 he was denied a professorship at the Collège de France because of his attachment to radical scientific and political doctrines. He had meanwhile left France for Turkey and Greece. In 1866 he joined a revolt in Crete against the Turks and distinguished himself as a guerrilla leader. The grateful Cretans with whom he had fought appointed him to head a delegation to the Greek Parliament, but the Greek government and the French consul in Athens contrived to deny him and his delegation their places.

Flourens soon returned to France and to political activism. He collaborated on an influential left-wing journal, *La Marseillaise;* fought a duel with Paul de Cassagnac, a right-wing journalist; and led an abortive revolt at the funeral of Victor Noir, an obscure young newspaperman who had been shot by Prince Pierre Bonaparte (January 1870). Flourens was arrested in February 1870 after leading another unsuccessful uprising but was soon released to help defend Paris against the German siege during the Franco-German War (1870–71). Following the capitulation of Paris, he was rearrested that October, once again for revolutionary politics.

Flourens was free when the Paris Commune revolted in mid-March 1871. He quickly joined the revolutionary movement as elected delegate from the 19th *arrondissement* of Paris. He played a key role in the military leadership of the Commune and served on the commission of war, but he was killed during a skirmish at Chatou shortly thereafter.

Flourens, Marie-Jean-Pierre (b. April 15, 1794, Maureilhan, Fr.—d. Dec. 6, 1867, Montgeron), French physiologist who was the first to demonstrate the general functions of the major portions of the vertebrate brain.

Under the sponsorship of the renowned French naturalist Georges Cuvier in Paris, Flourens undertook a series of experiments (1814–22) to determine physiological changes in pigeons after removal of certain portions of their brains. He found that removal of the cerebral hemispheres, at the front of the brain, destroys the senses of perception but not of equilibrium, that removal of the cerebellum, at the base of the brain, destroys the animal's sense of equilibrium, and that removal of the medulla oblongata, at the back of the brain, results in death. These experiments led him to conclude that the hemispheres are responsible for higher psychic and intellectual abilities, that the cerebellum regulates all movements, and that the medulla controls vital functions, especially respiration. Flourens was also first to recognize the role of the semicircular canals of the inner ear in maintaining body equilibrium and coordination. He summarized his brain studies in *Recherches expérimentales sur les propriétés et les fonctions du système nerveux dans les animaux vertébrés* (1824; "Experimental Researches on the Properties and Functions of the Nervous System in Vertebrate Animals").

flow: *see* deformation and flow.

flowchart, graphical representation of a process, such as a manufacturing operation or computer operation, indicating the various steps that are taken as the product moves along the production line or the problem moves through the computer. Individual operations can be represented by closed boxes on the flowchart, with arrows between boxes indicating the order in which the steps are taken. *See also* critical path analysis (CPA).

flower, the reproductive portion of any plant in the division Magnoliophyta (Angiospermae), commonly called flowering plants or angiosperms. Flowers may be conspicuous or inconspicuous by virtue of their size, form, colour, or clustering. Despite the tremendous range in types, a flower is a highly modified shoot, the major parts of which are the perianth, androecium, and gynoecium, which in

a typical flower are all present and arranged closely along a floral axis or receptacle.

The perianth, or floral envelope, surrounds the essential reproductive organs. It consists of the calyx (composed of sepals) and the corolla (composed of petals), either or both of which may be colourful and showy. Sepals and petals that are indistinguishable, as in lilies and tulips, are sometimes referred to as tepals. The male parts of the flower are the stamens, each of which consists of a supporting filament and an anther, in which pollen is produced. Stamens collectively are known as the androecium, the male complex. The female parts of the flower are the pistils, each of which consists of an ovary, with an upright extension, the style, on the top of which rests the stigma, the pollen-receptive surface.

The ovary encloses the ovules, or potential seeds. A pistil may be simple, made up of a single carpel, or ovule-bearing modified leaf; or compound, formed from several carpels joined together. Pistils or carpels collectively are termed the gynoecium, or female complex.

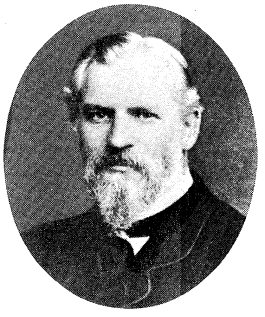
Flowers can occur singly at the ends of stems or in the axils of leaves, as in chrysanthemums and hollyhocks, or arranged in a distinctive cluster (*see* inflorescence), as in phloxes and lilacs. The perianth surrounds and protects the reproductive organs. It may be adapted to attract certain pollinating agents through fragrance, colour, form, nectar, etc., or it may simply and directly produce pollen or ovules (or both) in inconspicuous structures of little resemblance to the common notion of a flower, as in grasses and many trees.

A flower having sepals, petals, stamens, and pistils is complete; lacking one or more of such structures, it is incomplete. Lacking stamens, a flower is pistillate, or female; lacking pistils, it is staminate, or male. If a flower contains both stamens and pistils it is said to be perfect, bisexual, or hermaphroditic, regardless of a lack of any other part that renders it incomplete.

A flower may be radially symmetrical, as in roses and petunias, in which case it is termed regular or actinomorphic. A bilaterally symmetrical flower, as in orchids and snapdragons, is irregular or zygomorphic.

A flower is hypogynous, perigynous, or epigynous depending upon the position of the ovary relative to other floral parts. When floral parts are inserted below the ovary, the ovary is superior and the flower is either hypogynous, with the ovary directly resting on the insertion of other parts; or perigynous, with other parts inserted on the edge of a cuplike hypanthium rising around the ovary. When floral parts are inserted above the ovary, the ovary is inferior and the flower epigynous.

Flower, Sir William Henry (b. Nov. 30, 1831, Stratford upon Avon, Warwickshire, Eng.—d. July 1, 1899, London), British zoologist who made valuable contributions to structural anthropology and the comparative anatomy of mammals.

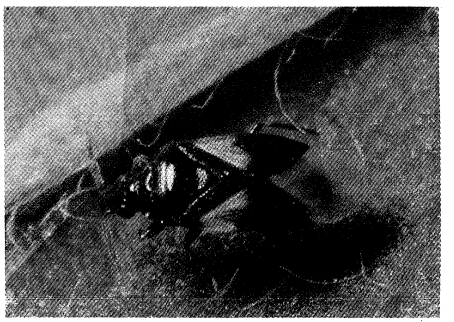


Flower, 1883
BBC Hulton Picture Library

Flower became a member of the surgical staff at Middlesex Hospital, London, after serving as an assistant surgeon in the Crimean War. He was subsequently appointed curator of the Hunterian Museum of the Royal College of Surgeons (1861) and Hunterian professor of comparative anatomy and physiology (1870). In 1884 he succeeded Sir Richard Owen, the British naturalist, as director of the British Museum of Natural History, where he revolutionized the art of museum display. Foremost among Flower's many thorough mammalian studies are those dealing with marsupials, whales, and primates. He was the first to show that lemurs are primates and, in the course of extensive anthropological research, made complete and accurate measurements of at least 1,300 human skulls. He was knighted in 1892.

His chief publications are *Diagrams of the Nerves of the Human Body* (1861), *An Introduction to the Osteology of the Mammalia* (1870), *Introduction to the Study of Mammals, Living and Extinct* (1891), and *Essays on Museums and Other Subjects* (1898).

flower bug, also called MINUTE PIRATE BUG or ANTHOCORID BUG, any member of the insect family Anthocoridae (order Heteroptera), which numbers about 400 species. The flower bug is important because it feeds on aphids and aphid eggs, although several species suck



Flower bug (*Orius tristicolor*)
William E. Ferguson

human blood (*e.g.,* the cosmopolitan *Lectocoris campestris* and the Sudanese *Anthocoris kingi*).

These small insects (2 to 5 millimetres, or 0.08 to 0.2 inch) are black with white markings; they are usually found on flowers, under loose bark, or in leaf litter. Their eggs are deposited in plant tissue, and the adults pass the winter in trash piles. Flower bugs differ from most heteropterans because they have a well-defined embolium (a section of the wing). The insidious flower bug, *Orius* (*Triphleps*) *insidiosus,* is a common North American species that preys on the grape phylloxera and the chinch bug.

flower chafer, any member of the beetle subfamily Cetoniinae (family Scarabaeidae, order Coleoptera). These insects, distributed worldwide, are brilliantly coloured, with the majority of the iridescent species occurring in the tropics. Most measure less than 12 millimetres (½ inch), although a few well-known ones are longer. The pollen-feeding adults tend to be hairy and are good pollinators. *Euphoria inda* resembles a bumblebee and even buzzes while flying. The North American green June beetle (*Cotinus nitida*) is about 25 mm long, dull velvet green in colour, and edged in yellow and brown. It feeds on figs and other fruits, often causing great damage. Muscular pads on the back of the long white grubs are used instead of their legs for locomotion.

African goliath beetle (*Goliathus giganteus*)
Appel

Probably the best known member is the African goliath beetle (*Goliathus giganteus*). This insect, white with bold black lines on its body and with brown wing covers (elytra), may be more than four inches long; its black, leathery wings are larger than those of a sparrow. Most flower beetles have only small protuberances on the tops of their heads and prothorax (region immediately behind the head), although some have long hornlike structures. *Cremastocheilus* is held captive by ants to provide them with a nutritive fluid. The colour of *Hetorrhina dohrni* of Sumatra, one of the most beautiful insects, changes with shifts in light from black and gold-green to deep orange-red.

Consult the INDEX *first*

flower fly: *see* hover fly.

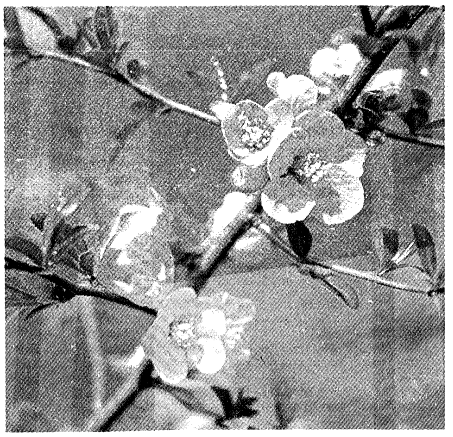
flower-of-an-hour, also called VENICE MALLOW (*Hibiscus trionum*), annual plant, of the mallow family (Malvaceae), native to central Africa. In North America it is sometimes cultivated for its attractive flowers, often naturalized and sometimes a troublesome weed. The plant grows about 0.6 metre (2 feet) tall and has leaves with sharply toothed lobes. The white or pale-yellow flowers have a dark centre and measure about 7.5 centimetres (3 inches) across. When in shadow, the flowers close.

Flower-of-an-hour (*Hibiscus trionum*)
Alvin E. Staffan—The National Audubon Society Collection/Photo Researchers

flowering currant (plant): *see* Ribes.

flowering plant: *see* angiosperm.

flowering quince, any shrub of the genus *Chaenomeles* within the rose family (Rosaceae). The three known species are native to eastern Asia but cultivated in other regions for the flowers that appear early in the spring. The leaves are alternate, and the pink or red flowers are solitary or in small clusters. The green,



Flowering quince (*Chaenomeles*)
Walter Chandoha

apple-like fruit is used in preserves. *C. japonica* has provided several horticultural varieties.

flowering rush (*Butomus umbellatus*), perennial freshwater plant native to Eurasia, now common throughout the North Temperate Zone. *B. umbellatus* is the only species of the family Butomaceae.

Flowering rush (*Butomus umbellatus*)
Kitty Kohout from Root Resources—EB Inc.

Long, tapering leaves extend the full height of about 1 metre (about 40 inches) from the base of the plant. The rose-coloured flowers have three sepals and three petals.

flowerpecker, any of 47 species belonging to the songbird family Dicaeidae, order Passeriformes, that have a double-tubed and brush-tipped tongue and finely serrated bill. Flowerpeckers occur in southern Asia, western Pacific islands, and Australia. They flit about, twittering, in trees and shrubs where they find small fruits. The pouchlike, felted nest may have a porched side entrance. A species seen in gardens from India and southern China to the East Indies is the scarlet-backed flowerpecker (*Dicaeum cruentatum*); 9 centimetres (3½ inches) long, it is red, black, and white. The pygmy flowerpecker (*D. pygmeum*) of the Philippines is only about 6 cm (2½ in.) long. The largest flowerpeckers are only about 23 cm (9 in.) in total length.

Philippine flowerpecker (*Prionochilus plateni*)
Painting by H. Jon Janosik

flowstone, mineral deposit found in "solution" caves in limestone. Flowing films of water that move along floors or down positive-sloping walls build up layers of calcium carbonate (calcite), gypsum, or other cave minerals. These minerals are dissolved in the water and are deposited when the water loses its dissolved carbon dioxide and therefore its carrying ability. Flowstone is usually white or translucent but may be stained various colours by minerals dissolved in the water.

Floyd, John Buchanan (b. June 1, 1806, Montgomery County, Va., U.S.—d. Aug. 26, 1863, Abingdon, Va.), U.S. politician who served as governor of Virginia, secretary of war, and Confederate general.

As a member of the state legislature (1847–48; 1855) and as a states' rights Democratic governor (1849–52), Floyd opposed secession, but his growing belief in the Southern cause led him to resign in 1860 from the Cabinet post to which Pres. James Buchanan had appointed him in 1857. At the same time, however, charges of financial irregularities in his office (never substantiated) prompted the President to request his resignation. With the outbreak of the Civil War (1861), he was appointed brigadier general by Confederate Pres. Jefferson Davis. In 1862 he was in command of the Confederate forces at Ft. Donelson in Tennessee but withdrew his brigade before the surrender, under circumstances never clarified. For this he was relieved of his command but was later made a major general of Virginia troops by the Virginia assembly.

Floyd
By courtesy of the Library of Congress, Washington, D.C.

Floyd, Pretty Boy, byname of CHARLES ARTHUR FLOYD (b. Feb. 3, 1904, Akins, Okla., U.S.—d. Oct. 22, 1934, near East Liverpool, Ohio), U.S. gunman whose run-ins with police and violent bank robberies made newspaper headlines.

After imprisonment for a payroll robbery (1925–29), Floyd mixed with gangsters in Kansas City, Mo., and adopted the machine gun as his professional trademark. He teamed up with others to rob banks in Ohio, Michigan, and Kentucky and then returned to Oklahoma and further bank robberies. He was gunned down by FBI agents pursuing him in an Ohio field.

flu: *see* influenza.

Fludd, Robert, Fludd also spelled FLUD, Latin ROBERTUS DE FLUCTIBUS (b. 1574, Bearsted, Kent, Eng.—d. Sept. 8, 1637, London), British physician, author, and mystical philosopher remembered for his devotion to the Rosicrucian Fraternity and for his occultic opposition to the scientific attitude.

Fludd, detail of an engraving from *Integrum Morborum Mysterium,* 1631
By courtesy of the Royal College of Physicians, London

The son of Sir Thomas Fludd, paymaster to Queen Elizabeth I's forces in France and the Low Countries, he studied at St. John's College, Oxford, before travelling in Europe for six years. On his return to Oxford he earned medical degrees (1605) and joined the College of Physicians (1609), although that body was reluctant to grant him the right to practice medicine. Nevertheless, he eventually became a prosperous London doctor and was able to afford an amanuensis who recorded his varied treatises. The Rosicrucian Fraternity, of debated origin, was the subject of his first book, *Apologia Compendiaria Fraternitatem de Rosea Croce* (1616; "Brief Apology for the Fraternity of the Rosy Cross").

Most of Fludd's writings represent the culmination of the occult, as distinct from the scientific, tendencies of the 17th century. Deriving his ideas from such diverse sources as the story of the creation of Adam in Genesis, the Jewish Kabbala, and the general tradition of alchemy, astrology, sympathetic magic, and chiromancy, Fludd was primarily interested in establishing the parallelisms between man and the world, both of them images of God. The experimental observations in Fludd's works are few, and their general tendency is opposed to the growing Rationalism and scientific approach of his time. In his view, medicine's role is to understand the functioning and malfunctioning of the human body by clues provided, for example, by parallelisms between the mind of man and the light of the Sun. The special analogies revealed by astrology and numerology are said to provide other medical insights.

In his time Fludd was criticized widely as a magician and for his occultic beliefs; the 19th-century British essayist Thomas de Quincey saw in his obscure writings a principal source of the symbolic ideas of freemasonry.

Flüe, Saint Nicholas of, German SANKT NIKLAUS VON FLÜE: *see* Nicholas of Flüe, Saint.

flügelhorn, brass musical instrument, the valved bugle used in European military bands. It has three valves, a wider bore than the cornet, and is usually pitched in B♭, occasionally in C. It was invented in Austria in the 1830s.

In the mid-20th century the flügelhorn found favour in some jazz bands. "Flügelhorn" also sometimes refers to the soprano and sopranino saxhorns.

fluid, any liquid or gas or generally any material that cannot sustain a tangential, or shearing, force when at rest and that undergoes a continuous change in shape when subjected to such a stress. This continuous and irrecoverable change of position of one part of the material relative to another part when under

shear stress constitutes flow, a characteristic property of fluids. In contrast, the shearing forces within a solid, held in a twisted or flexed position, are maintained; the solid undergoes no flow and can spring back to its original shape. Compressed fluids can spring back to their original shape, too, but while compression is maintained, the forces within the fluid and between the fluid and the container are not shear forces. The fluid exerts an outward pressure, called hydrostatic pressure, that is everywhere perpendicular to the surfaces of the container.

Various simplifications, or models, of fluids have been devised since the last quarter of the 18th century to analyze fluid flow. The simplest model, called a perfect, or ideal, fluid, is one that is unable to conduct heat or to offer drag on the walls of a tube or internal resistance to one portion flowing over another. Thus, a perfect fluid, even while flowing, cannot sustain a tangential force; that is, it lacks viscosity and is also referred to as an inviscid fluid. Some real fluids of low viscosity and heat conductivity approach this behaviour.

Fluids of which the viscosity, or internal friction, must be taken into account are called viscous fluids and are further distinguished as Newtonian fluids if the viscosity is constant for different rates of shear and does not change with time. The viscosity of non-Newtonian fluids either varies with the rate of shear or varies with time, even though the rate of shear is constant. Fluids in a class in this last category that become thinner and less viscous as they continue to be stirred are called thixotropic fluids. Printer's ink and paint, which run with difficulty but are easily applied, are thixotropic. In general, water, solutions, simple organic liquids, dilute suspensions and emulsions, and gases may be classified as Newtonian fluids. Concentrated suspensions and emulsions are generally non-Newtonian fluids.

fluid, in physiology, water of the body carrying ions and salts, found both intracellularly and extracellularly.

A brief treatment of body fluids follows. For full treatment, *see* MACROPAEDIA: Tissues and Fluids.

Water is taken into the body by drinking and excreted in sweat, urine, and feces. The body of a 145-pound (66-kilogram) man incorporates about 42 quarts (about 40 litres) of water; 29 quarts inside the cells and 13 quarts outside. This volume fluctuates constantly within narrow bounds, monitored and internally regulated by a volume-control system involving the heart, kidneys, vagus nerve, hypothalamus, and pituitary gland. The hormones associated with this system are vasopressin or antidiuretic hormone (ADH), adrenocorticotropic hormone, and aldosterone, which act in the kidneys to effect the increased retention of salt and water.

The body fluid is made electrolytic (*i.e.*, able to conduct electricity) by the presence of cations (positively charged atoms and molecules) and anions (negatively charged atoms and molecules). To maintain life, the fluid in the blood must show a slightly alkaline pH (hydrogen ion concentration) of 7.35–7.45, where pH 7 represents acid-base neutrality, and a pH of less than 7 indicates acidity. A viable pH is the product of a balance in the blood between carbonic acid (H_2CO_3), which enters the bloodstream during respiration through the alveoli (small air sacs in the lungs), and the alkaline bicarbonate (HCO_3), production and retention of which is regulated in the kidneys.

Various conditions can cause an excess or depletion of water or salts or an unhealthy hydrogen ion concentration in the body. Sensations of thirst and satiety result from dehydration and originate in the hypothalamus, at the base of the brain. Dehydration also is a factor in sodium deficiencies, when the kidneys (as a result of either insufficient renal blood supply, poor hormonal control, or in connection with a condition of diabetes mellitus) fail to conserve adequate salt. Sodium depletion can instigate low blood pressure, reduced urine volume, and inhibition of the excretory system leading to kidney failure. Mild cases may be treated by having the affected person drink salt water. In severe cases salt water is injected into a vein.

Sodium deficiency without dehydration occurs when drinking salt-free beverages after heavy sweating makes up for fluid loss without replenishing salt loss, resulting in a net reduction in the concentration of sodium in the body fluid.

Acute or chronic diarrhea, vomiting, intestinal fistulae, or various urinary abnormalities bring about potassium deficiencies. Symptoms are apathy, confusion, and weakness; severe cases may produce paralysis, changes in heartbeat, and even death. Potassium must be given either orally or intravenously.

Potassium intoxication, which may follow upon kidney failure, causes reduction in the volume of urine excreted, producing symptoms much like those of potassium depletion. Treatment is by elimination of potassium-rich foods (especially fruits) and protein from the diet.

Edema is the abnormal retention of body fluids in body tissues. Various disorders, including heart failure and liver and kidney disease, may produce a condition of low blood volume. Low blood volume initiates a flow of fluid out of the blood vessels into the surrounding tissue, since the number of proteins in the blood is reduced and fluids tend by osmosis to move from less concentrated to more concentrated areas. Then the system which regulates the volume of water in the body responds to the drop in blood volume by a series of hormonal changes which swell the volume of water in the tissues even more. General edema results when the cause is kidney dysfunction, edema of the peritoneal cavity when the cause is liver disease, and edema of the pulmonary or the systemic circulation when the cause is heart failure. These conditions are now treated by treating the diseases that give rise to them, or, sometimes, by the administration of diuretics.

Alkalosis is a condition of excess alkalinity of the blood resulting from a loss of hydrogen ions. Hydrogen ions are taken from the blood to make the hydrochloric acid used by the stomach in digestion; the loss of ions which occurs when a large meal is vomited may result in alkalosis, which is generally corrected by the system without treatment. More serious or chronic alkalosis resulting from prolonged vomiting or potassium deficiency may require treatment by injection of a solution containing sodium, ammonium, and potassium chloride. Respiratory alkalosis may occur when thin air at high altitudes stimulates an increase in respiration with a concomitant increase in the rate of loss of the carbon dioxide the body uses to make carbonic acid. It also occurs as a consequence of hyperventilation.

Acidosis is a condition of excess acidity of the blood, resulting from an overabundance of hydrogen ions. Metabolic acidosis may occur as a result of increased formation of hydrogen ions during exercise, or decreased elimination of hydrogen ions (frequently through kidney failure), or an increased loss of bicarbonate ions (often as a result of diarrhea or fistulas). The acid-alkali balance may be restored automatically by the system, or in severe cases the affected person may be given sodium bicarbonate. Respiratory acidosis results from failure of the lungs to eliminate sufficient carbon dioxide. It occurs in conditions such as barbiturate or morphine poisoning, or respiratory muscle paralysis, as in poliomyelitis. Respiratory acidosis is also treated by treating the underlying disease.

fluid mechanics, the study of the effects of forces and energy on liquids and gases. Like other branches of classical mechanics, the subject subdivides into statics (often called hydrostatics) and dynamics (fluid dynamics, hydrodynamics, or aerodynamics). Hydrostatics is a comparatively elementary subject with a few classical results of importance but little scope for further development. Fluid dynamics, in contrast, is a highly developed branch of science that has been the subject of continuous and expanding research activity from about 1840 to the present day.

A brief treatment of fluid mechanics follows. For full treatment, *see* MACROPAEDIA: Mechanics: *Fluid mechanics.*

The development of fluid dynamics has been strongly influenced by its numerous applications. Some of the fields of application to engineering, the environmental sciences, and the biological sciences are evident: aeronautical engineering, marine engineering, meteorology, oceanography, and the study of blood flow, the dynamics of swimming, and the flight of creatures. There are also many less immediately obvious applications.

Fluid dynamics is studied both theoretically and experimentally, and the results are described both mathematically and physically. The phenomena of fluid motion are governed by known laws of physics—conservation of mass, the laws of classical mechanics (Newton's laws of motion), and the laws of thermodynamics. These can be formulated as a set of nonlinear partial differential equations, and in principle one might hope to infer all the phenomena from these. In practice, this has not been possible; the mathematical theory is often difficult, and sometimes the equations have more than one solution, so that subtle considerations arise in deciding which one will actually apply. As a result, observations of fluid motion both in the laboratory and in nature are also essential for understanding the motion of fluids.

Liquids and gases are classified together as fluids because, over a wide range of situations, they have identical equations of motion and thus exhibit the same flow phenomena. Scaling analysis makes it possible to infer when two geometrically similar situations—of perhaps quite different size and involving different fluids (either both liquids, both gases, or one of each)—will give rise to the same type of flow. It leads to the formulation of various nondimensional parameters, with names like Reynolds number, Mach number, Froude number, in terms of which fluid-dynamical results are usually presented.

Flow configurations equally applicable to liquids and gases include flow through pipes, flow due to relative motion between a body and ambient fluid, and thermal convection—gravitationally driven flow due to temperature differences. Sometimes the effect of rotation of the whole system (of particular significance in meteorology and oceanography) is included. A common feature of all these flows is their tendency to undergo a spontaneous transition from one type of motion to another. The best known type of transition is that from laminar flow (a smooth, regular type of flow) to turbulent flow (in which rapid, irregular fluctuations arise). Instability can also lead to a complicated flow with a highly regular structure (such as an orderly array of vortices or of convection cells). Much current research is concerned with gaining an understanding of these various transitions and, in particular, of how a deterministic set of equations can account for the chaotic behaviour of turbulent fluids.

During flow at speeds comparable to the speed of sound, the density of fluids changes significantly. This phenomenon is of practical

importance only for gases, in which shock waves may occur. These waves involve an almost discontinuous change in the velocity, temperature, pressure, and density of the fluid.

The main phenomena of importance for liquids but not for gases are those associated with free surfaces, such as the upper boundary of a liquid in a partly filled vessel. The fact that the speed of water waves varies with wavelength and with amplitude leads to a wide variety of effects. These include the hydraulic jump (or bore)—a sudden change in water level, analogous to a shock wave—and the soliton—a single large-amplitude pulse that propagates without change of form.

fluid power: *see* hydraulic power.

fluidics, the technology of using the flow characteristics of liquid or gas to operate a control system (*q.v.*). One of the newest of the control technologies, fluidics has in recent years come to compete with mechanical and electrical systems.

Although fluidic principles are fairly old, it was not until about 1960 that researchers attempted to use fluidics commercially. The demand for reliable controls in space research stimulated progress. In the 1930s Henri Coandă, a Romanian scientist, described what is now known as the Coandă effect, a major contribution to fluidic technology. He observed that as a free jet emerges from a jet nozzle the steam will tend to follow a nearby curved or inclined surface. It also "attaches" itself to and flows along this surface if the curvature or angle of inclination is not too sharp. Coandă explained this tendency as being caused by the jet stream's entraining (picking up) nearby fluid molecules. When the supply of these molecules is limited by an adjacent surface, a partial vacuum develops between the jet and the surface. If the pressure on the other side of the jet remains constant, the partial vacuum, which is a lower pressure region, will force the jet to bend and attach itself to the wall.

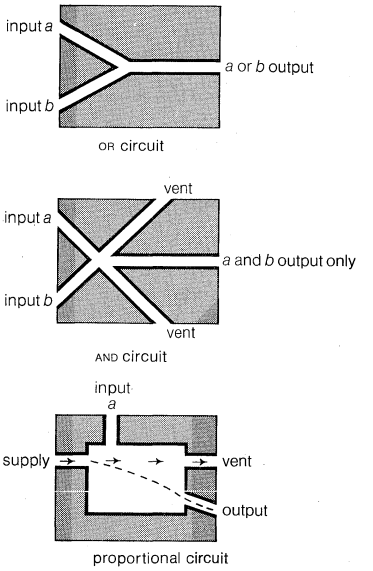
Because fluidics is not as rapid as electronics, it is unlikely to compete in fields with ultrahigh-speed requirements. On the other hand, in many applications fluidics is advantageous. It is now possible to detect, interlock, and power complex operations by using air throughout a system. Controls can be installed by a competent fitter who might not be capable of dealing with electronic or electrical systems. The elimination of electrical contacts prevents a possible fire hazard.

Pneumatic circuits require controls with simple interlocking, performed by air-piloted and mechanically operated control valves. Because it employs the same medium, fluidics is useful for sensitive detection and complex control as part of a pneumatic system.

Combining hydraulics and fluidics is more complicated, however, because the same medium is not used. Yet since both systems require plumbing expertise, labour problems can be reduced. Power-output devices handling hydraulic pressures that respond to fluidic signals are available commercially.

Fluidics has been applied to industrial problems on a wide scale, with no particular industry emerging as an obvious choice. Fluidics can operate in hazardous environments and sense objects by methods not available previously. Some typical applications include a weighing system that selects 10 different weights of raw material before machining; air-jet detection of delicate material (the roof lining of an automobile) that would be damaged by mechanical methods; and sonic detectors operating in the highly inflammable, contaminated area of a paint-spray booth. These detectors sense sound waves without disturbing the freshly painted surface.

Principles of operation. Fluidic devices operate on either the digital principle (they are either "on" or "off") or the analogue principle (the output of the device is continuously proportional to the input). The accompanying Figure illustrates the distinction.



Basic fluidic circuits

In the case of an OR circuit, as shown in the Figure, input *a* or *b* can produce an output signal, because each has a path through which the signal can flow to the output. This system is called logical (and digital) because no output is possible without an input. Either condition will satisfy the required output (the OR function, as an output, is produced whenever one or the other input is energized).

When an AND circuit is involved, both inputs are required for an output because the flow from *a* or *b* alone, without a counterbalancing force, will go out one of the vents. If both are applied, they will collide, producing flow out of the centre port marked *a* and *b*. This again is logical (and digital) because no output is possible unless both signals are applied. All conditions must be satisfied before an output is obtained (the AND function) as an output signal will be produced only if an input is applied to both inputs *a* and *b* simultaneously.

With a proportional circuit, fluid flowing from the supply will go out of the vent unless input *a* is applied. This is an analogue effect because the output can be altered proportionally from minimum to maximum by varying the power of input *a*.

Fluidic devices can thus produce both logic (digital) and analogue (proportional) effects or functions. The OR and the AND are the most common logic functions.

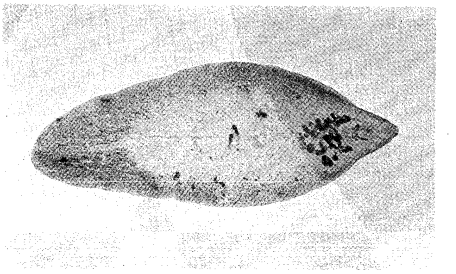
In most fluidic devices, low-value input pressures or flows can control higher output pressures or flows. This is what is meant by the term fluid amplifier. A supply of fluid entering a device becomes a stream forced to follow a chosen path through carefully designed internal shapes before giving an output. Input jets of far lower power are positioned to give the greatest possible effect on the stream, thereby controlling the output. Fluid amplifiers respond to very small fluid signals provided by such devices as temperature or velocity detectors, generally by input sensors attached to existing mechanical movements. The number of devices controlled by one similar device is called the fan-out ratio. For example, if the output of one device is so strong that it can switch four others at the same time, the fan-out ratio is four.

Technological developments. Among the more recent advances in fluidics is modular construction of circuits—*i.e.,* construction of combinations of components that can be readily fitted together to form whole systems. A motor governor system, for example, converts pulsating frequencies of air motor exhausts into pressure levels, which are then compared to preset values. The difference in pressure is amplified to provide speed regulation of the motor. Converting the frequency of ON/OFF pulses into progressively increasing or decreasing values is called digital proportional. Fluidic devices are stacked in layers to provide a common supply and interconnections.

Another significant development is the edge tone amplifier, which works very much like a musical instrument; air blown at a sharp wedge oscillates at very high frequencies (about 5,000 hertz) to produce an output that is virtually continuous. Frequency of oscillation (sound) is controlled mechanically or by varying the force of the air directed at the wedge.

Sound detection is possible with laminar streams that can be made sensitive to certain sound frequencies. A beam of sound can span distances for detection without even the slight force exerted by an air jet.

fluke, also called TREMATODE, any member of the invertebrate class Trematoda (phylum Platyhelminthes), a group of parasitic flatworms including nearly 6,000 species. Flukes occur worldwide and range in size from about 5 millimetres (0.2 inch) to several centimetres; most do not exceed 100 millimetres (4 inches) in length.



Liver fluke (*Fasciola hepatica*)
Grant Heilman—EB Inc.

Flukes are parasites of all classes of vertebrates but most commonly parasitize fish, frogs, and turtles; they also parasitize humans, domestic animals, and invertebrates such as mollusks and crustaceans. Some are external parasites (ectoparasites); some attach themselves to internal organs (endoparasites); others are semi-external, attaching themselves to the lining of the mouth, to the gills, or to the cloaca (the end of the digestive tract). Some attack a single host, while others require two or more hosts.

The symmetrical body of a fluke is covered with a noncellular cuticle. Most are flattened and leaflike or ribbonlike, although some are stout and circular in cross section. Muscular suckers on the ventral (bottom) surface, hooks, and spines are used for attachment. The body is solid and filled with a spongy connective tissue (mesenchyme) that surrounds all the body organs. A circulatory system is absent. The digestive system consists of a simple sac with a mouth either at the anterior end or in the middle of the ventral surface. An anus is usually absent, but some species have one or two anal pores. The nervous system consists of a pair of anterior ganglia, or nerve centres, and usually three pairs of lengthwise nerve cords.

Most species are hermaphroditic; *i.e.,* functional reproductive organs of both sexes occur in the same individual. In some, however, the sexes are separate. Most species pass through egg, larval, and mature stages.

Blood flukes occur in most types of vertebrates; three species attack humans: the urinary blood fluke (*Schistosoma haematobium*), the intestinal blood fluke (*S. mansoni*), and

the Oriental blood fluke (*S. japonicum*). The human diseases caused by them are known as schistosomiasis (bilharziasis); they affect millions of persons, particularly in Africa and east Asia.

The urinary blood fluke (*S. haematobium*), which lives in the veins of the urinary bladder, occurs mainly in Africa, southern Europe, and the Middle East. Eggs, laid in the veins, break through the vein wall into the bladder and are voided during urination. The larval fluke develops in the body of a snail (chiefly of the genera *Bulinus* and *Physopsis*), the intermediate host. The mature larva makes its way into the body of the final host, man, through the skin or the mouth.

The intestinal blood fluke (*S. mansoni*), which lives in the veins around the large and small intestines, occurs primarily in Africa and in northern South America. The eggs pass from the host with the feces. The larva enters the body of a snail (any of several genera), the intermediate host, and returns to a human host through the skin.

The Oriental blood fluke (*S. japonicum*), which occurs primarily in China, Japan, Taiwan, the East Indies, and the Philippine Islands, differs from *S. mansoni* and *S. haematobium* in that it may attack vertebrates other than man, including various domestic animals, rats, and mice. Snails of the genus *Oncomelania* are the intermediate host. The adult occurs in the veins of the small intestine. Some eggs are carried in the bloodstream to various organs and may cause a variety of symptoms, including enlargement of the liver. Human hosts may die from severe infestations.

Flukes of detrimental economic significance to man include the widely occurring liver fluke of cattle (*Fasciola hepatica*) and the Chinese, or Oriental, liver fluke (*Opisthorchis sinensis,* or *Clonorchis sinensis*). *F. hepatica* causes the highly destructive "liver rot" in sheep and other domestic animals. Man may become infested with this fluke by eating uncooked vegetables.

The Chinese liver fluke infests a variety of mammals, including man. In addition to the snail as an intermediate host, the Chinese liver fluke infests fish as a second intermediate host before passing to the final host. The cat liver fluke, *Opisthorchis felineus,* which may also infest man as the final host, also requires a fish as its second intermediate host.

Flumendosa River, Italian FIUME FLUMENDOSA, river, rising in Monti del Gennargentu in southeastern Sardinia, Italy, and flowing 79 mi (127 km) west and southeast, entering the Tyrrhenian Sea near Muravera. The Ente Autonomo del Flumendosa, a dam and irrigation project, was established in 1946 to develop the resources of the Flumendosa Basin.

fluorapatite, common phosphate mineral, a calcium fluoride phosphate, $Ca_5(PO_4)_3F$, that occurs as minute, often green, glassy crystals in almost all igneous rocks and in magnetite deposits, high-temperature hydrothermal veins, and metamorphic rocks; it also occurs as collophane in marine deposits. For detailed physical properties, *see* phosphate mineral (table).

The fluoride ion is often replaced in the crystal structure by chloride or a hydroxide group; in nature there are complete chemical variations, called solid-solution series, between fluorapatite and chlorapatite and between fluorapatite and hydroxylapatite. Manganese can replace up to 10 percent of the calcium in fluorapatite derived from granite pegmatites.

fluorescein, also called RESORCINOLPHTHALEIN, a deep red, synthetic colouring matter named for the intense, yellowish-green fluorescence of its solutions, visible even at dilutions of 1:40,000,000. Its sodium salt, uranine, is used as a water tracer and marker. Halogenated derivatives made from fluorescein include eosin and erythrosin.

Fluorescein was first prepared in 1871 by the German chemist Adolf von Baeyer by heating phthalic anhydride and resorcinol; the modern procedure differs only in the use of zinc chloride as a catalyst.

fluorescence photography, process that records the glow or visible light given off by certain substances when they are irradiated by ultraviolet rays. The exclusively ultraviolet irradiation is accomplished by means of a filter at the light source; another filter, placed over the camera lens, absorbs the reflected ultraviolet rays, permitting only the visible light (fluorescence) from the object itself to be recorded on the film. Normal lenses and either black-and-white or colour film materials are used.

Fluorescence photography can identify dyes, stains, and markings, specific chemical substances, and fluorescent components in microscope specimens.

fluorescent lamp, electric discharge lamp, cooler and more efficient than incandescent lamps, that produces light by the fluorescence of a phosphor coating. A fluorescent lamp consists of a glass tube filled with a mixture of argon and mercury vapour. Metal electrodes at each end are coated with an alkaline-earth oxide that gives off electrons easily. When current flows through the ionized gas between the electrodes, it emits ultraviolet radiation. The inside of the tube is coated with phosphors, substances that absorb ultraviolet radiation and fluoresce (re-radiate the energy as visible light). Two common phosphors are zinc silicate and magnesium tungstate. A starter and ballast provide the extra voltage, up to four times operating voltage, needed to ionize the gas when starting.

fluorescent screen (image-forming device): *see* fluoroscope.

fluorine (F), most reactive chemical element, lightest member of the halogen elements, or Group VIIa of the periodic table. Under ordinary conditions fluorine is a gas a little heavier than air, with a pale greenish-yellow colour and an irritating odour; inhalation except in very low concentrations is dangerous. Upon cooling, fluorine becomes a yellow liquid at −188° C (−306° F) and freezes at about −219.62° C (−362° F). Fluorine occurs combined in the widely distributed mineral fluorite (calcium fluoride, fluorspar), its chief source, in the minerals cryolite and fluorapatite, and in small amounts in seawater, bones, and teeth. Not a rare element, it makes up about 0.065 percent of the Earth's crust. Only one isotope occurs in nature, stable fluorine-19.

Fluorine is difficult to isolate from its compounds, and in fact it is impossible to free it by chemical means. No other element is powerful enough, as an oxidizing agent, to replace it. The French chemist Henri Moissan first isolated fluorine (1886) by electrolysis of anhydrous hydrogen fluoride (HF), in which potassium hydrogen fluoride (KHF_2) had been dissolved to make it conduct a current. Elemental fluorine of high purity is prepared commercially by Moissan's procedure. The elemental gas is used as an oxidizer in rocket fuels and to prepare fluorides.

Fluorine, composed of two-atom molecules (F_2), combines with all other elements except helium, neon, and argon to form ionic or covalent fluorides. Its chemical activity can be attributed to its extreme ability to attract electrons (it is the most electronegative element) and to the small size of its atoms. The oxidation state of −1 is the only one observed in fluorine compounds. Because of the small size of the fluoride ion (F^-), it forms many stable complexes with positive ions; for example, hexafluorosilicate(IV) (SiF_6^{2-}) and hexafluoroaluminate(III) (AlF_6^{3-}).

One of the principal industrial compounds of fluorine is hydrogen fluoride, obtained by treating fluorite with sulfuric acid. It is employed in the preparation of numerous inorganic and organic fluorine compounds of commercial importance; *e.g.,* sodium aluminum fluoride (Na_3AlF_6), used as an electrolyte in the electrolytic production of aluminum metal; and uranium hexafluoride (UF_6), utilized in the fractional diffusion process of separating uranium-235 from uranium-238 for reactor fuel. A solution of hydrogen fluoride gas in water is called hydrofluoric acid, large quantities of which are consumed in industry for cleaning metals and for polishing, frosting, and etching glass.

Boron trifluoride (BF_3) and antimony trifluoride (SbF_3), like hydrogen fluoride, are important catalysts for organic reactions; cobaltic fluoride (CoF_3) and chlorine trifluoride (ClF_3) are useful fluorinating agents; and sulfur hexafluoride is used as a gaseous electrical insulator. Sodium fluoride (NaF) is employed in the treatment of dental caries and is often added in small amounts to fluoride-deficient water supplies (fluoridation) to reduce tooth decay.

Elemental fluorine, often diluted with nitrogen, reacts with hydrocarbons to form corresponding fluorocarbons in which some or all hydrogen has been replaced by fluorine. The resulting compounds are usually characterized by great stability, chemical inertness, high electrical resistance, and other valuable physical and chemical properties. This fluorination may be accomplished also by treating organic compounds with cobaltic fluoride or by electrolyzing their solutions in anhydrous hydrogen fluoride. Useful plastics with non-sticking qualities such as Teflon, polytetrafluoroethylene, $(CF_2CF_2)_x$, are readily made from unsaturated fluorocarbons. Organic compounds containing chlorine, bromine, or iodine are fluorinated to produce compounds such as dichlorodifluoromethane (Cl_2CF_2), the coolant used in most household refrigerators and air conditioners and the propellant widely used to disperse aerosols such as insecticide and paint sprays.

atomic number	9
atomic weight	18.9984
melting point	−219.62° C (−362° F)
boiling point	−188° C (−306° F)
density (1 atm, 0° C)	1.696 g/litre
oxidation states	−1
electronic config.	2-7 or $1s^22s^22p^5$

fluorine deficiency, condition in which an organism fails to receive an adequate supply of fluorine, a water-soluble element stored in teeth and bones. Massive doses of fluorine or fluoride compounds can be lethal, and fluorides are used as the toxic ingredient of many insect poisons. Scientists feel they have proved conclusively, however, that dental caries is reduced in areas where natural fluoridation of water is moderate. In many areas where fluorides are low or lacking, this mineral has been added to water supplies, although such actions have in some cases provoked controversy. Studies have determined that the enamel of sound teeth contains more fluoride than is found in the teeth of persons prone to dental caries. Excess amounts of fluorine may cause tooth mottling, which, however, presents no problem other than appearance.

Fluorine is also known to decrease the incidence of rickets in infants and children. It accentuates the effect of thyroid secretion in maintaining a normal basal metabolic rate. It has been determined that fluorides in minute amounts limit the acid production of bacteria in the mouth.

Dietary sources cover a wide range of foods, depending on regional variations in soil and water supply of fluorine.

fluorite, also called FLUORSPAR, common halide mineral, calcium fluoride (CaF_2); the

principal fluorine mineral. It is usually quite pure, but as much as 20 percent yttrium or cerium may replace calcium. Fluorite occurs

Fluorite from Durham, Eng.

By courtesy of the Field Museum of Natural History, Chicago; photograph, John H. Gerard—EB Inc.

most commonly as a glassy, many-hued vein mineral and is often associated with lead and silver ores; it also occurs in cavities, in sedimentary rocks, in pegmatites, and in hot-springs areas. It is widespread in Germany, France, England, Mexico, and the central United States. Fluorite is used as a flux in the manufacture of open-hearth steel, of aluminum fluoride, of artificial cryolite, and of aluminum. It is used in opalescent glass, in iron and steel enamelware, in the production of hydrofluoric acid, in the refining of lead and antimony, and in the manufacture of high-octane fuels (as a catalyst). Because of its low index of refraction and low dispersion, clear, colourless fluorite of optical quality is used for apochromatic lenses. At one time blue john, a variety from Derbyshire, Eng., was widely used in ornamental vases and other objects. For detailed physical properties, *see* halide mineral (table).

fluorocarbon, compound composed of the elements carbon and fluorine; *see* halocarbon.

fluoroethylene: *see* vinyl fluoride.

fluoroscope, also called FLUORESCENT SCREEN, instrument consisting of a surface containing phosphors that glow when impinged on by X-rays or gamma rays; it is used to transform images made up of invisible radiations into visible light. In diagnostic radiology (fluoroscopy), a beam of penetrating radiation is passed through parts of the body; transmitted radiation forms an image of the internal organs in motion on the screen for viewing. Fluoroscopes are also used for the examination of, and search for flaws in, raw materials, manufactured articles, and welded joints.

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

fluorosis, chronic intoxication with fluorine (usually combined with some other element to form a fluoride) that results in changes in the skeleton and ossification of tendons and ligaments. Exposure to fluoride in optimum amounts (about one part per million of fluoride to water) is claimed to be beneficial to the teeth (in the prevention of caries) and probably to bone development; fluorides ingested in very high amounts over a short period are general poisons that produce quick death. Mild chronic exposure (6–8 parts per million of water) will cause mottling of tooth enamel in children, but the bones are unaffected. In more severe chronic exposure, bone calcium is gradually replaced by fluorine; the bones become soft and crumbly and turn chalky white. Protrusions of new bone develop in abnormal places. There are few early symptoms, but late developments include stiffness, inability to move the spine, and neurologic symptoms when nerves of the spinal cord are compressed.

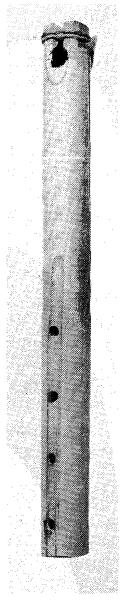
Chronic exposure occurs from air pollution in certain areas, among workers in the insecticide, aluminum-mining, and phosphate-fertilizer industries, and in whole groups of people who live in areas with waters naturally high in fluorides. The latter form of exposure is not a significant cause of fluorosis in the Western Hemisphere, but in parts of India and Arabia bone affections are endemic.

Fluothane (medicine): *see* halothane.

Flushing (The Netherlands): *see* Vlissingen.

Flushing, northern section of the borough of Queens, New York City, U.S., at the head of Flushing Bay (East River). Settled in 1645 by English nonconformists (who had probably been living at Vlissingen [Flushing], Holland), it became a Quaker centre under the leadership of John Bowne. The Flushing Remonstrance (1657) protested the persecution of Quakers and the trial of Bowne. In the late 18th and early 19th centuries Flushing was noted for its commercial nurseries. It flourished as a township and then a village until it was absorbed by Queens in 1898. Flushing Meadow–Corona Park was the site of the 1939–40 and 1964–65 New York world's fairs (the Hall of Science remains as an exhibition centre), and in 1946–49 it served as the temporary headquarters for the United Nations General Assembly. In 1978 the park became the site of the U.S. Tennis Association's National Tennis Center. Shea Stadium, home of the New York Mets and Jets (baseball and football teams, respectively), is also in Flushing Meadow.

flute, French FLÛTE, German FLÖTE, wind instrument in which the sound is produced by a stream of air directed against a sharp edge, upon which the air breaks up into eddies that alternate regularly above and below the edge, setting into vibration the air enclosed in the flute. In vertical, end-vibrated flutes—such as the Balkan *kaval,* the Arabic *nāy,* and panpipes—the player holds the pipe end to his



Indonesian duct flute, bamboo; in the Horniman Museum, London

By courtesy of the Horniman Museum, London; photograph, J.R. Freeman & Co. Ltd.

mouth, directing his breath against the opposite edge. In China, South America, Africa, and elsewhere, a notch may be cut in the edge to facilitate sound generation (notched flutes). Vertical nose flutes are also found, especially in Oceania. In transverse, or cross, flutes (*i.e.,* horizontally held and side blown), the stream of breath strikes the opposite rim of a lateral mouth hole. Vertical flutes such as the recorder, in which an internal flue or duct directs the air against a hole cut in the side of the instrument, are known as fipple, or whistle, flutes.

Flutes are typically tubular but may also be globular, as with the ocarina and primitive gourd flutes. If a tubular flute is stopped at the lower end, its pitch is an octave lower than that of a comparable open flute.

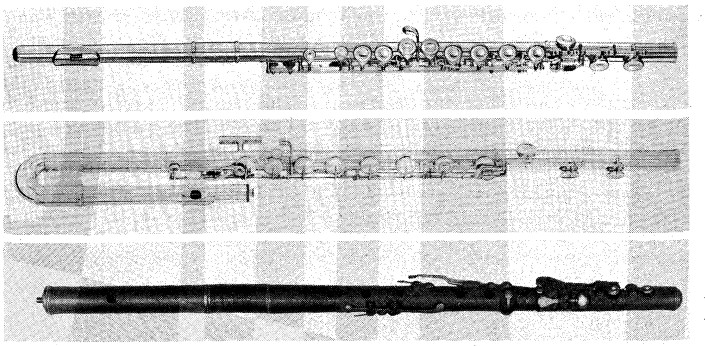
The characteristic flute of Western music is the transverse flute held sideways to the right of the player. It was known in ancient Greece and Etruria by the 2nd century BC and was next recorded in India, then China and Japan, where it remains a leading wind instrument. It is first depicted in Europe *c.* 1100 AD. In the 16th century the tenor flute, pitched in G, was played in consort with descant and bass flutes (pitched in D and C respectively). All were typically of boxwood with six finger holes and no keys, semitones being made by cross-fingering (uncovering the holes out of sequence), and retained the cylindrical bore of their Asiatic bamboo relatives. These 16th-century flutes were made obsolete late in the 17th century by the one-keyed conical flute, probably conceived by the celebrated Hotteterre family of makers and players in Paris. A conical flute is made in separate joints, the head joint being cylindrical, the others contracting toward the foot. Two joints were common in the 18th century, the upper being supplied in alternate lengths for tuning purposes. The instrument was known then as the *flauto traverso, traversa,* or German flute, as distinct from the common flute, usually called the recorder.

From 1760, in order to improve various semitones, three chromatic keys in addition to the original E♭ key began to be used. By 1800 the typical orchestral flute had these keys plus a lengthened foot joint to C, making six keys altogether. Two more keys produced the eight-keyed flute, which preceded the modern instrument and which lasted, with various auxiliary keys, in some German orchestras into the 20th century.

Theobald Böhm, a Munich flute player and inventor, set out to rationalize the instrument, creating his new conical model in 1832. He replaced the traditional hole layout with an acoustically based one and improved the venting by replacing closed chromatic keys with open-standing keys, devising for their manipulation a system of ring keys on longitudinal axles (rings allow a player to close an out-of-reach key in the same motion as covering a finger hole).

This flute was superseded in 1847 by Böhm's second design, with its experimentally evolved cylindrical bore (having a contracting or parabolic head)—the flute since used. The loss of a certain depth and intimacy of tone of the old conical flute has been offset by gains in evenness of notes, complete expressive control throughout the compass at all dynamic levels, and almost limitless technical flexibility.

A modern Böhm-system flute (pitched in C with the range c′–c) is made of wood (cocuswood or blackwood) or metal (silver or a substitute). It is 26½ inches (67 centimetres) long, with a bore of about ¾ inch, built in three sections. The body, or middle joint, and the foot joint (sometimes made in one piece) have the note holes (13 at least), which are controlled by an interlocking mechanism of padded key plates hinged on a longitudinal axis. The bore narrows in the head joint, which contains the mouth hole, and is closed just above the hole by a cork or fibre stopper; it is open at the foot end. Other flute sizes include the piccolo, the alto flute (in England sometimes called the bass flute) in G, the bass



(Top to bottom) Contemporary Western flute, bass flute, and eight-keyed conical flute; in the Victoria and Albert Museum, London

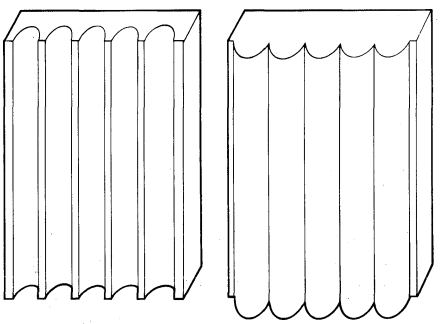
By courtesy of (top, centre) Conn Corporation, Oak Brook, Ill., (bottom) the Victoria and Albert Museum, London

(or contrabass) flute an octave below the flute, and the various sizes used in military flute bands, generally pitched in D♭ and A♭.

flutemouth, either of two families of elongated, long-snouted, marine fishes: Fistulariidae, the cornetfish (*q.v.*), and Aulostomidae, the trumpet fish (*q.v.*).

fluting and reeding, also called GADROONING, in architectural decoration, surfaces worked into a regular series of (vertical) concave grooves or convex ridges, frequently used on columns. In Classical architecture fluting and reeding are used in the columns of all the orders except the Tuscan. In the Doric order there are 20 grooves on a column and in the Ionic, Corinthian, and Composite orders there are 24.

Sometimes, although not in the Doric, the flutes are partly filled by a small, round, convex molding, or bead, and are then known as cabled; this decoration does not usually extend higher than one-third of the shaft. Sometimes channeling, slightly resembling fluting, is found on Norman pillars, an instance of which is found in the crypt of Canterbury Cathedral, Kent, Eng. Exactly the same kind



(Left) Fluting and (right) reeding

From M.S. Briggs, *Everyman's Concise Encyclopaedia of Architecture*; E.P. Dutton & Co., Inc., and J.M. Dent & Sons Ltd.

of ornament occurs frequently in Germany—*e.g.*, in the crypt of Roda Rolduc, near Aachen, which, it has been suggested, might be copied from Canterbury, and in many 12th-century buildings in other parts of Europe. Sometimes the flutings are carried diagonally across the columns, as in the pillars of the cathedral at Durham, Eng.

flutter and wow, in sound reproduction, waver in a reproduced tone or group of tones that is caused by irregularities in turntable or tape drive speed during recording, duplication, or reproduction. Low-frequency irregularities (as one per revolution of a turntable, referred to as "once arounds") cause wow and are recognized aurally as fluctuations in pitch. Irregularities that occur at higher frequencies are called flutter and cause a roughening of the tone: a piano sounds like a harp, and voices waver with small, rapid variations above and below proper pitch. Included among the causes of flutter and wow in disks are high spots in drive rollers and an off-centre hole in the disk. In tape and film reproducers, characteristic causes include nonuniform tension in take-up and payoff reels and mechanical distortion of the tape. Low-frequency background noise, either recorded on disk or tape from the recording mechanism or added to the reproduced tone from the reproducing mechanism, is known as rumble and is usually the result of vibration of the drive mechanism.

fluvial process, the physical interaction of flowing water and the natural channels of rivers and streams. Such processes play an essential and conspicuous role in the denudation of land surfaces and the transport of rock detritus from higher to lower levels.

A brief treatment of fluvial processes follows. For full treatment, *see* MACROPAEDIA: Geomorphic Processes.

Over much of the world the erosion of landscape, including the reduction of mountains and the building of plains, is brought about by the flow of water. As the rain falls and collects in watercourses, the process of erosion not only degrades the land, but the products of erosion themselves become the tools with which the rivers carve the valleys in which they flow. Sediment materials eroded from one location are transported and deposited in another, only to be eroded and redeposited time and again before reaching the ocean. At successive locations, the riverine plain and the river channel itself are products of the interaction of a water channel's flow with the sediments brought down from the drainage basin above.

The velocity of a river's flow depends mainly upon the slope and the roughness of its channel. A steeper slope causes higher flow velocity, but a rougher channel decreases it. The slope of a river corresponds approximately to the fall of the country it traverses. Near the source, frequently in hilly regions, the slope is usually steep, but it gradually flattens out, with occasional irregularities, until, in traversing plains along the latter part of the river's course, it usually becomes quite mild. Accordingly, large streams usually begin as torrents with highly turbulent flow and end as gently flowing rivers.

In floodtime, rivers bring down large quantities of sediment, derived mainly from the disintegration of the surface layers of the hills and valley slopes by rain and from the erosion of the riverbed by flowing water. Glaciers, frost, and wind also contribute to the disintegration of the Earth's surface and to the supply of sediment to rivers. The power of a river current to transport materials depends to a large extent on its velocity, so that torrents with a rapid fall near the sources of rivers can carry down rocks, boulders, and large stones. These are gradually ground by attrition in their onward course into shingle, gravel, sand, and silt and are carried forward by the main river toward the sea or partially strewn over flat plains during floods. The size of the materials deposited in the bed of the river becomes smaller as the reduction of velocity diminishes the transporting power of the current.

Since the earliest days of modern applied hydraulics, engineering research has attempted to better understand sediment transportation. Because sediment particles are generally heavier than the amount of water they displace, the Archimedes principle could not be used to explain the fact that heavy sediment was capable of being lifted and transported by flowing water. Another explanation was, consequently, required. Twentieth-century research distinguishes, in this connection, between "bed load" on the one hand and "suspended load" on the other. The former is composed of the larger particles, which are either rolled or pushed along the bed of the stream or which "jump," or saltate, from the crest of one ripple to another if the velocity is sufficiently great. On the other hand, the smaller particles, the suspended sediment once picked up and lifted by the moving water, may remain in suspension for considerable periods of time and thus be transported over many kilometres.

flux, in metallurgy, any substance introduced in the smelting of ores to promote fluidity and to remove objectionable impurities in the form of slag. Limestone is commonly used for this purpose in smelting iron ores. Other materials used as fluxes are silica, dolomite, lime, borax, and fluorite. In soldering, a flux is used to remove oxide films, promote wetting, and prevent reoxidation of the surfaces during heating. Rosin is widely used as a noncorrosive flux in soldering electronic equipment; for other purposes, a water solution of zinc chloride and ammonium chloride may be used. *See also* slag.

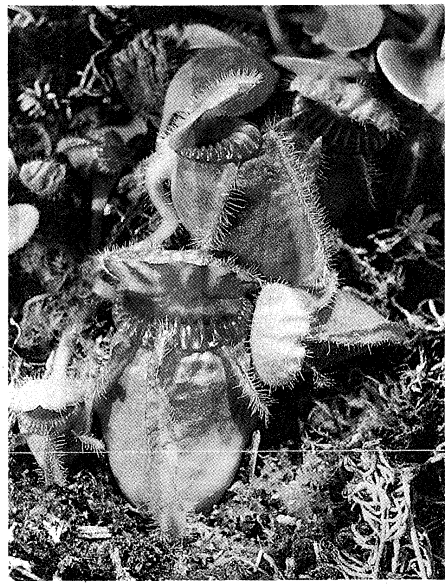
fluxion, in mathematics, the original term for derivative (*q.v.*), introduced by Isaac Newton in 1665. Newton referred to a varying (flowing) quantity as a fluent and to its instantaneous rate of change as a fluxion. Newton stated that the fundamental problems of the infinitesimal calculus were: (1) given a fluent (that would now be called a function), to find its fluxion (now called a derivative); and, (2) given a fluxion (a function), to find a corresponding fluent (an indefinite integral). Thus, if $y = x^3$, the fluxion of the quantity y equals $3x^2$ times the fluxion of x; in modern notation, $dy/dt = 3x^2(dx/dt)$. Newton's terminology and notations of fluxions were eventually discarded in favour of the derivatives and differentials that were developed by G.W. Leibniz. *See also* calculus.

fly, any of several thousand species of insects belonging to the order Diptera and characterized by the use of only one pair of wings for flight and the reduction of the second pair of wings to knobs (called halteres) used for balance. The term fly is commonly used for almost any small flying insect. In entomology, however, the name refers specifically to the approximately 85,000 species of dipterans, or "true" flies, which are distributed throughout the world, including the subarctic and high mountains.

Dipterans are known by such common names as gnats, midges, mosquitoes, and leaf miners, in addition to numerous sorts of flies, including the horsefly, housefly, and blowfly and fruit, bee, robber, and crane flies. Many other species of insects are called flies (*e.g.*, dragonflies, caddisflies, and mayflies), but their wing structures serve to distinguish them from true flies. Many species of dipterans are of great importance economically, and some, such as the common housefly and certain mosquitoes, are of importance as disease carriers. *See* dipteran.

fly-catcher plant, also called AUSTRALIAN PITCHER PLANT (*Cephalotus follicularis*),

only species in the flowering plant family Cephalotaceae, native to damp sandy or swampy terrain in southwestern Australia. It is a perennial herb with a deep taproot



Fly-catcher plant (*Cephalotus follicularis*)
W.H. Hodge

and a short, woody underground stem and buff-coloured flowers. The lower leaves are adapted to a pitcher shape which traps insects and secretes a liquid that digests them.

Fly River, one of the largest rivers of New Guinea, flowing almost wholly through Papua New Guinea. For a short stretch of its middle course, it forms the border between Papua New Guinea on the east and the Indonesian province of Irian Jaya on the west. Rising on the Star, Kaban, and Hindenburg ranges of the Victor Emanuel Range in the central highlands, the Fly, fed by its principal tributaries, the Strickland, Alice, and Palmer rivers, flows south and southeast for more than 700 mi (1,100 km) to the Gulf of Papua, Coral Sea. Traversing deep gorges through rain forests in its upper course, the river broadens and deepens its channel below the Palmer junction. From this junction to the sea (540 mi) the river is navigable in all seasons to boats drawing less than 8 ft (2½ m) of water. This lowest stretch, in which the stream falls only about 50 ft, is bordered by open savanna-like country and swampy plains with numerous lakes. The Fly may be in flood from October to April, moving large quantities of material downstream to be deposited as shifting sandbars and islands (Kiwai, Wabuda, Purutu) in its 40-mi-wide mouth. The material, together with that transported by the Digoel and other neighbouring streams, has built up an enormous plain bordering the Torres Strait. There are no settlements of any size along the river. Total indigenous population is scanty, and there are only a few coconut plantations in the area. Crocodiles are also hunted. The river was named by Captain F.P. Blackwood, of HMS "Fly," who explored the estuary in 1842.

Fly River turtle: *see* pitted shell turtle.

fly-tying, the hobby or business of imitating the live food of gamefish by attaching various materials to a hook. Most often used to imitate various life stages of insects, the craft also imitates minnows and other natural foods. It has been estimated that more than a quarter of a million persons pursue fly-tying as a hobby. The origins of fly-tying date to the 1st or 2nd century BC in Macedonia, where brown-trout anglers attached feathers to their hooks to imitate the insect life in the streams. In England the art of fly-tying was systematized and recorded by Charles Cotton in Part 2 of later editions of Izaak Walton's *The Compleat Angler* in the second half of the 17th century. Thus began centuries of experimentation, dispute, and often bickering among competing schools of fly-tying. The literature of angling and fly-tying is immense with more than 5,000 volumes in English alone.

Most fly-tying is designed for trout and salmon fishing. There are three stages of insect life that fly-tiers attempt to imitate. Dry flies, representing the perfect or imago stage, are those that float on the surface. Constructed from materials that will aid flotation, these flies attempt to imitate insects that are either emerging from the stream or returning to it to lay eggs or to die after mating. These flies are carefully tied to exactly imitate a number of insects that are found in trout streams. An entire school of anglers, particularly in England, refuses to fish with anything but the dry fly. The second type of fly is the wet fly, designed to drift underwater and to be taken by the fish as either a nymph, a drowned mature fly, a minnow, or at any rate a morsel. The third is the nymph, which seeks to imitate the nymphal or larval stage of a fly's life. Nymphs are tied to represent larvae that have been dislodged from their mooring on the bottom or a rock, or that are rising to the surface to split their outer skin and emerge with wings. Nymphs are often tied over lead wire to cause them to sink. Trout flies are also tied as streamers to imitate minnows and other baitfish.

In salmon fishing, a variety of surface and subsurface flies are tied as attractors. Because the salmon does not feed upon entering the stream, the flies are designed to provoke a strike. Flies are also tied for bass fishing, panfishing, and ocean fishing. Among the most popular of saltwater fish taken on the fly is the bonefish.

The materials used in fly-tying include a wide variety of furs used for their various qualities and colours. Feathers of varied stiffness and colours are also mainstays of the fly-tier. Thread, tinsel, wool, and many other materials including synthetics are used by the fly-tier.

flycatcher, any of a number of perching birds (order Passeriformes) that dart out to capture insects on the wing, particularly members of the Old World songbird family Muscicapidae (*q.v.*) and of the New World family Tyrannidae, which consists of the tyrant flycatchers. Many taxonomists expand the family Muscicapidae to include the thrushes, warblers, and babblers, treating the Old World flycatchers in two or more subfamilies, Muscicapinae (typical flycatchers) and Monarchinae (monarch flycatchers) and, in some classification systems, Rhipidurinae (fantailed flycatchers).

Pied flycatcher (*Muscicapa hypoleuca*)
John Markham

The main muscicapine genus is *Muscicapa* (including *Ficedula*), and the commonest species, breeding in Europe and typical of the subfamily, is the spotted flycatcher (*M. striata*), a 14-centimetre (5½-inch) streaked grayish-brown bird of open woodlands and gardens eastward through Asia. It has a thin sibilant call and has the habit of flicking its wings. The pied flycatcher (*M. hypoleuca*) breeds in Europe, northern Africa, and western Asia; the male is black and white. Found in forests from India to the Philippines is Tickell's blue flycatcher (*M. tickelliae*); it is blue above and red below—much like an American bluebird. A Japanese example of brightly coloured muscicapines is the narcissus flycatcher (*M. narcissina*), in which the male is black, yellow, and white; unlike most of the subfamily, it is a good singer. Widespread in Africa is the 10-cm (4-in.) dusky flycatcher (*Alseonax adustus*).

Among familial relatives, for monarch and paradise flycatchers, *see* monarch; for puffback flycatchers, *see* wattle-eye; and for fan-tailed flycatchers, *see* fantail.

flying bomb: *see* V-1 missile.

flying doctor service, method for supplying medical service by airplane to areas where doctors are few and communications difficult. The plan for the first service of this type was conceived in 1912 by the Rev. John Flynn, superintendent of the Australian Inland Mission of the Presbyterian Church. Flynn's plan came to fruition in May 1928, when the first base of what is now the Royal Flying Doctor Service of Australia began operating at Cloncurry, Queensland, under Dr. K. St. Vincent Welch. An Adelaide electrical engineer, A.H. Traeger, developed a low-powered, portable, pedal-driven, Morse radio transmitter-receiver with a range of 300 miles. This transceiver, with the use of airplanes, made possible a system of regular long-distance medical consultations and the flying of doctors to patients in emergencies.

More than a dozen bases, run by state branches, came to cover two-thirds of the Australian continent and part of Tasmania. The Australian state governments contribute one-third of the finances; the rest is derived from voluntary and outpost subscriptions and message charges. The flying doctor service is free.

Other parts of the world regularly use aircraft for the assistance of the isolated sick. In Canada the Saskatchewan Air Ambulance Service was inaugurated in 1947. Newfoundland operates from the International Grenfell Association at St. Anthony an air ambulance service, likewise begun in 1947, covering northern Newfoundland and Labrador. The Royal Canadian Air Force operates a search and rescue service for Eskimos and Indians in the Arctic.

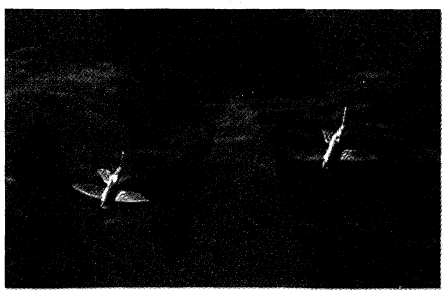
In East Africa the African Medical and Research Foundation, established in 1957 by joint British and American enterprise, was enabled in 1961 to begin a flying doctor service with a single airplane provided by private United States benefaction. In collaboration with this body, the Flying Doctor Service of Africa, Ltd., registered in the United Kingdom, planned a pilot scheme to be based at Gusau, northern Nigeria.

Flying Dutchman, in European maritime legend, spectre ship doomed to sail forever; its appearance to seamen is believed to signal imminent disaster. In the most common version, the captain, Vanderdecken, gambles his salvation on a rash pledge to round the Cape of Good Hope during a storm and so is condemned to that course for eternity; it is this rendering which forms the basis of the opera *Der fliegende Holländer* (1843) by the German composer Richard Wagner.

Another legend depicts a Captain Falkenberg

sailing forever through the North Sea, playing at dice for his soul with the devil. The dice-game motif recurs in the *Rime of the Ancient Mariner* (1798) by the English poet Samuel Taylor Coleridge; the mariner sights a phantom ship on which Death and Life in Death play dice to win him. The Scottish writer Sir Walter Scott adapted the legend in his narrative poem *Rokeby* (1813); murder is committed on shipboard, and plague breaks out among the crew, closing all ports to the ship.

flying fish, any of about 40 species of oceanic fishes of the family Exocoetidae (order Atheriniformes), found worldwide in warm waters and noted for their ability to fly. They are all small, attaining a maximum length of about 45 centimetres (18 inches), and have wing-



Flying fish (*Cypselurus*)
Jane Burton—Bruce Coleman Inc.

like fins and an unevenly forked tail. Some species, such as the widely distributed *Exocoetus volitans,* are two-winged, with only the pectoral fins enlarged; others, such as the California flying fish (*Cypselurus californicus*), are four-winged, with both the pectoral and pelvic fins enlarged.

The fishes glide, rather than flap their wings. They build up speed underwater, and, on breaking the surface, gain additional thrust from rapid beats of the still-submerged tail. Once airborne, they can make several consecutive glides, the tail propelling them up again each time they sink back to the surface. They can attain enough height to carry them onto the decks of ships in their waters, where their remains are frequently discovered at dawn.

Flying Fortress (U.S. aircraft): *see* B-17.

flying fox, also called FOX BAT, any of numerous tropical Old World bats belonging to the family Pteropodidae (*q.v.*).

flying gurnard, any of a small group of marine fish comprising the family Dactylopteridae (or Cephalacanthidae) and the order Dactylopteriformes (sometimes placed in Scorpaeniformes). Flying gurnards are similar to the sea robins, or gurnards (family Triglidae, order Scorpaeniformes), and are sometimes considered as relatives of that group (*see* sea robin).

Atlantic flying gurnard (*Dactylopterus volitans*)
Carl Roessler

Found in warm and tropical seas, flying gurnards are elongated fish with very large pectoral fins, each of which is divided into a shorter forward portion and a much larger, winglike posterior section. These fins are quite colourful; those of the Atlantic *Dactylopterus volitans,* for example, are brightly spotted with blue. Flying gurnards are further characterized by a covering of bony plates on their heads and by a single dorsal fin ray, separate from the rest of the fin and located on the nape of the neck. Flying gurnards grow to a maximum length of about 50 centimetres (20 inches). They are bottom dwellers but are reportedly able to glide above the water for short distances on their outspread pectoral fins.

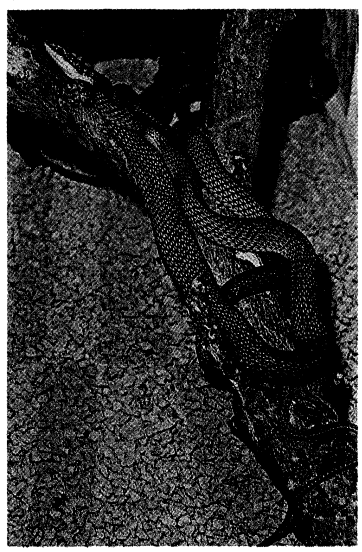
flying lemur (mammal): *see* colugo.

flying phalanger (marsupial): *see* glider.

flying saucer *see* unidentified flying object.

flying snake (*Chrysopelea*), any of three species belonging to the family Colubridae. These slender arboreal snakes, found in southern Asia and the East Indies, are able to glide short distances through the air by straightening the body and drawing up the ventral scales to make the underside concave.

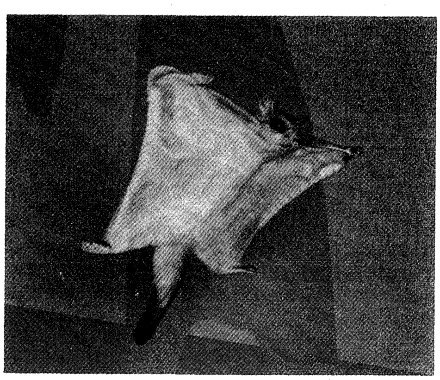
They are active by day, capturing rodents, bats, birds, and lizards. *Chrysopelea ornata*



Flying snake (*Chrysopelea*)
Bucky Reeves—The National Audubon Society Collection/ Photo Researchers

of India and Sri Lanka (Ceylon), sometimes called golden tree snake, is up to 100 centimetres (40 inches) long and usually black or greenish, with yellow or reddish markings.

flying squirrel, any member of two distinct groups of rodents that are able to make gliding leaps by means of the parachute-like membranes connected on each side to their forelegs and hind legs. The North American and Eurasian flying squirrels form one group, the subfamily Petauristinae of the squirrel family, Sciuridae (order Rodentia). The scaly-tailed



North American flying squirrel (*Glaucomys*)
C.G. Hampson

flying squirrels are African rodents of an entirely different family, Anomaluridae.

There are about 12 genera and 35 species of flying squirrels in the family Sciuridae. Slender, long-limbed forest dwellers, these squirrels have soft fur and large eyes and are 8 to 60 centimetres (3 to 24 inches) in length, exclusive of the long, often flattened, tail. They live in trees, usually nest in tree holes, and feed on nuts, fruit, other plant material, and insects. They seldom descend to the ground. Unlike other squirrels, they are nocturnal.

The gliding membranes of these squirrels are furry flaps of skin and muscle. Rods of cartilage at the wrists serve to spread the membranes. In "flying," the squirrels leap spread-eagled and use their outstretched gliding membranes for gliding and their bushy tails for guidance. Glides of 60 metres (almost 200 feet) or more have been recorded.

There are two species of gliding sciurids in North America and one that reaches eastern Europe; all others are Asian. North American flying squirrels (*Glaucomys*) are reddish or grayish brown and are 21 to 37 cm long including the 8- to 18-cm tail. Gregarious animals, they nest at times in birdhouses or buildings. Old World flying squirrels (*Pteromys*) are long haired, silvery or grayish, and 10 to 20 cm long without the 10- to 15-cm tail. There are two species, *P. momonga* of Japan and *P. volans* of Eurasia. Exclusively Asian flying squirrels include the large, brown or black, giant flying squirrels (*Petaurista*); the long-haired, gray-brown woolly flying squirrel (*Eupetaurus,* or *Hylopetes, cinereus*); and the grayish to reddish-brown or black Indo-Malaysian flying squirrels (*Hylopetes*).

Scaly-tailed flying squirrels, or scaletails, are placed in 4 genera and about 12 species, all but one of which, the flightless scaletail (*Zenkerella insignis*), possess gliding membranes. The membranes differ from those of the sciurids in being attached to a cartilage rod at the elbow instead of the wrist. Rows of scales on the underside of their tufted tails aid these squirrels in climbing and in clinging to trees after a glide. Scaletails are similiar to the sciurid in appearance and are about 10 to 40 cm long without the tail. They live in tree hollows and feed on both plant material and insects. With the possible exception of the nongliding, flightless scaletail, they are nocturnal.

Flying Tigers, byname of AMERICAN VOLUNTEER GROUP, U.S. civilian volunteer pilots recruited by Col. Claire L. Chennault (*q.v.*) to fight the Japanese in Burma and China during 1941–42, at a time when Japan's control over China's ports and transportation system had almost cut off the nationalist Chinese government from the outside world. Flying in battered, obsolete planes and facing chronic shortages of fuel, parts, and pilots, this small company of air fighters nevertheless scored victory after victory over the far larger and better equipped Japanese air force. They flew supplies, provided air cover for the Burma Road, succeeded in protecting the Chinese capital of Chungking, and fought the Japanese over most of China. Surprise, mobility, precision flying, and unorthodox tactics enabled the Tigers to outwit the Japanese and inflict considerable damage on their air and ground forces. On July 4, 1942, members of the unit who wished were absorbed into the U.S. 10th Air Force and became the nucleus of the China Air Task Force (reorganized in March 1943 as the 14th Air Force), still under the command of Chennault, who was promoted to brigadier general.

Flynn, Elizabeth Gurley (b. August 7, 1890, Concord, N.H., U.S.—d. September 5, 1964, Moscow), U.S. labour organizer, political radical, and Communist.

Flynn began her career in radical politics in 1906 at the age of 16. She began speaking in 1907 under the auspices of the Socialist Party, the Socialist Labor Party, and the Industrial Workers of the World (IWW). She was active in supporting unions that turned to the IWW for help during strikes, particularly in the textile and mining industries. In December 1918 she was instrumental in establishing a Workers' Liberty Defense Union; she served as chairman of the International Labor Defense, 1926–30. Flynn joined the Communist Party in 1936 and was a columnist for the *Daily Worker;* she was named chairman of the Communist Party U.S.A. in 1961. She was sentenced to three years in prison in 1953 under the Smith Act for conspiring to advocate the forcible overthrow of the U.S. government. Flynn died while visiting the Soviet Union and was given a state funeral in Red Square.

Flynn, Errol (Leslie Thomson) (b. June 20, 1909, Hobart, Tasmania, Australia?—d. Oct. 14, 1959, Vancouver, B.C., Can.), motion-picture actor who, on stage and off, was known as a romantic adventurer. Given to making up stories about himself, he is known to have claimed either Antrim, Ire., or Tasmania as his birthplace.

The son of a biologist, he did spend his youth in New Guinea prospecting for gold, sailing his own schooner, and sending off a regular column to the *Sidney Bulletin.* He went to Hollywood in 1935 where, as a last minute stand-in for Robert Donat, he achieved instant stardom in *Captain Blood.* There followed many swashbuckling roles to which he contributed his athletic grace and extraordinary good looks: *The Charge of the Light Brigade* (1936), *The Adventures of Robin Hood* (1938), *The Private Lives of Elizabeth and Essex* (1939), *Dodge City* (1939), *The Sea Hawk* (1940), *They Died with Their Boots On* (1941), and *Gentleman Jim* (1942).

Flynn's tremendous popularity suffered when he was tried for statutory rape in 1942 (and acquitted). After a number of ill-chosen roles, his reputation as an actor was restored by *The Sun Also Rises* (1957), *The Roots of Heaven* (1958), and *Too Much Too Soon* (1958). He completed an autobiography, *My Wicked, Wicked Ways,* shortly before his death.

Flynn, John (b. Nov. 25, 1880, Moliagul, Victoria, Australia—d. May 5, 1951, Sydney), moderator of the Presbyterian Church in Australia (1939–42) and missionary to the country's wild central and northern inland, who in 1928 founded what later became the Royal Flying Doctor Service of Australia.

After serving as a staff member of the Presbyterian Home Mission in Victoria (1902–10), Flynn moved to South Australia and was ordained in 1911. In September 1912 he presented a report to the Presbyterian Church assembly on the hardships of life that he had observed in central and northern Australia. The church responded by establishing the Australian Inland Mission, which Flynn directed until his death. Before 1920 Flynn had conceived of a plan that would provide medical care by airplane to remote areas. He spent several years developing a communications network between rural outposts and a medical base established at Cloncurry, Queensland; the service began operations in 1928.

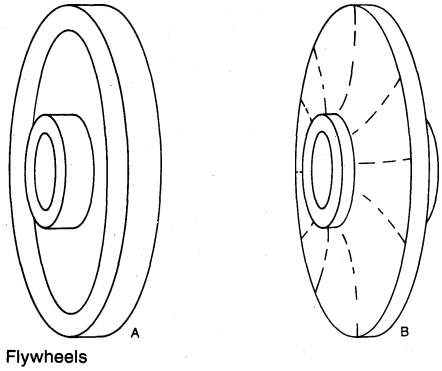
flysch, sequence of shales rhythmically interbedded with thin, hard, graywacke-like sandstones. The total thickness is commonly many thousands of metres, but the individual beds are thin, only a few centimetres to a few metres thick. The presence of rare fossils indicates marine deposition. The flysch facies is now generally believed to have accumulated in moderate to deep (up to 2,000 metres [6,500 feet]) marine waters. Coarse angular sands probably were deposited from turbidity currents (subaqueous sediment-laden flows); the extraordinary coarse conglomeratic mudstones in some flysch may be a product of submarine mudflows. The term originally was applied to a formation of Tertiary Age (2,500,000 to 65,000,000 years old) occurring in the northern Alpine region, but it now denotes similar deposits of other ages and other places.

flyting (Scots dialect: "scolding"), poetic competition of the Scottish *makaris* (plural of *makar—i.e.,* poet) of the 15th and 16th centuries, in which two highly skilled rivals engaged in a contest of verbal abuse, remarkable for its fierceness and extravagance. Although contestants attacked each other spiritedly, they actually had a professional respect for their rival's vocabulary of invective. The tradition seems to be derived from the Gaelic *filid* (class of professional poets), who composed savage tirades against persons who slighted them. A Scandinavian counterpart is the *Lokasenna* ("Flyting of Loki"), a poem in the *Poetic* (*Elder*) *Edda* in which the trickster-god Loki bandies words with the other gods, taunting them with coarse jests. Although true flyting became obsolete in Scottish literature after the Middle Ages, the tradition itself never died out among writers of Celtic background. The style and language of Robert Burns's "To a Louse" ("Ye ugly, creepin, blastit wonner / Detested, shunn'd by saunt an' sinner") parodies earlier Scots flyting, and James Joyce's poem "The Holy Office" is a bard's curse on the society that spurns him.

Examples of true flyting are *The Flyting of Dunbar and Kennedie* (the poets William Dunbar and Walter Kennedy) and *Flyting betwixt Montgomerie and Polwart* (the poets Alexander Montgomerie and Sir Patrick Hume of Polwarth).

flyway, route used regularly by migrating birds, bats, or butterflies. The large majority of such migrants move from northern breeding grounds to southern wintering grounds and back, and most of the well-used flyways follow north–south river valleys (*e.g.,* the Mississippi River Valley), coastlines (especially those of North America and eastern Asia), or mountain ranges. A flyway may be only a few hundred metres wide at certain points, such as mountain passes and the crossing points of water bodies; in other places it may be hundreds of kilometres wide. Hundreds of thousands of storks and large birds of prey from eastern Europe cross the Bosporus in a narrow stream, spread out over Asia Minor and around the eastern end of the Mediterranean Sea, then bunch together again to cross the north end of the Suez Canal into Africa.

flywheel, heavy wheel attached to a rotating shaft so as to smooth out delivery of power from a motor to a machine. The inertia of the flywheel opposes and moderates fluctuations in the speed of the engine and stores the excess energy for intermittent use. To oppose speed fluctuations effectively, a flywheel is given a high rotational inertia—*i.e.,* most of its weight is well out from the axis. A wheel with a heavy rim connected to the central hub by spokes or a web, wheel A in the Figure, has a high rotational inertia. Many flywheels used on reciprocating engines to smooth out the flow of power are made in this way. The energy stored in a flywheel, however, depends on both the weight distribution and the rotary speed; if the speed is doubled, the kinetic energy is quadrupled. A rim-type flywheel will burst at a much lower rotary speed than a disk-type wheel of the same weight and diameter. For minimum weight and high energy-storing capacity, a flywheel may be made of high-strength steel and designed as a tapered disk, thick at the centre and thin at the rim (*see* wheel B in the Figure).



Flywheels

In automobile engines the flywheel serves to smooth out the pulses of energy provided by the combustion in the cylinders and to provide energy for the compression stroke of the pistons. The larger the rotational inertia of the flywheel, the smaller the changes in speed resulting from the intermittent power supply and demand.

In power presses the actual punching, shearing, and forming are done in only a fraction of the operating cycle. During the longer, nonactive period, the speed of the flywheel is built up slowly by a comparatively low-powered motor. When the press is operating, most of the required energy is provided by the flywheel.

FM, abbreviation of FREQUENCY MODULATION, variation of the frequency of a carrier wave, commonly a radio frequency, in accordance with the characteristics of a signal, such as that produced by the audio frequencies of the human voice or musical instruments. *See* modulation.

FMD: *see* foot-and-mouth disease.

FN MAG (Belgian machine gun): *see* MAG machine gun.

Fo, Dario (b. March 24, 1926, Leggiuno-Sangiamo, Italy), Italian playwright, manager-director, and actor-mime—also described as a theatrical caricaturist, social agitator, and radical clown.

Fo's first theatrical experience was collaborating on satirical revues for small cabarets and theatres. After his marriage to actress Franca Rame, they founded the Campagnia Dario Fo–Franca Rame in 1959, and their humorous sketches on the television show "Canzonissima" soon made them popular public personalities. They gradually developed an agitprop theatre of politics, often blasphemous and scatological, but rooted in the tradition of commedia dell'arte and blended with what Fo called "unofficial leftism."

In 1968 Fo and Rama founded another acting group, Nuova Scena, with ties to the Italian Communist party, and in 1970 they started the Collettivo Teatrale La Comune and began to tour factories, parks, gymnasiums, and other sites where the public gathered. Among their most popular plays are *Morte accidentale di un anarchico* (1974; *Accidental Death of an Anarchist,* 1980) and *Non si paga, non si paga!* (1974; *We Can't Pay? We Won't Pay!,* 1978). As a performer, Fo is best known for his solo tour de force *Mistero Buffo* (1973, "Comic Mystery"), based on medieval mystery plays but so topical in contemporary content that it changes with each audience.

Fo-shan, Pinyin FOSHAN, city in central Kwangtung Province (*sheng*), China. Fo-shan is a prefecture-level municipality (*shih*) and the administrative centre of Fo-shan Prefecture (*ti-ch'ü*), which comprises the Chu Chiang (Pearl River) Delta and coastal area to the west of Canton. Fo-shan itself is situated in the delta 10 mi (16 km) southwest of Canton, on a spur of the Canton–San-shui railway. His-

torically, Fo-shan was a subordinate county of nearby Canton.

Fo-shan has always been a prosperous trade centre, with excellent river communications with western Kwangtung Province and Kwangsi Chuang Autonomous Region and a location at the centre of an extremely productive and populous plain. Its growth was greatly accelerated in the Ming (1368–1644) and Ch'ing (1644–1911/12) periods, when it became the centre of flourishing handicraft industries, specializing in the manufacture of silk threads and silk textiles and in such ancillary handicrafts as embroidery and dyeing. Metal implements and paper were also manufactured. During the 18th century, Fo-shan was known as one of the four greatest commercial centres in China, ranking with Hank'ou. In 1912 it became the seat of Nan-hai County. During the 20th century, Fo-shan suffered badly from the competition of the ever-growing city of Canton and also from the silting up of its waterways, which could only be used by shallow-draft junks.

Before 1949, Fo-shan (meaning "Buddha's mountain") was a centre of popular religion, manufacturing vast quantities of paper money, firecrackers, images, and incense for use in religious ceremonies. It has experienced some light industrial growth since 1949, many of its handicraft industries having been expanded on a cooperative basis. Sculptures and handicrafts are displayed in the Ancestral Temple (built about 1200). On the southern edge of the city are the peaks, caves, and waterfalls of scenic Hsi-ch'iao Shan (mountain). Pop. (1982) 137,280.

foam, in physical chemistry, a colloidal system (*i.e.,* a dispersion of particles in a continuous medium) in which the particles are gas bubbles and the medium is a liquid. The term is also applied to material in a lightweight cellular spongy or rigid form. Liquid foams are sometimes made relatively long-lasting—*e.g.,* for fire fighting—by addition of some substance, called a stabilizer, that prevents or retards the coalescence of the gas bubbles. Of the great variety of substances that act as foam stabilizers, the best known are the soaps (natural and synthetic) and proteins. Proteins, because they are edible, find wide use as foaming agents in foodstuffs such as whipped cream, marshmallow (made from gelatin and sugar), and meringue (from egg white). The foam used to combat oil fires consists of bubbles of carbon dioxide (liberated from sodium bicarbonate and aluminum sulfate) stabilized by dried blood, glue, or other cheap protein-containing materials. Beer foam is believed to be stabilized by the colloidal constituents present, which include proteins and carbohydrates. Foaming may be undesirable, as in lubricating oils, and its prevention is not always easy. Aqueous foams can usually be broken by treatment with small amounts of certain alcohols.

foam glass, lightweight, opaque glass material having a closed cell structure. It is made in molds that are packed with crushed or granulated glass mixed with a chemical agent such as carbon or limestone. At the temperature at which the glass grains become soft enough to cohere, the agent gives off a gas that is entrapped in the glass and forms the closed cell structure that remains after cooling. Foam glass is light enough to float in water and has been used as a substitute for cork, but its main uses are for thermal and sound insulation. It is impervious to moisture, most fumes, and vermin.

foam rubber, also called SPONGE RUBBER, or LATEX FOAM, flexible, porous substance made from a natural or synthetic latex compounded with various ingredients and whipped into a froth. The resulting product contains roughly 85 percent air and 15 percent rubber and can be molded and vulcanized. Its uses include padding for furniture, mattresses, and pillows. In special processes, a blowing agent is incorporated into the latex to liberate gas during vulcanization, forming small closed cells; the resulting foam is nonabsorbent and useful for thermal insulation, as in refrigerators. Molded into sheets, it is used in gaskets, weather stripping, and vibration damping materials.

foamed plastic, synthetic resin converted into a spongelike mass with a closed-cell or open-cell structure, either of which may be flexible or rigid, used for a variety of products including cushioning materials, air filters, furniture, toys, thermal insulation, sponges, plastic boats, panels for buildings, and even lightweight beams. Under appropriate conditions almost any thermosetting or thermoplastic resin can be converted into a foam. Plastics that are commonly foamed include vinyls, polystyrene, polyethylene, phenolics, silicones, cellulose acetate, and urethanes.

Foams with a closed-cell structure are produced by incorporating a blowing agent that decomposes at the fusion point of the plastic, releasing gas bubbles that are trapped during the gelling. Foams with an open-cell structure are produced by incorporating an inert gas into the resin under pressure and then releasing the mixture to the atmosphere and curing the resulting foam.

Foça (Turkey): *see* Phocaea.

focal seizure, type of epilepsy in which the seizure originates in a specific area of the brain, and the onset or entire seizure relates to the functional properties of that area. Focal motor attacks (originating in motor areas of the brain) are characterized by sustained or jerking movements of a part of an extremity or of the face or by coordinated movements of the head and eyes toward one side (adversive movements). A progressive spread of twitching from one part of an extremity to the adjacent parts and then to involvement of the other extremity on the same side or of the face is known as a jacksonian seizure (*see* jacksonian epilepsy). Most focal motor seizures originate in the frontal lobe, but adversive movements occasionally arise from other areas. Focal sensory attacks are characterized by numbness or tingling in local parts of the body. These seizures originate in the cortex of the parietal lobe; the excessive neuronal discharging often spreads across the Rolandic fissure to the motor cortex of the adjacent frontal lobe, and localized movements follow. Seizure discharges from either of these areas often spread to involve the remainder of the brain, so that generalized convulsions result. *See also* epilepsy.

Focas, Antonio de Curtis Gagliardi Griffo: *see* Totò.

Foch, Ferdinand (b. Oct. 2, 1851, Tarbes, Fr.—d. March 20, 1929, Paris), marshal of France and commander of Allied forces during the closing months of World War I, generally accounted the leader most responsible for the Allied victory.

Foch
EB Inc.

Early years. Foch was the son of a civil servant. His family had originally lived in Valentine, a village in the Comminges area to which he used to return every year. As a very young child he had been inspired by the Napoleonic epic through the stories of the campaigns of his maternal grandfather, who was an officer during the Revolution and then under the Emperor, and at the age of six he began to devour the descriptions of military battles he found in historical works.

After attending several schools, in 1869 he entered the well-known Jesuit school of Saint-Clément in Metz, in order to prepare for the entrance examination for the École Polytechnique (Polytechnic School). At Saint-Clément he also worked out the solid religious training he had received from his family. His religious faith was later to be one of the essential elements of his moral strength.

In Metz the experience of France's defeat in the Franco-German War left an indelible impression on him. When he passed his examinations in July of 1870, the war had already broken out, and cannons were thundering nearby. Once back home, he enlisted in the army but did not take part in the fighting. In 1871, after the armistice, when he returned to Saint-Clément, he was forced to live alongside the German soldiers who were there. Metz had become a German city. His pain and anger dictated the decision that was to give meaning to his life: he would become a soldier in order to return Lorraine and Metz to France.

Rise in the military hierarchy. After two years at the École Polytechnique, he entered the École d'Application de l'Artillerie (the artillery training school) in 1873. As an artillery officer, he proved himself to be both an ardent cavalryman and an experienced technician. After appointment to the Artillery Committee in Paris, he was married in Brittany in 1883 and acquired the château of Trofeunteuniou, which then became his second family home.

In 1885 he entered the École Supérieure de Guerre (War College), which for the next 25 years was to be his "laboratory" to prepare for war. He returned there as a major in 1895 to become an assistant professor—and soon a full professor—teaching general tactics. Finally in 1908, when he was a brigadier general, the prime minister, Georges Clemenceau, appointed him head of the school. In the meantime Foch had exercised commands and served on various staffs, thus adding to his experience and judgment. He formulated his doctrine of action in two works: *Des principes de la guerre* (1903; *The Principles of War,* 1918) and *De la conduite de la guerre* (1904; "On the Conduct of War"). "Thought" and "will" were the key words of the teachings that he imprinted on the minds and hearts of generations of officers.

After commanding a division in 1911 and briefly commanding an army corps, he was, in August 1913, put in command of the XX Army Corps in Nancy, which protected the Lorraine frontier. It seemed to be the crowning point of Foch's career because he would reach retirement age in three years.

Under Joffre in World War I. When war broke out on Aug. 2, 1914, Foch first fought on the right flank, in Lorraine. On August 28 a dangerous gap appeared in the centre, and the commander in chief, Joseph Joffre, called Foch to command the army detachment—which later became the IX Army—that was being formed there. The enemy tried to break through, but Foch held on. He had taught that "Where there is a will, there is victory."

His tenacity made it possible for Joffre to win at the first of the battles of the Marne. The same was true at the battles of the Yser and of Ypres, where he had been sent by Joffre to coordinate the efforts of the English, the French, and the Belgians, who were being severely attacked. King Albert I of Belgium later said of Foch, "That man could make the dead fight."

For two thankless years—1915 and 1916—Foch, commanding the Northern Army Group, vainly tried to break through the German line in Artois and at the Somme. This time, however, his indomitable will could not compensate for the lack of equipment and supplies.

On May 15, 1917, he was appointed chief of the war minister's general staff, a position that made him adviser to the Allied Armies. But advising was not commanding.

Russia was about to collapse, thus allowing Germany to bring all its forces back to the Western Front, where the Belgians, the English, and the French were lined up under separate commands. Foch predicted that, when the battering ram struck this poorly consolidated front, each force would think only of its own fate and that the front would be broken up. That was why he advocated the establishment of a single command. But the British prime minister David Lloyd George and Clemenceau, who had in November 1917 once again been appointed premier, refused to listen to Foch, believing that simply an agreement of cooperation between the English and French commanders in chief, Field Marshal Douglas Haig and Gen. Philippe Pétain, would suffice.

Events, however, were to prove Foch right. On March 21, 1918, the British front in Picardy collapsed under the impact of the German attack. On March 23 the Anglo-French agreements were outstripped by events. On March 24 it was already "every man for himself." Douglas Haig was thinking about his embarkation ports, and Pétain was thinking about Paris. The severance of the two armies had begun. The Germans, who quickly perceived that the enemy had become nothing more than a body without a head, were already crying victory.

Generalissimo of the Allied Armies. Lloyd George and Clemenceau shared that feeling. They realized that there was only one possible head to fill that void, and that was Foch, the very personification of determination. And so on March 26, on the very brink of disaster, they gave Foch the responsibility of "coordinating the action of the Allied Armies on the western front." These powers were enlarged at the inter-Allied conference in Beauvais on April 3 and were extended to the Italian front on May 2.

The battle of two wills began: Erich Ludendorff, who was in virtual command of the German forces, versus Foch. Ludendorff, who had the initiative and superiority in numbers, redoubled his attacks. Foch had to resign himself to parrying, in order to hold out until the arrival of the American armies. Deaf to the calls of distress, he husbanded his meagre reserves, urging his men on to the limits of their endurance. His shrewd tenacity succeeded in stopping Ludendorff in Picardy and then in Flanders. On May 8 Foch received the official title of commander in chief of the Allied Armies.

But, in order to give full support to the English, who were being pushed back to the sea by Ludendorff, Foch did not hesitate to withdraw troops from the French front. Ludendorff took advantage of this. On May 27 he broke through that front, and his troops spread as far as the Marne. On June 9 a new gap appeared at the Oise: Foch stopped it up again. Ludendorff then decided to gamble everything he had before the Americans joined the battle. On July 15 he made a massive attack in Champagne. Two days later he was stopped; he had lost.

Foch's will had gained the upper hand; now it was his turn to strike. In two offensives on July 18 and on August 8—Ludendorff was to call the latter a "black day"—Foch drove him back to a defensive position.

The honour of marshal of France was conferred on Foch on August 6, just as he was intensifying his offensive and unrelentingly striking the German front, giving no respite to the enemy nor to his own troops. Finally, the German Army, already exhausted and dwindling in numbers, was threatened by disintegration by the revolution in Germany. It had, moreover, been abandoned by its allies and now found itself forced to ask for an armistice the conditions of which were dictated by Marshal Foch in the name of the Allies on Nov. 11, 1918, at Rethondes. On November 26 Foch returned to Metz. He had succeeded in giving Alsace and Lorraine back to France: the lifelong goal that he had set for himself had been reached.

Foch, who had been made a marshal of Great Britain and of Poland and who had been elected a member of the Académie Français and of the Supreme War Council, died in Paris and was buried near Napoleon under the dome of the church of Saint-Louis-des-Invalides. (C.-A.La.)

BIBLIOGRAPHY. Ferdinand Foch, *Des principes de la guerre* (1903; *The Principles of War,* 1918), and *De la conduite de la guerre* (1904), are works essential for understanding the formation of the Marshal's military thought and of his character. See also his *Mémoires pour servir à l'histoire de la guerre de 1914–1918,* 2 vol. (1931; *The Memoirs of Marshal Foch,* 1931), a well-balanced review of Foch's thought and action; Maxime Weygand, *Foch* (1947), a major study (in French) by the chief of the general staff from August 1914 to April 1923, who, as Foch's faithful friend, brings alive the personality of the Marshal from his birth to his death; and *Mémoires,* vol. 1, *Idéal vécu* (1953), an excellent account of Foch's wartime activities, particularly those of 1918; and André Laffargue, *Foch et la bataille de 1918* (1967), written by a participant in the battles of 1918, who was in personal correspondence with the Marshal. A fine study in English is that of B.H. Liddell Hart—*Foch: The Man of Orleans* (1931).

Focinho da Rosa (Portugal): *see* Roca, Cape.

Focşani, city, capital of Vrancea *judeţ* (district), east central Romania, 100 mi (160 km) north-northeast of Bucharest. It is situated on the Milcov River, which was once the boundary between Moldavia and Walachia. In the city is a monument marking the old frontier and the building that in 1859–61 housed the commission set up by the Paris Conference to prepare the common laws of the Romanian principalities.

The city is the centre of a wine-making region that has been famous for its vineyards since the 15th century; among the best known wine-growing localities are Coteşti, Faraoanele, Jariştea, Nicoreşti, and Odobeşti. Focşani is also an industrial city, processing dairy products and manufacturing furniture and clothing. Pop. (1982 est.) 70,941.

focusing, also called OCULAR ACCOMMODATION, adjustment of the eye to see things at different distances. (The term can also apply to the adjustment of man-made lenses, as in a camera or microscope.)

Fish, for example, focus their eyes by altering the distance between lens and retina (as, in the camera, the distance between lens and light-sensitive film is adjusted). In man and other mammals the forward surface of the lens is made more convex for seeing closer objects and the pupil becomes smaller; at the same time the two eyes turn inward enough so that their gaze is fixed on the object. The capsule, or envelope enclosing the lens of the eye, is attached by ligaments to the ringlike ciliary muscle. The inside diameter of this muscle is greatest when the muscle is relaxed, smallest when it is contracted. Thus when the gaze is fixed on a distant object, as when the camera is set at infinity, the ciliary muscle relaxes, the muscle's inside diameter is increased, more pull is exerted on the lens by the ligaments, and the front surface of the lens is flattened. When near objects are viewed the ciliary muscle contracts, the ligaments relax, and the lens, being elastic, bulges in front and gains more curvature. In middle age the lens becomes less elastic, so that it fails to gain sufficient anterior curvature when near objects are viewed (presbyopia); reading glasses supply the curvature needed.

foedus, plural FOEDERA, treaty or compact contracted by ancient Rome with one or more allied states (*foederati*). The treaty contained various conditions establishing permanent friendly relations between the contracting parties. A *foedus aequum* was a bilateral agreement recognizing both parties as equals obliged to assist each other in defensive wars or when otherwise called upon, in perpetuity. A *foedus iniquum* defined Rome as superior, the second party being bound to assist Rome in offensive wars, thus limiting the ally's sovereignty. *Foedera* were inscribed on bronze tablets and kept in the Capitol at Rome.

The earliest known *foedus* is the Foedus Cassianum signed by the consul Spurius Cassius in 493 BC, which established a common army of defense between the Romans and the collective Latin states. As Rome gained dominance over the Italian peninsula Latin, Etruscan, and Italian polities lost their status as equals, eventually becoming provinces of Rome. Similarly, earlier Roman treaties with states outside Italy were usually equal, but the growth of Roman power in the Mediterranean eventually led to the subordination of the *foederati.* In time they lost both their local autonomy and their freedom from payment of tribute; this was especially true in the western provinces of the empire (after 27 BC). Certain peoples and rulers, however, termed *socii et amici populi Romani* ("allies and friends of the Roman people") were given intermediate status between complete autonomy and organization as a Roman province. They usually paid tribute to Rome, while Rome was spared the burden of direct rule—which meant not having to underwrite the cost of defensive forces that would be a drain on the Roman treasury. Such status, however, was a privilege that could be revoked at any time.

foehn, German FÖHN, warm and dry, gusty wind that descends the leeward slopes of nearly all mountains and mountain ranges. The name was first applied to a wind of this kind that occurs in the Alps, where the phenomenon was first studied.

A foehn results from the ascent of moist air up the windward slopes; as this air climbs, it expands and cools until it becomes saturated with water vapour, after which it cools more slowly because its moisture is condensing as rain or snow, releasing latent heat. By the time it reaches the peaks and stops climbing, the air is quite dry. The ridges of the mountains are usually obscured by a bank of clouds known as a foehn wall, which marks the upper limit of precipitation on the windward slopes. As the air makes its leeward descent, it is compressed and warms rapidly all the way downslope because there is little water left to evaporate and absorb heat; thus, the air is warmer and drier when it reaches the foot of the leeward slope than when it begins its windward ascent.

Foehn winds in various parts of the world have local names: chinook in the North American Rockies, *ghibli* in Libya, and *zonda* in the Andes of Argentina.

foenugreek (herb): *see* fenugreek.

Foerster, Josef Bohuslav (Bohemian composer): *see* Förster, Josef Bohuslav.

Foeth, Afanasy Afanasyevich (Russian poet): *see* Fet, Afanasy Afanasyevich.

foetus: *see* fetus.

fog, cloud of small water droplets near ground level and sufficiently dense to reduce horizontal visibility to less than 1,000 metres (3,281 feet). The word fog also may refer to clouds of smoke particles, ice particles, or mixtures of these components. Under similar conditions, but with visibility greater than 1,000 m, the phenomenon is termed a mist or haze, depending on whether the obscurity is due to water drops or solid particles.

Fog is formed by the condensation of water vapour on condensation nuclei that are always present in natural air. This results as soon as the relative humidity of the air exceeds saturation by a fraction of 1 percent. In highly polluted air the nuclei may grow sufficiently to cause fog at humidities of 95 percent or less. Growth of the drops may be helped by the absorption of certain soluble gases, notably sulfur dioxide to form dilute sulfuric acid. The relative humidity of the air can be increased by three processes: cooling of the air by adiabatic expansion; mixing two humid airstreams having different temperatures; and direct cooling of the air by radiation.

The first process, adiabatic expansion, is responsible for the formation of clouds and plays a part in the formation of upslope fogs that are formed by the forced ascent of humid air up the sides of hills and mountains.

The mixing process is manifest when air that has been in contact with a wet ground or water surface having a different temperature from that of the air above is mixed with this air.

The most stable fogs occur when the surface is colder than the air above; that is, in the presence of a temperature inversion. Fogs also can occur when cold air moves over a warm, wet surface and becomes saturated by the evaporation of moisture from the underlying surface. Convection currents, however, tend to carry the fog upward as it forms, and it appears to rise as steam or smoke from the wet surface. This is the explanation of steam fogs that are produced when cold Arctic air moves over lakes, streams, inlets of the sea, or newly formed openings in the pack ice; hence, the term Arctic sea smoke.

Advection fog is formed by the slow passage of relatively warm, moist, stable air over a colder wet surface. Common at sea whenever cold and warm ocean currents are in close proximity, it may affect adjacent coasts. A good example is provided by the frequent dense fogs formed off the Grand Banks of Newfoundland in summer, when winds from the warm Gulf Stream blow over the cold Labrador Current. It also may occur over land, especially in winter when warm air blows over frozen or snow-covered ground (Figure 1). Advection fogs occur most readily with winds of about 5 metres per second (10 miles per hour), sufficiently light to maintain a temperature contrast between air and surface and not strong enough to produce turbulent mixing through a considerable depth of the atmosphere. Typical advection fogs extend up to heights of a few hundred metres and sometimes also occur together with radiation fogs.

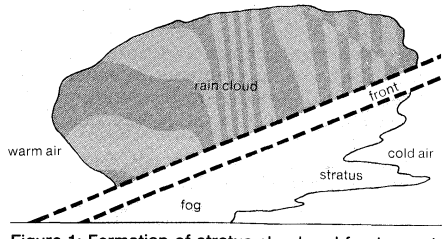


Figure 1: Formation of stratus cloud and fog beneath a frontal surface

Radiation fog forms over land on calm, clear nights when loss of heat by radiation cools the ground and chills the air in the lowest few metres to below the dew-point temperature. Once dense fog has formed, the top of the fog replaces the ground as the effective surface cooled by radiation and the fog increases progressively in depth as long as there is sufficiently moist air above it. The development of a strong temperature inversion tends to stabilize the fog and suppress air motions but slow, turbulent stirring motions are usually present and probably are important in maintaining the fog. They do so by replacing the air in the lowest layers, which is losing moisture by deposition on the ground, with moister air from above. Typical inland radiation fogs reach to heights of 100–200 m.

Inversion fogs are formed as a result of a downward extension of a layer of stratus cloud, situated under the base of a low-level temperature inversion. They are particularly prevalent off western coasts in tropical regions during the summer, when the prevailing winds blow toward the Equator and cause the upwelling of cold water along the coast. Air that passes over the cold water becomes chilled, its relative humidity rises, and it becomes trapped under the inversion. Subsequent nocturnal cooling may then cause a stratus layer to form and build down to the ground to form an inversion fog as demonstrated in Figure 2.

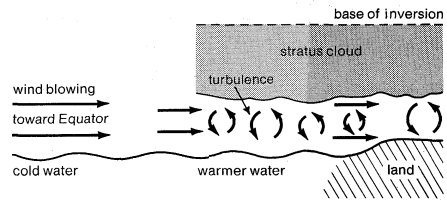


Figure 2: Formation of inversion fog

Frontal fog forms near a front when raindrops, falling from relatively warm air above a frontal surface, evaporate into cooler air close to the Earth's surface and cause it to become saturated.

When the air temperature falls below 0° C (32° F) the fog droplets become supercooled. At temperatures between 0° and −10° C (32° and 14° F), only a small proportion of the droplets freeze and the fog is composed mainly or entirely of liquid water. However, at lower temperatures, more and more droplets freeze so that below about −35° C (−31° F) and certainly below −40° C (−40° F), the fog is composed entirely of ice crystals. The visibility in an ice fog is often considerably worse than that in a water fog containing the same concentration of condensed water.

Although it is convenient to classify fogs according to the physical processes that produce saturation of the air, it is difficult to apply such a clear-cut classification in practice. Usually, more than one of the processes acts at the same time, and their relative importance varies from case to case and with time. Probably no two fogs are controlled by exactly the same combination of factors, a fact which makes forecasting the formation and dispersal of fog difficult.

In most geographical locations subject to fog, frequency and persistence of the fogs show a marked seasonal dependence. Conditions favourable to the formation of radiation fog—namely, clear skies and light winds—often occur in the central regions of anticyclones (*see* anticyclone) and ridges of high pressure so that the advantages of dry settled weather are often nullified by the occurrence of fog, especially in autumn and winter. Advection fog may occur in any season of the year and at any time of day or night and is not restricted to conditions of light winds and clear skies. Over land it is especially liable to occur in winter with the incursion of mild damp air over a frozen or snow-covered surface. Over the coastal waters of the British Isles, it occurs chiefly in late spring and early summer when the sea is still cold.

Dense fog presents one of the greatest hazards to aviation and to nearly all forms of surface transportation. Modern aircraft generally are not allowed to take off or land if the visibility along the runway is less than 600 m. In many countries, especially those in temperate latitudes, fog causes widespread dislocation and delay in transportation systems on several days each year.

fog dispersal, artificial dissipation of fogs, usually by seeding or heating. It is done primarily at airports to improve visibility. Many attempts have been made to clear fogs at temperatures above freezing by seeding them with salt particles and by heating them with burners, but these techniques are still not very dependable. The dissipation of fogs at temperatures below freezing is, on the other hand, regularly performed at many airports by seeding them with solid carbon dioxide or with propane gas sprayed from the ground. *Compare* cloud seeding.

fog signal, sound or light signal emitted in fog or mist by lighthouses and buoys to indicate the shoreline, channel, or dangerous waters, and by vessels to indicate their position. Each signal has a distinctive code. All vessels, whether stationary or moving, are required by law to utilize fog signals in inclement weather; the type, number, length, and timing of the signal indicate the size of the vessel and its position. The nature and application of fog warnings is codified in the International Regulations for Preventing Collisions at Sea (commonly called International Rules of the Road), applicable to all international waters. Earliest sound signals were made by bells, gongs, and explosives; these have been largely replaced by compressed air or electric fog horns.

Fogaras (Romania): *see* Făgăraş.

Fogazzaro, Antonio (b. March 25, 1842, Vicenza, Republic of Venice—d. March 7, 1911, Vicenza, Italy), Italian novelist whose works reflect the conflict between reason and faith.

Coming from a wealthy family, he cultivated his interest in music and literature at his leisure and established his reputation as a novelist only late in life with *Malombra* (1881; *The Woman,* 1907), *Daniele Cortis* (1885; *Daniele Cortis,* 1887), and *Il mistero del poeta* (1888; *The Poet's Mystery,* 1903). His best known work, *Piccolo mondo antico* (1896; *The Little World of the Past,* 1962), was highly acclaimed, even by critics unsympathetic to his religious and philosophical ideas.

Fogazzaro became a member of the Italian Senate in 1896. He was the author of short stories and plays as well as of novels, and his poetry is collected in *Valsolda* (1886).

Fogerty, Elsie (b. Dec. 16, 1865, London—d. July 4, 1945, Leamington, Warwickshire, Eng.), British teacher of voice and dramatic diction, a major figure in theatrical training.

Trained under Hermann Vezin and at the Paris Conservatoire, in 1889 Fogerty became a teacher of elocution at the Crystal Palace School of Art and Literature and later at Sir Frank Benson's London School of Acting. In 1906 she founded the Central School of Speech Training and Dramatic Art in London, which she directed until her death. Among her pupils were Sybil Thorndike, Peggy Ashcroft, John Gielgud, and Laurence Olivier. She adapted

and produced a number of classical Greek plays to support her advocacy of the study and use of choral speaking and wrote several treatises, the best known of which is *The Speaking of English Verse* (1923). She also pioneered in speech therapy.

Fogie (1967) was compiled and edited by Marion Cole, a student of Fogerty.

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Fogg Art Museum, museum founded at Harvard University in Cambridge, Mass., in 1895 as a study collection of Eastern and Western art from prehistory to the present, as well as an important art reference library of more than 150,000 volumes. The Fogg Museum is especially distinguished for its collection of drawings and prints.

Its research fields include classical art, coins, conservation, drawings, Islāmic and Oriental art, photography, and prints. The Busch-Reisinger Museum at Harvard is a subsidiary.

foggara (water-supply system): *see* qanāt.

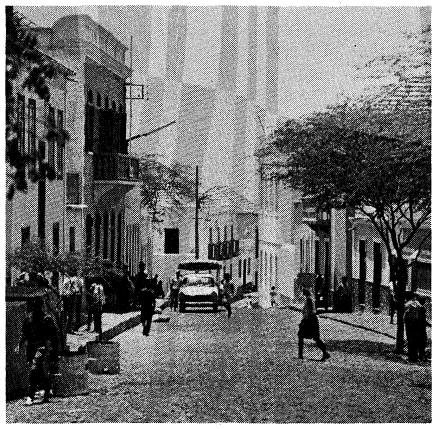
Foggia, city, capital of Foggia province, Puglia (Apulia) region, southeastern Italy, in the centre of the Puglia Tableland, west-northwest of Barletta.

Foggia is believed to have been founded by the inhabitants of Arpi (also called Argyrippa, Greek Argos Hippion), a Greek and Roman town that declined after the Second Punic War (3rd century BC); the ruins of Arpi are a few miles north. Foggia may have been named after local pits or cellars used for grain storage, or after (Latin *foveae*) that supply drinking water for the flocks, still called *fogge.* It was a favourite seat of the Holy Roman emperor Frederick II, who had the town's fortifications dismantled after it supported the pope in the latter's struggle with him. It passed to Charles I of Anjou, king of Naples and Sicily, who died there in 1285. From 1447 to 1806 it was the centre for collection of the sheep tax on flocks migrating between highlands and plains. After the restoration following the Napoleonic Wars, it became a centre for Carbonari revolutionary societies and took a vigorous part in the revolts of 1820, 1848, and 1860 against the Kingdom of Naples. The capture of the Foggia military airfields in 1943 was an important action in consolidating the Allied position in southern Italy in World War II.

Partially destroyed by an earthquake in 1731 and severely damaged in World War II, Foggia has been rebuilt along modern lines. Only a door remains of Frederick II's palace, but the cathedral, begun by William II the Good, king of Sicily, with Baroque alterations, survives. There are a museum, a picture gallery, and a library, the archives of which include those of the sheep tax.

Foggia lies on the main railway from Bologna to Bari and is also connected by rail with Naples. A major wool market for centuries, Foggia is also an important agricultural centre for the wheat, vegetables, olives, grapes, fruit, tobacco, and cheese of the Puglia Tableland. In addition to food industries, there are cellulose and paper mills. Pop. (1983 est.) mun., 157,108.

Fogo Island, Portuguese ILHA DO FOGO, island of Cape Verde, in the Atlantic Ocean, about 400 mi (640 km) off the West African coast between the islands of São Tiago (Santiago) and Brava. It has an area of 184 sq mi (476 sq km). The island's active volcano, Pico (9,281 ft [2,829 m]), is the highest point of the archipelago. Peanuts (groundnuts), beans, coffee, oranges, and tobacco are grown on the



Street scene in São Filipe, Fogo Island
Walter Imber

north and west sides of the island. The chief town is São Filipe, on the west shore. Pop. (1980 prelim.) 31,115.

föhn (wind): *see* foehn.

foie gras (French: "fat liver"), a delicacy of French cuisine, the liver of a goose or duck that has been fattened by a process of force feeding. What is generally regarded as the best foie gras is produced in the province of Strasbourg. Foie gras is ideally very firm and smoothly textured, with a colouring of creamy white tinged with pink.

Foie gras is often baked in a crust, as pâté de foie gras, which may be served hot or cold. The pâté, or pastry crust, is lined with jelly and the foie gras is prepared with brandy, seasonings, and truffles. Foie gras may also be served in purée form with bread or toast and jelly, with garnishes or pancakes, or in terrines.

foil, solid metal that has been reduced to a leaflike thinness by mechanical beating or rolling. Jewellers have long used a thin foil of copper-zinc alloy as backing for paste jewels and inferior gemstones. The colour and lustre of the gems is heightened by foil that has been silvered, burnished, and coated with translucent colouring.

The first mass-produced and widely used foil was made from tin, now replaced by aluminum for nearly all purposes. The reduction of sheet metal to foil is achieved principally through vertical pressure exerted by finishing-mill rolls combined with horizontal tension applied through mandrels paying out and rewinding the foil stock. Backup rolls mounted above the work rolls of the finishing mills provide increased vertical pressure. Finishing mills may be two, three, or four rolls high, depending on the foil width and thickness required. To produce very light gauge (thin) material, two sheets of aluminum may be rolled together, then parted and rewound individually. By rolling a double web, foil is produced that is bright on one side and matte finished on the other. Aluminum foil may be coloured, printed, embossed, bonded to other materials, or coated with a plastic film. *See also* tinfoil.

foil, a sword with a light, flexible blade of rectangular cross section tapering to a blunt point. Designed as a practice weapon for the smallsword fashionable in the 17th century, it is now used primarily in the sport of fencing.

The modern fencing foil has a maximum overall length of 110 centimetres (3 feet, 7 inches) and a maximum weight of 500 grams (about 17.5 ounces), although it is usually lighter for greater speed of movement. The blade is of finely tempered steel up to 900 millimetres (35.4 inches) long, with a usually circular handguard up to 120 millimetres in diameter.

There are two principal forms: the French, with a plain, slightly curved handle, and the Italian, with a crossbar about 5 cm behind the guard and a strap that binds the weapon to the wrist. The Italian foil provides a somewhat stronger grip, whereas the French gives greater freedom of action to the fingers and wrist.

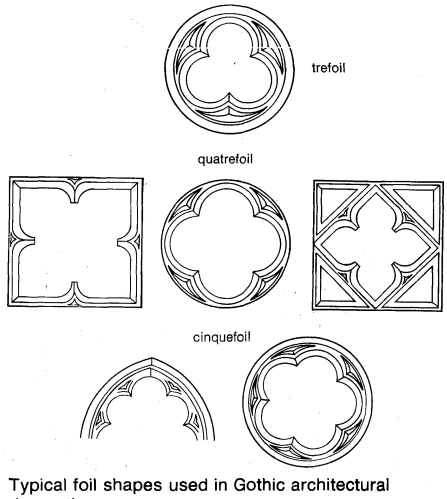
The foil is the only weapon used in international competition by both men and women. In contests, touches must be made with the point on a target that includes the trunk from the top of the collar to the groin lines in front and to a line across the top of the hips in back. The target for both women and men has been the same since 1960. A retreat of more than 4 metres (13 feet) also scores a touch against the defender. Other touches are foul but incur no penalty other than stopping the action and voiding any touches made between the time of the foul and resumption of the match.

An attacker generally has the right-of-way, and the defender must parry, or neutralize, the attack before making a counterattack (riposte). A double touch is scored for the fencer who has the right-of-way. An electrical scoring apparatus was adopted for international events in 1956, but judges still rule on right-of-way.

The first to score five touches (four in women's events) against an opponent is the winner.

Fencing with the foil has long been a standard international and Olympic Games event. *See* Sporting Record: *Fencing. See* Olympic Games.

foil, in architecture, leaf-shaped, indented spaces which, combined with cusps (small, projecting arcs outlining the leaf design), are found especially in the tracery (decorative openwork) of Gothic windows. The term is derived from the Latin *folium,* meaning "leaf." A window or wall ornamented with foils is referred to as foiled. There are three kinds of



Typical foil shapes used in Gothic architectural decoration
From M.S. Briggs, *Everyman's Concise Encyclopaedia of Architecture*; E.P. Dutton & Co., Inc., and J.M. Dent & Sons Ltd.

such stylized foliated decoration: trefoil, quatrefoil, and cinquefoil, or three-, four-, and five-lobed leaves.

Foix, feudal county of southwestern France, corresponding approximately to the modern *département* of Ariège. Between the 11th and the 15th century, the counts of Foix built up a quasi-independent power bounded by Languedoc on the north and on the east, by the territories of the counts of Roussillon and of the kings of Aragon on the south, and by those of the counts of Comminges and of Armagnac on the west.

At the beginning of the 11th century the town of Foix, from which the county took its name, belonged to the counts of Carcassonne. In his will (1002), Roger I of Carcassonne left "the land of Foix," Conserans (Couserans), and some adjacent domains to his second son,

Bernard, who was styled count of Conserans and lord of Foix. The first count of Foix was this Bernard's second son, Roger I (died *c.* 1064), whose descendants held the countship for three centuries. The most famous of this line was Gaston III Phoebus. On the death of his successor in 1398, the countship passed to a collateral line, Foix-Grailly, which in the 15th century became involved through marriage in the affairs of Navarre. As a result of family alliances, Foix, Béarn, and Navarre passed to the House of Albret in 1484. The heiress Jeanne d'Albret (1528–72), by her marriage to Anthony of Bourbon, passed her possessions on to her son, the future Henry IV of France. On his accession (1589) Foix became part of the crown lands.

Foix, town, capital of Ariège *département,* Midi-Pyrénées region, southwestern France, located in the foothills of the Pyrenees. Situated 1,250 ft (380 m) above sea level, at the fork where the Arget River joins the Ariège, it is dominated by its medieval castle, which stands on a high rock. The restored (19th-century) castle has three towers (12th–15th century) and some ruined walls. A museum is housed in the keep. When the town was the capital of the counts of Foix, the castle resisted repeated sieges (1212–17) by the Norman crusader Simon de Montfort, but was taken by King Philip the Bold of France in 1272. Modern Foix is a market town and tourist centre. Pop. (1982) 9,212.

Fokine, Michel, original name MIKHAIL MIKHAYLOVICH FOKINE (b. April 23 [April 11, old style], 1880, St. Petersburg, Russia—d. Aug. 22, 1942, New York City), dancer and choreographer who profoundly influenced the 20th-century classical ballet repertoire. In 1905 he composed the solo *The Dying Swan* for the Russian ballerina Anna Pavlova. As chief choreographer for the impresario Sergey Diaghilev's Ballets Russes from 1909 to 1914, he created *L'Oiseau de feu* (1910; *The Firebird*) and *Petrushka* (1911).

Fokine was born of a prosperous middle-class family and entered the Imperial Ballet School at the Mariinsky Theatre in 1889, where he distinguished himself for the breadth of his interests and studies. Fokine was talented not only as a dancer but also as a student of music and painting. He had a fresh and inquiring attitude toward everything connected with the ballet and began quite early to plan choreography, to seek appropriate music in the school library, and to sketch designs. His development as a dancer—he made his debut with the Imperial Russian Ballet on his 18th birthday—was paralleled by his development as a choreographer and designer.

Fokine as Perseus in *Medusa*

By courtesy of the Dance Collection, the New York Public Library at Lincoln Center, Astor, Lenox and Tilden Foundations

In 1904 he wrote the scenario for his first ballet, which was based on the ancient Greco-Roman legend of Daphnis and Chloe. He sent it to the director of the Imperial Theatre with a note about reforms he wanted to see adopted by choreographers and producers. His crusade for artistic unity in ballet had already begun, but at this stage it made little impact. He was not encouraged to produce *Daphnis et Chloé* (he created it later, in 1912, for Diaghilev).

All the same, although at St. Petersburg he had no power to implement his beliefs, he began to work as a choreographer. His first ballet, created in 1905 for performance by his pupils, was *Acis et Galatée,* based on an ancient Sicilian legend. Fokine's enthusiasm for antiquity owed nothing in origin to the "free dance" ideas of the American dancer Isadora Duncan, although her appearance in Russia in 1905 greatly consolidated his own views. In 1905 he also composed the brief solo *The Dying Swan* for the Russian ballerina Anna Pavlova. He continued to create ballets and three of his Mariinsky works were included in revised versions in the momentous season of the Ballets Russes that the impresario Sergey Diaghilev arranged in Paris in 1909: *Le Pavillon d'Armide, Une Nuit d'Égypte* (*Cléopâtre*), and *Chopiniana* (*Les Sylphides*).

Fokine was an integral part of the Ballets Russes's Paris triumph. Diaghilev's genius for bringing artists together in successful collaboration made Fokine, as his chief choreographer, the link between the dancers Tamara Karsavina, Vaslav Nijinsky, and Adolph Bolm; the designers Alexandre Benois and Léon Bakst; and the composer Igor Stravinsky, in such superbly unified creations as *L'Oiseau de feu* and *Petrushka.*

Fokine's relationship with the Diaghilev ballet deteriorated when Diaghilev launched Nijinsky as choreographer; but he remained with the company until 1914, when he returned to Russia. Also in that year, he set down his manifesto on ballet in a letter to *The Times* (London), advocating the creation in each ballet of a new form of movement corresponding to the subject, period, and character of the music; that dancing and mime have no meaning unless they express dramatic action; that conventional mime should be used only when the style of the ballet requires it; otherwise, meaning should be expressed by the movement of the whole body; that this expressiveness should extend from the individual to the group, to ensembles as much as to solos; and that there should be complete equality in the alliance of the component arts that make up a ballet—dance, music, and scenic and costume design.

Fokine left Russia in 1918 and made his home in New York City from 1923. He worked with various companies in the U.S. and Europe, creating new ballets, such as *L'Épreuve d'amour* (1936) and *Don Juan* (1936). None of these later ballets, however, had the impact of his earlier work. He began his last ballet, a comedy, *Helen of Troy,* for the American Ballet Theatre shortly before his death. It was completed by David Lichine and was premiered at Mexico City on Sept. 10, 1942. His wife, the dancer Vera Fokina, who had performed in many of his ballets, survived him until 1958.

One of the few choreographers to come to a first rehearsal with clear and complete ideas for a ballet, Fokine had great facility and speed in choreographic invention, intense musicality, and the ability to memorize an orchestral score. He was by no means equable at work. Tamara Karsavina wrote in her autobiography *Theatre Street* that "he was extremely irritable and had no control of his temper," but she emphasized that dancers became devoted to him.

The vocabulary of classical ballet has been enormously extended since Fokine's day, and subsequent audiences sometimes feel that his choreography is dated. Those of his ballets remaining in production have inevitably suffered distortion. He himself was conscious that this would happen. "The longer a ballet exists in the repertoire," he wrote in his *Memoirs,* "the further it departs from its original version. . . . After my death the public, watching my ballets, will think 'What nonsense Fokine staged! "

(K.S.W.)

BIBLIOGRAPHY. *Memoirs of a Ballet Master,* ed. by Anatole Chujoy, trans. by Vitale Fokine (1961), is a valuable but condensed version of Fokine's own memoirs. Cyril W. Beaumont, *Michel Fokine and His Ballets* (1935), is an account by an English ballet historian and critic.

Fokís (Greece): *see* Phocis.

Fokker, Anthony Herman Gerard (b. April 6, 1890, Kediri, Java, Netherlands East Indies—d. Dec. 23, 1939, New York City), Dutch airman and pioneer aircraft manufacturer who, during World War I, produced more than 40 types of airplanes (designed by Reinhold Platz) for the German High Command. Initially, he offered his designs to both combatants, but the Allies turned him down.

Fokker

Ullstein Bilderdienst

Fokker built his first plane in 1910 and taught himself to fly. In 1912 he established a small aircraft factory at Johannisthal near Berlin. During World War I he introduced the gear system that made it possible to fire a machine gun through the propeller arc without hitting the blades; the propeller itself, by means of levers and gears, operated the gun at properly timed intervals.

In the early 1920s Fokker sold an increasing number of planes to the U.S. military, and in 1922 he established the Atlantic Aircraft Corp. in New Jersey. He also maintained a large aircraft factory in The Netherlands. The first nonstop flight across the United States was made in the Fokker T-2 transport. Richard Byrd and Floyd Bennett flew over the North Pole (May 9, 1926) in one of Fokker's trimotor planes. During the 1920s and the 1930s Fokker concentrated on the design and development of commercial aircraft that were widely used in the fledgling U.S. commercial aviation industry. His autobiography, *The Flying Dutchman,* was published in 1931.

folacin (vitamin): *see* folic acid.

Folard, Jean-Charles, chevalier de (knight of) (b. Feb. 13, 1669, Avignon, Fr.—d. March 23, 1752, Avignon), French soldier and military theorist who championed the use of infantry columns instead of battle lines in warfare. Although he had a small but influential following during his lifetime, his concepts were not generally accepted by Europe's mili-

tary establishment. During the 18th and 19th centuries, the increasing firepower and accuracy of cannons and rifles finally made his ideas increasingly impractical.

Folard, lithograph by Antoine-François Sergent-Marceau, 1790
By courtesy of the Bibliotheque Nationale, Paris

Serving in the French army during the War of the Spanish Succession (1701–14) and from 1714 under Charles XII of Sweden, Folard developed his tactical ideas, which he published as *Nouvelles Découvertes sur la guerre . . .* (1724; "New Discoveries on War"). A second treatise followed a few years later. Folard believed that firepower alone was not sufficient to bring victory. He suggested the shock of a deep mass of troops in the form of infantry columns used in conjunction with battle lines as the answer. Part of Folard's justification was the small range of contemporary firearms. France's marshal Maurice de Saxe and Austria's Guido von Starhemberg approved his tactics; but most other authorities disagreed, and Folard died in obscurity. Though French armies during the early 1790s won several victories using infantry columns, advances in military technology eventually proved his ideas untenable.

fold, in geology, undulation or waves in the stratified rocks of the Earth's crust. Stratified rocks were originally formed from sediments that were deposited in flat, horizontal sheets, but in a number of places the strata are no longer horizontal but have been warped. Sometimes the warping is so gentle that the inclination of the strata is barely perceptible, or the warping may be so pronounced that the strata of the two flanks may be essentially parallel or lie nearly flat (as in the case of a recumbent fold). Folds vary widely in size; some are several kilometres or even hundreds of kilometres across, and others measure just a few centimetres or less. The tops of large folds are commonly eroded away on the Earth's surface, exposing the cross sections of the inclined strata.

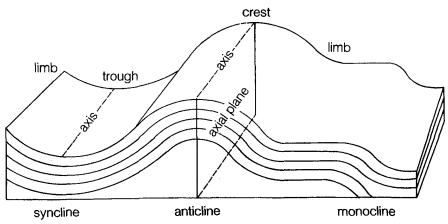


Figure 1: Three forms of folds

Folds are generally classified according to the attitude of their axes and their appearance in cross sections perpendicular to the trend of the fold. As shown in Figure 1, the axial plane of a fold is the plane or surface that divides the fold as symmetrically as possible. The axial plane may be vertical, horizontal, or inclined at any intermediate angle, as in the folds in Figure 2. An axis of a fold is the intersection of the axial plane with one of the strata of which the fold is composed.

Although in the simpler types of folds the axis is horizontal or gently inclined, it may be steeply inclined or even vertical. The angle of inclination of the axis, as measured from the horizontal, is called the plunge. The portions of the fold between adjacent axes form the flanks, limbs, or slopes of a fold.

An anticline is a fold that is convex upward, and a syncline is a fold that is concave upward (Figure 2). An anticlinorium is a large anticline on which minor folds are superimposed, and a synclinorium is a large syncline on which minor folds are superimposed. A symmetrical fold (Figure 2) is one in which the axial plane is vertical. An asymmetrical fold (Figure 2) is one in which the axial plane is inclined. An overturned fold, or overfold, has the axial plane inclined to such an extent that the strata on one limb are overturned (Figure 2). A recumbent fold has an essentially horizontal axial plane (Figure 2). When the two limbs of a fold are essentially parallel to each other and thus approximately parallel to the axial plane, the fold is called isoclinal.

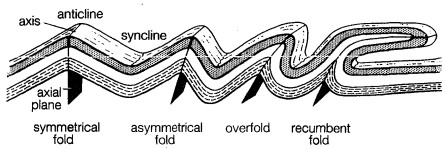


Figure 2: Folds, progressively decreasing from left to right in the inclination of the axial plane

Many folds are distinctly linear; that is, their extent parallel to the axis is many times their width. Some folds, however, are not linear but are more or less circular in plan. A dome is such a fold that is convex upward; this means that its strata dip outward from a central area. A basin is a circular fold that is concave upward—*i.e.,* the strata dip inward toward a central area.

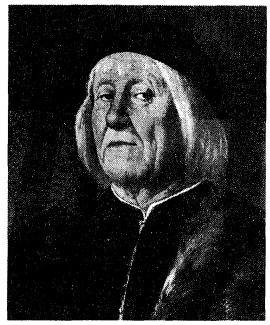
The long linear folds that are characteristic of mountainous regions are believed to have resulted from compressional forces acting parallel to the surface of the Earth and at right angles to the fold. Some geologists believe that many folds are the result of strata sliding from a vertically uplifted area under the influence of gravity. The push exerted by an advancing glacier also may throw weakly consolidated rocks into folds, and the compaction of sedimentary rocks over buried hills gives rise to gentle folds. In nature, folds are rarely produced by a single process but by a combination of processes.

Folda, fjord, Nordland *fylke* (county), northern Norway. The fjord's mouth opens into Vest Fjord of the Norwegian Sea and is 25 miles (40 km) northeast of the town of Bodø and about 75 miles (120 km) north of the Arctic Circle. The Folda extends two branches inland: the Nordfolda, 25 miles (40 km) long, and the Sørfolda, 18 miles (29 km) in length. Each is dotted with small fishing villages; herring is the main catch. The heads of both branches are crossed by the North Cape (Nordkapp) Highway connecting the counties north of the fjord with the more densely settled portion of the country to the south.

Folengo, Teofilo, original name GIROLAMO FOLENGO (b. Nov. 8, 1491, Mantua [Italy]—d. Dec. 9, 1544, near Bassano Campese, Republic of Venice), Italian inventor of verse written in macaronics (*q.v.*), a synthetic combination of Italian and Latin.

Folengo entered the Benedictine order as a young man, taking the name Teofilo by which he is known. He lived in the monasteries of Brescia, Mantua, and Padova (Padua), then left the order in about 1525. After 1530 he lived as a hermit near Sorrento, then was readmitted to the Benedictine order in 1534 and remained in it until his death.

Though he wrote much poetry in various forms, Folengo's masterpiece is *Baldus,* a 20-book poem in macaronic hexameters, published under the pseudonym Merlin Cocai. Four versions of *Baldus* are known, published in 1517, 1521, 1539–40, and 1552 (modern edition, *Le maccheronee,* 1927–28). Written with a rich vein of satire, humour, and fantasy, Folengo's poem narrates the adventures of a rustic hero, Baldus, descendant of the medieval epic hero Roland's cousin Rinaldo.

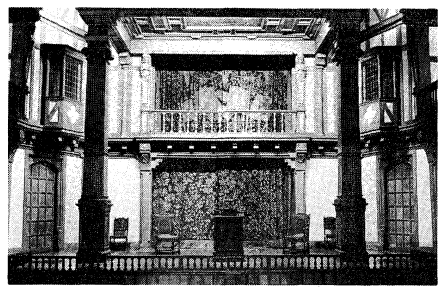


Folengo, portrait by an unknown artist, 16th century
Alinari—Art Resource/EB Inc.

Folger, Henry Clay (b. June 18, 1857, New York, N.Y., U.S.—d. June 11, 1930, Brooklyn, N.Y.), American lawyer, business executive, and founder of the Folger Shakespeare Library in Washington, D.C.

At Amherst College Folger won prizes in English composition and oratory, was elected to Phi Beta Kappa, and developed an interest in Shakespeare. After graduation in 1879 he studied law at Columbia University, earning the LL.B. degree in 1881. As a student he worked for Pratt and Company, which was part of the Standard Oil group of companies. In 1908 he became a director of the Standard Oil Company of New York and in 1911 became its president. Under his direction the firm prospered, and he was made chairman of the board in 1923. A man of diverse cultural interests, he gradually built up a collection of Shakespeareana. In 1928 he announced plans for a library of Shakespearean materials, which was built on Capitol Hill in Washington, D.C.

Folger Shakespeare Library, research centre in Washington, D.C., for the study of William Shakespeare, his contemporaries, Elizabethan society and culture, and 16th- and 17th-century British drama, literature, and history. The library, with approximately 250,000 volumes and 40,000 manuscripts, possesses an unrivaled collection of Shakespeare's folios—79 copies of the first folio (1623), 58 copies of the second folio (1632), and 24 copies of the third folio (1663–64)—and constitutes the second largest collection of English books printed prior to 1641. It also possesses world-famous collections of 18th- and 19th-century theatrical materials (such as theatre playbills, theatre programs, promptbooks, and costumes); 16th- and 17th-century French political pamphlets;



Modern reproduction of an Elizabethan stage in the Folger Shakespeare Library, Washington, D.C.
Seymour Linden

tracts by various Reformation leaders including Martin Luther; and materials associated with Desiderius Erasmus and John Dryden. Completed in 1932 and administered by the trustees of Amherst College, the library is named after Henry Clay Folger, a Standard Oil Company of New York executive whose will bequeathed his Shakespeare collection to the American people and provided the necessary funds to house, maintain, and expand it. The reading room is open only to advanced scholars. An exhibition gallery and a model Elizabethan theatre are open to the public. Publications include a "Folger Facsimile" series, a series of booklets for the general reader, and *Shakespeare Quarterly*. The library published B.A. Kane's *The Widening Circle—the Story of the Folger Shakespeare Library and its Collections* (1976).

foliation, planar arrangement of structural or textural features in any rock type, but particularly that resulting from the alignment of constituent mineral grains of a metamorphic rock of the regional variety along straight or wavy planes. Foliation often occurs parallel to original bedding, but it may not be ostensibly related to any other structural direction. Foliation is exhibited most prominently by sheety minerals, such as mica or chlorite.

Regional metamorphic rocks are usually subdivided into schist, slate, and gneiss on the basis of grain size and foliation type. The schists, for example, exhibit strong foliation with partings along well-defined planes of medium-grained micas or hornblendes. The gneisses, which are characteristically rich in feldspar and quartz, tend to be coarse-grained and less distinctly foliated. They do not split, or cleave, along their planes as schists do. A few contact-metamorphic rocks are foliated, but most, such as hornfels and granulite, tend to be granular.

folic acid, also called PTEROYLGLUTAMIC ACID, or FOLACIN, a vitamin of the B complex. It is essential in animal nutrition and is required by bacteria as a growth factor. In humans, folic acid is necessary for the synthesis of nucleic acids and the formation of red blood cells. Its major sources in the human diet include leafy vegetables and liver.

Folic acid, or a derivative of it, is required by all higher animals studied, but the requirement is difficult to demonstrate in some animals because the vitamin is synthesized by bacteria contained in an animal's intestinal tract. In such instances, a deficiency may be observed when the animals are given drugs, such as sulfonamides, that interfere with synthesis of the vitamin by microorganisms. For coverage of disorders associated with deficiency of folic acid, *see* folic-acid-deficiency anemia; tropical sprue.

Consult the INDEX *first*

folic-acid-deficiency anemia, severe disease characterized by deficiency of red blood cells (anemia) and often white cells (leukopenia) and platelets (thrombocytopenia) in the circulation, ineffective blood formation in the bone marrow, and progressive gastrointestinal problems. Folic-acid deficiency develops over a period of several months and may result from inadequate diet (lacking in leafy vegetables or liver), intestinal malabsorption, cirrhosis of the liver, or anticonvulsant-drug therapy; it may also occur in the last three months of pregnancy and in persons with severe hemolytic anemia (dissolution of red blood cells by hemolysin). In infants it can result from a diet of unsupplemented goat's milk or dried milk.

Symptoms and signs of folic-acid deficiency include a blood picture indistinguishable from that of pernicious anemia, with megaloblastic bone marrow, macrocytes in the circulation, and marked gastrointestinal problems, such as sore tongue, fissures at corners of the mouth, diarrhea, inflammation of the pharynx or esophagus or both, and ulceration of the stomach and intestines. Treatment is specific: the administration of folic acid by mouth produces quick improvement in all symptoms; an adequate diet results in cure in cases due to simple malnutrition.

Folies-Bergère, Parisian music hall and variety-entertainment theatre that is one of the major tourist attractions of France. Following its opening in a new theatre on May 1, 1869, the Folies became one of the first major music halls in Paris. During its early years it presented a mixed program of operetta and pantomime, with the renowned mime Pierre Legrand performing the latter. Leon Sari served as the theatre's first manager, from 1869 to 1885.

In 1887 the Folies' highly popular revue entitled "Place aux Jeunes" established it as the premiere nightspot in Paris. By the last decade of the 19th century, the theatre's repertory encompassed musical comedies and revues, operettas, vaudeville sketches, playlets, ballets, eccentric dancers, acrobats, jugglers, tightrope walkers, and magicians. When the vogue of nudity seized the music halls of Paris in 1894, the Folies elaborated it to such an extent that the theatre's reputation for sensational displays of female nudity came to overshadow its other performances.

The Folies achieved an international reputation under the management of Paul Derval (from 1918 to 1966). He staged a series of sumptuous and grandiose spectacles featuring beautiful young women parading in a state of near nudity (despite their gaudy costumes) against backdrops of exotic scenery. Parisians and tourists alike were also attracted to the singers, acrobats, and dramatic sketches that comprised the remainder of the program. The Folies has showcased the talents of many of the great entertainers and music-hall artists of France from the late 19th century on. Among these have been Yvette Guilbert, Mistinguett, Fernandel, Josephine Baker, and Maurice Chevalier.

The Folies-Bergère was managed by Hélène Martini from 1974. Each of its shows requires about 10 months of planning and preparation, 40 different sets, and 1,000 to 1,200 individually designed costumes. The titles of all the Folies' shows since the late 1880s have each consisted of a total of 13 letters.

Foligno, Latin FULGINIUM, town, Perugia *provincia,* Umbria *regione,* central Italy. It lies along the Topino River, southeast of Perugia. Originally an Umbrian settlement, the present site is that of the Roman town of Fulginium and still reflects the Romans' regular street plan. The town owed its importance to its command of the principal pass between the Umbrian plain and the Adriatic coast. A powerful rival of medieval Perugia, Foligno enjoyed great prosperity under the government of the Trinci family as semi-independent deputies of the Holy See (1305–1439). After their fall at the hands of Pope Eugenius IV in 1439, the town became part of the Papal States until 1860. Foligno was famous as the seat of a flourishing school of painting in the 15th century. The town was badly damaged by an earthquake in 1832 and was largely rebuilt in the aftermath of heavy bombing in World War II.

Among the principal monuments of interest in the town are the cathedral (1133–1201; restored), the Romanesque Church of Santa Maria Infra Portas, and the Trinci Palace (1389–1407), which houses the archaeological museum and the picture gallery. Raphael's "Madonna di Foligno," now in the Vatican, was painted for the Italian nobleman Sigismondo di Comitibus. The first edition of Dante's poem *La divina commedia* was printed (1472) in Foligno's Orfini Palace.

A commercial and industrial centre, Foligno has sugar refineries and metallurgical, textile, building-materials, and paper and timber industries. Pop. (1988 est.) mun., 53,545.

Foliot, Gilbert: *see* Gilbert Foliot.

folk art, any genre of art produced by peasants, pastoralists, seamen, artisans, or tradespeople who live away from urban centres in societies that are not highly industrialized. Folk art can also be the art of social or ethnic minorities that have preserved earlier traits by living apart, culturally and frequently physically. Sometimes the naive or religious art of certain unfolkish city people is considered folk art. Folk art embraces literature, music, dance, and the visual arts.

Folklore, religion, and superstition all contribute to the style, content, and motifs of a folk art within a particular grouping. Folk art is not static and rigid, and new themes are constantly evolving from traditional forms to meet new circumstances. Folk art reaches across national boundaries, and any comparative study must take into account all the cultural, traditional, and environmental considerations that affect it.

A brief treatment of folk art follows. For full treatment, *see* MACROPAEDIA: Folk Arts.

Folk literature. Folk literature is the oral lore of cultures with no written language and has at some time been produced by nearly all known peoples. It even exists side by side with the written record in advanced cultures, being carried on by children and by the illiterate, but in many urbanized areas it is gradually being replaced by books and newspapers, radio, and television. Major forms of folk literature include the folk song, ballad, fable, folktale, proverb, riddle, and charm.

One of the most enduring forms of folk literature is the folk song; this is typically a song that lives in oral tradition, is learned through hearing rather than reading, and is disseminated within families and restricted social networks. Folk songs worldwide are characterized by their close association with the routine activities of daily life. The traditional roles of the folk song were to transmit news and gossip, document local genealogies and history, and preserve the lore and literature of a people. In modern times many of these needs are met by the mass media, and some collectors have feared that folk traditions are dying. In fact, folk songs now fulfill new functions, such as symbolizing the unity and identity of a minority group. In the United States the children and grandchildren of European immigrants, for example, still preserve some of the rich song traditons of their respective motherlands, which, in all likelihood, they have never visited. In addition, a vast repertoire of native folk songs has grown up in the United States, centred on that country's history, regions, and diverse ethnic and social groups.

The folktale is a prose story, traditional in content, that is transmitted orally through many generations. Folktales may contain elements of myths, often devoid of religious meaning; but many scholars draw no firm dividing line between myth and folktale. Motifs (*e.g.,* grateful beasts, tests, return of the dead) and skeletal plots (types) appear in various genres of tales. Folktales have traveled from culture to culture and into and out of written literature.

Among genres of folktales are *Märchen,* or fairy tales and household tales; local traditions (legends, or *Sagen*); saints' legends; animal tales; trickster stories; tales of heroes; jests, or merry tales; and etiological tales (*Natursagen*

or *pourquoi* stories), explaining how a natural phenomenon, animal feature, or institution of society came to be. The saga is a Scandinavian literary culmination of an orally transmitted prose tale. *See also* fairy tale; legend; Märchen.

Folk music. Folk music, learned through hearing, is disseminated within families and restricted social networks. It survives independently of both classical and popular music and is recreated constantly by the performers who learn, play, and sing it. Each country tends to have a repertoire of its own tunes, which change when they cross ethnic or cultural boundaries. Of the four major groups of folk instruments, the simplest consists of rattles, flutes, bullroarers, whistles, and long, wooden trumpets such as the alpenhorn. The second group, taken to Europe and the Americas from other cultures, includes bagpipes, folk oboes, banjos, xylophones, and folk fiddles. The third, made up of instruments developed in European folk cultures from simple materials, is represented by the Dolle, a fiddle fashioned from a wooden shoe, and the bowed lyre. The fourth, and most important, group is composed of instruments from urban music culture, though sometimes changed drastically: the violin, bass viol, clarinet, guitar, violin with sympathetic strings, and hurdy-gurdy.

In order to survive, a new folk composition must be accepted by the community and in some way reflect their values and taste. But musicians are free to vary and embellish (or simplify) the original model as it is passed down from one generation to the next. This process, known as communal re-creation, is essential to the development of a genuine folk tradition. Modern recording techniques pose a threat to this feature of folk art, perpetuating a single variant and thus inhibiting innovation and change.

Most traditional folk melodies are monophonic (having one part), although polyphonic forms (having two or more simultaneous parts) are found in southern and eastern Europe; the *ganga* of Yugoslavia, for example, have parallel major and minor seconds, an unusual and exciting dissonance for the Western listener. Multi-part choral singing is common in parts of the Soviet Union, especially the Caucasus. Rounds are another common form of rudimentary folk polyphony. Most folk melodies are strophic (having repeated stanzas, often of four lines). Exceptions include children's songs, which are usually very simple, and epics, particularly those of eastern Europe, which often consist of a single line repeated, varied, and embellished. Rhythm in folk songs often owes much to the local language and its patterns of stress. In many European countries $\frac{2}{4}$ and $\frac{4}{4}$ are most typical, but in Bulgaria and some other areas *aksak* (Turkish: "limping") rhythm is common, characterized by asymmetrical rhythmic patterns.

Folk music often embodies something of a people's character, and composers have long turned to it for ideas and inspiration. This well-established practice became especially conspicuous with the burgeoning of nationalist sentiment during the late 19th century. Composers such as the Hungarians Béla Bartók and Zoltán Kodály, the British musicians Ralph Vaughan Williams and Frederick Delius, the Norwegian Edvard Grieg, and the American Aaron Copland all relied heavily on the folk idiom. In India there is constant cross-fertilization between the *rāgas* (modes) and *tālas* (rhythmic formulas) of classical music (often called the "great" tradition) and the melodies and metres of the village folk songs (the "little" tradition).

Folk dance. Defined variously as traditional dance as it evolves from everyday activities, as native dance having magical or economic functions, or as dance performed nonprofessionally; folk dance generally excludes primitive, theatrical, classical, and popular forms of dance. Rural folk dance frequently reveals ancient ritual origins and serves recreational purposes, while urban equivalents may be much more recent and serve secular purposes. Both celebrate original festivals, such as those based on local calendars for agricultural ecology, but also have adapted to church festival calendars. Almost universally the older, experienced men and women are the leaders in folk dance, with the children serving as apprentices, though generally the individual of any age or sex is submerged in the larger society and must fit into the dance group harmoniously.

The folk dances that were recorded and described in most European countries during the first half of the 20th century fall into two main groups: (1) the ritual-ceremonial and (2) the social. The dances in the first group are, except in a very few instances (such as certain harvest dances of eastern Europe), performed by men. Derived from pre-Christian religious ceremony, the ritual dances are typically associated with local annual customs, which can be grouped under such seasonal events as: winter carnival, Easter, May Day, and midsummer. The customs may include some dance action together with ritual drama, such as Christmas mumming and carnival masquerading, or they may be composed wholly of dance, as in the English morris dance and other young men's dances of the European spring festivals.

The second group includes all those dances in which the unit is the man-woman couple with sex relationship as a dominant feature. Social folk dances possibly originated when the young medicine men shared their magic-making with the unmarried girls in a ceremonial fertility rite. Many examples of communal processions and chains survive in Europe, such as the farandole, the floral, and the different types of maypole dance. The English, Scottish, and Irish country dances have evolved from the "long" dance processions and from the maypole rounds. Adapted through the centuries to indoor dancing, they attracted the interest and ingenuity of dancing masters and musicians, who composed on the old base a continuing stream of new dances for the social dancers in court and hall. This stream of folk-type dances overflowed their countries of origin to mix with and fertilize homegrown forms, as in the North American square dance.

Couple folk dances are also of ancient origin with erotic content, as in the Spanish jota, the Italian saltarello, and the somewhat more acrobatic displays of the man partner in the Basque *aurresku* and the "halling" of Norway.

A number of social folk dances traditional to particular countries, such as the Austrian waltz, the Czech polkas, and the Argentine tango, have established themselves as cosmopolitan ballroom dances or have provided the basis for such dances. Stage dancing, including the classical forms of ballet, constantly borrows and has borrowed from folk sources of many countries to enrich its content and techniques. Meanwhile the ancient country customs and the rustic revels persisted, often receiving reinforcement in the shape of a new step or rhythm or even a complete dance that had briefly been the rage in the fashionable dance world.

Visual folk art. Predominantly functional or utilitarian, visual folk art is typically created by hand for use by the maker or a small circumscribed group and contains an element of retention—the prolonged survival of tradition. Natural, local materials—such as straw, wood, and leather—and common, even crude, tools are usually utilized. Visual folk art is the creative expression of man's struggle toward civilization within his particular environment through the production of useful but aesthetic buildings and objects.

Although folk art has produced painted pictures meant to be hung on the wall, such as the portraits and local scenes of American folk art, most painted depictions in folk art are incorporated as decorative features of other objects, such as clock faces, chests, and chairs. Paintings on exterior walls are widespread in the folk art of Europe, North Africa, and India.

In sculpture, folk art has produced religious objects, toys, and decorative items, as well as such useful objects as bottles, flasks, and candlesticks in sculpted form. Wood has served as an almost universal medium, but stone and metal have also been used.

The designs of basic residential dwellings and simple public buildings may be considered the architectural component of the visual folk arts. The Alpine house of Switzerland and the log cabin of the American frontier are examples of residential folk architecture, while the wooden churches of Eastern Europe are representative of folk architecture in public buildings. Other common examples of visual folk arts are prints made from wood blocks, scrimshaw (the carving of whalebone), and the design of pottery, textiles, and costumes.

folk high school, type of residential school for adults that is standard in Scandinavian countries and has also been adopted elsewhere in Europe. The concept of the folk high school was originated in Denmark by the theologian N.F.S. Grundtvig as a means of providing the common people with a knowledge of their history, religion, and cultural heritage. The model school for the movement was established by the young educator Kristen Kold in 1851 and was soon widely imitated. After Denmark's military defeat by Prussia in 1864, these schools were a powerful instrument of national regeneration. There are no entrance qualifications or leaving examinations; attendance is completely voluntary. The atmosphere is homelike. Students and teachers live, work, and play together. The singing of hymns and folksongs is characteristic. Subjects of general interest in literature and social science predominate. Most students are young adults, originally rural workers, but now urban as well. The schools are private but receive state subsidies, and many attract an international body of students.

folk society, an ideal type or concept of society that is completely cohesive—morally, religiously, politically, and socially—because of the small numbers and isolated state of the people, because of the relatively unmediated personal quality of social interaction, and because the entire world of experience is permeated with religious meaning, the understanding and expression of which are shared by all members. The folk society is generally assumed to be the model of preliterate or so-called primitive societies that anthropologists have traditionally studied.

The most important and enduring modern effort to make the concept of folk culture relevant to anthropology remains the work of the U.S. anthropologist Robert Redfield, who saw folk society as including not only primitive groups but also peasant peoples whose operations entailed some degree of dependence on the city (*see* peasantry). Although criticized for this interpretation of peasant life, as well as for underrating the impersonal and economic values and relations that may obtain in folk societies, Redfield's construction of the ideal folk culture continues to be the authoritative ideal type. Especially significant characteristics of folk society, as Redfield saw it, are its self-conception as the vessel of the sacred (this conception endowing the moral order with absolute authority and rendering the life-styles rigidly conventionalized) and its quality of being the whole of social and spir-

itual reality, with functions satisfying all the needs of an individual from birth, through all his life crises and transitions, to death.

Folkers, Karl August (b. Sept. 1, 1906, Decatur, Ill., U.S.), U.S. chemist whose research on vitamins resulted in the isolation of vitamin B_{12}, the only effective agent known in countering pernicious anemia.

In 1934 Folkers joined the research laboratories of Merck and Co., Inc., Rahway, N.J. His early work included pioneering studies of curare, erythrina alkaloids, and morphine alkaloids. During the 1930s his research team synthesized and helped establish the chemical structure of numerous B-vitamins.

Folkers' search for the antipernicious anemia factor, begun in 1938, ended in 1948 with the isolation of a red crystalline compound now called vitamin B_{12}. His research team also discovered mevalonic acid, which is a key substance in the production of numerous important biochemical compounds, including carotenoids, steroids, and terpenes.

In 1948 Folkers' team isolated, synthesized, and determined the structure of numerous members of the streptomycin group of antibiotics. His work also encompassed the antibiotics penicillin, grisein, oxamycin, neomycin, and novobiocin.

Folkers served as president of the Stanford Research Institute, Menlo Park, Calif., from 1963 to 1968 and then became director of the Institute for Biomedical Research at the University of Texas, Austin.

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

Folkestone, town, Shepway district, county of Kent, England. Once a "limb" of the Cinque Port of Dover (7 mi [11 km] east), Folkestone shared that town's privileges and duties until, in 1629, the local inhabitants obtained a license to build a port. From the beginning of the railway age, Folkestone developed both as a cross-Channel passenger port (Boulogne, Fr., lies 26 mi away) and as a high-class seaside resort. Along the sandy cliff to the west, the Leas, a broad promenade with lawns, extends 2 mi to Sandgate above the shore road and gardens. William Harvey, the 17th-century physician, was a native and is commemorated by a statue on the Leas.

In 1805, under threat of French invasion, three defensive Martello towers were built east of the town. There the railway line to Dover follows a difficult course by cuttings and tunnels in the chalk cliffs. Like Dover, Folkestone was considerably damaged in World War II both by enemy raids and cross-Channel artillery bombardment. Located outside the town is a popular racecourse. Pop. (1981 prelim.) 43,742.

folklore, in modern usage, an academic discipline the subject matter of which (also called folklore) comprises the sum total of traditionally derived and orally or imitatively transmitted literature, material culture, and custom of subcultures within predominantly literate and technologically advanced societies; comparable study among wholly or mainly nonliterate societies belongs to the disciplines of ethnology and anthropology. In popular usage, the term folklore is sometimes restricted to the oral literature tradition.

A brief treatment of folklore scholarship follows. For full treatment of the discipline and its subject matter, *see* MACROPAEDIA: Folk Arts.

Folklore studies began in the early 19th century. The first folklorists concentrated exclusively upon rural peasants, preferably uneducated, and a few other groups relatively untouched by modern ways (*e.g.*, gypsies). Their aim was to trace preserved archaic customs and beliefs to their remote origins in order to trace the mental history of mankind. In Germany, Jacob Grimm used folklore to illuminate Germanic religion of the Dark Ages. In Britain, Sir Edward Tylor, Andrew Lang, and others combined data from anthropology and folklore to "reconstruct" the beliefs and rituals of prehistoric man. The best-known work of this type is Sir James Frazer's *The Golden Bough* (1890).

Large collections of material were amassed in the course of these efforts. Inspired by the Grimm Brothers, whose first collection of fairy tales appeared in 1812, scholars all over Europe began recording and publishing oral literature of many genres: fairy tales and other types of folktales, ballads and other songs, oral epics, folk plays, riddles, proverbs, etc. Similar work was undertaken for music, dance, and traditional arts and crafts; many archives and museums were founded. Often the underlying impulse was nationalistic; since the folklore of a group reinforced its sense of ethnic identity, it figured prominently in many struggles for political independence and national unity.

As the scholarship of folklore dveloped, an important advance was the classification of material for comparative analysis. Standards of identification were devised, notably for ballads (by F.J. Child) and for the plots and component motifs of folktales and myths (by Antti Aarne and Stith Thompson). Using these, Finnish scholars, led by Kaarle Krohn, developed the "historical-geographical" method of research, in which every known variant of a particular tale, ballad, riddle, or other item was classified as to place and date of collection in order to study distribution patterns and reconstruct "original" forms. This method, more statistical and less speculative than that of the anthropological folklorists, dominated the field throughout the first half of the 20th century.

After World War II new trends emerged, particularly in the United States. Interest was no longer confined to rural communities, since it was recognized that cities too contained definable groups whose characteristic arts, customs, and values marked their identity. Although some Marxist scholars continued to regard folklore as belonging solely to the working classes, in other circles the concept lost its restrictions of class and even of educational level; any group that expressed its inner cohesion by maintaining shared traditions qualified as a "folk," whether the linking factor be occupation, language, place of residence, age, religion, or ethnic origin. Emphasis also shifted from the past to the present, from the search for origins to the investigation of present meaning and function. Change and adaptation within tradition were no longer necessarily regarded as corruptive.

In the view of "contextual" and "performance" analysis in the late 20th century, a particular story, song, drama, or custom constitutes more than a mere instance to be recorded and compared with others of the same category. Rather, each phenomenon is regarded as an event arising from the interaction between an individual and his social group, which fulfills some function and satisfies some need for both performer and audience. In this functionalist, sociological view, such an event can be understood only within its total context; the performer's biography and personality, his role in the community, his repertoire and artistry, the role of the audience, and the occasion on which the performance occurs all contribute to its folkloric meaning.

folkway, the learned behaviour, shared by a social group, that provides a traditional mode of conduct. According to the American sociologist William Graham Sumner, who coined the term, folkways are social conventions that are not considered to be of moral significance by members of the group (*e.g.*, customary behaviour for use of the telephone). The folkways of groups, like the habits of individuals, originate in the frequent repetition of acts that prove successful for satisfying basic human needs. These acts become uniform and are widely accepted. Folkways operate primarily at an unconscious level and persist because they are expedient. They tend to group themselves around major social concerns, such as sex, forming social institutions (*e.g.*, the family). Sumner believed that folkways from diverse areas of life tended to become consistent with each other, creating definite patterns.

Tradition, habit, and religious sanctions tend to strengthen folkways as time passes, making them more and more arbitrary, positive, and compelling. Some folkways become mores (borrowed from the Latin word for customs by Sumner) when they become ethical principles, the behaviours considered essential to the welfare of the society. Mores are more coercive than folkways: relatively mild disapproval follows an infringement of a folkway; severe disapproval or punishment follows the breaking of mores. Polygamy violates the mores of American society; failure to wait one's turn in line is a breach of folkways.

Sumner saw folkways and mores as essentially conservative and doubted the ability of members of the society to change them consciously. The small variations introduced by individuals in their observance, however, allows for some change, according to Sumner. *See also* norm.

Follen, Adolf Ludwig, also called AUGUST ADOLF FOLLENIUS (b. Jan. 21, 1794, Giessen, Hesse—d. Dec. 26, 1855, Bern), German political and Romantic poet, an important founder and leader of radical student groups in the early 19th century.

While studying at Giessen in 1814, he founded the democratic Deutsche Lesegesellschaft (German Reading Society). Expelled for his political views in 1815, he went to Heidelberg, where he was among the founders of the political student association Teutonia. With his brother, Karl, he was also the leader of the Unbedingten (Uncompromising Ones), or Schwarzen (Blacks), a radical student group whose ideas resulted in the assassination of the conservative dramatist August Kotzebue in 1819. Based on an idealized picture of the medieval Christian empire, Follen's political ideas were aimed at incorporating the German states into a national, united, Christian republic. He expressed these goals in his collection of songs, *Freye Stimmen frischer Jugend* (1819; "Free Voices of Fresh Youth").

Banished after a political trial, Follen moved to Switzerland, where he taught at Aarau (1821–27) and published *Harfen-Grüsse aus Deutschland und der Schweiz* (1823; "Harp Greetings from Germany and Switzerland"). Follen also wrote non-political poetry, inspired, like his political ideas, by a Romantic enthusiasm for the Middle Ages. This sentiment is evident in his ballads on events in Swiss history, in his novel *Malagys und Vivian* (1829), and in *Siegfrieds-Tod* (1840; "Siegfried's Death"), a ballad of part of the *Nibelungenlied.* His last important work was the epic poem *Tristans Eltern* (1857; "Tristan's Parents").

Follett, Mary Parker (b. Sept. 3, 1868, Quincy, Mass., U.S.—d. Dec. 18, 1933, Boston), U.S. author and sociologist who was a pioneer in the study of interpersonal relations and personnel management.

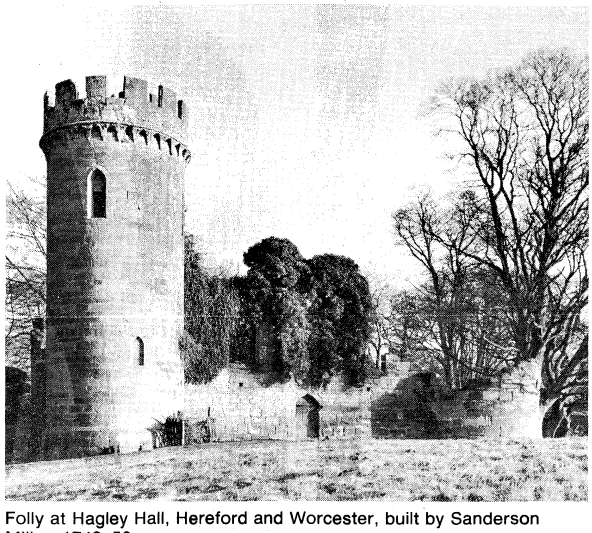
Interested in social work early in her career, Follett organized social centres in Boston schools in the opening years of the 20th century. Later she participated in the development of vocational guidance programs in the school system. From these experiences she developed new ideas about the importance in

an industrialized society of small neighbourhood groups emphasizing individual responsibility and the creative encounter—ideas that she expressed in *The New State* (1918) and *Creative Experience* (1924).

During the last years of her life she lectured extensively on the various aspects of industrial management and served as a consultant to business executives and government administrators.

follicle-stimulating hormone (FSH), one of two gonadotropic hormones (*i.e.,* hormones concerned with the regulation of the activity of the gonads, or sex glands) produced by the pituitary gland. The FSH, a glycoprotein operating in conjunction with luteinizing hormone (LH), stimulates development of the graafian follicle, a small, egg-containing vesicle in the ovary of the female mammal; in the male, it promotes the development of the tubules of the testes and the differentiation of sperm. Though in the male, the presence of FSH is necessary for the maturation of spermatozoa, additional FSH may not be required for months because testosterone can maintain this activity. In the female, however, there is a rhythmic or cyclical increase and decrease of FSH, which is essential for monthly ovulation. *See also* luteinizing hormone; menstruation.

folly (from French *folie,* "foolishness"), also called EYECATCHER, in architecture, a costly, generally nonfunctional building that was erected to enhance a natural landscape. Follies first gained popularity in England, and they were particularly in vogue during the 18th and early 19th centuries, when landscape design was dominated by the tenets of Romanticism (*q.v.*). Thus, depending on the designer's or owner's tastes, a folly might be constructed to resemble a medieval tower, a ruined castle overgrown with vines, or a crumbling Classical temple complete with fallen, eroded columns.



Folly at Hagley Hall, Hereford and Worcester, built by Sanderson Miller, 1749–50

A.F. Kersting

During this period in landscape design, much care was taken to emphasize the landscape's pictorial qualities, such that a distinct foreground, middle ground, and background could be perceived; to suit the general design purposes, follies were usually built on a much smaller scale than the buildings they imitated. Though follies were sometimes used as pavilions, they were typically built for visual effect alone, and, with other deliberately wrought effects—such as simulated grottoes and rocky chasms—they were intended to improve or complete the natural setting.

In the United States, the term folly has also been applied to ornate gazebos or garden pavilions.

Folquet DE MARSEILLE, also called FOULQUES DE TOULOUSE (b. *c.* 1155, Marseille?, Provence—d. Dec. 25, 1231, Toulouse), Provençal troubadour and cleric.

Born into a Genoese merchant family, Folquet left his life as a merchant to become a poet in about 1180. He was widely respected and successful throughout Provence and Aragon. His works, which include love lyrics (often dedicated to his patron's wife), crusading songs, and religious poems, demonstrate a classical education and careful metrical forms. In 1195 Folquet, with his wife and children, entered a Cistercian abbey and renounced his love poetry. He became abbot and, in about 1205, bishop of Toulouse, in which capacity he engaged in persecuting the Albigensians and helped to found the University of Toulouse.

Folsom complex, an early archaeological complex of North America characterized by a distinct leaf-shaped projectile point called a Folsom point. The Folsom complex of artifacts, which also includes a variety of scrapers, knives, and blades, was one variety of the Paleo-Indian hunting cultures; it centred in the Great Plains, beginning sometime prior to 10,000 BC, and involved the hunting of large animals, now mostly extinct. Much of the importance of the Folsom complex derives from the fact that the initial discovery at Folsom, N.M., in 1926 marked the first association in the Americas of man-made artifacts with the bones of long-extinct mammalian forms. Similar associations were also found at such locations as the Lindenmeier site in eastern Colorado (*see also* Clovis complex).

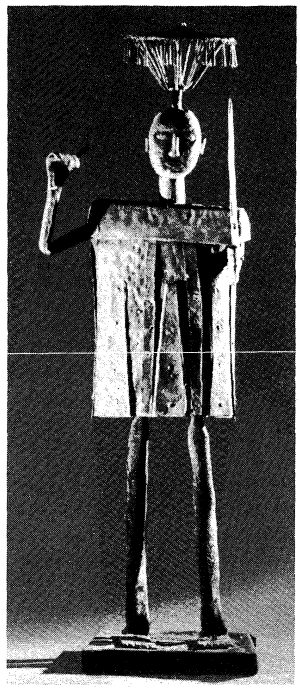
The classic Folsom point is a more or less leaf-shaped, or lanceolate, point with a concave base, projecting ears at the basal corners, and fluted sides. The Folsom complex also includes unfluted points, blunt-tipped knives, scrapers, and bone tools. Most Folsom artifacts have come from various parts of the Great Plains. The majority of datable artifacts seem to fall between 9000 and 8000 BC.

Fomalhaut, also called ALPHA PISCIS AUSTRINI, the 18th star (excluding the Sun) in order of apparent brightness. It is used in navigation because of its conspicuous place in a sky region otherwise lacking in bright stars. It lies in the southern constellation Piscis Austrinus, about 22.5 light-years from the Earth. A white star, it has an apparent magnitude of 1.18. A sixth-magnitude companion star is yellow.

Fomalhaut was associated with the Roman goddess Ceres (associated with the analogous Sicilian and Greek goddess Demeter) and was worshiped; in astrology it is one of four royal stars.

Fombona, Rufino Blanco: *see* Blanco Fombona, Rufino.

Fon, also called DAHOMEY, people living in the south of Benin (called Dahomey until 1975) and speaking a dialect of Ewe, a language of the Kwa branch of the Niger-Congo family of African languages.



Iron statue of the god of arms and war, made by the Fon of Benin, in the Musée de l'Homme, Paris

Marc and Evelyne Bernheim—Woodfin Camp and Associates

The traditional economy of the Fon is based on agriculture, relying mainly on corn (maize), cassava, and yams for subsistence; palm oil is the major commercial product. Men clear and hoe the fields, and both men and women plant; the crops are tended and harvested by women. A cooperative organization of adult males aids in such tasks as land clearing and house building. Each village also has a group of professional hunters who are surrounded by supernatural sanctions. Craft specialists include male ironworkers and weavers and female pottery makers.

The primary Fon social unit is the polygynous family, each woman and her children occupying a house within a compound. A lineage, consisting of families related through male descent, usually occupies several neighbouring compounds; the eldest male member serves as the lineage head. Patrilineal clans dispersed throughout Dahomey were formerly important, but clan organization has broken down in recent times. The worship of ancestors, however, remains a major feature of Fon religion.

The village under a hereditary chief was traditionally the primary political unit. In the Kingdom of Dahomey, which flourished in the 18th and 19th centuries, the chiefs were representatives of a powerful king. A main function of the kingship was the conduct of war, which was followed by the Annual Custom, at which prisoners were sacrificed and the goodwill of royal ancestors was sought. The king also exercised judicial powers, collected tribute, and filled political offices. In general, members of the royal clan did not hold political offices because it was believed

they would be tempted to intrigue against the king; important posts were filled by commoners who would owe their appointment to the king and thus remain loyal.

Fond du Lac, city, seat (1836) of Fon ' du Lac county, Wisconsin, U.S. It lies at the southern end of Lake Winnebago, 55 miles (89 km) north-northwest of Milwaukee. It originated in 1785 as a French trading post, named for its location at the "farther end of the lake." Laid out by speculators in 1835, the town attracted many German immigrants. The economy was originally based on lumbering but is now diversified and depends primarily on dairy farming and manufacturing (machine tools, dairy equipment, leather, auto ignition parts, and outboard motors). The Episcopal Cathedral of St. Paul has wood carvings from Oberammergau, Ger. Marian College of Fond du Lac was established in 1936, and the University of Wisconsin centre at Fond du Lac in 1968. Inc. village, 1847; city, 1952. Pop. (1988 est.) 36,719.

Fonda, Henry (Jaynes) (b. May 16, 1905, Grand Island, Neb., U.S.—d. Aug. 12, 1982, Los Angeles, Calif.), American stage and motion-picture actor.

Developing an interest in community theatre, Fonda abandoned studies in journalism at the University of Minnesota to pursue an acting career in New York City. A series of minor Broadway roles in the 1930s led to a leading role in the play *The Farmer Takes a Wife* (1934), in which he subsequently made his movie debut in 1935. He was introduced as a leading film actor in *You Only Live Once* (1937) and went on to establish a distinctively American screen persona in such films as *Young Mr. Lincoln* (1939), *Drums Along the Mohawk* (1939), *The Grapes of Wrath* (1940), and *My Darling Clementine* (1946). He typically played a thoughtful, even ingenuous man of great honesty and integrity.

Fonda was a versatile actor with a simple, natural style who could deliver skillful performances in romantic comedies (*The Lady Eve,* 1941), suspense thrillers (*The Wrong Man,* 1957), and socially significant dramas (*The Ox-Bow Incident,* 1943, and *Twelve Angry Men,* 1957). In the 1955 film version of *Mister Roberts,* he reprised his Tony Award-winning Broadway stage performance in the title role. The following decades saw his appearances in such films as *Fail-Safe* (1963) and *Sometimes a Great Notion* (1971), interspersed with stage roles, most notably as Clarence Darrow in a one-man show (1974). In 1978 the American Film Institute honoured him with its Life Achievement Award, and in 1982 he received an Academy Award as best actor for his performance in the previous year's film *On Golden Pond.* He was the father of the actress Jane Fonda and the actor Peter Fonda.

Fonda, Jane, in full JANE SEYMOUR FONDA (b. Dec. 21, 1937, New York, N.Y., U.S.), American motion-picture actress who was also noted for her political activism.

The daughter of actor Henry Fonda, she left Vassar College after two years and lived in New York City. She studied acting under Lee Strasberg at the Actors Studio there in 1958 and worked as a model. Her acting career began with appearances in the Broadway play *There Was a Little Girl* (1960) and the motion picture *Tall Story* (1960), and she went on to appear in comic roles in numerous films in the 1960s, including *Cat Ballou* (1965) and *Barefoot In the Park* (1967). Her subsequent, more substantial roles were in such socially conscious films as *They Shoot Horses, Don't They?* (1969), *Klute* (1971), *Coming Home* (1978), and *The China Syndrome* (1979). She received Academy Awards for best actress for her performances in *Klute* and *Coming Home.* She costarred with her father in the film *On Golden Pond* (1981).

In the 1970s and '80s Fonda was active on behalf of left-wing political causes. She was an outspoken opponent of the Vietnam War who journeyed to Hanoi in 1972 to denounce the U.S. bombing campaigns there. In the 1980s she devised a popular exercise program for women while continuing to appear in motion pictures. She was married twice, to the French film director Roger Vadim and then to the American politician Tom Hayden.

fondant, confection of sugar, syrup, and water, and sometimes milk, cream, or butter, that is cooked and beaten so as to render the sugar crystals imperceptible to the tongue. The candy is characteristically glossy white in colour, velvety in texture, and plastic in consistency.

Usually, as a first step in making fondant, sugar, corn syrup, and invert sugar, or sugar broken down by heat and graining retardants, are dissolved in water. The resulting mass is heated and beaten or agitated vigorously to dissolve the sugar further.

Icings and confectionery centres made of fondant are predominantly sugar; the proportion of corn syrup is increased to make the chewier fondant used in coating bonbons.

Fondi, Latin FUNDI, town, Latina *provincia,* Lazio (Latium) *regione,* south-central Italy. It lies along the Appian Way at the foot of the Aurunci Mountains, northeast of Fondi Lake and 56 miles (90 km) southeast of Rome. Originally a town of the ancient Volsci people, it received Roman citizenship in 188 BC. The town became papal property in the 5th century, although this control remained largely nominal until the 17th century. Fondi was disputed between the papacy and the Kingdom of Naples in the later Middle Ages. In 1378 it was the scene of the conclave that elected Antipope Clement VII, giving rise to the Great Schism of the Western church (1378–1417).

Many of Fondi's notable buildings were damaged during World War II, including the Castello (13th–15th century), the Palazzo del Principe (1466–77), the medieval Church of San Pietro, and the late Gothic Church of San Domenico (containing a cell used by St. Thomas Aquinas). Roman antiquities in the town include the remains of a temple beneath San Pietro's and the town's ancient cyclopean walls, which are partly of polygonal masonry (late 3rd or early 2nd century BC) and partly of rubble masonry (1st century BC).

Fondi is an agricultural centre noted for citrus fruits, being the northernmost point in Italy where they are regularly cultivated. Pop. (1988 est.) mun., 30,649.

fondue neuchâteloise, Swiss national dish of melted Emmentaler and Gruyère cheeses. In its preparation, white wine is heated in a heavy casserole, called a *caquelon,* that has been rubbed with garlic. The grated cheese is added to the hot wine along with a little cornstarch and a flavouring of nutmeg or kirsch. The fondue is eaten communally from its pot. Diners are provided with small cubes of crusty bread, which they spear on long-handled forks and dip into the hot mixture. The crust that remains at the bottom of the pot is divided among the diners.

There is a legend that the dish originated in the 16th century during fighting between the Protestant and Roman Catholic Swiss. The factions declared a truce after the day's battle and shared a similar dish, one side providing the bread and the other the cheese.

Fonseca, Gulf of, Spanish GOLFO DE FONSECA, sheltered inlet of the Pacific Ocean, bounded northwest by El Salvador, northeast by Honduras, and southeast by Nicaragua. Discovered in 1522, it reaches inland for approximately 40 miles (65 km) and covers an area of about 700 square miles (1,800 square km). Its entrance, marked by Cape Amapala in El Salvador and Cape Cosigüina in Nicaragua, is about 20 miles (32 km) across, but widens to approximately 50 miles (80 km). The gulf is fed by the Goascorán, Choluteca, and Negro rivers of Honduras and the Estero Real River of Nicaragua. The gulf's shores are covered with mangrove swamps, except in the west, where Conchagua Volcano in El Salvador rises sharply from the shore. Notable among the islands in the gulf are Zacate Grande, El Tigre, and Meanguera. The main ports are La Unión in El Salvador, Amapala on Isla del Tigre in Honduras, and Puerto Morazán (upstream on the Estero Real) in Nicaragua.

Fonseca, Manuel Deodoro da (b. Aug. 5, 1827, Alagôas, Braz.—d. Aug. 23, 1892, Rio de Janeiro), leader of the coup that toppled Emperor Pedro II. He became the first president of the Brazilian republic.

The son of an army officer, Fonseca was trained for a military career. He distinguished himself in the Paraguayan War (1864–70) and rose to the rank of major. Although he was politically conservative and personally loyal to the emperor, he felt that it was his duty as an officer to protest the despotic acts of the government and insist that his fellow officers had a right to express their political views.

Manuel da Fonseca, portrait by A. Leterre

By courtesy of the Arquivo Nacional do Brasil

Declared insubordinate by Pedro II, Fonseca led the military revolt of Nov. 15, 1889, which established Brazil as a republic. He served as provisional president until February 1891, when he was elected president by the constituent assembly, a body largely controlled by the generals. As president, Fonseca was both arbitrary and ineffective. When he attempted to rule by decree, he was forced to resign in November 1891.

Font-de-Gaume, cave known for its lavish prehistoric wall paintings, located in the Beune valley near Les Eyzies, in Dordogne, Fr. The cave, with its high, narrow main gallery and several side passages, contains about 200 engraved and painted figures, including bison, horses, mammoths, reindeer, aurochs, woolly rhinoceros, a wolf, and a lioness.

The animals were painted in monochrome and in polychrome, usually in shades of red, brown, and black, and were often superimposed on earlier pictures, making it possible to discern a chronological sequence of artistic development. Most of the paintings probably date to the early and middle Magdalenian period, though some may be as much as 10,000 years older.

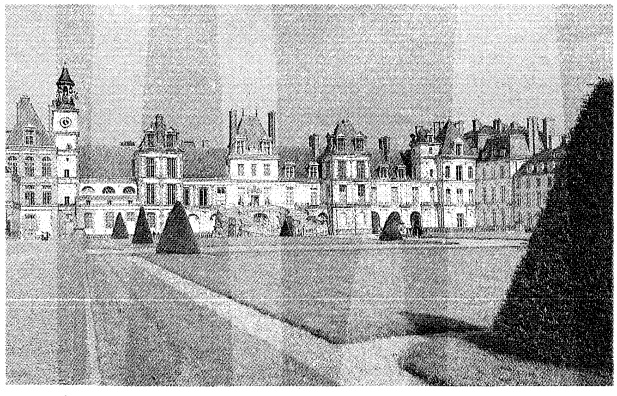
Fontaine, Hippolyte (b. 1833, Dijon, Fr.—d. 1917, Paris), French engineer who discovered that a dynamo can be operated in reverse as an electric motor; he was also the first to transmit electric energy (1873).

After completing his education at the École Nationale Supérieure des Arts et Métiers

at Châlons-sur-Marne, he travelled around France making models of new inventions. He then became an industrial designer and by 1857 had become chief of design in a factory. During the Franco-German War of 1870–71, he organized the manufacture of cannons. After discovering the reversibility of the dynamo, he constructed an electric motor based on that principle, then used the motor in the first transmission of electricity at Vienne in 1873. While serving as president of the Société Internationale des Electriciens, he founded the *Revue Industrielle*, a learned journal.

Fontaine, Jean de La (poet): *see* La Fontaine, Jean de.

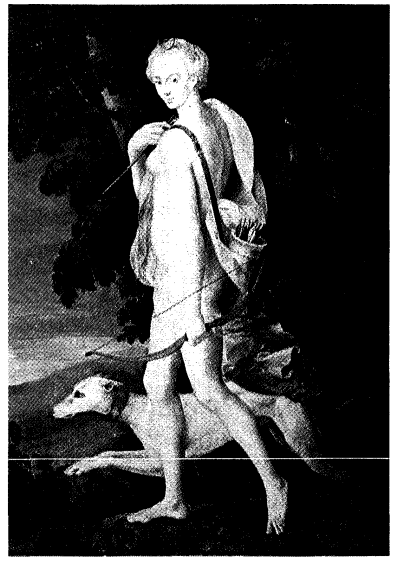
Fontainebleau, town, northern France, in the Seine-et-Marne *département,* Île-de-France region, 40 mi (65 km) south-southeast of Paris by road, situated in the forest of Fontainebleau, 2 mi from the left bank of the Seine. The famous château, southeast of the town, is one of the largest residences built by the kings of France. Originally a medieval royal hunting lodge enlarged by Louis IX, or St. Louis (1214–70), it was entirely rebuilt by the best French architects of the time in 1527; only one tower of the earlier building still stands. Famed craftsmen, including the Italian painter Francesco Primaticcio and the Italian sculptor Benvenuto Cellini, were called to the court to further embellish the palace; these artists, collectively referred to as the School of Fontainebleau, blended Italian and French styles. Henry II (reigned 1547–59), Catherine de Médicis (1519–89), and Henry IV (reigned 1589–1610) enlarged the palace. The spacious gardens were redesigned by André Le Nôtre, the 17th-century French landscape architect, during the reign of Louis XIV. The château is a succession of five courtyards of different shapes. The Gallery of Francis I (reigned 1515–47), the horseshoe exterior staircase, the ballroom, and the council chamber are of particular interest. The château is surrounded by pleasant gardens crossed by a canal built in the reign of Henry IV.



The château of Fontainebleau, Fr., with the "Horseshoe" staircase entrance (centre)
Carl Purcell—Photo Researchers

Fontainebleau was little more than a hamlet until the 19th century, when it became a popular resort for Parisian holidaymakers. Three historical documents signed at the château were the revocation of the Edict of Nantes by Louis XIV (1685); the concordat between France and Rome (1814); and (in the same year) Napoleon's act of abdication. During World War II the palace of Fontainebleau was a German headquarters. Liberated in 1944 by U.S. Gen. George Patton, it was the seat of a Western Allied headquarters from 1945 to 1965. The national forest of Fontainebleau is one of the most scenic wooded tracts in France. It covers 42,000 ac (17,000 ha); nearly a quarter of it is rocky. Pop. (1982) 14,687.

Fontainebleau, school of, the vast number of artists, both foreign and French, whose works are associated with the court of Francis I at Fontainebleau during the last two-thirds of the 16th century. There is both a first and a second school of Fontainebleau. The earlier works are the more important.



"Diana the Huntress," oil painting by an anonymous artist of the school of Fontainebleau, *c.* 1550; in the Louvre, Paris
Giraudon—Art Resource/EB Inc.

The palace itself can be described as charming and picturesque, though architecturally it is not a work of consequence, being chiefly a transformation of the previous medieval castle, even incorporating some of the older parts. The King began rebuilding in 1528 and by 1530 had persuaded Rosso Fiorentino (1494–1540), the first of many Italians who were to work there, to locate in France. Rosso was joined in 1532 by Primaticcio (1504–70). Artists of great merit, they evolved a brilliant system of combining painted panels with stucco nudes, garlands, and other forms sculpted in high relief. In addition, Rosso developed a much imitated "strapwork" technique; that is, he treated stucco like pieces of leather that had been rolled, folded, and cut into shape. Artists who could not visit Fontainebleau knew of the work there through engravings, and these same engravings are useful today as records of what has been lost. Much of the most characteristic Fontainebleau decorative sculpture and painting can still be seen there in the Galerie François I, the Chambre de la Duchesse d'Etampes, and the Salle de Ball.

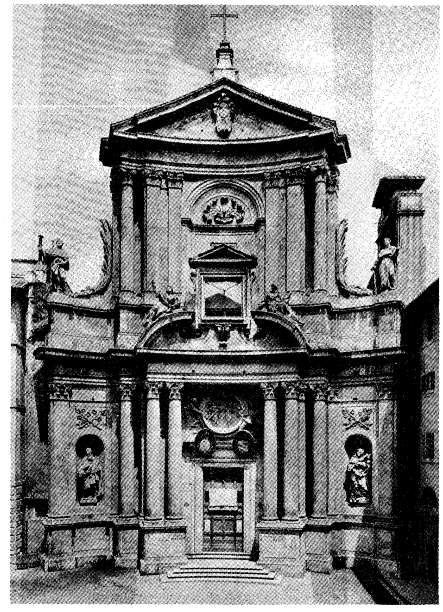
Primaticcio was active long after the death of Rosso, and his manner of representing the human figure with long limbs, thin necks, small heads, and exaggerated classical profiles was canon for the rest of the century. Other foreign masters included the painter of mythological landscapes, Niccolò dell'Abbate, who was at Fontainebleau from 1552, and Benvenuto Cellini, Florentine goldsmith and sculptor, who is well known for his saltcellar made for Francis I (1540; Kunsthistorisches Museum, Vienna) and "Nymph of Fontainebleau" (1543/44; Louvre, Paris).

The so-called second school of Fontainebleau generally refers to the painters Ambroise Dubois (1563–1614), Toussaint Dubreuil (1561–1602), and Martin Fréminet (1567–1619), men who, though competent, lacked imagination and invention and were content to work within the artistic boundaries set by their predecessors at Fontainebleau.

Fontana, Carlo (b. 1634/38, Bruciate, near Como, Milan—d. 1714, Rome), Italian architect, engineer, and publisher whose prolific studio produced widely imitated designs for fountains, palaces, tombs, and altars, as well as the curved facade on the S. Marcello al Corso (1682–83). His many international students included M.D. Poppelmann of Germany, James Gibbs of England, Filippa Juvarra of Italy, Johann Lucas von Hildebrandt and Fischer von Erlach of Austria, and others.

Fontana worked for Gian Lorenzo Bernini on Sta. Maria dei Miracoli (1662–79) and finished Bernini's Palazzo di Montecitorio (1650–94) (formerly the Palazzo Ludovisi), which had been started for the family of Innocent X. Fontana's students continued the Bernini tradition into the 18th century.

Fontana's other works are the church of S. Biagio in Campitelli (reassembled on Piazza Capizucchi; before 1665), SS. Apostoli (1702–08), the Casanatense Library (1708), the Cappella Sistina of Sta. Maria Maggiore, Cappella Ginetti in S. Andrea della Valle (1671), the Cappella Cibo in Sta. Maria del Popolo (1683–87), the Baptismal Chapel in St. Peter's (1692–98), and the Cappella Albani in S. Sebastiano (1705). His tombs include those of Queen Christina of Sweden in St. Peter's (1702), Clement XI, and Innocent XII. His largest ecclesiastical ensemble was the Jesuit church and college at Loyola, Spain (1681–



Church of S. Marcello, Rome, by Carlo Fontana, *c.* 1683
Anderson—Alinari from Art Resource/EB Inc.

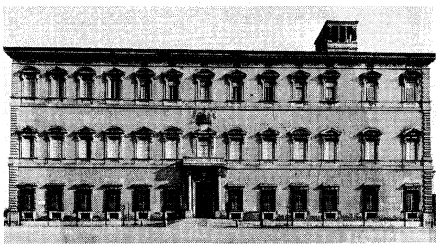
1738), which influenced Spanish, Austrian, and south German architects.

After he was appointed surveyor of St. Peter's, he published the *Templum Vaticanus*, with its many engravings (1694). Twenty-seven volumes of his manuscripts and drawings are now in the Royal Library at Windsor.

Fontana, Domenico (b. 1543, Melide, Milan—d. 1607, Naples), Italian architect who worked on St. Peter's Basilica and other famous buildings of Rome and Naples.

Fontana went to Rome in 1563, where he was employed by Cardinal Montalto (later Pope Sixtus V) to design a chapel in the church of Sta. Maria Maggiore (1585). When Cardinal Montalto was elected pope, he appointed Fontana as architect to the papacy.

Fontana designed the Vatican Library (1587–90), the Acqua Felice (1587), and the present Lateran palace, built on the ruins of the old medieval palace. He collaborated with Giacomo della Porta on the completion of St. Peter's dome (1588–90) from Michelangelo's model. His most famous undertaking was the removal of the Egyptian obelisk (brought to Rome in the 1st century AD) from its place in the circus of the Vatican and its erection in front of St. Peter's (1586). Accused of misappropriating public money, Fontana was dismissed from his post in 1592 by Pope Clement VIII. He then became Royal Engineer at Naples to the count of Miranda (1592) and built the Palazzo Reale (1600–02).



The Lateran Palace, Piazza San Giovanni in Laterano, Rome, by Domenico Fontana, 1586–88

Anderson—Alinari from Art Resource/EB Inc.

Despite his association with a number of important projects, Fontana is not considered a great architect; his fame largely rests on his commission as architect to Sixtus V.

Fontana, Lavinia (b. 1552, Bologna, Papal States—d. Aug. 11, 1614, Rome), Italian painter of the Mannerist school, one of the first women to execute large, publicly commissioned figure paintings.

She studied with her father, Prospero Fontana (*c.* 1512–97), a minor painter of the school of Bologna, and Lavinia Fontana herself became one of the most important portraitists in Bologna during the late 16th century. Her works were admired for the beauty of their colour and the detail of the clothes and jewelry that her subjects wore. The subjects of Fontana's paintings are religious, and some of her most famous works are large altarpieces executed for the churches of her native city and, later, for those of Rome, where she went in 1603. She married the painter Gian Paolo Zappi, who was willing to subordinate his career to her own. She enjoyed the patronage of the family of Pope Gregory XIII and painted the likenesses of many eminent people.

Fontana's largest work was a painting of "The Stoning of St. Stephen," which she undertook as an altarpiece for S. Paolo Fuori le Mura (St. Paul's Outside the Walls) in Rome, a basilica that was destroyed in the fire of 1823. Her "Visit of the Queen of Sheba" (National Gallery, Dublin) is her most ambitious surviving narrative work. She was elected a member of the Roman Academy, a rare honour for a woman.

Fontane, Theodor (b. Dec. 30, 1819, Neuruppin, Brandenburg—d. Sept. 20, 1898, Berlin), writer who is considered the first master of modern Realistic fiction in Germany.

He began his literary career in 1848 as a journalist, serving for several years in England as correspondent for two Prussian newspapers. From this position he wrote several books on English life, including *Ein Sommer in London* (1854; "A Summer in London") and *Jenseits des Tweed* (1860; "Beyond the Tweed"). From 1860 to 1870 he wrote for the conservative newspaper *Kreuzzeitung,* and between 1862 and 1882 he published a four-volume account of his travels in the March of Brandenburg. He combined historical and anecdotal material with descriptions of the Prussian landscape and the seats of historic families. He also wrote popular ballads, *Männer und Helden* (1850; "Men and Heroes") and *Balladen* (1861; "Ballads"), stirring celebrations of heroic and dramatic events, some drawn from Prussian history.

Fontane produced his best work after he became the drama critic for the liberal newspaper *Vossische Zeitung* and was freed from the earlier conservative restraint. Turning to the novel late in life, he wrote, at the age of 56, *Vor dem Sturm* (1878; "Before the Storm"), considered to be a masterpiece in the genre of the historical novel. He portrayed the Prussian nobility both critically and sympathetically. His aim was, as he said, "the undistorted reflection of the life we lead." In several of his novels Fontane also dealt with the problem of women's position in society; *Frau Jenny Treibel* (1893) and *Effi Briest* (1898) are among his best. *Effi Briest,* in particular, is known for its superb characterization and the skillful portrayal of the milieu of Fontane's native Brandenburg. His other major works are *Der Stechlin* (1899), which is noted for its charming style, and *Schach von Wuthenow* (1883), in which he portrays the weaknesses of the Prussian upper class.

fontanel, also spelled FONTANELLE, soft spot in the skull of an infant, covered with tough, fibrous membrane. There are six such spots at the junctions of the cranial bones; they allow for molding of the fetal head during passage through the birth canal. Those at the sides of the head are irregularly shaped and located at the unions of the sphenoid and mastoid bones with the parietal bone. The posterior fontanel is triangular and lies at the apex of the occipital bone. The largest fontanel, the anterior, is at the crown between the halves of the frontal and the parietals. It is diamond shaped and about 2.5 centimetres by 4 centimetres (about 1 by 1.5 inches). The lateral fontanels close within three months of birth, the posterior fontanel at about two months, and the anterior fontanel by two years.

Bony fish, some amphibians, and other mammals also have fontanels during embryonic and infant stages.

Fontanes, Louis, marquis de (b. March 6, 1757, Niort, Fr.—d. March 17, 1821, Paris), French man of letters who represented Catholic and conservative opinion during the First Empire and was appointed grand master of the University of Paris by Napoleon.

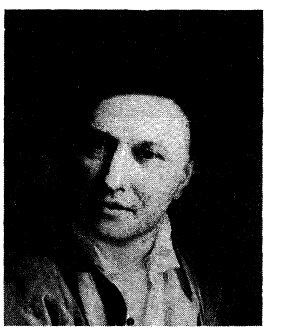
As a young man, Fontanes lived in Paris and associated with the important literary figures of the time. When the Revolution came, he at first enthusiastically supported it, expressing his sentiments in *Poème séculaire, ou chant pour la Fédération du 14 Juillet* (1790) and editing a newspaper, *Modérateur,* in Lyon. Eventually, however, the excesses of the Revolution disgusted him; and after he courageously protested the atrocities of the Terror in Lyon to the National Convention in December 1793, he was forced to go into hiding. But in 1795, after the establishment of the Directory, he was appointed professor of literature at the École Centrale des Quatre-Nations and was one of the first members of the Institut National, in which he opposed antireligious views. Forced to leave Paris by the Directory because of his journalistic activities in 1797, he spent two years in London, where he became a friend of one of the founders of French Romanticism, the royalist Chateaubriand.

Returning to France in 1799, Fontanes founded the political and literary journal *Mercure de France.* A member of the legislative body from 1802, Fontanes served as its president from 1804 to 1808. Napoleon appointed him grand master of the University of Paris in 1808; and despite the Emperor's plans to reorganize it along secular and military lines, Fontanes endeavoured to maintain its traditions and its religious identity. After Napoleon's abdication in 1814, Fontanes supported Louis XVIII and was a member of the commission appointed to draft the Charte Constitutionnelle, Louis's constitution. In 1817 he was created a marquis.

Fontanne, Lynn: *see* Lunt, Alfred; and Fontanne, Lynn.

Fontenelle, Bernard Le Bovier, sieur de (sire of) (b. Feb. 11, 1657, Rouen, Fr.—d. Jan. 9, 1757, Paris), French scientist and man of letters, described by Voltaire as the most universal mind produced by the era of Louis XIV. Many of the characteristic ideas of the Enlightenment are found in embryonic form in his works.

Fontenelle was educated at the Jesuit college in Rouen. He did not settle in Paris until he had passed the age of 30 and had become famous as the writer of operatic librettos. His literary activity during the years 1683–88 won him a great reputation. The *Lettres galantes* (1683, "Gallant Letters"; expanded edition, 1685) contributed to this, but the *Nouveaux Dialogues des morts* (1683, "New Dialogues of the Dead"; 2nd part, 1684) enjoyed a greater success and is more interesting to a modern reader. The *Dialogues,* conversations modelled on the dialogues of Lucian, between such figures as Socrates and Montaigne, Seneca and Scarron, served to disseminate new philosophical ideas. The popularization of philosophy was carried further by the *Histoire des oracles* (1687; "History of the Oracles"), based on a Latin treatise by the Dutch writer Anton van Dale (1683). Here Fontenelle subjected pagan religions to criticisms that the reader would inevitably see as applicable to Christianity as well. The same antireligious bias is seen in his amusing satire *Relation de l'île de Bornéo* (1686; "Account of the Island of Borneo"), in which a civil war in Borneo is used to symbolize the dissensions between Catholics (Rome) and Calvinists (Geneva).



Fontenelle, detail of an oil painting by L. Galloche, 1723; in the Musée National de Versailles et des Trianons, France

Cliche Musees Nationaux

Fontenelle's most famous work was the *Entretiens sur la pluralité des mondes* (1686; *A Plurality of Worlds,* 1688). These charming and sophisticated dialogues were more influ-

ential than any other work in securing acceptance of the Copernican system, still far from commanding universal support in 1686. Fontenelle's basis of scientific documentation was meagre, and some of his figures were wildly erroneous even for his own day. He was unfortunate in the moment of his publication: the Cartesian theory of vortices, on which his work was based, was refuted the next year in Newton's *Principia*. But the *Entretiens* were nevertheless exceedingly successful. Fontenelle was elected to the Académie Française in 1691 and was elected to the Académie des Inscriptions in 1701.

As permanent secretary of the Académie des Sciences from 1697, Fontenelle held a highly influential office. He published the memoirs presented to the academy and wrote its history. He kept abreast of new developments in science, corresponding with scientists in most European countries, and developed his talent for lucid popular exposition, notably in some of his obituary notices read to the academy (*e.g.*, those of Newton and Leibniz).

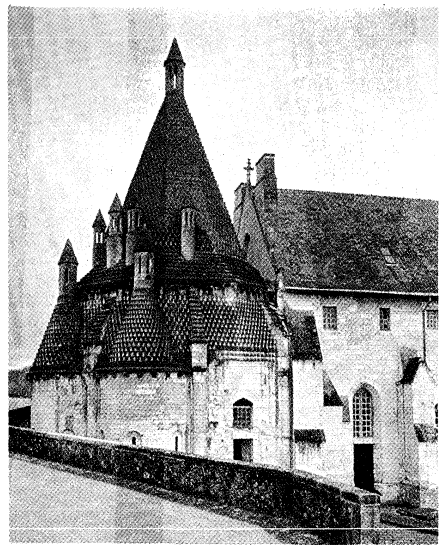
Fontenelle was a close friend of Montesquieu and well known to Voltaire, who mocked him in his *Micromégas* (1752), a dissertation on the smallness of man in relation to the cosmos. Fontenelle's most original contribution is in his approach to historiography, shown in his *De l'origine des fables* (1724; "Of the Origin of Fables"), in which he supports the theory that similar fables arise independently in several cultures and also tentatively addresses himself to comparative religion.

Articles are alphabetized word by word, not letter by letter

Fontenoy, Battle of (May 11, 1745), confrontation that led to the French conquest of Flanders during the War of the Austrian Succession. It was the most famous victory of the French marshal Maurice, comte de Saxe.

The battle was fought five miles (eight kilometres) southeast of Tournai (in modern Belgium), between 52,000 French troops under de Saxe and about 50,000 Allied troops (composed of English, Hanoverian, Dutch, and Austrian units) under William Augustus, duke of Cumberland, son of King George II of England. Cumberland was marching to relieve Tournai, which the French had besieged. De Saxe prepared to meet the Allied attack from a strong defensive position, which included hastily constructed redoubts. The Allied attack was a direct frontal push, with the Dutch and Austrians attacking the French right and the British and Hanoverians striking the well-prepared left. After initial attacks failed, Cumberland sent 15,000 infantry against the French left. When these troops halted to dress ranks, there occurred a celebrated incident in which Lord Charles Hay, of the Allied forces, dashed forward from the lines, drank a toast, and, according to a doubtful story related by Voltaire, invited the French to fire first. After entering the French camp in this first assault, the British retreated to reform and advance once again. Finally, the French artillery, cavalry counterattacks, and the charge of the Irish Brigade (in the French service) against the British right forced the massive Anglo-Hanoverian infantry formation to retreat with about 50 percent losses. Dutch losses in the other sector were also heavy. Total French losses were about 7,500. Cumberland retreated toward Brussels, and de Saxe followed the victory by taking Tournai and most of Flanders during the next four months.

Fontevrault-l'Abbaye, also spelled FONTEVRAUD, village near Saumur, Maine-et-Loire *département*, Pays de la Loire region, France. It lies near the confluence of the Vienne and Loire rivers and is surrounded by fields and woods.



The abbey kitchen (left) and church at Fontevrault-l'Abbaye, Fr.
Bruno Barbey—Magnum

Fontevrault-l'Abbaye is the site of the great abbey of Notre-Dame de Fontevrault, which, housing both monks and nuns, was founded in 1099 or 1101 by the Breton hermit Robert d'Abrissel; it was a triple monastery with five separate buildings. The abbey church and three of the buildings are still standing.

The order of Fontevrault was inspired by the Benedictine Rule, but the abbess was in complete control. The nuns came mostly from the highest families; and in the 12th century there were three dependent houses belonging to the order in England, several in Spain, and about 100 elsewhere in France.

In 1792 the abbey was suppressed as a religious community. Under Napoleon the buildings were turned into a prison, which was closed down only in 1963, when restoration work was undertaken.

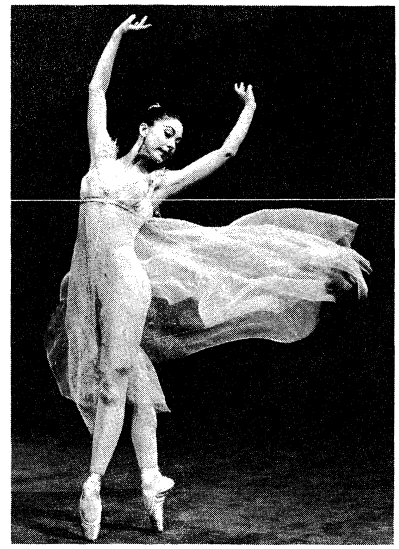
The abbey church and other buildings, including a 12th-century double octagonal kitchen and 16th-century cloisters, are open to the public. In the abbey church, recumbent statues mark the burial places of Henry II of England; his wife, Eleanor of Aquitaine; and their son Richard I the Lion-Heart (Coeur de Lion). Pop. (1982) 964.

Fonteyn, Dame Margot, original name MARGARET HOOKHAM, married name DAME MARGOT FONTEYN DE ARIAS (b. May 18, 1919, Reigate, Surrey, Eng.), outstanding ballerina of the English stage.

As a child she studied dance in Hong Kong and then in London with Serafima Astafieva and at the Sadler's Wells Ballet school. Her debut was with the Vic-Wells Ballet in 1934. When Markova left the company the following year, Fonteyn took over many of her classical roles, including *Giselle*, and became a leading danseuse of the Vic-Wells Ballet. In 1939 she danced Aurora in a revival of *The Sleeping Beauty;* her interpretation is still considered the definitive Aurora of the era.

Apart from the classical repertoire, she created many roles in such ballets by Frederick Ashton as *Horoscope*, *Symphonic Variations*, *Daphnis and Chloë*, and *Ondine* (considered by many her greatest creation) and gave outstanding performances in revivals of Fokine's *Firebird* and *Petrushka*. Other ballets associated with her career are MacMillan's *Romeo and Juliet* (1965) and Cranko's *Poème de l'extase* (1970) and, with Nureyev as partner, *Swan Lake, Raymonda, Le Corsaire* pas de deux, and other classics plus new ballets created especially for them. Her musicality, technical perfection, and precisely conceived and executed characterizations made her an international star, the first developed by an English school and company.

After 1959 she appeared with the Royal Ballet as guest artist and also toured extensively. Her celebrated partnership with the Soviet expatriate Rudolf Nureyev began in the early 1960s and is generally considered to have enriched her characterizations. In 1955 she married Roberto Emilio Arias, former Panamanian ambassador to Great Britain. She became president of the Royal Academy of Dancing in 1954 and was created Dame of the Order of the British Empire in 1956. In the late 1970s, as she began to curtail her performing, she turned to television presentations and to the writing of such books as *An Autobiography* (1975), *A Dancer's World* (1979), and *The Magic of Dance* (1979).



Margot Fonteyn in *Ondine*
London Express

Fontina, semihard cow's-milk cheese that originated in the Valle d'Aosta region of northern Italy. Made in wheels 13 to 15 inches (33–38 centimetres) in diameter and 3 to 4 inches thick, Fontina has a tough, beige natural rind, sometimes coated in wax, and a pale gold interior with a few small holes. The characteristic flavour of Fontina is mild but distinctively nutty and savoury. Fontinas from Sweden, Denmark, and the United States have milder flavour, softer texture, and more holes than those of Italy.

The European Economic Community protects the designation Fontina; similar cheeses produced outside Valle d'Aosta but within the Common Market are usually called *fontal.*

Fonvizin, Denis Ivanovich (b. April 14 [April 3, old style], 1744/45, Moscow—d. Dec. 12 [Dec. 1, O.S.], 1792, St. Petersburg), playwright who satirized the cultural pretensions and privileged coarseness of the nobility; he is considered his nation's foremost 18th-century dramatist.

Educated at the University of Moscow, he worked as a government translator until 1769. His wit and his knowledge of French and German classics made him a favourite in the enlightened circles of the court of Catherine the Great. In 1769 he became secretary to the liberal count Nikita Ivanovich Panin, an advocate of constitutionalism. His first important comedy, *Brigadir* (written 1766–69, published 1783; "Brigadier"), ridiculed the contemporary fashion of aping French manners and speech—or rather of aping them incorrectly. His masterpiece, *Nedorosl* (published 1783;

"The Minor"), is considered the first truly Russian drama. It deals with a gentry family so ignorant and brutish that they survive only through the industry of their ill-treated serfs. The plot centres on the tyrannical mother's attempts to educate her spoiled and loutish son for the civil service and to marry him to an heiress. The characters are portrayed with a realism unknown at the time, and the play is still performed. In 1783 Fonvizin sharply criticized the Russian aristocratic polity in a tract on political reform and as a result fell out of favour with Catherine. Thereafter, his works were banned, and his last years were spent in travel.

Foochow (China): *see* Fu-chou.

Food and Agriculture Organization (FAO), oldest permanent specialized agency of the United Nations, established at the end of World War II with the objective of eliminating hunger and improving nutrition. The FAO seeks to coordinate the efforts of governments and technical agencies in programs for developing agriculture, forestry, and fisheries.

The FAO carries on research; provides technical assistance on a project basis to individual countries; operates an educational program through seminars and training centres; maintains statistics on world production, trade, and consumption of agricultural commodities; and publishes a number of periodicals, yearbooks, and research bulletins.

The permanent headquarters of the FAO are in Rome, with other offices throughout the world. The organization is governed by the biennial FAO conference, in which each member country is represented. The conference elects a council consisting of representatives of member governments.

An Indicative World Plan for Agricultural Development was issued in 1969, analyzing the main problems in world agriculture and suggesting strategies for their solution. From the 1960s on, the FAO concentrated on programs for the development of high-yield strains of grain, the elimination of protein deficiencies, the provision of rural employment, and the promotion of agricultural exports.

Food and Drug Administration (FDA), agency of the U.S. federal government authorized by Congress to inspect, test, approve, and set safety standards for foods and food additives, drugs, chemicals, cosmetics, and household and medical devices. First known as the Food, Drug, and Insecticide Administration when it was formed as a separate law enforcement agency in 1927, the FDA derives the greater part of its regulatory power from four laws: the Federal Food, Drug, and Cosmetic Act, which established safety and purity standards and provided for factory inspection and for legal remedy; the Fair Packaging and Labeling Act, which required honest, informative, and standardized labeling of products; the Radiation Control for Health and Safety Act, which was designed to protect consumers from possible excess radiation generated by x-ray machines, televisions, microwave ovens, and the like; and the Public Health Service Act, which gave the FDA authority over vaccines and serums and justified and agency's programs for milk sanitation and the inspection of restaurants and travel facilities.

Generally, the FDA is empowered to prevent untested products from being sold and to take legal action to halt sale of undoubtedly harmful products or of products which involve a health or safety risk. Through court procedure, the FDA can seize products and prosecute the persons or firms responsible for legal violation. FDA authority is limited to interstate commerce. The agency cannot control prices nor directly regulate advertising except of prescription drugs and medical devices.

food chain, in ecology, the sequence of transfers of matter and energy from organism to organism in the form of food. Food chains intertwine locally into a food web because most organisms consume more than one type of animal or plant. Plants, which convert solar energy to food by photosynthesis, are the primary food source. In a predator chain, a plant-eating animal is eaten by a larger animal. In a parasite chain, a smaller organism consumes part of a larger host and may itself be parasitized by even smaller organisms. In a saprophytic chain, microorganisms live on dead organic matter.

Because energy, in the form of heat, is lost at each step, or trophic level (*q.v.*), chains do not normally encompass more than four or five trophic levels. In overpopulated areas people commonly increase the total food supply by cutting out one step in the food chain: instead of consuming animals that eat cereal grains, the people themselves consume the grains. Because the food chain is made shorter, the total amount of energy available to the final consumers is increased.

food colouring, any of numerous additives used to enhance the appearance of fresh and processed foods. Colouring ingredients include natural colours, derived primarily from vegetable sources and sometimes called vegetable dyes; inorganic pigments; combinations of organic and metallic compounds (called lakes); and synthetic coal-tar substances. They are added to orange and potato skins, sausage casings, baked goods, candies, carbonated drinks, gelatin desserts, powdered drink mixes, and many other foods.

While natural, or vegetable, colourings are generally considered safe, the potential hazards of artificial and synthetic colourings are a subject of controversy. Modern testing methods have shown toxic effects for some colour ingredients previously considered harmless. As a result, many countries have deleted these substances from their lists of approved additives.

Various red dyes, for example, have been the focus of controversy since the 1950s, when the U.S. Food and Drug Administration (FDA) tested the widely used Red Dye No. 2 (also called Amaranth) and declared it to be safe. Later tests in the U.S. and the Soviet Union linked the substance to cancerous tumours in laboratory animals. Finally, in the 1970s, the FDA banned Red No. 2. It was replaced in many products with Red No. 40, which is prohibited by law in Canada, Great Britain, and many Western European countries. Yellow No. 5 (Tartazine) has also been cited as harmful and has been alleged to cause or aggravate hyperactivity in children.

Many of these substances are also employed as colouring agents in cosmetics, drugs, and products such as toothpaste and mouthwash, and their potential hazards to consumers have aroused similar controversy.

food poisoning, illness resulting from the eating of foods containing one or more representatives of three main groups of harmful agents: natural poisons present in certain plants and animals, chemical poisons contaminating foods, and microorganisms (mainly bacteria) and their toxic secretions.

The majority of cases of acute food poisoning are caused by bacteria (*see* salmonellosis) and their toxic products (*see* botulism; staphylococcus).

Among the chemical poisons contaminating foods are certain heavy metals used in fungicides and insecticides (*see* mercury poisoning; lead poisoning; arsenic poisoning). Instances of metal poisoning may sometimes be traced to the serving or preparation of acidic fruits (*e.g.*, lemonade) in certain cookware or vessels (*see* antimony poisoning; cadmium poisoning). Various food additives and preservatives, though generally innocuous on a short-term basis, may exert a cumulative toxic effect when ingested over a long period.

The more common poisonous plants and animals that cause food poisoning in man include certain varieties of mussels and clams (*see* shellfish poisoning); ocean and freshwater fish (*see* fish poisoning); fungi (*see* mushroom poisoning); plants (*e.g.*, water hemlock; rhubarb greens); and nuts (*e.g.*, akee nuts), seeds (*e.g.*, tung seeds), and beans (*e.g.*, *Vicia fava*).

food preservation, any of a number of methods by which food is kept from spoilage after harvest or slaughter.

A brief treatment of food preservation follows. For full treatment, *see* MACROPAEDIA: Food Processing.

The practice of preserving food can be traced to prehistory, when fruits and vegetables were dried, cereal grains were parched, and fish and game were salted and dried. These age-old methods developed very slowly and were purely empirical—fermentation, drying, smoking, and curing with salt being the principal techniques. As the biological causes of food spoilage became better understood, rapid advances followed, and appropriate methods were soon developed for dealing with the causative agents.

Since most foods either carry or eventually acquire bacteria, molds, or yeasts, microorganisms are the major cause of food spoilage. Other factors leading to deterioration or spoilage are the natural enzymes present in some foods and various chemical reactions, particularly oxidation. Some factors that lead to spoilage in one food are regarded as desirable in another instance and may be, indeed, essential for the protection of certain foods. For example, yeasts are applied in making wine, bacteria in the manufacture of sour milk and pickled products, and molds in cheese making. Enzymes are used in both cheese production and in brewing, and the browning of roasts and bread crust is a type of chemical reaction that in many other foods leads to deterioration and spoilage.

There are several major processes for food preservation. Enzyme activity and the growth of microorganisms in foods may be retarded by cooling or almost entirely prevented by freezing. Since water is necessary for the growth of microorganisms, dried (dehydrated) foods will keep for long periods. The enzymes and microorganisms present in foods also may be completely or almost completely destroyed by the application of heat, as in thermal processing (canning). In canned foods, reinfestation by microorganisms must be prevented, hence the need for hermetically sealed containers. Finally, both enzyme action and microbial growth can be prevented by the addition of certain chemicals or through chemicals produced in fermentation. Smoking, salting, and candying are the age-old examples of this type of food preservation, but both organic and inorganic chemical preservatives and inhibitors have been used much more frequently in the 20th century. Often several principles are applied in combination. For instance, cabbage is preserved as sauerkraut in the presence of salt and by the chemicals produced by the microorganisms during fermentation, and much of this product is later marketed in cans after heat sterilization. Some frozen food products are heated before freezing in order to deactive the enzymes or to reduce the number of viable organisms present. A combination of dehydration and freezing is used in the process known as freeze-drying, whereby solid food remains frozen while its liquid escapes as a vapour.

The modern objective of food preservation includes more than the mere prevention of spoilage. Quality, economy, and, especially, convenience are in most instances important in the production and marketing of processed

foods. Colour or appearance, flavour, texture or consistency, and nutritive value are the major quality factors. Most countries have detailed and exacting requirements governing food processing from the standpoint of sanitation and quality, but the extent to which such regulations are enforced varies greatly. However, quality requirements for any food are also firmly ingrained in the consumer's mind and thus will govern his purchases. Therefore, quality must be retained by the processed food during preservation and in the period between its manufacture and consumption. Naturally, the emphasis given to quality factors depends somewhat on the level of economic development; high purchasing power and an abundance of food result in greater consumer choice.

food processing, any of a variety of operations by which raw foodstuffs are made suitable for consumption, cooking, or storage.

A brief treatment of food processing follows. For full treatment, *see* MACROPAEDIA: Food Processing.

Food processing generally includes the basic preparation of foods, the alteration of a food product into another form (as in making preserves from fruit), and preservation and packaging techniques.

Many food-processing innovations have even resulted in new products, such as concentrated fruit juices, freeze-dried coffee, and instant foods. Foods and food supplements have also been processed from such hitherto untapped sources as oilseeds (chiefly protein-rich soybeans and cottonseeds); mutant varieties of crops; leaves, grasses, and aquatic plants; and highly nutritious fish meal and concentrates.

food processor, electric appliance developed in the late 20th century, used for a variety of food-preparation functions including kneading, chopping, blending, and pulverizing.

The food processor was invented by Pierre Verdon, whose Le Magi-Mix, a compact household version of his own earlier restaurant-scaled Robot-Coupe, was first exhibited in Paris in 1971. Carl Sontheimer, a U.S. engineer and inventor, refined Verdon's machines to produce the Cuisinart. The widespread success of the Cuisinart following its exhibition in Chicago in 1973 led a number of other manufacturers to design competing models, and hundreds of thousands of food processors were sold in the late 1970s.

Food processors are of two basic types: those in which most of the work is done in a single bowl by a flat blade, and those fitted with many attachments. Standard accessories include a work bowl, lid, chopping blade, mixing blade, and disks for slicing and shredding.

food service industry, industry designed for obtaining, preparing, and serving food in high volume for consumption outside the home. For food service establishments, *see* restaurant; cafeteria. For some commercial aspects of food preparation, *see* food processing; food preservation.

fool, also called JESTER, a comic entertainer whose madness or imbecility, real or pretended, made him a source of amusement and gave him license to abuse and poke fun at even the most exalted of his patrons. Professional fools flourished from the days of the Egyptian pharaohs until well into the 18th century, finding a place in societies as diverse as that of the Aztecs of Mexico and the courts of medieval Europe. Often deformed, dwarfed, or crippled, fools may have been kept for luck as well as for amusement, in the belief that deformity can avert the evil eye and that abusive raillery can transfer ill luck from the abused to the abuser. Fool figures played a part in the religious rituals of India and pre-Christian Europe, and, in some societies, such as that of Ireland in the 7th century BC, they were regarded as being inspired with poetic and prophetic powers. The raillery of the fool and his frequent ritual association with a mock king suggest that he may have originated as a sacrificial scapegoat substituted for a royal victim. A resemblance between the sacrificial garments of ancient ritual and the costume of a household jester in the Middle Ages—coxcomb, eared hood, bells, and bauble, with a motley coat—has been noted.

The earliest record of the use of court fools dates from the 5th dynasty of Egypt, whose pharaohs attached great value to Pygmies brought from the mysterious lands to the south, apparently employing them as dancers and buffoons. Fools were a part of many wealthy households of imperial Rome, in which imbecility and deformity fetched high prices in the slave markets. References to household fools appear increasingly in records from the 12th through the 15th century. Fools were attached to courts, private households, taverns, and even brothels. In the 18th century, household jesters declined in western Europe but flourished in Russia, and offending courtiers were sometimes degraded to court jesters.

The figure of the fool has also been important in literature and drama. The clown-player in Shakespeare's dramatic company, Robert Armin, was interested in household fools and published a historical account of them in 1605. His knowledge may have influenced the playwright, who produced some of the best known fools in literature: Touchstone in *As You Like It;* Feste in *Twelfth Night;* and the fool in *King Lear. See also* fool's literature.

Fools, Feast of, popular festival during the Middle Ages, held on or about January 1, particularly in France, in which a mock bishop or pope was elected, ecclesiastical ritual was parodied, and low and high officials changed places. Such festivals were probably a Christian adaptation of the pagan festivities of the Saturnalia. By the 11th century these feasts had become a burlesque of Christian morality and worship. In spite of repeated prohibitions and penalties imposed by the Council of Basel in 1431, the feasts did not die out entirely until the 16th century.

fool's gold (mineral): *see* pyrite.

fool's literature, allegorical satires popular throughout Europe from the 15th to the 17th century, featuring the fool (*q.v.*), or jester, who represented the weaknesses, vices, and grotesqueries of contemporary society. The first outstanding example of fool's literature was *Das Narrenschiff* (1494; "The Ship of Fools"), a long poem by the German Humanist and satirist Sebastian Brant, in which more than 100 fools are gathered on a ship bound for Narragonia, the fools' paradise. An unsparing, bitter, and sweeping satire, especially of the corruption in the pre-Reformation Roman Catholic Church, *Das Narrenschiff* was translated into Latin, Low German, Dutch, and French and adapted in English by Alexander Barclay (*The Shyp of Folys of the Worlde,* 1509); it stimulated the development of hard, biting, moral satires that include Thomas Murner's poem *Narrenbeschwörung* (1512; "Exorcism of Fools") and Erasmus' *Encomium moriae* (1509; *In Praise of Folly*). *Ship of Fools* (1962), by Katherine Anne Porter, used Brant's title for an allegorical novel in which the German ship "Vera" is a microcosm of life.

"Ship of Fools," woodcut illustration by Albrecht Dürer from *Das Narrenschiff* by Sebastian Brant, 1494

By courtesy of the Bayerische Staatsbibliothek, Munich

foot, plural FEET, in anatomy, terminal part of the leg of a land vertebrate, on which the creature stands. In most two-footed and many four-footed animals it consists of all structures below the ankle joint: heel, arch, digits, and contained bones such as tarsals, metatarsals, and phalanges; in mammals that walk on their toes and hoofed mammals, it includes the terminal parts of one or more digits.

The major function of the foot in land vertebrates is locomotion. Three types of foot posture exist in mammals: (1) plantigrade, in which the surface of the whole foot touches the ground during locomotion (*e.g.,* man, baboon, bear); (2) digitigrade, in which only the phalanges (toes, fingers) touch the ground, while the ankle and wrist are elevated (*e.g.,* dog, cat); (3) unguligrade, in which only a hoof (the tip of one or two digits) touches the ground—a specialization of running animals (*e.g.,* horse, deer).

In primates the foot, like the hand, has flat nails protecting the tips of the digits, and the undersurface is marked by creases and friction-ridge patterns. In most primates the foot is adapted for grasping (*i.e.,* is prehensile), with the first digit set at an angle from the others. The foot may be used for manipulation in addition to its use in climbing, jumping, or walking.

The human foot is nonprehensile and is adapted for a form of bipedalism distinguished by the development of the stride—a long step, during which one leg is behind the vertical axis of the backbone—which allows great distances to be covered with a minimum expenditure of energy. The big toe converges with the others and is held in place by strong ligaments. Its phalanges and metatarsal bones are large and strong. Together, the tarsal and metatarsal bones of the foot form a longitudinal arch, which absorbs shock in walking; a transverse arch, across the metatarsals, also helps distribute weight. The heel bone helps support the longitudinal foot arch.

It is believed that in the evolutionary development of bipedalism, running preceded striding. *Australopithecus africanus,* who lived between two and five million years ago, had a fully modern foot and probably strode.

The term foot is also applied to organs of locomotion in invertebrates; *e.g.,* the muscular, creeping or burrowing organ of a mollusk and the limb of an arthropod.

foot, plural FEET, in English-speaking countries, any of numerous ancient and modern lineal measures (commonly 25 to 34 centimetres) based on the length of the human foot. In most countries, the foot, with its multiples and subdivisions, has been superseded by the metric unit, the metre. In a few countries the foot was retained but eventually (by 1893 in the U.S.) became defined in terms of the me-

tre. In the United States the definition of the foot as exactly 30.48 cm took effect in 1959.

foot, plural FEET, in verse, the smallest metrical unit of measurement. The prevailing kind and number of feet, revealed by scansion, determines the metre of a poem. In classical (or quantitative) verse, a foot, or metron, is a combination of two or more long and short syllables. A short syllable is known as an arsis, a long syllable as a thesis. There are 28 different feet in classical verse, ranging from the pyrrhic (two short syllables) to the dispondee (four long syllables). The adaptation of classical metrics to the strongly accented Germanic languages, such as English, does not provide an entirely reliable standard of measurement. The terminology persists, however, a foot usually being defined as a group of one stressed (′) and one or two unstressed (˘) syllables. An exception is the spondee, which consists of two stressed syllables; in English verse, this is usually two monosyllables, such as the phrase "He who." The commonest feet in English verse are the iamb, an unstressed followed by a stressed syllable, as in the word re|port; the trochee, a stressed followed by an unstressed syllable, as in the word dai|ly; the anapest, two unstressed syllables followed by a stressed syllable, as in ser|e|nade; and the dactyl, a stressed syllable followed by two unstressed syllables, as in mer|ri|ly.

If a single line of the poem contains only one foot, it is called monometer; two feet, dimeter; three feet, trimeter; four feet, tetrameter; five feet, pentameter; six feet, hexameter; seven feet, heptameter; eight feet, octameter. More than six, however, is rare. The metre of a poem (*e.g.,* iambic pentameter, dactylic hexameter) is the kind plus the number of feet in each line.

Foot, Michael (b. July 23, 1913, Plymouth, Devon, Eng.), leader of Britain's Labour Party from November 1980 to October 1983, an intellectual left-wing socialist.

A member of a strongly Liberal family (his father had been a member of Parliament), Foot attended Wadham College, Oxford, and then began a career as a newspaper editor and columnist (1937–74). The mass unemployment of the 1930s turned him to socialism; and from 1945 on, apart from a break between 1955 and 1960, he was a Labour member of Parliament. In 1974 he established himself as a leading member of Prime Minister Harold Wilson's Cabinet, first as secretary of state for employment (1974–76) in charge of complex and controversial trade-union legislation, and then (1976–79) as leader of the House of Commons, a role that required him to hold the parliamentary party together. From deputy leader of the Labour Party (1976–80) he rose to become the party's chief, defeating Denis Healey, the candidate of Labour's right wing, in 1980 by a vote of 139 to 129. This vote, as well as other leftward trends in the party, caused some right-wing Labourites to resign from the party and four months later to found the Social Democratic Party. Following a disastrous showing in the June 1983 general election, Foot announced that he would not continue as party leader; Neil G. Kinnock succeeded him in October 1983.

Foot had acquired a reputation as a rebel of the left. For many years he was a pamphleteer and political writer fervently espousing the cause of nuclear disarmament. He was a strong ally of the British trade unions and an advocate of sharply increased public expenditures and state ownership of industries. He wrote a number of books, including *Aneurin Bevan, a Biography,* 2 vol. (1962–73).

foot-and-mouth disease (FMD), also called HOOF-AND-MOUTH DISEASE, or AFTOSA, a highly contagious viral disease affecting practically all cloven-footed mammals, including cattle, sheep, goats, and swine. Wild herbivores such as bison, deer, antelope, reindeer, llama, camel, giraffe, and elephant are also susceptible. The horse is resistant to the infection. The disease is characterized by the formation of painful fluid-filled vesicles (blisters) on the tongue, lips, and other tissues of the mouth and on parts of the body where the skin is thin, as on the udder and teats, between the two toes of the feet, and around the coronary band above the hoof.

There are seven major immunologically distinct types of the foot-and-mouth virus, and these types affect different species and produce symptoms of differing severity. The virus is spread by both inhalation and ingestion, and it has an affinity for epithelium (the covering of the skin and mucous membranes of the gastrointestinal tract); it forms a primary vesicle where it gains entrance in the body. Within 24 to 48 hours it enters the bloodstream, causing fever. During this phase, lasting 24 to 36 hours, the virus is excreted in the saliva, the milk, the urine, and the feces. A characteristic smacking of the lips then usually becomes prominent in the infected animal, ushering in the phase of the formation of vesicles on the tongue, gums, and lips of the mouth. These vesicles rupture in about 24 hours, leaving raw, inflamed, and extremely painful surfaces that heal in one to two weeks. By this time the animal refuses to eat solid food. Blisters also appear on the foot, causing lameness.

The losses caused by foot-and mouth disease are tremendous. The mortality in ordinary mild epizootics (animal epidemics) is only about 5 percent, but malignant forms of the disease have led to losses of up to 50 percent. In those animals that survive, great losses in weight occur because the animals cannot eat. In surviving milk-producing animals the flow of milk is sharply diminished. Abortions and mastitis are common, and secondary infections are frequent.

Foot-and-mouth disease is endemic throughout much of Europe, Asia, Africa, and South America. The virus can survive for relatively long periods of time in the air, in food and garbage, and even in hides, hair, and wool, so measures for controlling the disease are necessarily rigorous. A diagnosis of the affected animals must be made quickly and the area quarantined, after which all infected or susceptible animals are slaughtered and their carcasses burned. Other contaminated objects are cleaned and disinfected, and the farm or other quarantined area is left uninhabited for several months.

The development of effective vaccines has helped control epidemics but has not eliminated the disease. As a result of strict quarantine measures and the prompt destruction of infected animals, North America has remained largely free of the disease; the last major outbreak in the United States was in 1929. There is no effective treatment for infected animals.

foot washing: *see* feet, washing of.

football (soccer): *see* association football.

football, in Canada, popular game that is played between two 12-member teams on a rectangular field with goalposts at each end. It originated from English rugby, but changes in rules over the years have made it more closely resemble American football.

A brief treatment of Canadian football follows. For full treatment, *see* MACROPAEDIA: Sports, Major Team and Individual.

Rugby was introduced to Canada in the 1860s. By 1883 two amateur leagues, the Ontario Rugby Football Union and the Quebec Rugby Football Union, were formed and became affilated in 1891 with the reorganized Canadian Rugby Union. Intercollegiate competition started in 1898, and in 1909 Lord Earl Grey, then the governor-general of Canada, donated the prestigious Grey Cup for the best amateur team. As Canadian and American schools played each other, their styles grew more similar. By the early 1930s Frank "Shag" Shaughnessy, the football coach at McGill University in Montreal, introduced several innovations, such as the forward pass and running interference, all of which established Canadian football in its present form.

A series of disputes prompted college teams to withdraw from Grey Cup competition in 1936, and thereafter professional teams dominated the sport. In 1956 the two professional leagues formed what became the Canadian Football League (CFL), and the amateurs were ruled out of Grey Cup play.

Canadian football differs in several ways from American football. There are 12 players on a team instead of 11; the 12th member is used in the backfield on offense and as a linebacker or pass defender on defense. The other positions are the same, but the field and end zones are larger, and teams are only allowed three downs in which to advance the ball 10 yards. In addition, a punt or a kick-off that enters the end zone must be advanced beyond the goal line by the receiving team or one point (a single) is awarded to the kicking team. Offensive and defensive formations are similar, but they are designed more for a wide-open type of play, emphasizing the passing game. For a list of the winners of the Grey Cup, *see* Sporting Record: *Football.*

football, in the United States, popular game that is played between two 11-member teams on a rectangular field with goalposts at each end. Each team tries to score points by moving the oval ball over the opponent's goal line for a touchdown (by carrying or passing the ball to a teammate) or by kicking it between the goalposts. A team must advance the ball 10 yards in four attempts, called downs. Defensive and offensive teams alternate positions on the field as the possession of the ball changes from side to side.

A brief treatment of American football follows. For full treatment, *see* MACROPAEDIA: Sports, Major Team and Individual.

American football evolved in the 19th century as a combination of rugby and soccer. The first intercollegiate football match in the United States is usually credited to the game played in 1869 by Princeton University and Rutgers College at New Brunswick, N.J., but that game more resembled the kicking style of association football (soccer) than modern football; there were 25 players on a team, and the game was won by the number of goals scored rather than by touchdowns. In 1873 the first collegiate rules were standardized by Princeton, Yale, Columbia, and Rutgers, and soon afterward the distinct American version of football began to develop.

The innovations of the sports authority Walter Camp were fundamental in the evolution of American football. In 1880 Camp substituted the scrimmage for the rugby scrum, initiated the dominant role of the quarterback, and reduced the number of players on a team from 15 to 11. He established the standard formations now used and introduced systems for scoring and measuring downs and yards gained. Tackling rules were also liberalized.

Although these steps were intended to make the game more safe, the violence of play continued, and a series of deaths and injuries in 1905 prompted President Theodore Roosevelt to call for more changes. Rules were thus created that included the introduction of the forward pass, new formations, and the prohibition of blocking with extended arms. In 1910 the National Collegiate Athletic Association (NCAA) was formed to govern Ameri-

can intercollegiate competition. Postseason, or "bowl," games played between leading college teams, became popular and now include the Rose Bowl (Pasadena, Calif.), Orange Bowl (Miami), Sugar Bowl (New Orleans), Sun Bowl (El Paso, Texas), Cotton Bowl (Dallas, Texas), and Gator Bowl (Jacksonville, Fla.).

Professional football began in the 1890s, but it was not until the rise of television after World War II that it became one of the dominant American sports. In 1922 the American Professional Football Association was reorganized as the National Football League (NFL), which remains the main force of the professional game. A rival league, the American Football League (AFL), was created in 1959, but an agreement in 1966 led to the merger of the two in 1970 under the NFL title. The NFL is now divided into an American and a National conference; the winners of the conferences compete for the Super Bowl championship. In the early 1980s the U.S. Football League (USFL) emerged to threaten the NFL, but it ended after only three seasons. For lists of NFL, AFL, and Super Bowl champions, as well as a listing of the unofficial college football national champions and the results of the Sugar, Orange, Rose, and Cotton bowls, *see* Sporting Record: *Football.*

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

Football Association (FA), ruling body for English association football (soccer), founded in 1863. The FA controls every aspect of the organized game, both amateur and professional, and is responsible for national competitions, including the Challenge Cup series that culminates in the traditional Cup Final at Wembley.

The FA helped organize Scottish, Welsh, and Irish associations in the late 1800s to supervise the game in those countries. It later joined the Fédération Internationale de Football Association (FIFA) to formulate rules of international competition.

By the early 1980s the FA represented about 37,000 clubs and more than 1,000,000 players. Its activities included producing instructional materials for coaches, players, and referees, advising foreign football organizations, approving rules and regulations of English leagues, and serving as a court for those charged with breaking such rules. FA headquarters are at Lancaster Gate in London.

Football League, British professional association football (soccer) organization. The first such league was formed in England in 1888, largely through the efforts of William McGregor, known afterward as the "father of the league." Twelve of the strongest professional clubs of the time joined in the league, and the first season's championship was won by Preston North End. In 1892 a second division was formed and the first division increased to 16 clubs. Soon after, the league adopted the practice of promoting the first two clubs in the second division at the end of each season into the places of the last two clubs of the first division, which were relegated to the second division. A third division was added in 1920 and reorganized to form a fourth in 1958; a four-up, four-down promotion and relegation system between these two divisions was set up at the same time. The league includes more than 90 clubs. Football League headquarters are at Lythom St. Anne's, Lancashire.

Similar leagues were formed in Ireland and Scotland in the 1890s and subsequently in many other countries where association football became a major sport.

Foote, Robert Bruce (b. 1834—d. 1912), British geologist and archaeologist, often considered to be the founder of the study of the prehistory of India.

At the age of 24, Foote joined the Indian geological survey, with which he remained for 33 years. After the archaeological survey was established in 1862, he began the first systematic research of mankind's prehistoric remains in India, making the first discovery of hand axes in that country in 1863. Without the benefit of excavation but from surface remains and field observation only, he was able to make a fairly accurate reconstruction of Indian prehistory, naming the major cultural periods Paleolithic, Neolithic, and Iron Age after their European analogues. The Madras Museum, India, purchased his large collection of prehistoric objects in 1903. His *Catalogue Raisonné* (1914; "Classified List") and *Indian Prehistoric and Protohistoric Artefacts* (1916) summarized his years of research and contained his delineation of Indian prehistory.

Foote, Samuel (b. 1720, Truro, Cornwall, Eng.—d. Oct. 21, 1777, Dover, Kent), English actor, wit, and playwright whose gift for mimicry, often directed at his peers, made him a figure of both fear and delight on the London stage.

Samuel Foote, engraving by W. Greatbatch after Sir Joshua Reynolds

By courtesy of the Mander and Mitchenson Theatre Collection

Foote attended Worcester College, Oxford, but left without taking a degree. In 1744, having dissipated his inheritance, he turned to the theatre. His first efforts were not successful, but, while playing in the 2nd Duke of Buckingham's *Rehearsal,* he demonstrated his ability as a mimic. In 1747 he presented a series of farcical entertainments called *Diversions of the Morning,* in which he ridiculed other actors and celebrities. Later, to avoid the restraints of the Licensing Act, which required patents for public performances, he styled his entertainments for his friends as "teas."

After 1753 Foote returned occasionally to the regular stage, but he was unsuccessful except in his own plays, which, like his "teas," depended on topical allusions and mimicry. Foote was adept in exploiting any event for his purposes, even his own misfortune. In 1766 he fell from a horse and broke his leg, which had to be amputated. Characteristically, he turned this to account by writing *The Devil Upon Two Sticks* and *The Lame Lover.* Another consequence of this misfortune was that the Duke of York, who was responsible for the accident, secured for Foote a life patent, which permitted him to continue his performances without subterfuge.

Foote was undoubtedly a man of many talents, but he employed them only in savage attacks upon others. David Garrick, who frequently befriended him, avoided Foote's public ridicule only through flattery. Samuel Johnson, who considered Foote's wit "irresistible," was obliged to threaten physical chastisement. In 1777, however, Foote met his match. Agents of the notorious Elizabeth Chudleigh, duchess of Kingston, whom Foote had satirized in *A Trip to Calais* and *The Capuchin,* retaliated with such persistence that he was compelled to quit the stage.

footing, in building construction, part of a structure that distributes foundation-wall, pier, or column loads to the bearing rock, soil, or piling. For light loads, or when the footing is based on bedrock, a simple pedestal is used. For heavy loads on soil, footings must be spread wide enough so that the load pressure does not cause local settling. Usually of reinforced concrete, footings may be squares or rectangles of uniform thickness, but very heavy loads require a truncated pyramid or a stepped structure.

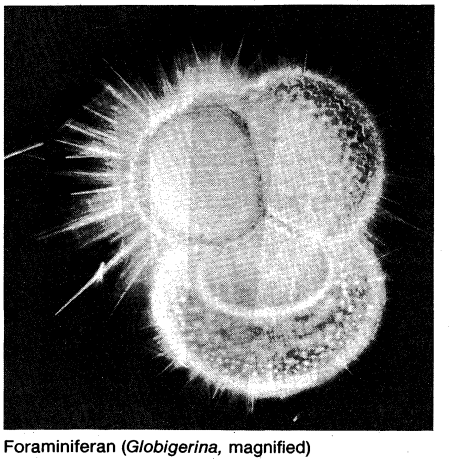
footman moth, any of the insects belonging to the subfamily Lithosiinae of the tiger moth family Arctiidae (order Lepidoptera). The common name footman is probably derived from the stiff, elongate appearance of the adult moths, which usually align their narrow wings (span 2 to 5 cm [4/5 to 2 inches]) with the body as if standing at attention. Some species are colourful, although most are drab. The larvae of the footman moth have long, sparse hairs arising from wartlike tubercles; they feed on lichen.

Foppa, Vincenzo (b. 1427/30, Brescia, Republic of Venice [now in Italy]—d. 1515/16), Italian painter, leading figure in 15th-century Lombard art, and an artist of exceptional integrity and power.

His earliest dated work is a dramatic painting of the "Three Crosses" (1456; Bergamo). He spent the middle of his life in Pavia in the service of the dukes of Milan, and until the arrival of Leonardo da Vinci he was the most influential painter in the Lombard region. From 1480 he became receptive to the Renaissance style, influenced by Donato Bramante, Andrea Mantegna, and Leonardo. This influence appears in the modeling and perspective of his best-known fresco, "The Martydom of St. Sebastian" (1485; Brera, Milan).

forage, vegetable food of wild or domestic animals. In agriculture, harvested, processed, and stored forage is called silage (*q.v.*).

foraminiferan, any protozoan of the rhizopodan order Foraminiferida (formerly Foraminifera), characterized by long, fine pseudopodia that extend from a uninucleated or multinucleated cytoplasmic body encased within a test, or shell. Depending on the species, the test ranges in size from minute to more than 5 centimetres (2 inches) in diameter and varies in shape, number of chambers, chemical composition, and surface orientation. Tests of a South Pacific species are large enough to be used as jewelry by oceanic islanders; *Nummulite* specimens from the Eocene limestones of the Egyptian pyramids often exceed 5 centimetres in diameter. Foraminiferans inhabit



Foraminiferan (*Globigerina,* magnified)

John J. Lee and Hugo D. Freudenthal

virtually all marine waters and are found at almost all depths, wherever there is protection and suitable food (microscopic organisms).

An important constituent of the present-day planktonic (floating) and benthic (bottom dwelling) microfaunas, foraminiferans have an extensive fossil record that makes them useful as index fossils in geological dating and in petroleum exploration. The word foraminiferan does not refer to the external pores found in some species but to the foramina (openings or apertures) between adjacent chambers after a new chamber envelops a previous one. When the foraminiferans die, their empty calcareous tests sink and form the so-called foraminiferal ooze that covers about 30 percent of the ocean floor. Limestone and chalk are products of the foraminiferan bottom deposits.

The major factors governing the growth, reproduction, and distribution of foraminiferans are water temperature, depth, and salinity; availability of suitable food; nature of the substratum; and oxygen supply. The present-day foraminiferan population of the seas consists of six recognizably different faunas; four occur in warmer waters, two in colder waters.

Although some species of foraminiferans reproduce exclusively by asexual means (multiple fission, budding, fragmentation), for most species there is a regular or an occasional sexual generation. Reproduction usually occupies one to three days, depending on the size and complexity of the species. Small species may complete both the sexual and asexual generations within a month, but larger species often require a year or two. Reproduction normally terminates the life of the parent, since all its cytoplasm is generally devoted to formation of the young.

Forbach, town, Moselle *département,* Lorraine region, northeastern France, just southwest of Saarbrücken, Ger. The town, which has an important cokery and manufactures mining equipment, is at the edge of the Saar Coal Basin. Remains of the medieval castle of the counts of Forbach crown a nearby hill (Schlossberg). Forbach was the scene of a French defeat (Aug. 6, 1870) during the Franco-German War. Pop. (1982) 26,279.

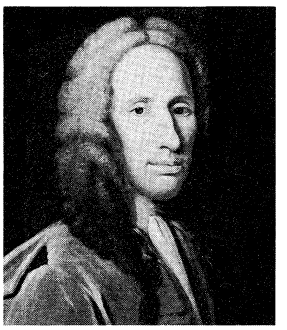
Forberg, Friedrich Karl (b. Aug. 30, 1770, Meuselwitz, Saxe-Gotha—d. 1848, Hildburghausen, Saxe-Coburg), German philosopher and educator.

An exponent of the Idealist school developed by Johann Gottlieb Fichte, Forberg is best known for his essay *Über die Entwicklung des Begriffs Religion* (1798; "On the Development of the Concept of Religion"), a work that occasioned Fichte's dismissal from the University of Jena on the charge of atheism after he had published a corroborative treatise. Forberg also wrote further apologetical works in support of atheism.

Forbes, town, south central New South Wales, Australia, on the Lachlan River. Named after former New South Wales chief justice Sir Francis Forbes, it was proclaimed a town in 1861 during a gold rush and became a municipality in 1870. The bushranger (outlaw) Ben Hall was shot and killed there in 1865. Now a marketing centre in an irrigated wheat, fruit, vegetable, and livestock region, Forbes processes meats, flour, animal feed, and lumber and manufactures light engineering items. It has rail and road (Newell Highway) links to Sydney, which lies 180 mi (290 km) southeast. Pop. (1981) 8,029.

Forbes (of Culloden), Duncan (b. Nov. 10, 1685, near Inverness, Inverness-shire, Scot.—d. Dec. 10, 1747, Edinburgh), Scottish statesman whose loyalty to the Hanoverian king George II of Great Britain contributed markedly to the defeat of the Jacobite rebellion of 1745–46.

Trained in law, Forbes entered local politics and in 1715 aided the Hanoverian cause during the unsuccessful Jacobite rebellion of that year. Forbes was elected to Parliament in 1722, and in 1737 he became lord president of the Court of Session. When Charles Edward, the Young Pretender, the Stuart claimant to the British throne, invaded Scotland in 1745, Forbes kept Inverness loyal to George II and persuaded the chiefs of two powerful clans—the Macdonalds and the Macleods—not to take the field for the Jacobites. From September 1745 until the suppression of the insurrection in April 1746, Forbes was the main representative of the government in northern Scotland. Nevertheless, he later fell into disfavour with the English for his efforts to mitigate the punishment of the rebels. Charles de Bois Murray's *Duncan Forbes of Culloden* was published in 1936.



Duncan Forbes, detail of a portrait after J. Davison, c. 1737; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

Forbes, Edward (b. Feb. 12, 1815, Douglas, Isle of Man—d. Nov. 18, 1854, near Edinburgh), British naturalist, pioneer in the field of biogeography, who analyzed the distribution of plant and animal life of the British Isles as related to certain geological changes.

While a medical student at Edinburgh, Forbes embarked upon a botanical tour of Norway (1833). Drawn to natural science, he then began an extensive study of mollusks and starfishes, to which he devoted much of his life, participating in dredgings and expeditions in the Irish Sea (1834), France, Switzerland, Germany, Algeria (1836), Austria (1838), and the Mediterranean (1841–42). During this period, he pursued the study of life in the littoral zones (the ocean from the shore to the continental shelf) and developed an interest in the geographical distribution of animals.

After publication of his *History of British Starfishes* (1841), Forbes became curator at the Museum of the Geological Society of London (1842), professor of botany at King's College, London (1842), and paleontologist to the British Geological Survey (1844). In 1846 he published an important essay, "On the Connexion Between the Distribution of the Existing Fauna and Flora of the British Isles, and the Geological Changes Which Have Affected Their Area." In this work he divided the plants of Great Britain into five well-defined groups, maintaining that the majority of them, like terrestrial animals, had migrated to the islands over continuous land at three separate periods—before, during, and after the glacial epoch.

Forbes was appointed professor of natural history to the Royal School of Mines in 1851 and completed publication of his *History of British Mollusca* (4 vol.) the following year. He became the youngest man elected president of the Geological Society (1853) and, shortly before his death, was awarded the natural history chair at the University of Edinburgh.

Forbes, George William (b. May 12, 1869, Lyttelton, N.Z.—d. May 17, 1947, Cheviot), farmer and politician who served as prime minister of New Zealand during the depression years (1930–35).

Forbes held a seat in the House of Representatives for thirty-five years as member for Hurunui (1908–43). He began his political career as a member of the Liberal Party, and when that party declined he became in 1928 a leader of the newly created United Party. However, he stepped aside when the ailing 72-year-old former prime minister, Sir Joseph Ward, formed a government of the United Party with Labour support (1928). Forbes was minister of lands and agriculture but *de facto* head of the Cabinet until asked to form his own ministry in 1930.

At odds with the Labour Party, Forbes formed a coalition government with the Reform Party and went on to win a general election in 1931. As prime minister he maintained only the most conservative policies to combat the deepening depression, however. His government allowed widespread reductions of wages by employers, and his deflationary policies further contracted an already shrinking economy, thus swelling the ranks of the unemployed. Overwhelmingly defeated by the Labour Party in elections in 1935, he became leader of the opposition, helped to form the new National Party out of the then-moribund United Party, and resigned from leadership though reelected to his seat (1938).

Forbes, James David (b. April 20, 1809, Edinburgh—d. Dec. 31, 1868, Edinburgh), Scottish physicist noted for his research on heat conduction and glaciers.

Educated at the University of Edinburgh, Forbes became a professor there in 1833. Between 1836 and 1844 he published four series of "Researches on Heat" in which he described the polarization (alignment of waves to vibrate in a plane) of radiant infrared heat by the mineral tourmaline, by transmission through a bundle of thin mica plates, and by reflection from the surfaces of a pile of mica plates. In 1846 he began experiments on the temperature of the Earth at different depths and in different soils near Edinburgh. Later he investigated the laws of heat conduction in bars, and in his last piece of work reported that iron conducts heat less efficiently as its temperature rises. The Royal Society awarded him the Rumford Medal in 1838 and the Gold Medal in 1843 for his work on heat. He made several visits to Switzerland and Norway to study the movement of glaciers and to observe their internal structure.

Forbes-Robertson, Sir Johnston (b. Jan. 16, 1853, London—d. Nov. 6, 1937, St. Margaret's Bay, near Dover, Eng.), English actor

Forbes-Robertson, c. 1900

By courtesy of the Victoria and Albert Museum, London

who was considered the finest Hamlet of his time, noted for his elocution and ascetic features.

Educated at Charterhouse School, he studied art before turning to the theatre in 1874, when he first appeared on the London stage. He acted with the Bancrofts and John Hare, played opposite Mary Anderson in England

and the United States, and for some time was a leading member of Sir Henry Irving's company. His first outstanding success was in Sir Arthur Pinero's *Profligate* in 1889. In 1895 he took over the management of the Lyceum, with Mrs. Patrick Campbell as leading lady, giving memorable performances in *Romeo and Juliet, Hamlet,* and *Macbeth,* and also producing Maurice Maeterlinck's *Pelléas and Mélisande,* in which his Romantic style of acting was highly successful. In 1900 he married Gertrude Elliott, who became his leading lady, appearing with him in such plays as *The Light That Failed,* Shaw's *Caesar and Cleopatra,* and, one of his biggest successes, Jerome K. Jerome's *Passing of the Third Floor Back.* Forbes-Robertson was knighted in 1913 and retired in 1915. His daughter Jean Forbes-Robertson (1905–62) became a distinguished actress.

Forbes' disease, also called CORI'S DISEASE, or GLYCOGENOSIS TYPE III, rare hereditary disease in which the the metabolic breakdown of glycogen to the simple sugar glucose is incomplete, allowing intermediate compounds to accumulate in the cells of the liver. Affected persons lack the enzyme amylo-1,6-glucosidase, one of several enzymes involved in glycogen breakdown. Children with the disease have enlarged livers (which usually become normal in size by puberty), are generally stunted in growth, have doll-like facial features, and experience muscular weakness. The disease is fairly mild but can cause frequent hypoglycemia (low blood sugar), producing severe convulsions that may lead to mental retardation. Forbes' disease is inherited as an autosomal recessive trait.

Forbidden City, the Imperial Palace complex within the Inner City of Peking, China. Surrounded by a wall 35 feet (11 m) high extending for 2½ miles (4 km) on each side, it contains hundreds of buildings, the principal ones of which served as the imperial palaces of the emperors of China from 1421 to 1911. The 9,000 rooms in the Forbidden City housed the entire imperial court. The Forbidden City was so-called because no commoner or foreigner was allowed to enter it without special permission from the court officials. Under the People's Republic of China after 1949, the palaces were converted into museums and opened to the public.

forbidden lines, in astronomical spectroscopy, bright emission lines in the spectra of certain nebulae (H II regions), not observed in the laboratory spectra of the same gases, because on Earth the gases cannot be rarefied sufficiently. The term forbidden is misleading; a more accurate description would be "highly improbable." The emissions result from electrons in long-lived orbits within the radiating atoms—*i.e.,* the transition from an upper energy level to a lower energy level that produces the emissions requires a long time to take place. As a result, emission lines corresponding to such atomic transitions are extremely weak compared with other lines. In the laboratory, moreover, an excited atom tends to strike another particle or the walls of the gas container before it emits a photon, thereby further reducing the possibility of observation. In an H II region in interstellar space, by contrast, the atom will remain undisturbed long enough to emit the photon. Another factor favouring forbidden radiation in an H II region is the transparency of the constituent ionized gases to visible light, which permits the photons given off through the entire depth of the nebula to contribute to the emission lines. *See also* nebulium.

Forbin, Claude de (b. Aug. 6, 1656, Gardanne, Fr.—d. March 4, 1733, Saint-Marcel), French naval officer notable for his daring exploits in Louis XIV's wars. These he recorded in his lively but not always objective *Mémoires,* first published in 1730.

Forbin, detail from an engraving by L. Pierron, 17th century

Giraudon—Art Resource/EB Inc.

After becoming an experienced seaman, he went on a French mission to the king of Siam, whom he served as grand admiral for two years (1685–87). Returning to France as commandant of a frigate stationed at Dunkirk, Forbin was captured by the English but managed to escape. Early in the War of the Spanish Succession (1701–13) his squadron in the Adriatic cut the supply line of the imperial forces in Italy. Forbin was transferred to the northern squadron, where he played havoc with the Dutch Baltic convoy off the Dogger Bank in October 1706. He seized 22 English merchantmen and 2 men-of-war the following May and captured 34 ships of the Dutch Muscovy convoy in June. He resigned from the navy following his failure to carry out an expedition that was to transport James the Old Pretender, claimant to the English throne, to Scotland in 1708.

Forbush effect, in astronomy, an occasional decrease in the intensity of cosmic rays as observed on Earth, attributed to magnetic effects produced by solar flares, which are disturbances on the Sun. The effect was discovered in 1937 by the American physicist Scott E. Forbush. Its cause became clearer in 1960, when, while the unmanned U.S. space probe Pioneer 5 was in flight some 5,000,000 km (3,000,000 miles) from Earth, a solar flare occurred, followed by an observation on Earth of the Forbush effect. Data from the probe indicated that the cause of the Forbush effect is a thin, hot plasma (of highly ionized gas) emitted by the Sun and carrying with it a tongue or lobe of the Sun's magnetic field as far as Earth; this magnetic field tends to deflect away from Earth the electrically charged particles making up primary cosmic rays.

Forcados River, river, a major navigable channel of the Niger Delta, southern Nigeria. It leaves the main course of the Niger River about 20 miles (32 km) downstream from Aboh and flows through zones of freshwater swamps, mangrove swamps, and coastal sand ridges before completing its 123-mile (198-kilometre) westerly course to the Bight of Benin. Since about 1900 it has been the chief link for small ship traffic between the Niger River and the Gulf of Guinea.

Forcados and Burutu, respectively 15 and 20 miles (24 and 32 km) upstream from the Bight, are ports on the river; but much of the agricultural produce shipped down the Niger and the Forcados is instead exported from Warri, a Delta port connected to the river by the 25-mile- (40-kilometre-) long Warri River. Petroleum deposits were discovered offshore from Burutu in 1964, and crude oil was exported from a loading point at sea after 1965. In 1971 the disused port of Forcados was revived as an oil tanker terminal, connected by pipelines to the oilfields.

Although the Forcados River is used by considerable commercial traffic, oceangoing vessels have not been able to use its exit to the sea since 1939 because of accumulated silt. Rivercraft and larger vessels now cross to the sea by the Escravos River, an arm of the Niger immediately to the north that was enlarged (1961–64) to accommodate vessels of 22-foot (7-metre) draft.

force, in mechanics, any action that tends to maintain or alter the position of a body or to distort it. The concept of force is commonly explained in terms of Newton's three laws of motion set forth in his *Principia Mathematica* (1687). According to Newton's first principle, a body that is at rest or moving at a uniform rate in a straight line will remain in that state until some force is applied to it. The second law says that when an external force acts on a body, it produces an acceleration (change in velocity) of the body in the direction of the force. The magnitude of the acceleration is directly proportional to the magnitude of the external force and inversely proportional to the quantity of matter in the body. Newton's third law states that when one body exerts a force on another body, the second body exerts an equal force on the first body. This principle of action and reaction explains why a force tends to deform a body (*i.e.,* change its shape) whether or not it causes the body to move. The deformation of a body can usually be neglected when investigating its motion.

Because force has both magnitude and direction, it is a vector quantity and can be represented graphically as a directed line segment; that is, a line with a length equal to the magnitude of the force, to some scale, inclined at the proper angle, with an arrowhead at one end to indicate direction. The representation of forces by vectors implies that they are concentrated either at a single point or along a single line. This is, however, physically impossible. On a loaded component of a structure, for example, the applied force produces an internal force, or stress, that is distributed over the cross section of the component. The force of gravity is invariably distributed throughout the volume of a body. Nonetheless, when the equilibrium of a body is the primary consideration, it is generally valid as well as convenient to assume that the forces are concentrated at a single point. In the case of gravitational force, the total weight of a body may be assumed to be concentrated at its centre of gravity (*see* gravity, centre of).

Physicists use the newton, a unit of the International System (SI), for measuring force. A newton is the force needed to accelerate a body weighing one kilogram by one metre per second per second. The formula $F = ma$ is employed to calculate the number of newtons required to increase or decrease the velocity of a given body. In countries still using the English system of measurement, engineers commonly measure force in pounds. One pound of force imparts to a one-pound object an acceleration of 32.17 feet per second squared.

force, line of, in physics, path followed by an electric charge free to move in an electric field or a mass free to move in a gravitational field, or generally any appropriate test particle in a given force field. More abstractly, lines of force are lines in any such force field the tangent of which at any point gives the field direction at that point and the density of which gives the magnitude of the field. The concept of lines of force was introduced into physics in the 1830s by the English scientist Michael Faraday, who considered magnetic and electric effects in the region around a magnet or electric charge as a property of the region rather than an effect taking place at a distance from a cause.

The electric lines of force that represent the field of a positive electric charge in space consist of a family of straight lines radiating uniformly in all directions from the charge where they originate. A second positive charge placed in the field would travel radially away from the first charge.

In the case of a magnetic field, since no isolated unit pole has ever been discovered, the field lines are called lines of force only in the sense that a small magnet is forced to align itself in the direction of these field lines. An electric charge traveling along a magnetic field line undergoes no magnetic force.

force, moment of a: *see* torque.

Force Acts, in U.S. history, series of four acts passed by Republican Reconstruction supporters in the Congress between May 31, 1870, and March 1, 1875, to protect the constitutional rights guaranteed to blacks by the Fourteenth and Fifteenth Amendments.

The most important provisions of the acts authorized federal authorities to enforce penalties upon anyone interfering with the registration, voting, officeholding, or jury service of blacks, provided for federal election supervisors, and empowered the president to use military forces to make summary arrests. Under the act of April 20, 1871, nine South Carolina counties were placed under martial law in October 1871. This act and earlier statutes eventually resulted in more than 5,000 indictments and 1,250 convictions throughout the South. In subsequent Supreme Court decisions, various sections of the acts were declared unconstitutional.

forced labour, also called SLAVE LABOUR, labour performed involuntarily and under duress, usually by relatively large groups of people. Forced labour differs from slavery in that it does not involve the ownership of one person by another, but rather merely the forced exploitation of that person's labour.

Forced labour has existed in various forms throughout history, but it was a peculiarly prominent feature of the totalitarian regimes of Nazi Germany and the Soviet Union (especially during the rule of Joseph Stalin), in which it was used on a vast scale. Under these regimes, persons either suspected of opposition or considered racially or nationally unfit have been summarily arrested and placed under long or indefinite terms of confinement in concentration camps, remote labour colonies, or industrial camps. There the inmates have been forced to labour, usually under harsh conditions.

The Nazi Party's rise to power in Germany during the 1930s was accompanied by the extensive use of concentration camps to confine classes of persons who were opposed to the regime or who were otherwise undesirable. The outbreak of World War II created a tremendous demand for labour in Germany, and the Nazi authorities turned to the concentration camp population to augment the labour supply. By the end of 1944 some 2,000,000 prisoners of war (mostly Russians and Ukrainians) and some 7,500,000 civilian men, women, and children from every German-occupied nation of Europe had been put to work in German arms factories, chemical plants, mines, farms, and lumber operations. Although the earlier arrivals in Germany were "volunteers," the vast majority (from 1941 on) were rounded up by force, transported to Germany in boxcars, and put to work under appallingly harsh and degrading conditions. A large percentage of the slave labourers had died from disease, starvation, overwork, and mistreatment by the time the war ended. Many of those who had become unfit for further labour because of the harsh conditions were simply exterminated by the Nazis.

Forced labour was also extensively used by the early Soviet government. In 1923 the Soviet secret police established a concentration camp on Solovetski Island in the White Sea in which political prisoners were first used extensively for forced labour. The secret police established many corrective labour camps in the northern Russian S.F.S.R. and in Siberia beginning in the late 1920s, and as the number of those arrested in Stalin's great purges of the 1930s grew into the millions, a network of hundreds of labour camps grew up throughout the Soviet Union. The Soviet concentration camp system became a gigantic organization for the exploitation of inmates through work. The inmates of the camps in the northern U.S.S.R. were used primarily in lumbering and fishing industries and on large-scale public-works projects, such as the construction of the White Sea–Baltic Sea canal. The inmates of the Siberian camps were used in lumbering and mining. The inmates of the Soviet labour camps were inadequately clothed for the severe Russian climate, and the standard rations of bread and soup were scarcely adequate to maintain life. It is variously estimated that from 5,000,000 to 10,000,000 persons died in the Soviet labour camp system from 1924 to 1953. (*See* Gulag.) The use of forced labour greatly diminished after the death of Joseph Stalin in 1953 and the subsequent de-Stalinization of Soviet society. Forced labour was also used by Japan during World War II, and by the Communist government of China at times from the 1950s to the 1970s. The Khmer Rouge regime (1975–79) of Kampuchea made a particularly widespread and brutal use of forced labour.

In 1957 the International Labour Organisation adopted a resolution that condemned the use of forced labour throughout the world. The convention was ratified by 91 member nations. Despite such efforts, forced labour continues to be used by a few authoritarian and totalitarian governments on a relatively small scale.

Forchheimer, Philipp (b. Aug. 7, 1852, Vienna—d. Oct. 2, 1933, Vienna), Austrian hydraulic engineer, one of the most significant contributors to the study of groundwater hydrology during the late 19th and early 20th centuries. He showed that many of the standard techniques of mathematical physics could be applied to problems of groundwater movement, establishing this subject on a firm scientific basis.

Forchheimer's chief contribution was the demonstration that Laplace's equation (*q.v.*) may be applied to the phenomena of groundwater flow. Because the equation already had been thoroughly studied in relation to the phenomena of heat flow and fluid flow, a whole body of preexisting mathematical theory became available for the solution of problems of groundwater flow.

Forckenbeck, Max(imilian Franz August) von (b. Oct. 21, 1821, Münster, Westphalia [Germany]—d. May 26, 1892, Berlin, Ger.), prominent leader of the 19th-century German National Liberal Party.

Elected to the Prussian Chamber of Deputies in 1858, he subsequently helped found the left-liberal German Progressive Party (1861), which after 1862 spearheaded the continuing constitutional struggle over the state military budget with the Prussian prime minister—later to become German imperial chancellor—Otto von Bismarck. In 1866, however, Forckenbeck seceded from the Progressives to join the new National Liberal Party, and thereafter, along with most of his party colleagues, he increasingly accommodated himself to the political designs of Bismarck. After Bismarck's scuttling of the National Liberals in 1878, however, Forckenbeck joined with much of the party's left wing to form the secessionist Radical Liberal Party (1881)—a belated and ultimately futile attempt to salvage a compromised liberalism. As his national political career waned he rose to prominence in the city government of Berlin, where, as chief burgomaster from 1878, he carried out a program of public services and improvements.

Ford, Edmund Brisco (b. April 23, 1901, Papcastle, Cumberland, Eng.—d. Jan. 22, 1988, Oxford), British geneticist who made substantial contributions to the genetics of natural selection and defined and developed the science of ecological genetics.

Ford joined the faculty at Oxford in 1927; he was made professor of ecological genetics in 1963, becoming emeritus professor in 1969. He was the author of many works on genetics and zoology, including the important books *Mendelism and Evolution* (1931), *Ecological Genetics* (1964), and *Genetic Polymorphism* (1965). In collaboration with Julian Huxley (1923–26) he performed some of the earliest research on the genetic control of growth. Working with freshwater crustaceans, he found that genes control both the time of occurrence and the rate of physiological processes. By his quantitative studies of animal populations in nature and his genetic experiments in the laboratory, he identified conditions under which natural selection occurs. The techniques he developed, such as marking animal specimens and counting them later to estimate population change, became basic to the science of ecological genetics.

His later works include *Genetics and Adaptation* (1976), *Understanding Genetics* (1979), and *Taking Genetics Into the Countryside* (1981).

Ford, Ford Madox, original name FORD HERMANN HUEFFER, also called FORD MADOX HUEFFER (b. Dec. 17, 1873, Merton, Surrey, Eng.—d. June 26, 1939, Deauville, Fr.), English novelist, editor, and critic, an international influence in early 20th-century literature.

The son of a German music critic, Francis Hueffer, and a grandson of Ford Madox Brown, the Pre-Raphaelite painter, Ford grew up in a cultured, artistic environment. At 18 he wrote his first novel, *The Shifting of Fire* (1892). His acquaintance with Joseph Conrad in 1897 led to their collaboration in *The Inheritors* (1901) and *Romance* (1903). In 1908 he founded the *English Review,* publishing pieces by the foremost contemporary British authors and also by the then unknown D.H. Lawrence, Wyndham Lewis, Ezra Pound, and H.M. Tomlinson. At the same time Ford produced works of his own: a trilogy of historical novels about the ill-fated Catherine Howard and novels of contemporary life in which he experimented with technique and style. It was not until *The Good Soldier* (1915), considered by many to be his best work, that he matched an assured, controlled technique with powerful content. This work skillfully reveals the destructive effects of contradictory sexual and religious impulses upon a quartet of upper middle-class characters.

Ford took part in World War I, in which he was gassed and shell-shocked. Afterward he changed his name from Hueffer to Ford and tried farming in Sussex and Left Bank life in Paris. There he edited the *Transatlantic Review* (1924), which published works by James Joyce and Ernest Hemingway.

In his long literary career Ford had fruitful contacts with most of the important writers of the day and is remembered for his generous encouragement of younger writers. Of more than 70 published works, those on which his reputation rests are *The Good Soldier* and the tetralogy *Parade's End* (1950; comprising *Some Do Not* [1924], *No More Parades* [1925], *A Man Could Stand Up* [1926], and *Last Post* [1928]).

Ford, Francis Xavier (b. Jan. 11, 1892, Brooklyn, N.Y., U.S.—d. Feb. 21, 1952, Canton, China), American Roman Catholic missionary and bishop of Mei-hsien in Kwangtung Province, China, considered a martyr because of his imprisonment and death under the rule of the Chinese Communists.

Ford was ordained in 1917 and went to China the next year in the first group of Maryknoll missionaries sent to that country. He founded the Maryknoll Seminary for Chinese Boys in Yang-chiang in 1921 and in 1922 established the first overseas convent for Maryknoll sisters.

He became the first bishop of Mei-hsien (1935) and remained at his post during World War II, though surrounded by Japanese troops. Under the postwar Communist government, he was arrested on espionage charges on Dec. 23, 1950. He was publicly humiliated, forced to parade before the populace and to submit to public beatings en route to prison in Canton. His subsequent death in Canton was not known outside China until September 1952.

Ford, Gerald R(udolph, Jr.), original name LESLIE LYNCH KING, JR. (b. July 14, 1913, Omaha, Neb., U.S.), 38th president of the United States (1974–77), who, as 40th vice president, succeeded to the presidency on the resignation of President Richard M. Nixon.

While Ford was still an infant his parents were divorced and his mother moved to Grand Rapids, Mich., where she married Gerald R. Ford, Sr., who adopted the boy and gave him his name. Ford was a football star at the University of Michigan and received his law degree from Yale University in 1941.

In 1948 he was elected to the U.S. House of Representatives and was reelected successively

Gerald R. Ford
AP/Wide World Photos

thereafter, becoming House minority leader in 1965. After the resignation of Vice President Spiro T. Agnew, President Nixon, on Oct. 12, 1973, nominated Ford to fill the vacant vice-presidential post. He was sworn in on December 6, the first vice president to take office in the middle of an administration.

Ford's succession to the presidency on Aug. 9, 1974, after Nixon's resignation, marked the first time in U.S. history that the holder of the presidential office had not been elected either as president or as vice president. Ford promised "openness and candor," which seemed to be the needed antidote for the secretiveness of Nixon's last days. That halcyon period was short-lived, however, coming to an end on September 8 when Ford granted a full pardon to Nixon "for all offenses against the United States" that he might have committed while in office. The pardon effectively squelched any criminal prosecutions that Nixon might have been liable to in connection with the Watergate scandal. To counter a widespread negative reaction to the pardon, Ford voluntarily appeared before a subcommittee of the House of Representatives on October 17 to explain his reasoning—the first time an incumbent president had formally testified before a committee of Congress.

Ford's administration coped gradually but successfully with the high rate of inflation inherited from the Nixon administration. The conservative Ford's relations with the Democratic-controlled Congress were perhaps typified by his more than 50 vetoes of legislation by the end of 1976; more than 40 were sustained.

In the final days of the Vietnam War in April 1975, Ford ordered an airlift of anti-Communist Vietnamese refugees that totaled 237,000, most of whom were taken to the United States. A few weeks later, after the seizure by Cambodia of the American cargo ship *Mayaguez,* Ford declared the event an "act of piracy" and sent the Marines to seize the ship. Later that year guards and a bystander foiled two attempts to assassinate the president.

In a close contest at the Republican convention in August 1976, Ford won his party's nomination, despite a serious challenge by Ronald Reagan. That fall he became the first incumbent president to agree to public debates with a challenger—Jimmy Carter, the Democratic nominee. Running substantially behind from the beginning of the campaign, Ford was defeated in the November election.

Ford, Henry (b. July 30, 1863, Wayne County, Mich., U.S.—d. April 7, 1947, Dearborn), American industrialist who revolutionized factory production with his assembly-line methods.

A brief treatment of the life and works of Henry Ford follows. For a full treatment, *see* MACROPAEDIA: Ford, Henry.

The son of Irish immigrants, Ford dropped out of school and was employed at the age of 15 as a machinist's apprentice in Detroit. He intermittently returned to his father's farm, where he set up a small machine shop and sawmill. He then worked as chief engineer of the Edison Company in Detroit until 1899, when he and others formed the Detroit Automobile Company. He soon left this company to build racing cars. In 1903 he and his partners formed the Ford Motor Company (*q.v.*). The Model T appeared in 1908, and in 1913 Ford introduced the successful assembly-line method of production. In that year mass production enabled him to sell the Model T for as little as $500, thus putting automobile ownership within the economic reach of a large segment of the middle class for the first time.

Ford's business philosophy was to reduce the unit cost of each car built and thereby increase the volume of sales. After ceasing production of the Model T in 1927, he produced the entirely new Model A (an earlier one had been introduced in 1902). In 1932 he introduced the V-8 engine. He opposed unionization, but in 1941 he signed the first union shop and dues checkoff contract in the automotive industry with the United Auto Workers.

Ford ran for the U.S. Senate, but lost, and considered running for president. He was the author, with Samuel Crowther, of *My Life and Work* (1922) and *Today and Tomorrow* (1926).

Ford, Henry, II (b. Sept. 4, 1917, Detroit—d. Sept. 29, 1987, Detroit, Mich.), American industrialist and head of Ford Motor Company for 34 years (1945–79). He is generally credited with reviving the firm, which many considered virtually moribund prior to his taking control of it in 1945.

In 1940 Ford left Yale University without graduating to join the firm founded by his grandfather, Henry Ford, and at the time run by his father, Edsel Ford. A year later he joined the U.S. Navy; but in 1943, following the unexpected death of his father, he was released from duty and became a Ford vice president. After what amounted to a crash course in industrial management, Henry II succeeded to the presidency of the ailing company in 1945.

He promptly set about modernizing the Ford Motor Company and discharged the all-powerful personnel chief Harry Bennett, whose strong-arm union-busting tactics had earned the company a great deal of opprobrium. He brought in a group of talented systems analysts from the U.S. Air Force who became known as the "Whiz Kids," among them Robert S. McNamara, later to become Ford's president. One of the cars introduced during Henry II's tenure, the Edsel, was a legendary failure, but two others, the Mustang and the Thunderbird, were immensely popular and are widely considered to be classics. By the mid-1950s Henry II had restored the company to financial health, and subsequently he greatly expanded Ford's operations in overseas markets.

Ford, John (b. April 1586, Ilsington, Devon, Eng.—d. 1639?), post-Shakespearean British dramatist whose revenge tragedies showed insight into the human passions, austere beauty, and poetic diction of a high order.

In 1602 he was admitted to the Middle Temple (a training college for lawyers), and he remained there, except for a period of suspension (1606–08), until at least 1617.

Ford collaborated with Thomas Dekker in *The Sun's Darling* (1624), perhaps also in *The Welsh Embassador* (1623), and in three other plays, now lost, of about the same date; his hand has been seen in Thomas Middleton's and Samuel Rowley's *Spanish Gipsie* (1623), John Fletcher's *Faire Maide of the Inne* (1626), and other plays of Francis Beaumont and Fletcher.

Ford's own, noncollaborative plays, only two of which can be definitely dated, were written *c.* 1627–38: *The Broken Heart; The Lover's Melancholy* (1628); *Tis Pitty She's a Whore; Perkin Warbeck; The Queen; The Fancies, Chast and Noble; Love's Sacrifice;* and *The Ladies Triall* (1638). His reputation rests mainly on the first four.

Ford, John, original name SEAN ALOYSIUS O'FEENEY, or O'FEARNA (b. Feb. 1, 1895, Cape Elizabeth, Maine, U.S.—d. Aug. 31, 1973, Palm Desert, Calif.), American motion-picture director who was Hollywood's best-known director of westerns. He developed a distinctive directorial style characterized by effective cutting, an emphasis on action, colourful characterization, a sentimentalized vision of the past, and the skillful creation of mood.

In 1914 Ford joined his brother Francis in Hollywood, becoming a property man at the Universal Studios. He changed his name, became an assistant director, and was assigned to work on shorts and westerns.

Ford's first big success as a large-scale director was *The Iron Horse* (1924), the story of the first transcontinental railroad, a film that gave impetus to the growing popularity of the high-budget "big western." *The Informer* (1935) established Ford's critical reputation, and it, along with three later films—*The Grapes of Wrath* (1940), *How Green Was My Valley* (1941), and *The Quiet Man* (1952)—all won the Academy Award for best direction.

Although many of his outstanding films dealt with social themes, Ford was best-known for westerns, such as *Stagecoach* (1939), *My Darling Clementine* (1946), *Wagonmaster* (1950), *Rio Grande* (1950), *The Searchers* (1956), *The Man Who Shot Liberty Valance* (1962), *How the West Was Won* (1962), and *Cheyenne Autumn* (1964). Andrew Sinclair's *John Ford* was published in 1979.

Ford Foundation, American philanthropic foundation, established in 1936 with gifts and bequests from Henry Ford and his son Edsel. At its peak it had assets of more than $4,000,000,000. Its chief concerns have been international affairs (particularly population

control and the alleviation of food shortages), communications (especially public television), humanities and the arts, and, in later years, resources and the environment.

Ford Motor Company, American automotive corporation founded in 1903, by Henry Ford (*q.v.*) and 11 associate investors. In 1919 the company was reincorporated, with Ford, his wife, Clara, and his son, Edsel, acquiring full ownership; they, their heirs, and the Ford Foundation (formed 1936) were sole stockholders until January 1956, when public sale of the common stock was first offered. The company today is engaged in the manufacture, assembly, and sale of passenger cars (Ford, Mercury, Lincoln, and Continental), trucks, tractors, and related parts and accessories and in the development and manufacture of electronic products and appliances for consumers and for the aerospace industries (including communications and weather satellites). Headquarters are in Dearborn, Mich.

Henry Ford built his first experimental car in a workshop behind his home in Detroit in 1896. After formation of the Ford Motor Company, the first Ford car was assembled at the Mack Avenue Plant in July 1903. Five years later, in 1908, the highly successful Model T appeared; in 1911 Ford established the industry's first branch assembly plant (in Kansas City, Mo.); in 1913 he introduced the world's first moving assembly line for cars; in 1914, to improve labour relations, he introduced the $5 daily wage for an 8-hour day (replacing $2.34 for a 9-hour day).

By mid-1914 there were more than 500,000 Model T's on the roads of the world; by 1923 the company was producing more than half of America's automotive vehicles and by the end of the 1920s had more than a score of assembly plants overseas in Europe, Latin America, Canada, Asia, South Africa, and Australia. The Ford had become the world's most familiar make of car.

In 1927 the last Model T and the first new Model A were produced, followed in 1932 by the first Ford V-8. In 1922 Ford had acquired the Lincoln Motor Company (founded 1917), which would produce Ford's luxury Lincolns and Continentals. In 1938 Ford introduced the first Mercury, in the medium-priced range. Ford's only other independent make, the Edsel, was a financial failure and lasted but three years, 1957–59.

As early as 1906 Henry Ford had acquired 58½ percent of the company's stock; and, when the other stockholders balked at the idea of building the giant (and expensive) Rouge Plant in Dearborn, Mich., he bought them out, and his son Edsel Ford (1893–1943) became president (1919). On Edsel's death in 1943, Henry Ford returned to the presidency but in 1945 turned it over to his grandson, Henry Ford II (*q.v.*), chairman of the board and chief executive officer and head of the company until 1979.

In the 1950s and 1960s the Ford Motor Company began limited diversification, setting up a company to develop and manufacture weapons systems and guided and ballistics missiles (1956), acquiring Philco Corporation (1961) for the manufacture of electronic products, and establishing the Ford Tractor Division (1962) to produce tractors and farm implements.

Forde, (Cyril) Daryll (b. March 16, 1902, Tottenham, Middlesex, Eng.—d. May 3, 1973, London), English physical anthropologist noted for his work on the ecological and technical influences on primitive cultures. His comparative human geography of Arizona and New Mexico, *Habitat, Economy and Society* (1934), won acclaim as a classic text in ecological analysis. His subsequent fieldwork in southeastern Nigeria led to a comprehensive series of studies of the Yakö peoples of the Cross River, setting the style for the numerous kinship and political studies of Africa that would follow.

Forde studied geography and prehistoric archaeology at University College, London (Ph.D., 1928). In 1930 his appointment to the University of Wales made him the youngest full professor in the United Kingdom. As director of the International African Institute from 1944 until his death, he oversaw the rapid development of African anthropological studies. With his appointment in 1945 to the new anthropology chair at University College, London, he launched a massive research and publishing program, which was important in generating support for African research. Forde was also the editor of the journals *Africa* and *African Abstracts*.

Forde, Francis Michael (b. July 18, 1890, Mitchell, Queensland, Australia—d. Jan. 28, 1983, Brisbane, Queensland), politician and, for a short time, prime minister of Australia (1945).

Active in state politics as a young man, he was a member of the Australian House of Representatives (1922–46) and deputy leader of the Australian Labor Party (1932–46). In the cabinet he served as minister for the army (1941–46), minister for defense (1946), and deputy prime minister to John Curtin (1941–45) and Joseph Benedict Chifley (1945–46). He also served as prime minister for six days, July 6–12, 1945 (the shortest term in Australia's history), after the death of Curtin. He was Australian high commissioner to Canada from 1946 to 1953.

Fordwiche, William Cowper, Viscount: *see* Cowper, William Cowper, 1st Earl.

fore-and-aft sail, one of the two basic types of sailing rig, the other being the square sail. The fore-and-aft sail, now usually triangular, is set completely aft of a mast or stay, parallel to the ship's keel, and takes the wind on either side. The mainsail always has a boom, pivoted on the mast. Historically, it represented an important advance over the ancient square sail; it first appeared in the Mediterranean as the lateen sail (*q.v.*). Full-rigged ships carried both types of sail; modern sport sailing craft carry fore-and-aft sails exclusively because of their ready maneuverability and facility in tacking into the wind.

fore-edge painting, technique of painting the edges of the leaves, or folios, of a book, employed in the Middle Ages. Manuscript books with gold-tooled bindings often had the edges of their pages gilded with burnished gold. They were also frequently goffered with heated tools and were occasionally coloured. From 1650 onward a number of London binders practiced a new decorative method of fore-edge painting: floral scrolls or scenes were painted upon the fanned-out fore-edge of the leaves and concealed by a normal gilt edge when the book was closed; they became visible only when it was opened. This decorative device was continued in the 18th century, but by the late 19th century fore-edge painting began to wane in popularity.

Forécariah, town, western Guinea, western Africa. The town is located at the head of navigation of the Forécariah (Kissi-Kissi) River and is on the road from Kambia (Sierra Leone) to Conakry (the Guinean capital). It is the chief trading centre for the rice, bananas, pineapples, oranges, coconuts, fish, salt, and palm oil and kernels produced in the surrounding area. Pop. (1983 prelim.) 10,239.

forecasting, economic: *see* economic forecasting.

foreclosure, legal proceeding by which a mortgagor's rights to a mortgaged property may be extinguished if the mortgagor (borrower) fails to live up to the obligations agreed to in the mortgage. The mortgagee (the lender) may then declare the entire debt due and owing and may seek to satisfy the debt by foreclosing on the property. Most foreclosures are brought in equity proceedings. Most foreclosures are brought in equity proceedings. Strict foreclosure, considered the harshest method, may be used if the debtor is totally insolvent and all the worth of the property is used to pay off the indebtedness. Foreclosure is commonly by a court-decreed sale of the mortgaged property to the highest bidder, who is often the mortgagee. The proceeds of the judicial sale are first used to pay the debt; the surplus, if any, is paid to other creditors with subordinate claims on the same property and then to the mortgagor. If the proceeds are insufficient to pay the debt, the court makes the debtor responsible for paying whatever amount of the mortgage is still unpaid. Where a mortgage provides for it, a mortgagee may exercise his "power of sale" without prior recourse to the courts.

Foreign Affairs, journal of international relations, published in New York City five times a year, one of the most prestigious periodicals of its kind in the world. It is the organ of the Council on Foreign Relations, by which it was founded in 1922, and is, informally, the voice of the U.S. foreign-policy establishment. It has a world reputation for its careful and probing analyses of political, economic, and social developments in the world scene. The contributors of these authoritative and scholarly articles comprise a roster of the nation's most distinguished journalists, scholars, and statesmen. Ideas put forward tentatively in this journal often, if well received by the *Foreign Affairs* community, appear later as U.S. government policy or legislation; prospective policies that fail this test usually disappear.

foreign aid, an international transfer of capital, goods, or services for the benefit of other nations and their citizens. Official foreign aid is offered in two major forms: (1) capital transfers, in cash or kind, either as grants or loans, and (2) technical assistance and training, usually as grants in the form of human resources and technical equipment. The rationale of economic aid assumes that when a country reaches a stage of sustained economic growth, foreign aid can be reduced and cut off. Military assistance—in the form of either equipment or training advisers—has been an extremely important part of aid, both Eastern and Western.

Foreign aid as an instrument of national policy dates from the 18th century, when Frederick the Great subsidized certain allies in order to assure their military support and effectiveness. This practice continued intermittently in Europe during the 19th century.

In World War I the United States made substantial loans to its European allies that became, in effect, grants when the allies defaulted on their repayments at the outset of the Great Depression. Because of this experience, U.S. aid during World War II was offered in the form of "lend-lease": the United States provided its allies with essential equipment and supplies, and in return the allies equipped and supplied U.S. troops stationed abroad.

The establishment of the United Nations Relief and Rehabilitation Administration (UNRRA), which operated from 1943 to 1946, marked an important, although largely unwitting, transition from the older conception of aid as a subsidy to a new conception of foreign aid as an institutional element of policy. UNRRA demonstrated that rich nations, notably the United States, which supplied most of the funds, were beginning to view official international aid as an essential element of postwar reconstruction.

The economic and humanitarian motives

for promoting large-scale reconstruction after World War II were catalyzed by political considerations—the West's fear of Soviet expansion into western Europe. The first foreign-aid response was U.S. President Harry Truman's decision in March 1947 to provide military and economic aid to Greece and Turkey, which were faced by military aggression from Communist forces based in Yugoslavia. In June 1947 U.S. Secretary of State George Marshall proposed a European Recovery Program of aid to western Europe with a much heavier emphasis on economic reconstruction. During the four-year life of the "Marshall Plan," western Europe was provided with about $12,000,000,000 in U.S. government aid. The Marshall Plan is generally considered to have achieved its twin goals of promoting European reconstruction and preventing the westward spread of Soviet power. In the Marshall Plan a major power had for the first time explicitly linked aid for economic reconstruction to the promotion of its political and military interests.

During the 1950s it became apparent in both the United States and the Soviet Union that direct conflict between the two powers was unlikely and that there would be a struggle for the allegiance of developing countries of the "Third World." Thus, the Communist bloc countries and the West have competed for favours in developing nations.

The United States has furnished by far the most aid. The former colonial powers—France, the United Kingdom, Belgium, The Netherlands—advance relatively large amounts of aid to maintain political commitments. Germany, Japan, Norway, and Denmark have sought to build links with those developing countries that could be of economic or political benefit to them. For some of the smaller countries—The Netherlands, the Scandinavian countries, Canada—the main motives have been charitable.

One problem with foreign aid is that the donor normally requires the recipient to buy the donor's products. This "tied" aid creates special problems for recipients because the prices of donors' goods may be higher than world market prices. In effect, this aid imposes hidden interest charges on the borrower.

Multilateral programs have grown steadily. The major agency is the International Bank for Reconstruction and Development (the World Bank), which began operations in 1946 as an independent specialized agency of the United Nations. There are also several regional development banks, each lending funds to developing countries in its region. The oldest and largest is the Inter-American Development Bank, founded in 1959, which lends to Latin American countries. The African Development Bank, founded in 1964, has had relatively little success in attracting large amounts of capital. The Asian Development Bank, founded in 1965, has been more successful in generating capital.

European countries have established two institutions for multilateral aid—the European Development Fund and the European Investment Bank. Both are organs of the European Economic Community (EEC).

The United Nations finances a number of economic aid programs through grants awarded by specialized agencies, notably UNESCO, the World Health Organization, and the Food and Agriculture Organization.

The work of economic development has been discovered to be far more difficult than the rebuilding of Europe because it requires the transformation of entire societies and not simply their reconstruction. This task, it is now recognized, is the work of generations.

From the standpoint of the donor countries, foreign aid has often been politically unrewarding. The governments of new nations, with their colonial heritage, are naturally suspicious of the motives of industrial nations and are concerned with demonstrating their independence. The donor government may find itself tied to the fortunes of its client, often at considerable financial, military, and political cost. Aid-receiving nations naturally attempt to pursue what they perceive to be their own interests, which may conflict with the interests of the donor countries.

The frequent inability of foreign aid to stimulate rapid economic development in poor countries has led to considerable skepticism in parliaments and among the populations of the donor countries as to the economic merits of foreign aid. Economic aid is manifestly only one element in the complex of factors required to bring about economic development.

foreign exchange: *see* international exchange.

Foreign Legion, French LÉGION ÉTRANGÈRE, a military corps consisting originally of foreign volunteers in the pay of France but now including large numbers of Frenchmen. Its officers are nearly all from the French Army, and a foreign-born legionnaire becomes eligible for French citizenship after serving one enlistment (five years) with good conduct. Upon enlistment the recruit takes an oath to serve not France but the legion, and the organization's unofficial motto, "*legio patria nostra*" ("The legion is our fatherland"), further tells the legionnaire where his first loyalty lies. Often romanticized by novelists (as by Percival Christopher Wren in *Beau Geste* [1925]), who pictured the legion as a haven for criminals, forlorn lovers, and unhappy noblemen serving under assumed names, the organization is actually a highly disciplined professional army that has been in almost continuous combat since its founding in 1831. Because the legion keeps secret a volunteer's past, it has had more than its share of the above-mentioned types, but the man who wears the traditional white kepi headdress is more likely to be a European professional soldier who prefers fighting with the legion to garrison duty with his own army. Every major European war since the 1830s has swelled the legion's ranks with volunteers from unmustered forces. (After the Falklands War of 1982, British recruits rose to 10 percent of the total.)

Founded by King Louis-Philippe as an aid to controlling French colonial possessions in Africa, the legion established its headquarters at Sidi bel Abbès, Algeria. During its history its forces have fought or been stationed in such places as Spain, the Crimea, Italy, Mexico (where it supported the ill-fated emperor Maximilian), Dahomey, Morocco, Syria, and Indochina. Although formerly prohibited from being stationed in metropolitan France during peacetime, it did serve there in World Wars I and II. After the French collapse in World War II, units of the legion escaped to join General Charles de Gaulle's Free French forces. In 1961 one regiment of the legion supported insurgents in Algeria against the French government and, despite its outstanding combat record, was disbanded in disgrace. In 1962, with the coming of Algerian independence, the legion for the first time moved its headquarters to metropolitan France, to the town of Aubagne, near Marseilles. The Legion publishes a monthly magazine, *Kepi Blanc* (named after the white kepi).

The Foreign Legion on the march in Algeria before 1914
H. Roger-Viollet

foreign service, also called DIPLOMATIC SERVICE, the field force of a foreign office, comprising diplomatic and consular personnel engaged in representing the home government's interests abroad and providing the necessary information on which foreign policy is based. There is a marked similarity in the foreign service organizations of most countries. Diplomatic and consular functions are generally performed by a single service, which is expected to serve at home or abroad, enabling interchangeability of consular and diplomatic officers. The merger of the two functions came about when many European countries, beginning with France in 1880, recognized that the consular service, although less dependent on ceremony and prestige, could not be entirely separated from diplomatic affairs.

Originally, diplomatic officials were members of royal or noble families and served as the personal representatives of sovereign rulers. When governmental authority came to reside in institutions other than monarchs, diplomats became the representatives of the government in power. As such, they were for a long time drawn primarily from wealthy governing and aristocratic classes. Prior to World War I, candidates for the British diplomatic service, for example, had to show that they had an independent income. In the United States, despite the absence of an aristocracy or governing class, wealth and political connections were once important prerequisites because of low salaries and meagre representation (entertainment) allowances. In France under the Third Republic the diplomatic service remained largely in the hands of prosperous upper middle-class citizens and those members of the aristocracy whose wealth remained intact. In imperial Germany and Russia the diplomatic services were almost exclusively in the hands of the aristocracy and high reserve officers of the army and navy.

Great Britain in 1871 instituted the first competitive entrance examinations for the foreign service. In the 20th century, education and intellectual ability became the chief criteria of selection in most countries. The competitive entrance examination, merit system of advancement, and mandatory retirement at specified ages through a rigorous "selection up or selection out" procedure have been widely instituted.

Foreign service officers adhere to rules and customs that are of long standing and have proved indispensable to governments in conducting their international relations. Under international law and usage, personnel in missions abroad (usually embassies, legations, and consulates), including members of their households, are immune from the jurisdiction of the government to which they are accredited, and the mission itself has the status of extraterritoriality and, as such, is considered legally a part of the home country. Personnel may not be sued in civil action or compelled to testify as witnesses or compelled to pay taxes to the host country. Their official position does not sanction the evasion of private debts, however, and their private property is subject to local municipal law. An officer or staff member who does not conform to local regulations or who is otherwise unacceptable to the government to which he is accredited may be declared unacceptable (*persona non grata*) and his recall requested, a demand that is invariably obeyed. Accreditation of ambassadors or other chiefs of mission is handled in accordance with internationally accepted procedures, but appointment of both ambassadors and other officers follows the constitutional practice of individual states. *See also* diplomacy.

Forel, Auguste-Henri (b. Sept. 1, 1848, La-Gracieuse, near Morges, Switz.—d. July 27, 1931, Yvorne), Swiss neuroanatomist, psychiatrist, and entomologist known for his investigations of brain structure.

Forel studied medicine at the University of Zürich from 1866 to 1871 and then did work in neuroanatomy at the University of Vienna, where he received his medical degree in 1872. In 1879 he was appointed director of the Burghölzli Asylum in Zürich and professor of psychiatry at the University of Zürich. His first major contribution to the anatomy of the brain was his paper (1877) on the tegumental region, which described various previously unknown brain structures. In 1887 he published one of his most important works, on the neuron theory, describing those cellular functional units within the brain. In 1889 he founded an institute at Zürich for the medical treatment of alcoholism, and throughout his career he worked for social reforms to prevent such causes of mental illness as syphilis and alcoholism. Forel retired in 1893 and devoted the remainder of his life to social reform and the study of the psychology of ants.

Forel, François-Alphonse (b. Feb. 2, 1841, Morges, Switz.—d. Aug. 7, 1912, Morges), Swiss physician, scientist, and founder of limnology, the study of lakes.

While lecturing in physiology and anatomy at the University of Lausanne, Switz., Forel began his investigations of lakes, notably Lake Geneva, and he published his findings in *Le Léman: Monographie limnologique,* 3 vol. (1892–1904). His standard work on limnology, *Handbuch der Seenkunde* (1901), included a study of the hitherto unexplained movement of lake waters known as seiches. Forel is credited with the discovery of density currents, which occur in the Alpine lakes because of the cold temperatures of entering glacier-derived streams. He also explained the mechanism of seiches and studied earthquakes and glaciers.

Foreman, George (b. Jan. 22, 1948, Marshall, Texas, U.S.), American world heavyweight boxing champion from Jan. 22, 1973, when he knocked out Joe Frazier in two rounds at Kingston, Jam., until Oct. 30, 1974, when he was knocked out in eight rounds by Muhammad Ali at Kinshasa, Zaire. Foreman was a powerful puncher who nevertheless lacked endurance.

The 6-foot 3-inch, 218-pound Foreman was reared in Houston, Texas, and learned to box in a U.S. Job Corps camp in Oregon. In the Olympic Games in Mexico City in 1968 he won the gold medal in the heavyweight boxing competition. From his first professional fight (June 23, 1969) until his loss to Ali he won 40 consecutive bouts, including a sequence of 24 consecutive knockouts. He retired from the ring in 1977 and became an evangelist. Foreman resumed professional boxing in 1987 at the age of 39 with the avowed intention of reclaiming the world heavyweight title.

forensic medicine, the science that deals with the application of medical knowledge to legal questions.

The use of medical testimony in law cases predates by more than 1,000 years the first systematic presentation of the subject by the Italian Fortunatus Fidelis in 1598. Forensic medicine was recognized as a specialty early in the 19th century.

The chief tool of forensic medicine has always been the autopsy (*q.v.*). Often used for identification of the dead, autopsies may also be conducted to determine the cause of death. In cases of death caused by a weapon, for example, the forensic pathologist—by examining the wound—can often provide detailed information about the type of weapon used as well as important contextual information. (In a death by gunshot, for example, he can determine with reasonable accuracy the range and angle of fire.) Forensic medicine is a major factor in the identification of victims of disaster, such as landslide or plane crash. In cause-of-death determinations, forensic pathologists can also significantly affect the outcome of trials dealing with insurance and inheritance.

In the 19th century, two other forensic specialties arose, namely, forensic psychiatry (which is used to determine the mental health of an individual about to stand trial, and, thus, his blameworthiness) and forensic toxicology. The forensic toxicologist gives evidence on such topics as intentional poisonings and drug use. The toxicologist has played an increasingly important role in matters of industrial and environmental poisoning.

Fores, also spelled FOREST (French region): *see* Forez.

foreshortening, method of rendering a specific object or figure in a picture in depth. The artist records, in varying degrees, the distortion that is seen by the eye when an object or figure is viewed at a distance or at an unusual angle.

In a photograph of a recumbent figure, for instance, those parts of it, such as the feet, that are nearest the lens will seem unnaturally large, those at a distance, such as the head, unnaturally small. The artist may either record this effect exactly, producing a startling illusion of reality that seems to violate the picture plane (surface of the picture), or modify it, slightly reducing the relative size of the nearer part of the object, so as to make a less aggressive assault on the viewer's eye and to relate the foreshortened object more harmoniously to the rest of the picture. Insofar as foreshortening is basically concerned with the persuasive projection of a form in an illusionistic way, it is a type of perspective, but the term foreshortening is almost invariably used in relation to a single object, or part of an object, rather than to a scene or group of objects.

Foreshortened figure of Christ, "The Mourning over the Dead Christ," oil painting by Andrea Mantegna, *c.* 1475(?); in the Brera, Milan

SCALA—Art Resource/EB Inc.

Forest, Flemish VORST, southwestern commune, one of 19 forming Greater Brussels, Brabant *province,* central Belgium. Its two wooded parks on the slopes of the Zenne valley were once part of the Forêt de Soignes. Manufactures include vehicles, chemicals, paper, photographic materials, clocks, clothing, leather goods, and soap. Beer is also brewed. The Abbey of Saint-Benoit, built in 1106, includes monastic buildings added in the 18th century. Pop. (1986 est.) mun., 48,683.

forest, complex ecological system in which trees are the dominant life form.

A brief treatment of forests follows. For full treatment, *see* MACROPAEDIA: Biosphere, The.

Tree-dominated forests can occur wherever the temperatures rise above 50° F (10° C) in the warmest months and the annual precipitation is more than 8 inches (200 mm). They can develop under a variety of conditions within these climatic limits, and the kind of soil, plant, and animal life differs according to the extremes of environmental influences. In cool, high-latitude polar regions, forests are dominated by hardy conifers like pines, spruces, and larches. These taiga forests have prolonged winters and between 10 and 20 inches (250 and 500 mm) of rainfall annually. In more temperate high-latitude climates, mixed forests of both conifers and broad-leaved deciduous trees predominate. Broad-leaved deciduous forests develop in middle-latitude climates, where there is an average temperature above 50° F (10° C) for at least six months every year and annual precipitation is above 16 inches (400 mm). A growing period of 100 to 200 days allows deciduous forests to be dominated by oaks, elms, birches, maples, beeches, and aspens. In the humid climates of the equatorial belt, tropical rain forests develop. There heavy rainfall supports evergreens that have broad leaves instead of needle leaves, as in cooler forests. In the lower latitudes of the Southern Hemisphere, the temperate deciduous forest reappears.

Forest types are distinguished from each other according to species composition (which develops in part according to the age of the forest), the density of tree cover, type of soils found there, and the geological history of the forest region.

Soil conditions are distinguished according to depth, fertility, and the presence of perennial roots. Soil depth is important because it determines the extent to which roots can penetrate into the earth and, therefore, the amount of water and nutrients available to the trees. The soil of taiga forests is sandy and quickly drained. Deciduous forests have brown soil, richer than sand in nutrients, and less porous. Rain forests and savanna woodlands have a soil layer rich in iron or aluminum, which give the soils either a reddish or yellowish cast. The amount of water available to the soil, and therefore available for tree growth, depends

on the amount of annual rainfall. Water may be lost by evaporation from the surface or by leaf transpiration. Evaporation and transpiration also control the temperature of the air in forests, which is always slightly warmer in cold months and cooler in warm months than the air in surrounding regions.

The density of tree cover influences the amount of both sunlight and rainfall reaching every forest layer. A full-canopied forest absorbs between 60 and 90 percent of available light, most of which is absorbed by the leaves for photosynthesis. The movement of rainfall into the forest is considerably influenced by leaf cover, which tends to slow the velocity of falling water, which penetrates down to the ground level by running down tree trunks or dripping from leaves. Water not absorbed by the tree roots for nutrition runs along root channels, so water erosion is therefore not a major factor in shaping forest topography.

Forests are among the most complex ecosystems in the world, and they exhibit extensive vertical stratification. Conifer forests have the simplest structure: a tree layer rising to about 98 feet (30 m), a shrub layer that is spotty or even absent, and a ground layer covered with lichens, mosses, and liverworts. Deciduous forests are more complex; the tree canopy is divided into an upper and lower story, while rain forest canopies are divided into at least three strata. The forest floor in both of these forests consists of a layer of organic matter overlying mineral soil. The humus layer of tropical soils is affected by the high levels of heat and humidity, which quickly decompose whatever organic matter exists. Fungi on the soil surface play an important role in the availability and distribution of nutrients, particularly in the northern coniferous forests. Some species of fungi live in partnership with the tree roots, while others are parasitically destructive.

Animals that live in forests have highly developed hearing, and many are adapted for vertical movement through the environment. Because food other than ground plants is scarce, many ground-dwelling animals use forests only for shelter. In temperate forests, birds distribute plant seeds and insects aid in pollination, along with the wind. In tropical forests, fruit bats and birds effect pollination. The forest is nature's most efficient ecosystem, with a high rate of photosynthesis affecting both plant and animal systems in a series of complex organic relationships.

Forest Cantons, League of the Three: *see* Everlasting League.

forest fire, uncontrolled fire occurring in vegetation more than 6 feet (1.8 m) in height. These fires often reach the proportions of a major conflagration and are sometimes begun by combustion and heat from surface and ground fires. A big forest fire may crown, that is, spread rapidly through the topmost branches of the trees before involving undergrowth or the forest floor. As a result, violent blowups are common in forest fires, and they may assume the characteristics of a fire storm. *See* wildland fire.

Forest Heath, district, county of Suffolk, England. It takes its name from the vegetation of the area, which is a mixture of heathlands and forest plantations characteristic of the larger region known as the Breckland. With an area of 144 square miles (374 square km), it occupies the northwestern corner of the county. The local government reorganization of 1974 (by which the Forest Heath district was created) perpetuated the county boundary between Suffolk and Cambridgeshire and attached to Forest Heath the town of Newmarket, whose natural connection might have been considered to link it with Cambridge rather than with the empty hinterland of Forest Heath. The district thus includes Newmarket town, with its horse racetracks and gallops, upon which Newmarket so largely depends for its livelihood and renown. Pop. (1986 est.) 55,700.

Forest Hills, residential section of the borough of Queens, New York City, southeastern New York, U.S., on Long Island. Originally part of a district called Whitepot, which was settled about 1652, it was named Forest Hills in about 1910 for its location on wooded heights. The stadium of the West Side Tennis Club in Forest Hills was the site of the U.S. national lawn tennis tournaments from 1915 until they were moved in 1978 to Flushing Meadows Park (also in Queens).

Forest Negro local race, a subgroup, roughly corresponding to a breeding isolate in genetics, of the Negroid (African) geographic race. It consists of the populations of West Africa and both the Congo (Brazzaville) and Zaire, excluding the Pygmies. The chief physical characteristics of the Forest Negroes are: dark to black skin and eyes; black, tightly curly to frizzy hair; everted lips; wide noses; large teeth; short to medium stature; mesocephaly (skull is neither extremely short nor extremely long from front to back); and stocky build with tendencies toward obesity.

The Forest Negroes are also of note for their many abnormal or variant hemoglobins and haptoglobins (blood proteins), in particular the abnormal hemoglobin (hemoglobin S) that causes sickle-cell anemia (*q.v.*). In some Forest Negro populations, as many as 40 percent of the population may carry the gene for hemoglobin S. *See also* local race; Negroid geographic race.

Forest of Dean, district, county of Gloucestershire, south-central England, occupying an area of 204 square miles (528 square km) in the western part of the county. It is bordered on the southeast by the broad estuary of the River Severn and on the southwest by the River Wye, which (for the most part) forms the border with Wales. The district takes its name from one of the great primeval forests of England that still covers much of the 500- to 800-foot- (150- to 245-metre-) high sandstone ridges and valleys of the south-central part of the district. The woodland area was designated a national forest park in 1939. Its oaks, ashes, birches, and ferns have overlapped a coalfield little worked since the early 1960s and an ancient ironworks much used by the Crusaders. Timber from the forest was utilized in the construction of ships between the 16th and 18th century.

Coleford, the district seat, Cinderford, and Mitcheldean, all former coal-mining centres, are parishes (towns) in the region. Sheep and cattle are grazed, and dairying is the most significant economic endeavour along the fertile strip of lowland bordering the Severn. Limestone is quarried from the cliffs above the Wye valley. Dairy cattle also graze the fertile loams and marls of the Vale of Newent west of the city of Gloucester in the northern part of the district. Greenhouse produce (including lettuce, cucumbers, and tomatoes) is grown there, together with apples and pears for cider and perry (fermented pear juice). The Newent area is known for its fields of wild daffodils. Light industrial manufactures of the district include automobile accessories and plastics. Pop. (1986 est.) 75,200.

forester, also called GRAY KANGAROO, one of the largest species of kangaroo (*q.v.*).

Forester, C(ecil) S(cott) (b. Aug. 27, 1899, Cairo, Egypt—d. April 2, 1966, Fullerton, Calif., U.S.), British historical novelist and journalist, best known as the creator of the British naval officer Horatio Hornblower, whose rise from midshipman to admiral and peer during the Napoleonic Wars is told in a series of 12 novels, beginning with *The Happy Return* (1937; U.S. title *Beat to Quarters*).

Abandoning medicine for writing, Forester achieved success with his first novel, *Payment Deferred* (1926); others included *Brown on Resolution* (1929), *The Gun* (1933), *The General* (1936), and *The Ship* (1943). Many

Forester
By courtesy of Penguin Publishing Co. Ltd.

of his novels were adapted to motion pictures; most notable among them is *The African Queen* (1935), which was made into an extraordinarily successful film in 1951 by writer James Agee and director John Huston. Forester also wrote biographies and history books, including *The Last Nine Days of the Bismarck* (1959; also entitled *Sink the Bismarck!*). Forester described the genesis and progress of the Hornblower series in the self-revealing *Hornblower Companion* (1964). He was correspondent for *The Times* (London) during the Spanish Civil War and the German occupation of Czechoslovakia. During World War II, he worked as a propagandist in Great Britain and the United States. The last of the Hornblower books, *Hornblower and the Crisis* (1967), was published posthumously.

forester moth (*Procris,* or *Ino*), any of a genus of moths of the family Zygaenidae that are closely related to the burnet moths and are widespread in the Northern Hemisphere. The adult moth has shining green forewings (span about three centimetres), translucent, dark hind wings, and an iridescent body. The insect's green appearance at rest may have given rise to the common name forester. Young larvae bore into leaves of various herbaceous plants and feed within the tissues. Larger larvae stay under leaves and spin a tough, white, silken cocoon in which to pupate, often on a grass stem. Adult foresters are weak fliers and take to the wing only in sunshine.

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

Forestier Peninsula, peninsula in southeastern Tasmania, Australia, measuring 12 by 9 miles (19 by 14 km) and bounded by the Tasman Sea (east) and by Norfolk Bay (west). To the north the promontory is connected to the mainland by a short isthmus, and to the south it is linked to the Tasman Peninsula by the 1/4-mile-wide Eaglehawk Neck.

forestry, the management of forested land, together with associated waters and wasteland, primarily for harvesting timber but also for conservation and recreation purposes.

A brief treatment of forestry follows. For full treatment, *see* MACROPAEDIA: Forestry and Wood Production.

About one-third of the world's land surface is classified as forest land, and approximately 1 percent of the standing timber is harvested each year. Almost half of the felled timber is used for fuel, the remainder being made into wood products or pulp for paper and packaging materials. The trees providing the raw

materials are grouped into three general classifications: conifers, broadleaves, and monocotyledons.

Almost all conifers, which are also called softwood, or gymnosperm ("naked-seeded"), trees, are evergreen. The most common include species of northern pine (of the genus *Pinus*), spruce (*Picea*), Douglas fir (*Pseudotsuga*), cedar (*Cedrus*), cypress (*Cupressus*), redwood (*Sequoia*), and hemlock (*Tsuga*). Conifers are characterized by their needle-shaped leaves; they survive well in harsh climates and where soil conditions are relatively poor. Most conifer forests are found in the Northern Hemisphere, the largest concentration occurring in a northern band, called taiga, that cuts a broad swath across North America, northern continental Europe and Scandinavia, the Soviet Union, and northern China and Japan. There is also a discontinuous conifer forest in the southern portion of the Northern Hemisphere and small areas of conifer forest in the Southern Hemisphere. Conifers are among the most commercially useful trees and are commonly used for paper, furniture, and building materials.

The broadleaves, or hardwood trees, thrive not only in temperate climates but also in sub-tropical and tropical forests. This group includes species of such temperate trees as oak (*Quercus*), elm (*Ulmus*), birch (*Betula*), ash (*Fraxinus*), maple (*Acer*), chestnut (*Castanea*), poplar (*Populus*), beech (*Fagus*), and alder (*Alnus*), as well as such semitropical and tropical evergreens as eucalyptus (*Eucalyptus*), teak (*Tectona grandis*), mahogany (*Swietenia macrophylla*), and balsa (*Ochroma pyramidale*). Broadleaf trees growing in temperate climates are deciduous; they shed their leaves in autumn and remain leafless through the winter. They are used in a variety of commercial products, including furniture, wood veneers, panelling, and flooring.

Monocotyledons, or monocots, include palm and bamboo. Found mainly in tropical and subtropical climates, monocots have less commercial value than the conifers and broadleaves. Palms are economically more important for their fruit (*e.g.*, coconuts, dates, and products fashioned from their leaves) than for their timber. Bamboo, however, has a variety of commercial applications that range from pulp for paper to materials for construction and furniture making.

The planned management of forests originated in early medieval Europe. Large tracts of forest land were owned by monarchs and nobles who utilized the woodland resources for their own needs and for trade. Laws and regulations regarding the felling of timber and the use of forests for hunting were set and enforced by the feudal owners. As the value of timber for fuel and wood products increased and the commercial markets for it grew, the owners instituted programs for the replacement of trees that had been removed; this practice was the basis of modern forestry.

The science of forestry is built around the principle of multiple-use land management, although the harvesting and replanting of timber are still the primary activities. The main objective is to create a system of sustained yield, *i.e.*, to maintain a continuous supply of timber through carefully planned harvest and replacement.

Through legislation and policies, governments define the amount of timber that can be taken and often set aside areas that cannot be touched. Forest managers set strict controls over how trees will be removed—some areas are cleared while others are thinned, for example.

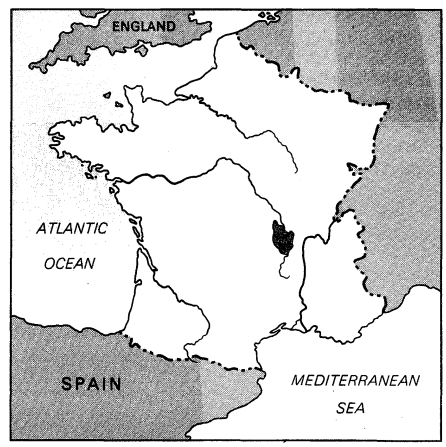
The replacement of timber that has been harvested is called silviculture. There are two techniques, each with its advantages and drawbacks: natural and artificial regeneration.

Natural regeneration is the method whereby timber is removed in such a way that gaps or swaths are left in the forest. Seeds from neighbouring trees are then naturally distributed and take root. An advantage of natural regeneration is that it involves much less work in terms of cultivation and nurture, but it restricts the renewal process to those trees that are native to the area.

Artificial regeneration involves collecting seeds or cuttings and then sowing them in forest nurseries. After their growth reaches a certain stage, the seedlings are planted in the areas that are being reforested. The method's advantages are that it permits the introduction of different kinds of trees into a specific area, that the process can be more scientifically controlled, and that it is generally a quicker way to restock a forest area. Its main disadvantages are the large amount of investment capital needed and the relatively long time required to recoup the investment.

Within the concept of multiple-use forest management, however, the forest manager is also responsible for the application of other land controls, which include the protection of wildlife and the implementation of programs to protect the forest from weeds, insects, fungal diseases, erosion, and fire. Forest areas must be preserved and maintained for recreational uses, ranging from scenic pleasures and nature study to such activities as hunting, fishing, camping, and hiking.

Forez, also spelled FORES, or FOREST, former region of France lying on the eastern side of the Massif Central and included within the modern *département* of Loire. The name is derived from that of its capital, Feurs (Forum



The county of Forez *c.* 1035

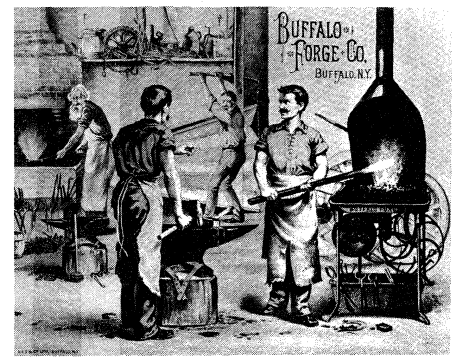
From W. Shephard, *Historical Atlas*, Harper & Row, Publishers (Barnes & Noble Books), New York; revision Copyright © 1964 by Barnes & Noble, Inc.

Segusiavorum in Roman times), a town midway between Roanne and Saint-Étienne, in an agriculturally rich area watered by the Loire River. The counts of Forez vied with the archbishops of Lyon for control of the Lyonnais from the latter part of the 10th century until 1173, when they were forced to renounce their claims to all but the county of Forez. From 1368 until 1527 Forez formed part of the Bourbon territories; in 1527 King Francis I seized the county and incorporated it into the new province of Lyonnais.

Forfar, small burgh and seat of the district of Angus, Tayside region, Scotland, situated at the eastern end of Forfar Loch (lake), in the scenic valley of Strathmore. It dates at least from *c.* 1057, when an early Scottish parliament met in the castle to confer titles on Scottish nobility. The castle also figured in English–Scottish conflicts, being finally seized and destroyed by Robert I the Bruce in the 14th century. The traditionally important textile industry still employs much of the population. Pop. (1981) 12,770.

Forfarshire (Scotland): *see* Angus.

forge, open furnace for heating metal ore and metal for working and forming. From earliest times, smiths heated iron in forges and formed it by hammering on an anvil. A bellows operated by an assistant or by a foot treadle provided the forced draft for raising the



"Buffalo Forge Co.," lithograph by Gies and Co., Buffalo, New York, *c.* 1877

Brown Brothers

temperature of the fire. Later, a waterwheel or animal power was often used to operate the bellows; modern forges have mechanically powered bellows or rotary blowers.

forgery, in art, a painting, sculpture, or *objet d'art* that purports to be the work of someone other than its true maker. The range of forgeries extends from misrepresentation of a genuine work of art to the outright counterfeiting of a work or style of an artist. Forgery must also be distinguished from copies produced with no intent to deceive.

Art forgeries have existed as long as there has been a market for art, and during those millennia many means for counterfeiting art have arisen. The work of a minor artist, for example, may be altered to pass for the work of a master. Alternatively the forger may paint a scene on old material, thereby lending credibility to any claim of extreme age. Even more confusing are forgeries and copies coeval with the original work. Such objects show the results of natural aging processes and must be detected by connoisseurship instead of by technical means. Forgeries made long after the original, however, often betray their age through anachronisms in costumes, composition, iconography, technique, or materials. The last two variables named enable the investigator to detect a fraudulent work with a large arsenal of technical facilities, including chemical analysis, microscopy, radiography, and X-ray, infrared, and ultraviolet photography. Such techniques are effective in analyzing paintings with their relatively large number of different materials. Technical analysis, however, is of little use on stone sculpture, unless it is polychromed, because the work consists entirely of chemically inert, homogeneous material.

Forgers sometimes parade their work as an extreme rarity, such as an unknown painting whose existence is suspected from historical evidence, hoping to deceive even connoisseurs through lack of comparable material. More often, however, a forger will mimic the popular, easily recognizable styles of such artists as El Greco, Vincent van Gogh, or Amedeo Modigliani because a novice buyer often shows more enthusiasm than prudence. Such tactics are so successful that there are now more fake paintings attributed to the French artist Jean-Baptiste-Camille Corot than there are genuine ones.

Prospective buyers should note that a signature on a work of art is no guarantee of authenticity. Indeed, forgeries almost never

lack a signature, while genuine articles sometimes do. Nor is the authenticity of a signature a proper guide, because many genuine masterpieces have the correct signature forged at a later date. Great care should be taken to ascertain a work's provenance, although many forgeries are also accompanied by forged documentation. A suspicious work should be accepted as genuine only after research confirms its authenticity.

forgery, in law, making of a false writing with an intent to defraud. Writing, to be forgery, must either have legal significance or be commonly relied upon in business transactions. It need not be handwriting; the law of forgery covers printing, engraving, and typewriting as well. In most jurisdictions, however, "writing" excludes objects such as works of art, which when misrepresented are legally considered to be falsifications or frauds.

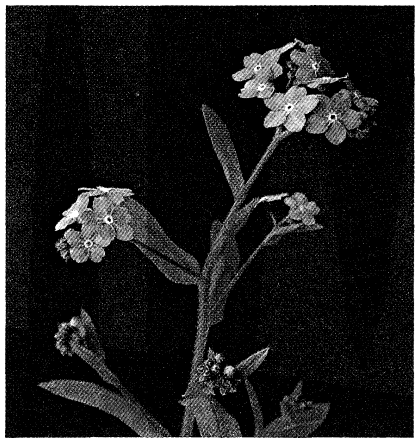
Checks, negotiable instruments, contracts, wills, and deeds are examples of documents that may be forged. But forgery also encompasses some documents that have no legal efficacy but are commonly relied upon in the business world, such as a false letter of recommendation for employment.

The forger may begin with an entirely blank piece of paper, with an incomplete genuine instrument with blanks to be filled, or with a complete genuine instrument that may be altered. The usual manner of forging is to prepare a false writing and sign another's name to it or to make a material alteration to a valid writing already signed by another. But a writing that contains false statements is not necessarily the "false-writing" that forgery requires. A check drawn on a bank wherein the drawer has no funds is not a forgery even though the drawer implies that he has funds there, but it is a genuine writing containing lies; the crime, therefore, is that of obtaining property by false pretenses.

It is not forgery to sign another's name or to fill in blanks or alter a genuine writing in the honest, though mistaken, belief that such conduct is authorized. There must be fraudulent intent. If such intent is present, there is forgery even if no one is actually defrauded by the false document.

One who does not himself forge an instrument may be guilty of the related crime of uttering a forged instrument, that is, the offering as genuine of a writing that the offender knows to be false—done with intent to defraud. Some modern statutes include this crime with forgery. *See also* counterfeiting.

forget-me-not, any of about 50 species of the plant genus *Myosotis* (family Boraginaceae), native to temperate Eurasia and North America and to mountains of the Old World tropics.



Woods forget-me-not (*Myosotis sylvatica*)
Ingmar Holmasen

Some are favoured as garden plants for their clusters of blue flowers. (For Chinese forget-me-not, *see* hound's-tongue.)

The woods forget-me-not (*M. sylvatica*), like most other *Myosotis,* changes colour from pink to blue as the tubular, flaring, five-lobed flower matures.

The water forget-me-not (*M. scorpioides*), shorter and more weak-stemmed, grows in marshlands but is otherwise similar. Both are perennial and occur in white- and pink-flowered forms as well as blue.

forging, in metallurgy, process of shaping metal and increasing its strength by hammering or pressing. In most forging an upper die is forced against a heated workpiece positioned on a stationary lower die. If the upper die or hammer is dropped, the process is known as drop forging. To increase the force of the blow, power is sometimes applied to augment gravity. The number of blows struck is carefully gauged by the operator to give maximum effect at minimum wear on the die.

For high-speed work in which the heavy impact of the drop hammer is not needed, an adaptation of the old-fashioned smith's technique, called helve-hammer forging, is used. The striking force is delivered by a wooden helve (handle) operating with the motion of a hand sledge. The helve hammer is usually used for preparatory and finishing operations.

Forging presses employ hydraulic or mechanical pressure instead of the blows of the drop forge. Most forging presses can exert only a few hundred tons of pressure, but giant presses, used for forging parts of jet aircraft, are capable of up to 50,000 tons of pressure.

Several other forging processes are also used. In roll forging, the metal blank is run through matched rotating rolls with impressions sunk in their surfaces. Impact forging is essentially hammer forging in which both dies are moved horizontally, converging on the workpiece. Counterblow forging is similar, except that the dies converge vertically. A principal advantage of these last two methods is that the two dies mutually absorb energy, eliminating the need for heavy foundations.

Forio, resort town and seaport on the western coast of the volcanic island of Ischia, Napoli province, Campania region, southern Italy. It is the centre of a productive wine-making region. The wine is called Epomeo after Mt. Epomeo, the extinct volcano that is at least partially responsible for the island's fertile volcanic soils. Forio—like Casamicciola, Lacco Ameno, and other cities on Ischia—has thermal mineral springs and is a popular vacation site. Pop. (1984 est.) mun., 10,270.

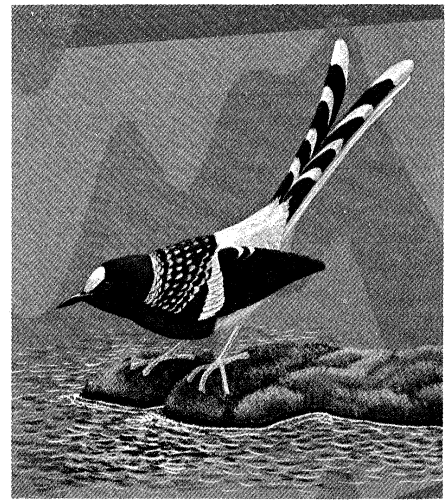
fork, implement consisting of two or more prongs supported by a handle, used for cooking, serving, and eating food. Forks and spoons together are known as flatware (*q.v.*).

fork moss: *see* wind-blown moss.

Forkel, Johann Nikolaus (b. Feb. 22, 1749, Meeder, near Coburg, Saxony—d. March 20, 1818, Göttingen, Westphalia), one of the first great musicologists and the first biographer of Johann Sebastian Bach. After brief legal studies, he became organist at the university church at Göttingen, where, from 1778 until his death, he was musical director of the university. Forkel's most important work is probably his *Allgemeine Literatur der Musik* (1792). His *Über Johann Sebastian Bachs Leben, Kunst und Kunstwerke* (1802) remains valuable (Eng. trans. by C.S. Terry, 1920).

forklift truck, specialized form of industrial truck (*q.v.*) for elevating or lowering a load.

forktail, any of seven birds of the Asian, chiefly Himalayan, genus *Enicurus.* Forktails usually are placed among chat-thrushes in the family Turdidae, but some authorities consider them a separate family, Enicuridae (order Passeriformes). Forktails pick insects from stones along mountain streams and have loud whistling calls. Most are strikingly patterned in black and white and have deeply forked tails, which they sway up and down. Six of the species are long-tailed and about 28 centimetres (11 inches) in length; examples are the spotted forktail (*E. maculatus*) and the black-backed forktail (*E. immaculatus*), both ranging to Indochina. The little forktail (*E. scouleri*), ranging to Taiwan, has a shorter tail than the other species.



Spotted forktail (*Enicurus maculatus*)
Painting by H. Douglas Pratt

Forlandet National Park, Norwegian FORLANDET NASJONALPARK, formerly PRINS KARL'S FORLAND NATIONAL PARK, national park and bird sanctuary established in 1973 by Norway's Environment Ministry for Svalbard. The Forlandet National Park has the greatest number of bird sanctuaries in the Svalbard archipelago: six in number, located throughout the southern and southeastern regions of the park. They include Kapp Linné, Boheman, Gåsøyane, Plankenholmane, Forlandsøyane, and Hermansenøya.

Forlì, Latin FORUM LIVII, city, capital of Forlì province, Emilia-Romagna region, in northern Italy on the Fiume (river) Montone and the Via Aemilia, southeast of Bologna. Known to the Romans as Forum Livii, it is said to have been founded by the consul Livius Salinator in the 2nd century BC. As a 12th-century commune, it was in league with Ravenna, and in the 13th it was the seat of the imperial count of Romagna province, a position that led to its deep involvement in the conflicts between Guelf and Ghibelline (papal and imperial) factions. Ruled by the Ordelaffi family from 1315, Forlì was taken by Cesare Borgia, the cardinal and military leader, in 1500 and annexed to the Papal States in 1504. It became part of the Kingdom of Italy in 1860.

Notable buildings include the 12th-century abbey of S. Mercuriale, the origins of which go back to the earliest bishops of Forlì in the 4th century; the 15th-century fortress of Caterina Sforza Riario, who defended it against Borgia; the cathedral, entirely rebuilt in the 19th century; and the town hall (1459). The chief works of the painter Melozzo da Forlì are in Rome and Loreto, but Forlì's art gallery contains works by Marco Palmezzano, a disciple of Melozzo and also a native of the city. The civic museum and library have fine collections.

Forlì is on the main railway and road from Milan to Bari and Brindisi and has an airport. The surrounding land is very fertile, and agriculture is the most important economic activity. Industries include the manufacture of artificial textiles, chemicals, shoes, and metal products. Pop. (1984 est.) mun., 110,943.

form, the external shape, appearance, or configuration of an object, in contradistinction to the matter of which it is composed; in metaphysics, the active, determining principle of a thing as distinguished from matter, the potential principle.

The word "form" has been used in a number of ways throughout the history of philosophy and aesthetics. It was early applied to Plato's term *eidos,* by which he identified the permanent reality that makes a thing what it is, in contrast to the particulars that are finite and subject to change. The Platonic concept of form was itself derived from the Pythagorean theory that intelligible structures (which Pythagoras called numbers), and not material elements, gave objects their distinctive characters. Plato developed this theory into the concept of "eternal form," by which he meant the immutable essence that can only be "received" or "imitated" by material, or sensible, things. Plato held that eternal forms, though they were not tangible, were of a higher reality than material objects.

For practical purposes Aristotle was the first to distinguish between matter (*hypokeimenon* or *hyle*) and form (*eidos* or *morphe*). He rejected the abstract Platonic notion of form and argued that every sensible object consists of both matter and form, neither of which can exist without the other. To Aristotle matter was the undifferentiated primal element; it is that from which things develop rather than a thing in itself. The development of particular things from this germinal matter consists in differentiation, the acquiring of the particular forms of which the knowable universe consists. Matter is the potential factor, form the actualizing factor. (Aristotle further posited the existence of a prime, or unmoved, mover, *i.e.,* pure form separate from matter, eternal and immutable.)

Thus according to Aristotle, the matter of a thing will consist of those elements of it which, when the thing has come into being, may be said to have become it; and the form is the arrangement or organization of those elements, as the result of which they have become the thing which they have. Thus, bricks and mortar are the matter that, given one form, become a house, or, given another, become a wall. As matter they are potentially anything that they can become; it is the form which determines what they actually become. Here "matter" is a relative term, for a brick on the pile, while potentially part of a house, is already actually a brick; *i.e.,* it is itself a composite of form and matter, clay being matter to the brick as the brick is to the house or to the wall. Matter is that which is potentially a given object but which actually becomes that object only when it is given the right form.

Aristotle's notion of form combines with his teleological viewpoint to give the conclusion that formal development has a direction and may have a goal and that some things are more informed than others. Bricks are more informed than clay, and a house more than bricks.

The Aristotelian concept of form was uniquely adapted to Christianity by Thomas Aquinas, whose works mark the high point of the medieval Scholastic tradition. Aquinas further delineated the concept of form to include "accidental form," a quality of a thing that is not determined by its essence; "sensible form," that element of form that can be distinguished from matter by sense-perception; and other such distinctions. Other Scholastic philosophers, including John Duns Scotus and William of Ockham, worked with the Aristotelian concept of form, but none to as great an effect as Aquinas.

For 18th-century German philosopher Immanuel Kant, form was a property of mind; he held that form is derived from experience, or, in other words, that it is imposed by the individual on the material object. In his *Critique of Pure Reason* Kant identified space and time as the two forms of sensibility, reasoning that though man does not experience space and time as such, he cannot experience anything except in space and time. Kant further delimited 12 basic categories that act as structural elements for human understanding.

Criticism. The concept of form is also indispensable to the practice and criticism of several disciplines other than philosophy. In literature, for example, the term may refer to the schema, structure, or genre that a writer chooses for the presentation of his subject—*e.g.,* novel, short story, maxim, haiku, sonnet, etc.; it may also refer to the internal structure of the work, and, to a great extent, a work's critical success depends on the degree to which the artist is able to integrate the content and internal structure within the framework of its external form. In criticism of the graphic arts, the term form refers to the effect achieved by draftsmanship or mass as distinct from that achieved by such elements as colour or texture. In sculpture and other plastic arts, form (or shape) is both tangible and visible and thus is the chief element of organization.

formal system, also called LOGISTIC SYSTEM, in logic and mathematics, abstract, theoretical organization of terms and implicit relationships that is used as a tool for the analysis of the concept of deduction. Models—structures that interpret the symbols of a formal system—are often used in conjunction with formal systems.

Each formal system has a formal language composed of primitive symbols acted on by certain rules of formation (statements concerning the symbols, functions, and sentences allowable in the system) and developed by inference from a set of axioms. The system thus consists of any number of formulas built up through finite combinations of the primitive symbols—combinations that are formed from the axioms in accordance with the stated rules.

In an axiomatic system, the primitive symbols are undefined; and all other symbols are defined in terms of them. In the Peano postulates for the integers, for example, 0 and ′ are taken as primitive, and 1 and 2 are defined by $1 = 0'$ and $2 = 1'$. Similarly, in geometry such concepts as "point," "line," and "lies on" are usually posited as primitive terms.

From the primitive symbols, certain formulas are defined as well formed, some of which are listed as axioms; and rules are stated for inferring one formula as a conclusion from one or more other formulas taken as premises. A theorem within such a system is a formula capable of proof through a finite sequence of well-formed formulas, each of which either is an axiom or is inferred from earlier formulas.

A formal system that is treated apart from intended interpretation is a mathematical construct and is more properly called logical calculus; this kind of formulation deals rather with validity and satisfiability than with truth or falsity, which are at the root of formal systems.

In general, then, a formal system provides an ideal language by means of which to abstract and analyze the deductive structure of thought apart from specific meanings. Together with the concept of a model, such systems have formed the basis for a rapidly expanding inquiry into the foundations of mathematics and of other deductive sciences and have even been used to a limited extent in analyzing the empirical sciences. *See also* deontological ethics; metalogic; metatheory.

formaldehyde, also called METHANAL (formulated $HCHO$), an organic compound, the simplest of the aldehydes, used in large amounts in a variety of chemical manufacturing processes. It is produced principally by the vapour-phase oxidation of methanol and is commonly sold as formalin, a 37 percent aqueous solution. Formalin may be dehydrated to trioxane, a crystalline trimer, or to an amorphous polymer, paraformaldehyde, which is a convenient source of gaseous formaldehyde.

Formaldehyde and ammonia yield methenamine, or hexamethylenetetramine, which is used as a urinary antiseptic. Nitration of methenamine gives the explosive cyclonite, or RDX. Formaldehyde and acetaldehyde react in the presence of calcium hydroxide to give pentaerythritol, the tetranitrate of which is the explosive PETN. Large quantities of formaldehyde are used in the manufacture of urea–formaldehyde, phenol–formaldehyde, and acetal resins. The reaction of formaldehyde with proteins leads to its use in the tanning industry and in treating various vegetable proteins to render them fibrous. The reactivity with proteins is also the basis for the use of formaldehyde as a disinfectant, an embalming agent, and a soil sterilant.

Pure formaldehyde is a colourless, flammable gas with a strong pungent odour; it is extremely irritating to the mucous membranes.

formalin, aqueous solution of formaldehyde (*q.v.*).

formalism, in mathematics, school of thought introduced by the 20th-century German mathematician David Hilbert, which holds that all mathematics can be reduced to rules for manipulating formulas without any reference to the meanings of the formulas. Formalists contend that it is the mathematical symbols themselves, and not any meaning that might be ascribed to them, that are the basic objects of mathematical thought. *Compare* intuitionism; logicism.

formalism, in art, representation of objects in terms of abstract geometrical form rather than of natural appearance for decorativeness or symbolism and also, by extension, the stereotyping of forms by tradition for the same reasons. Formalism corresponds to "stylization" but should be distinguished from the 20th-century notion of abstract art, which is a free arrangement of nonrepresentational shapes.

From early times examples of formalism in both senses are to be found in Neolithic statuettes and wooden sculpture and masks from Africa and Oceania, in the decoration of primitive pottery and Chinese bronze and jade, and in the object-symbols that make up the pattern of Oriental carpets; religious art has produced the hieratic figures of Byzantine mosaics and Russian icons and the Buddhist statuary of the Far East, all recognizable at once from pose and habiliments (*e.g.,* the Virgin Mary's blue robe, the halo, and the lotus throne). In modern times formalism is exemplified in the paintings of the Cubist, Futurist, and Vorticist movements. In architecture such elements as columns of Doric, Ionic, or Corinthian order, pediments, and decorative key pattern of classical Greek and Roman architecture have passed down through Renaissance and Neoclassical interpretations to modern times.

Formalism, also called RUSSIAN FORMALISM, Russian RUSSKY FORMALISM, 20th-century Russian school of literary criticism. It began in two groups: Opoyaz, an acronym for Russian words meaning Society for the Study of Poetic Language, founded in 1916 at St. Petersburg (later Leningrad) and led by Victor Shklovsky; and the Moscow Linguistic Circle, founded in 1915. Both groups made use of the linguistic techniques of Ferdinand de Saussure. Although they based their assumptions largely on Symbolist notions concerning the autonomy of the text and the discontinuity between literary and other uses of language, the Formalists sought to make their critical discourse more objective and scientific than that of Symbolist criticism. Closely allied to the Rus-

sian Futurists and opposed to sociological criticism, the Formalists placed an "emphasis on the medium" by analyzing the way in which literature, especially poetry, was able to alter artistically or "make strange" common language. They stressed the importance of form and technique over content. Although always anathema to the Marxist critics, Formalism was important in the Soviet Union until 1929, when it was condemned for its lack of political perspective. Later, largely through the work of the structuralist linguist Roman Jakobson, it became influential in the West, notably in Anglo-American New Criticism (*q.v.*), which is sometimes called Formalism.

Victor Erlich's *Russian Formalism* (1955) is a history; *Théorie de la littérature* (1965) is a translation by Tzvetan Todorov of important Russian texts. Anthologies in English include L.T. Lemon and M.J. Reis, eds., *Russian Formalist Criticism* (1965) and L. Matejka and K. Pomorska, eds., *Readings in Russian Poetics* (1971).

formalistic Idealism: *see* transcendental Idealism.

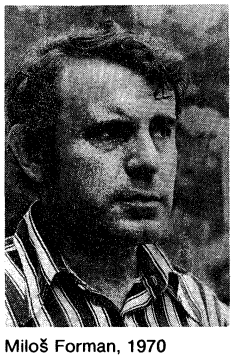
Forman, Andrew (b. *c.* 1465—d. March 11, 1521), Scottish prelate and diplomat during the reigns of James IV and James V.

He was educated at the University of St. Andrews. James IV employed him as his emissary to Rome and to England, where he took part in negotiating James's marriage (1503) to Margaret Tudor. From 1511 he was engaged in furthering the King's plan for a general peace in Europe and for a great crusade against the Turks. To this end he acted as mediator between Louis XII of France and Pope Julius II, who were at war in northern Italy. Despite his record of peacemaking, Forman was blamed, perhaps unjustly, for the breach between Scotland and England leading to the death of James IV at the Battle of Flodden (Sept. 9, 1513).

Forman's career gave him opportunities of acquiring benefices in Scotland, England, and France, including the bishopric of Moray (1501) and the archbishopric of Bourges (1513), but he failed to achieve elevation to the cardinalate. In 1514 Pope Leo X nominated him to the archbishopric of St. Andrews and appointed him papal legate in Scotland, although rival claimants kept him out of his see until 1516. As archbishop he issued constitutions for the discipline of clergy and laity.

Forman, Miloš (b. Feb. 18, 1932, Čáslav, Czech.), prominent director in the flowering of Czechoslovak films during the 1960s (the Czechoslovak "New Wave") and later a prominent director in the West.

Forman graduated from FAMU, the Prague Film School. He was a scriptwriter and assistant director until the success of *Audition,* a short, independently made documentary, brought him critical recognition and the chance to direct his first feature-length film.



Miloš Forman, 1970

© alix jeffry

The result was *Černý Petr* (1963; *Black Peter,* or *Peter and Pavla*), a lightly humorous treatment of the father–son relationship. It was followed by *Lásky jedné plavovlásky* (1965; *Loves of a Blonde*), the story of a young factory worker's romance, which established Forman's international reputation, and *Hoří, má panenko!* (1967; *Fireman's Ball*), a comedy about a provincial ball. Rich in emotion and informal in technique, his films deal mainly with the problems of the contemporary Czechoslovak teenager and sensitively portray the sorrows, joys, and humour in daily life.

In 1969 Forman left Czechoslovakia for the United States, where he directed *Taking Off* (1971), about wayward American youth and their parents, and was one of the contributing directors to *Visions of Eight* (1973), a highly personalized view of the Munich Olympic Games. Forman won an Academy Award for best direction for *One Flew over the Cuckoo's Nest* (1975) and for *Amadeus* (1984) and also won high praise for *Hair* (1979) and *Ragtime* (1981).

Forment, Damián (b. *c.* 1475, Valencia, Aragon—d. *c.* 1541, Santo Domingo de la Calzada, Castile), sculptor, recognized as perhaps the most important sculptor in 16th-century Spain. His early work demonstrated a mastery of Renaissance principles, and one of his last pieces is one of the earliest Mannerist works in Spain.

It is believed that Forment was trained in Florence and then moved back to his native Valencia for nine years (1500–1509). In 1509 he moved to Saragossa and maintained his studio there until his death, executing over the years many large altars, often in alabaster.

One of his earliest pieces is the altar in the church of El Pilar, Saragossa (1509–12), a work in a mixed style, combining Gothic ornament with Renaissance figures. He retained the Gothic frame in his sculpture until about 1520, using it in the Mannerist altarpiece for Huesca cathedral (1520–24). The figures in his early altars are much indebted to Donatello and are usually organized with careful attention to balance and symmetry. In the altar at Huesca, the figures have become elongated, and there is more movement in and out of the relief plane. His last work, the altar at Santo Domingo de la Calzada (1537–40), has a Renaissance frame, but the figures have become even more twisted and elongated. An important influence on later Spanish sculptors, he shows very clearly in his work the transition from the Gothic to the Mannerist style.

Formia, formerly MOLA DI GAETA, Latin FORMIAE, town, Latina province, Lazio (Latium) region, south central Italy, on the Golfo (gulf) di Gaeta between the mouth of the Garigliano and the Gaeta peninsula, northwest of Naples. A town of the ancient Volsci people, it was later taken by the Romans and became a popular Roman summer residence noted for the Caecuban and Falernian wines. Formia was destroyed by the Saracens in 842. There are ruins of prehistoric megalithic walls, and Roman remains include the villa of the statesman and orator Cicero and his restored mausoleum; Cicero was murdered nearby in 43 BC. The town was severely damaged in World War II but has been rebuilt. It is on the main Rome–Naples railway and has shipping services to the Isole (islands) di Ponza. Industries include food processing and the production of wine and olives. Pop. (1981 prelim.) mun., 30,306.

formic acid, also called METHANOIC ACID (HCO_2H), the simplest of the carboxylic acids, used in processing textiles and leather. It is made by the action of sulfuric acid upon sodium formate, which is produced from carbon monoxide and sodium hydroxide.

Formic acid is not a typical carboxylic acid: it is distinguished by its acid strength, its failure to form an anhydride, and its reactivity as a reducing agent, a property due to the $-CH=O$ group, which imparts some of the character of an aldehyde. The methyl and ethyl esters of formic acid are commercially produced. Concentrated sulfuric acid dehydrates it to carbon monoxide.

Pure formic acid is a colourless, fuming liquid with a pungent odour; it irritates the mucous membranes and blisters the skin. It freezes at 8.4° C and boils at 100.7° C.

Formica, trademark for hard, smooth, surface material used to make various laminated plastic products, especially tabletops and other furniture and wallboards and other constructions.

Special papers are impregnated with synthetic resins, such as melamine, then subjected to heat and pressure; about seven sheets are bonded together to form a hard and durable surfacing material, 1/16 inch (about 1½ millimetres) thick. The top sheet is coloured and patterned, and the finish may be either polished or dull. Wood grain and furniture finishes, either shiny or dull, are common. Formica is usually cemented to plywood or other suitable backing.

Formica is able to withstand heat, boiling water, food acids, alcohol, and alkalies found in the home and is easily cleaned. The product made for commercial uses, such as in restaurants, may contain a very thin sheet of metal in the laminate to increase resistance to heat.

Formicariidae (bird family): *see* antbird.

formio (plant): *see* phormium.

formonitrile: *see* hydrogen cyanide.

Formosa (island): *see* Taiwan.

Formosa, province, northern Argentina, lying within the Gran Chaco, a vast alluvial plain having poor drainage. It is covered with forests, grasslands, and marshes. Formosa is bordered by Paraguay (north and east) and has an area of 27,825 sq mi (72,066 sq km). The Pilcomayo, Bermejo, and Paraguay rivers define its northern, southern, and eastern limits, respectively. The 123,600 ac (50,000 ha) Río Pilcomayo National Park abuts the Río Pilcomayo near the confluence of the Río Paraguay; large numbers of indigenous Indians live within the park together with a rich collection of fauna including the maned wolf, La Plata otter, and giant anteater.

The territory was explored in 1528 by a Spanish expedition led by Sebastian Cabot and Diego García de Moguer. A Jesuit *reducción* (work mission) established in 1590 was destroyed by Indian raids in 1632. Except for occasional expeditions up the Pilcomayo and Bermejo rivers, the area remained virtually abandoned until 1763 when another *reducción* was built. Four years later the Jesuits were expelled from the New World, and until after the War of the Triple Alliance (1864–70), Formosa continued to be an extremely remote region visited only by punitive expeditions retaliating against Indian raids. Following the defeat of Paraguay, the disputed territory became officially integrated into Argentina. In 1879, to serve as the seat for territorial authorities, the city of Formosa (*q.v.*), now the provincial capital, was founded. Formosa was organized as a national territory in 1884 and became a province in 1955.

Agriculture (cotton, rice, bananas, and avocados) and cattle raising are the chief economic activities, but both are seriously handicapped by recurrent droughts and floods. A large water-control project on the Río El Riacho was begun in the 1970s. Quebracho trees (from which tannin is extracted) grow wild in the forests, providing another source of income. Pop. (1983 est.) 319,000.

Formosa, city, capital of Formosa province, northeastern Argentina, on the western bank

of the Río Paraguay, southwest of Asunción, Paraguay. It was founded in 1879 during the military conquest of the central Gran Chaco following the defeat of Paraguay in the War of the Triple Alliance (1864–70). It served as a headquarters for the newly established national territory of Gran Chaco (later subdivided into the national territory, then province, of Formosa).

Formosa is a river port and agricultural processing centre that experienced rapid growth in the 1960s and 1970s. Cattle, cotton, and rice are raised nearby. Pop. (1980) 95,100.

Formosa Strait: *see* Taiwan Strait.

Formosan languages, aboriginal languages of Formosa (Taiwan). They are now chiefly spoken only in small communities in remote areas.

The Formosan languages belong to the Austronesian family. They are diverse and fall into three major branches: Atayalic, Tsonic, and Paiwanic. The last is the largest and includes Ami, Bunun, Paiwan, and Saaroa.

Formosus (b. *c.* 816, Rome?—d. April 4, 896, Rome), pope from 891 to 896, whose posthumous trial is one of the most bizarre incidents in papal history.

In 864 he was made cardinal bishop of Porto, Italy, by Pope St. Nicholas I, who sent him to promote the conversion of Bulgaria. He was assigned missions to France by Pope Adrian II (869) and by Pope John VIII (875) but incurred the latter's mistrust in 876, fled from Rome, and was excommunicated. He was absolved under Pope Marinus I, who restored him to his see of Porto in 883. During the pontificates of popes Marinus, St. Adrian III, and Stephen V (VI), Formosus' influence grew, and he was elected Stephen's successor on Oct. 6, 891. Attempting to liberate Rome from the Spoletan Holy Roman coemperors Guy and his son Lambert, Formosus requested King Arnulf of the East Franks to invade Italy. In Rome in 896 Formosus crowned Arnulf emperor, but while preparing to attack Spoleto, Arnulf was seized with paralysis and was forced to return to Germany. Formosus died shortly thereafter, leaving the discord unresolved.

At a Roman synod (popularly called the "Cadaver Synod") conducted by Pope Stephen VI (VII), Formosus' political enemies had his corpse exhumed, propped up on a throne, and subjected to a posthumous trial—during which a deacon answered for the corpse. His election was declared invalid, his acts were quashed, and his fingers of consecration were cut off. Formosus' corpse was then cast into a grave, but later thrown into the Tiber River. These acts divided Rome politically, provoking Stephen's imprisonment and his death by strangulation. Pope Theodore II reinstated Formosus' ordinations and solemnly buried his body; Pope John IX condemned Stephen's synod and burned its acts. Formosus' letters were collected in J.-P. Migne (ed.), *Patrologia Latina*, vol. 129.

Formstecher, Solomon (b. July 28, 1808, Offenbach, Hesse [Germany]—d. April 24, 1889, Offenbach), Jewish idealist philosopher who was rabbi at Offenbach from 1842. *Die Religion des Geistes* (1841; "The Religion of the Spirit") is considered the most complete exposition of his philosophy and a thorough systematization of Judaism. He believed there were only two basic religions: the religion of nature (paganism) and the religion of spirit (Judaism). He thought the essence of Judaism was ethical. Its ethics, adulterated by myth and art, were also disseminated by Christianity and Islām but existed in purest form in Judaism.

In addition to other theological and philosophical books, Formstecher wrote a novel about ghetto life, *Buchenstein und Cohnberg* (1863).

formula weight, in chemistry, the sum of the atomic weights of all atoms appearing in a given chemical formula. It is generally applied to a substance that does not consist of individual molecules, such as the ionic compound sodium chloride. Such a substance is customarily represented by a chemical formula that describes the simplest ratio of the number of atoms of the constituent elements, *i.e.,* an empirical formula.

fornaldar saga (Old Icelandic: "saga of antiquity"), any of a class of Icelandic sagas dealing with the ancient myths and hero legends of Germania, with the adventures of Vikings, or with other exotic adventures in foreign lands. These stories take place on the European continent before the settlement of Iceland. Though the existing fornaldar sagas were written 1250–1350, after the Icelanders' family sagas, written 1200–20, they are thought to be of earlier oral composition. Despite their fantastic content, they are written in the terse, objective style of the family sagas.

These heroic sagas have not the same literary value as the Icelanders' sagas, but, because they are based on lost heroic poetry, they are of great antiquarian interest. The most important in this respect is the *Völsunga saga.* This story of Sigurd, grandson of Völsung, is the Northern version of the story of Siegfried (*q.v.*) and of the destruction of the Burgundians told in the Middle German epic *Nibelungenlied* (*q.v.*). It differs in many particulars from the *Nibelungenlied.*

Forner, Juan Pablo (b. Feb. 23, 1756, Mérida, Spain—d. March 17, 1797, Madrid), the foremost literary polemicist of the 18th century in Spain. His brilliant wit was often admirably used against fads, affectations, and muddleheadedness but also often cruelly and spitefully against personalities.

Forner was educated in Salamanca, studying widely in Greek, Latin, Hebrew, philosophy, and law. His brilliant wit and biting sarcasm are clearly seen in his early work *Sátira contra los abusos introducidos en la poesía castellana* (1782; "Satire Against the Abuses Introduced into Castilian Poetry"), an attack against the innovations of verse styles such as *gongorismo* (an ornate and exaggerated style named after the poet Luis de Góngora). A somewhat sour personality, Forner often turned his sarcasm on his contemporaries; in *El asno erudito* (1782; "The Erudite Ass") the dramatist Tomás de Iriarte and his work came under vicious attack. A ban prevented his writing more satires after 1785. His two most important works are *Exequias de la lengua castellana* (1795; "Exequies of the Castilian Language"), a defense of Castilian literature; and *Oración apologética por la España y su mérito literario* (1786; "Arguments on Behalf of Spain and Her Literary Merits"), in which he refuted the idea that Spanish literature was of no value when compared with the literature of the rest of Europe. His poetry was largely satirical and didactic.

Føroyar (islands, Atlantic Ocean): *see* Faeroe Islands.

Forrer, Ludwig (b. Feb. 9, 1845, Islikon, Switz.—d. Sept. 28, 1921, Bern), Swiss statesman, twice elected federal president, who was a noted proponent of Swiss legal reform.

A leader of Zürich radicalism and a lawyer of national prominence, Forrer served between 1873 and 1900 on the federal Nationalrat (national assembly), where he continually pressed for standardization of the legal code. In 1888 he presented a motion for penal law reform, and between 1891 and 1893 he worked on the draft of an industrial insurance law that was rejected.

Following the defeat of this proposal (1900), Forrer retired briefly from political life but was elected to the Bundesrat (federal council) in 1902 and later served twice (1906, 1912) as president of the confederation. As head of the department of posts and railways (1907), he completed the nationalization of the famous Gotthard line and worked toward the electrification of the federal railway service.

Forres, small royal burgh in Moray district, Grampian region, Scotland, lying 12 miles (19 km) west-southwest of Elgin. The town's first royal charter was probably granted in 1150 by King David I and, in any case, confirmed by James IV in 1496. The castle was a royal hunting seat frequented by the Scottish kings from William I the Lion onward and, traditionally, by Duncan and Macbeth. Sueno's Stone, situated at the east end of the town, is an impressive sculptured monolith, 23 feet (7 m) high, probably commemorating the victory of the Viking military leader Sweyn over the Scottish king Malcolm II in 1008. Also nearby is the Witches Stone, the scene of early witch burnings. Pop. (1981) 8,355.

Forrest, Edwin (b. March 9, 1806, Philadelphia—d. Dec. 12, 1872, Philadelphia), American actor who was the centre of two major scandals of the mid-19th century.

In 1820 he made his stage debut as Young Norval in John Home's tragedy *Douglas* at the Walnut Street Theatre in Philadelphia. In 1825 he played in support of Edmund Kean, and his maturity as an actor dated from this experience. During 1826 he played Othello in New York City to great critical acclaim. On offering cash prizes for plays by American authors, Forrest received several suited to his talents, including John Augustus Stone's *Metamora* and Robert Montgomery Bird's *Gladiator;* this has been considered the beginning of native American drama. Among his outstanding roles were Shakespeare's Macbeth, Hamlet, Lear, and Mark Antony.

Forrest was initially successful in his first engagement in England in 1836, when he introduced the American acting style, but a misunderstanding led him to publicly hiss a performance by William Macready, arousing great indignation in England. His disagreement with the English actor culminated in the so-called Astor Place riot in New York City in May 1849. While Macready was playing at the Astor Place Opera House, a mob of Forrest supporters stormed the theatre. The militia was called out, the rioters fought the militia, and the militia fired on the mob. Twenty-two persons were killed and 36 wounded. Forrest's reputation never quite recovered from this catastrophe, and only two years later he caused another national sensation when he instituted a divorce suit against his wife, the actress Catherine Sinclair, for adultery. Although he lost the verdict, he appealed the decision for 18 years. After 1852 Forrest acted only sporadically, spending much time alone in his gloomy Philadelphia mansion. He left most of his money for the establishment of a home for aged actors.

Opinions on Forrest as an actor varied. Although many critics considered him first-rate, he was described by the *New York Tribune* dramatic critic William Winter as "a vast animal, bewildered by a grain of genius." Richard Moody's *Edwin Forrest, First Star of the American Stage* was published in 1960.

Forrest, Sir John, also called (1918) BARON FORREST OF BUNBURY (b. Aug. 22, 1847, Preston Point, near Bunbury, Western Australia—d. Sept. 3, 1918, at sea), explorer and statesman who led pioneer expeditions into Australia's western interior. As Western Australia's first premier (1890–1901), he sponsored public works construction and negotiated the state's entry into the Australian Commonwealth in 1901.

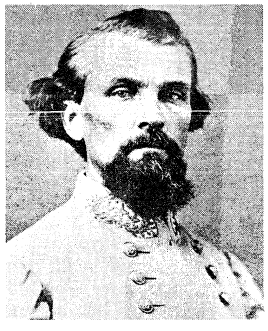
After entering Western Australia's survey de-

partment in 1865, Forrest in 1869 led a search expedition for the missing explorer Ludwig Leichhardt and, in 1870, an expedition from Perth along the Great Australian Bight to Adelaide. In 1874 he completed a 2,700-mile (4,300-kilometre) crossing of the continent from Champion Bay to the telegraph line between Adelaide and Port Darwin.

Forrest served as state surveyor general from 1883 to 1890, when he became premier of Western Australia. Serving also as colonial treasurer, he sponsored harbour works and railroad development and introduced a plan for supplying water to the goldfields. He also worked for woman suffrage and for expanding land settlement. In the negotiations for Australian federation between 1887 and 1901, he championed the interests of smaller states, winning railroad and tariff benefits for Western Australia. He was knighted in 1891.

Elected to the first federal Parliament in 1901, he served as minister of defense (1901–03), as treasurer in several Liberal ministries between 1905 and 1914, and in the coalition wartime ministry of William Morris Hughes (1917–18). In 1918 he became the first person born in Australia to enter the British peerage; he died without male issue, and the title lapsed. He wrote *Explorations in Australia* (1875) and *Notes on Western Australia* (1884).

Forrest, Nathan Bedford (b. July 13, 1821, near Chapel Hill, Tenn., U.S.—d. Oct. 29, 1877, Memphis, Tenn.), Confederate general in the American Civil War (1861–65) who was often described as a "born military genius"; his rule of action, "Get there first with



Nathan Forrest

By courtesy of the Library of Congress, Washington, D.C.

the most men," became one of the most often quoted statements of the war. A major blemish on his record, however, was the Massacre of Ft. Pillow (April 12, 1864)—the slaughter by his soldiers of more than 300 blacks after the surrender of Ft. Pillow, Tenn.

A self-taught man, Forrest bought and sold horses, cattle, and slaves before acquiring considerable wealth as a cotton planter in Mississippi. At the outbreak of the war, he raised a cavalry unit and, as a lieutenant colonel, took part in the defense of Ft. Donelson, Tenn. (February 1862). Refusing to capitulate with the rest of the Confederate forces, he made his way out before the fort was surrendered. After fighting with distinction at the Battle of Shiloh, Tenn. (April), he was promoted to brigadier general and took a brilliant part in the autumn campaign. The following winter he was continually active in raiding hostile lines of communication.

In keeping with Confederate policy at that time, Forrest—by then a major general—ordered his troops to "take no more Negro prisoners" when they assaulted and captured Ft. Pillow. A Congressional investigation committee verified the slaughter of more than 300 black men, women, and children within the fort.

In June 1864 Forrest decisively defeated a superior Union force at Brice's Cross Roads, Miss., and throughout the year he conducted successful raids in Mississippi, Tennessee, and Alabama. He was once more with the main Confederate Army of the West in the last disastrous campaign of Nashville (December) and fought a stubborn rearguard action to cover the retreat of the broken army. He was forced back at Selma, Ala., in April 1865 and surrendered his entire command in May.

After the war he was active in the railroad business, and was a leading organizer and the first Grand Wizard of the original Ku Klux Klan, a secret society advocating white supremacy.

Forrest City, seat (1874) of St. Francis County, east central Arkansas, U.S., on the west slope of Crowley's Ridge between the L'Anguille and St. Francis rivers. Originally a railroad camp, it was founded (1866) by the Confederate general Nathan Bedford Forrest, who contracted with the Memphis and Little Rock (now Chicago, Rock Island, and Pacific) Railroad to build a line over Crowley's Ridge. It developed as a commercial centre for an agricultural area (cotton, corn, peaches, rice, soybeans, and sweet potatoes). Subsequently, its economy diversified to include the manufacture of electrical and farming equipment. Inc. 1870. Pop. (1980) 13,803.

Forrestal, James V(incent) (b. Feb. 15, 1892, Beacon, N.Y., U.S.—d. May 22, 1949, Bethesda, Md.), first U.S. secretary of defense (1947–49); earlier, in the Navy Department, he directed the huge naval expansion and procurement programs of World War II.

After serving in naval aviation in World War I, Forrestal resumed his connection with a New York City investment firm, of which he became president in 1938. In June 1940 he was named administrative assistant to Pres. Franklin D. Roosevelt and in August became under secretary of the navy. In that capacity he was responsible for readying a peacetime navy to meet the enormous demands of a global war. He became secretary of the navy in May 1944 following the death of Frank Knox. Upon enactment of the National Security Act of 1947, he was appointed to the new Cabinet post of secretary of defense and initiated a reorganization and coordination of the armed services.

Forrestal resigned in March 1949. Suffering from what physicians called a depression similar to battle fatigue, he entered the Bethesda Naval Medical Center, Maryland, and soon after plunged to his death from a window.

Forrester, Jay Wright (b. July 14, 1918, Anselmo, Neb., U.S.), U.S. electrical engineer and management expert who invented the random-access magnetic core memory, the information-storage device employed in most digital computers.

Forrester was educated in electrical engineering at the University of Nebraska, Lincoln, and the Massachusetts Institute of Technology (MIT), Cambridge, where he remained to teach and do research. In 1945 he founded the Digital Computer Laboratory there and participated in the construction of Whirlwind I, an early general-purpose digital computer. During the course of this work, he realized that the slow and unreliable information-storage systems of early digital computers hindered their further development. Forrester devised in 1949 a memory system that stored information in three dimensions; in his invention a magnetic cell was employed for both storage and switching.

From 1951 until 1956, Forrester was associated with the Lincoln Laboratory, Lexington, Mass., operated by MIT for the federal government to apply electronic technology to problems of the national defense.

Forrester was led to experiment with the application of computers to management problems. In time he devised the technique of computer simulation in which real-world relationships, such as the flow of materials in a factory, are represented as a series of interconnected mathematical equations that can be fed to the computer. As a professor in MIT's Sloan School of Management, from 1956, Forrester wrote *Industrial Dynamics* (1961), *Principles of Systems* (1968), *Urban Dynamics* (1969), and *World Dynamics* (1971). His *Collected Papers* appeared in 1975.

Forsman, Georg Zacharias: *see* Yrjö-Koskinen, Sakari.

Forssmann, Werner (b. Aug. 20, 1904, Berlin—d. June 1, 1979, Schopfheim, W. Ger.), German surgeon who shared with André F. Cournand and Dickinson W. Richards the Nobel Prize for Physiology or Medicine in 1956; a pioneer in heart research, he contributed to the development of cardiac catheterization, a procedure in which a tube is inserted into a vein at the elbow and passed through the vein into the heart. While a surgical resident in Berlin (1929), Forssmann used himself as the first human subject, watching the progress of the catheter in a mirror held in front of a fluoroscope screen. Forssmann's daring experiment was condemned at the time as foolhardy and dangerous, and in the face of severe criticism he abandoned cardiology for urology.

Forssmann's procedure, with slight modifications, was put into practice in 1941 by Richards and Cournand, and has since become an extremely valuable tool in diagnosis and research. It has made possible, among other things, precise measurement of intracardiac pressure and blood flow, injection into the heart of drugs and of opaque material visible on X-ray photographs, and insertion of electrodes for the regulation of the heartbeat.

Forssmann graduated in medicine from the University of Berlin (1928) and then did postgraduate study in urology at Berlin and Mainz. He served as chief of surgery at the city hospital in Dresden-Friedrichstadt and in 1958 was named chief of the surgical division of the Evangelical Hospital in Düsseldorf.

Forster, town, eastern New South Wales, Australia, on Cape Hawke south of the entrance to Lake Wallis, a 30-sq-mi (80-sq-km) coastal lagoon. Founded in 1862 and named after William Forster, secretary for lands (1868–70), it was proclaimed a town in 1961. It is linked by a 1¼-mi (2-km) bridge (completed in 1959) north across the lake entrance to Tuncurry, a centre for logging operations carried on in the adjacent highlands. Both towns draw heavily upon the resources of the lake, the waters of which yield fish, prawns, and oysters for Sydney (142 mi southwest) as well as game fish for tourists. Pop. (1981) including Tuncurry, 9,261.

Forster, E(dward) M(organ) (b. Jan. 1, 1879, London—d. June 7, 1970, Coventry, Warwickshire, Eng.), British novelist, essayist, and social and literary critic. His fame rests largely on his novels *Howards End* (1910) and *A Passage to India* (1924) and on a large body of criticism.

Forster's father, an architect, died when the son was a baby, and he was brought up by his mother and paternal aunts. The difference between the two families, his father's being strongly evangelical with a high sense of moral responsibility, his mother's more feckless and generous-minded, gave him an enduring insight into the nature of domestic tensions, while his education as a dayboy (day student) at Tonbridge School, Kent, was responsible for many of his later criticisms of the English public school (private) system. At King's College, Cambridge, he enjoyed a sense of liberation. For the first time he was free to follow his own intellectual inclinations; and he gained a

E.M. Forster
BBC Hulton Picture Library

sense of the uniqueness of the individual, of the healthiness of moderate skepticism, and of the importance of Mediterranean civilization as a counterbalance to the more straitlaced attitudes of northern European countries.

On leaving Cambridge, Forster decided to devote his life to writing. His first novels and short stories were redolent of an age that was shaking off the shackles of Victorianism. While adopting certain themes (the importance of women in their own right, for example) from earlier English novelists such as George Meredith, he broke with the elaborations and intricacies favoured in the late 19th century and wrote in a freer, more colloquial style. From the first his novels included a strong strain of social comment, based on acute observation of middle-class life. There was also a deeper concern, however, a belief, associated with Forster's interest in Mediterranean "paganism," that, if men and women were to achieve a satisfactory life, they needed to keep contact with the earth and to cultivate their imaginations. In an early novel, *The Longest Journey* (1907), he suggested that cultivation of either in isolation is not enough, reliance on the earth alone leading to a genial brutishness and exaggerated development of imagination undermining the individual's sense of reality.

The same theme runs through *Howards End,* a more ambitious novel that brought Forster his first major success. The novel is conceived in terms of an alliance between the Schlegel sisters, Margaret and Helen, who embody the liberal imagination at its best, and Ruth Wilcox, the owner of the house Howards End, which has remained close to the earth for generations; spiritually they recognize a kinship against the values of Henry Wilcox and his children, who conceive life mainly in terms of commerce. In a symbolic ending, Margaret Schlegel marries Henry Wilcox and brings him back, a broken man, to Howards End, reestablishing there a link (however heavily threatened by the forces of progress around it) between the imagination and the earth.

The resolution is a precarious one, and World War I was to undermine it still further. Forster spent three wartime years in Alexandria, doing civilian war work, and visited India twice, in 1912–13 and 1921. When he returned to former themes in his postwar novel *A Passage to India,* they presented themselves in a negative form: against the vaster scale of India, in which the earth itself seems alien, a resolution between it and the imagination could appear as almost impossible to achieve. Only Adela Quested, the young girl who is most open to experience, can glimpse their possible concord, and then only momentarily, in the courtroom during the trial at which she is the central witness. Much of the novel is devoted to less spectacular values: those of seriousness and truthfulness (represented here by the administrator Fielding) and of an outgoing and benevolent sensibility (embodied in the English visitor Mrs. Moore). Neither Fielding nor Mrs. Moore is totally successful; neither totally fails. The novel ends in an uneasy equilibrium. Immediate reconciliation between Indians and British is ruled out, but the further possibilities inherent in Adela's experience, along with the surrounding uncertainties, are echoed in the ritual birth of the God of Love amid scenes of confusion at a Hindu festival.

The values of truthfulness and kindness dominate Forster's later thinking. A reconciliation of humanity to the earth and its own imagination may be the ultimate ideal, but Forster sees it receding in a civilization devoting itself more and more to technological progress. The values of common sense, goodwill, and regard for the individual, on the other hand, can still be cultivated, and these underlie Forster's later pleas for more liberal attitudes. During World War II he acquired a position of particular respect as a man who had never been seduced by totalitarianisms of any kind and whose belief in personal relationships and the simple decencies seemed to embody some of the common values behind the fight against Nazism and Fascism. In 1946 his old college gave him an honorary fellowship, which enabled him to make his home in Cambridge and to keep in communication with both old and young until his death.

Although the later Forster is an important figure in mid-20th-century culture, his emphasis on a kindly, uncommitted, and understated morality being congenial to many of his contemporaries, it is by his novels that he is more likely to be remembered, and these are best seen in the context of the preceding Romantic tradition. The novels sustain the cult of the heart's affections that was central to that tradition, but they also share with the first Romantics a concern for the status of man in nature and for his imaginative life, a concern that remains important to an age that has turned against other aspects of Romanticism.

In addition to essays, short stories, and novels, Forster wrote a biography of his great-aunt, *Marianne Thornton* (1956); a documentary account of his Indian experiences, *The Hill of Devi* (1953); and *Alexandria: A History and a Guide* (1922; new ed., 1961). *Maurice,* a novel with a homosexual theme, was published posthumously in 1971 but written many years earlier. (J.B.B.)

MAJOR WORKS. *Novels. Where Angels Fear to Tread* (1905); *The Longest Journey* (1907); *A Room with a View* (1908); *Howards End* (1910); *A Passage to India* (1924); and *Maurice* (posthumously, 1971).

Other works. Aspects of the Novel (1927), criticism; *The Collected Tales of E.M. Forster* (1947), *Abinger Harvest* (1936), and *Two Cheers for Democracy* (1951), essays; and *Billy Budd* (1951), libretto collaboration with E. Crozier for an opera by Benjamin Britten; and *The Life to Come and Other Stories* (posthumously, 1972).

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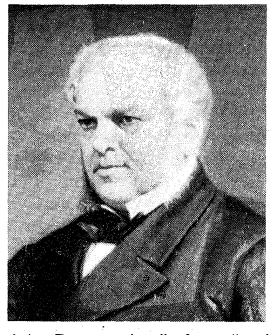
Forster, Georg, in full JOHANN GEORG ADAM FORSTER (b. Nov. 26, 1754, Nassenhuben, near Danzig—d. Jan. 12, 1794, Paris), explorer and scientist who helped to establish the literary travel book as a favoured genre in German literature.

Georg Forster, engraving
Historia-Photo

With his father, Johann Reinhold Forster, he emigrated to England in 1766. Both were invited to accompany Capt. James Cook on his second voyage around the world (1772–75). His account of the journey, *A Voyage Round the World* (1777), was based on his father's journals; it later appeared in a German version, *Reise um die Welt* (1778–80). A work of travel, science, and literature, the book not only established Forster as one of the most advanced German thinkers and accomplished stylists of the time but also influenced German scientific and literary writing, including that of Goethe, Johann Gottfried von Herder, and Alexander von Humboldt. In other writings Forster contributed to the scientific, especially botanical, knowledge of the South Seas.

He held professorships at the University of Kassel (1778–84), and at the University of Vilnius, Lithuania (1784–87), before becoming librarian at the University of Mainz. Sympathetic with the French Revolution, he championed the republican government in Mainz, occupied by the French in 1792, and in 1793 he went to Paris to negotiate on its behalf. Meanwhile the Germans seized Mainz. Forster spent his final days in Paris, reviled among Germans as a traitor and disillusioned by the excesses of the Reign of Terror.

Forster, John (b. April 2, 1812, Newcastle upon Tyne, Northumberland, Eng.—d. Feb. 2, 1876, London), writer and journalist,



John Forster, detail of an oil painting by C.E. Perugini; in the Victoria and Albert Museum, London
BBC Hulton Picture Library

a notable figure in mid-19th-century literary London who, through his friendship with the influential editor Leigh Hunt, became adviser, agent, and proofreader to many leading writers of the day. A close friend of Charles Dickens, he wrote *The Life of Dickens* (1872–74), an essential source book and a literary masterpiece, despite its personal bias and occasional suppressions and inaccuracies.

After early contributions to an encyclopaedia and to periodicals, he joined *The Examiner* (1833) and was its editor (1847–55). In 1855 he became secretary to the lunacy commissioners and in 1861 became a commissioner. Apart from his Dickens study, Forster's *Life and Adventures of Oliver Goldsmith* (1848; expanded into *The Life and Times . . .*, 1854), his *Walter Savage Landor* (1869), and his unfinished *Life of Jonathan Swift* (1876) remain authoritative and readable, as do his now superseded historical treatises on the 17th century.

Consult the INDEX *first*

Förster, Josef Bohuslav, Förster also spelled FOERSTER (b. Dec. 30, 1859, Prague—d. May 29, 1951, Nový Vestec, Czech.), Czech composer belonging to the school of Antonín Dvořák and Bedřich Smetana.

Josef Förster
H. Roger-Viollet

The son of the organ composer Josef Förster, he studied at the Prague Conservatory and was organist at several Prague churches and music critic of *Národní Listy*. From 1893 to 1903 he lived at Hamburg, where he became a friend of Mahler and taught at the conservatory. He was music critic of *Die Zeit* in Vienna (1903–18) and from 1919 professor (later director) at the Prague Conservatory. His works were largely inspired by personal memories and religious subjects. They include five symphonies; four masses; several operas, notably *Nepřemoženi* (1918; *The Invincibles*), *Srdce* (1923; *The Heart*), and *Bloud* (1936; *The Simpleton*); and the song cycle *Liebe.*

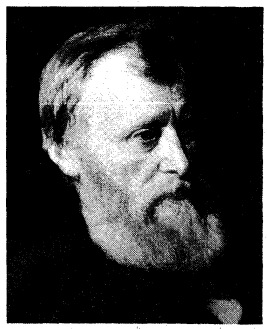
Forster, Thomas (b. *c.* 1675—d. Nov. 3, 1738, Boulogne, Fr.), English Jacobite, squire of Etherston, Northumberland, and leader of the 1715 uprising in Scotland and northern England.

He was member of Parliament from 1708 to 1716, but his Jacobite proclivities became known, and in 1715 he was ordered under arrest by the House of Commons. He fled before this could be done, however, and at Greenrig in Northumberland on Oct. 6, 1715, proclaimed the Old Pretender as James III. Forster assumed command of his small band of followers but proved a poor general. After failing to take Newcastle he allowed the rebellion to degenerate into a series of purposeless marches. He was joined by the rebels from southern Scotland under William Gordon, Lord Kenmure, and the combined force marched to Kelso in Roxburghshire, where on October 22 it was further reinforced by a detachment of Highlanders under Brigadier William Mackintosh of Borlum. Mackintosh had considerable military talents but was obliged to serve under the incompetent Kenmure in Scotland and the no less incompetent Forster once the rebels had crossed into England. Forster expected reinforcements from the Roman Catholic gentry of the northwestern shires of England, but these failed to appear. At Preston on November 17 he capitulated, despite the protests of his officers. He escaped from prison to France, where he died some 23 years later.

Forster, William Edward (b. July 11, 1818, Bradpole, Dorset, Eng.—d. April 5, 1886, London), British statesman noted for his Education Act of 1870, which established in Great Britain the elements of a primary school system, and for his term (1880–82) as chief secretary for Ireland, where his repression of the radical Land League won him the nickname "Buckshot Forster."

Forster, born of Quaker parents, was a nephew of the philanthropist Sir Thomas Fowell Buxton and brother-in-law of the poet and scholar Matthew Arnold. A member of the House of Commons from 1861 until his death, he began in 1866 to demand universal education as an essential complement of parliamentary reform. In 1868 he was charged with preparing an elementary education bill, which was passed on Aug. 9, 1870, after a prolonged wrangle about its religious clauses.

When W.E. Gladstone temporarily retired in January 1875, Forster was strongly supported for Liberal Party leadership in the House of Commons, but he yielded to the Marquess of Hartington (afterward 8th duke of Devonshire). On Gladstone's return to the office of prime minister in 1880, Forster was made chief secretary for Ireland. As a radical he approved of extensive land tenure reform in Ireland, but faced with the violence of the Irish agricultural revolution, he called for parliamentary measures of coercion to maintain law and order—a policy that completely failed. He was exhausted by his frequent travels between Dublin and London; and in Ireland, from the autumn of 1881, his life was in constant danger. In March 1882, nevertheless, he visited some of the most turbulent districts to address angry tenant farmers. On May 2, 1882, when the British government



William Edward Forster, detail of an oil painting by H.T. Wells, 1875; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

agreed to release Charles Stewart Parnell and other Irish nationalist leaders from Kilmainham jail, Forster seized the occasion to resign.

Four days later his successor, Lord Frederick Cavendish, was murdered by Irish terrorists in Phoenix Park, Dublin. Forster's offer to return as temporary chief secretary was declined. Later, he made several intemperate speeches on Irish personalities and issues, and he died an avowed opponent of Gladstone's policy of Home Rule for Ireland.

Förster-Nietzsche, Elisabeth (b. July 10, 1846, Röcken, near Lützen, Prussia—d. Nov. 8, 1935, Weimar, Saxe-Weimar-Eisenach), sister of the German philosopher Friedrich Nietzsche, who became his guardian and literary executrix.

An early believer in the superiority of the Teutonic races, she married an anti-Semitic agitator, Bernhard Förster. In the 1880s they went to Paraguay and founded Neuva Germania, a supposedly pure Aryan colony, but the enterprise failed, and Förster committed suicide. Amidst a major financial scandal, Elisabeth failed to make a national hero of her husband or to salvage the colony as an island of Teutonic Christianity. She next served as Nietzsche's guardian at Weimar after his mental breakdown in 1889. On his death (1900) she secured the rights to his manuscripts and renamed her family home the Nietzsche-Archiv. Refusing public access to her brother's works, she edited them without scruple or understanding.

While Elisabeth gained a wide audience for her misinterpretations, she withheld Nietzsche's self-interpretation, *Ecce Homo,* until 1908. Meanwhile, she collected some of his notes under the title *Der Wille zur Macht* ("The Will to Power") and presented this work, first as part of her three-volume biography (Leipzig, 1895–1904), then in a one-volume edition (1901), and finally in a completely remodelled two-volume edition (1906) that was widely considered Nietzsche's magnum opus. After her death scholars reedited his writings and found some of Elisabeth's versions distorted and spurious: she forged nearly 30 letters and often rewrote passages. The discovery of her forgeries and of the original texts had a profound influence on subsequent interpretations of Nietzsche's philosophy.

forsterite–fayalite series, the most important minerals in the olivine family and possibly the most important constituents of the Earth's mantle. Included in the series are the following varieties:

forsterite	
pure magnesium silicate, Mg_2SiO_4	0% to 10% Fe
chrysolite	10% to 30% Fe
hyalosiderite	30% to 50% Fe
hortonolite	50% to 70% Fe
ferrohortonolite	70% to 90% Fe
fayalite	
pure iron silicate, Fe_2SiO_4	90% to 100% Fe

These minerals are common as green to yellow, glassy crystals in many basic and ultrabasic rocks and are abundant in chondrite meteorites. Forsterite is typical of dunite. Chrysolite and hyalosiderite are common in gabbros, dolerites, basalts, and tracyhtes. Hortonolite and ferrohortonolite are less common but occur in dolerite, gabbro, and granophyre. Small amounts of fayalite are present in many volcanic rocks in which sodium is more common than potassium. The forsterite–fayalite minerals also occur in dolomitic limestones, marbles, and metamorphosed iron-rich sediments. These minerals are relatively infusible, not melting below 1,500° C (2,700° F), and are sometimes used in the manufacture of refractory brick. For detailed physical properties, *see* olivine (table).

Forsyth, Alexander John (b. Dec. 28, 1769, Belhevie, Aberdeenshire, Scot.—d. June 11, 1843, Belhevie), Scottish Presbyterian minister and inventor who between 1805 and 1807 produced a percussion compound for use in firearms that would explode from a sharp blow. By eliminating the necessity for priming powder and free, exposed sparks, he laid the basis for later, self-contained metallic cartridges (*i.e.,* bullets) and for contact fuses in shells.

The son of a minister, Forsyth decided to fol-

low his father's profession and in 1790 became his successor when the elder Forsyth died. He began experimenting with firearms in his spare time, initially trying to improve on priming powders then in use. He developed his first percussion system in 1805; he used mercury fulminate, rolled into "pills," or small pellets, that he placed in a nipple at the breech end of the barrel and detonated by the impact of a falling hammer. When he took his device to London the following spring, the master general of ordnance was impressed and asked him to continue his work. Space was provided in the Tower of London, and by 1807 Forsyth had perfected a system that worked in existing firearms. A new master general abruptly terminated the work, however, paying his expenses and sending him home. Many years later, when his invention was introduced into the army, friends urged Forsyth to petition the government for recompense. He was finally awarded a small pension but died before the first installment reached him.

Forsyth, Peter Taylor (b. May 12, 1848, Aberdeen, Aberdeenshire, Scot.—d. Nov. 11, 1921, London), Scottish Congregational minister whose numerous and influential writings anticipated the ideas of the Swiss Protestant theologian Karl Barth.

The son of a postman, Forsyth studied at Aberdeen University and at Göttingen, where he was deeply influenced by the German Protestant theologian Albrecht Ritschl. After serving several Congregational churches in England, including Emmanuel Church, Cambridge, he became principal of Hackney Theological College in London. He began as a theological liberal but gradually modified his position to one that resembled most the "positive theology" found in Germany. His *Positive Preaching and the Modern Mind* (1907) and *Lectures on the Church and the Sacraments* (1917) reminded Protestants of their own teaching about the church at a time when liberalism and evangelicalism together were in danger of helping them forget it. Forsyth's most famous book, *The Person and Place of Jesus Christ* (1909), attempted "to moralize dogma," to express the doctrine of Christ's divinity in terms of modern personal experience. In *Christ on Parnassus* (1911), dealing with theology and the arts, and in *The Justification of God* (1916), he considered the relation of Christian faith to the questions of his day. By bringing the word grace back into Protestant theology and by showing anew the sovereignty of God as revealed in Christ's love, Forsyth anticipated many insights characteristic of Karl Barth. Through Barth's work, Forsyth, often misunderstood in his own time, gained new attention.

BIBLIOGRAPHY. G.O. Griffith, *The Theology of P.T. Forsyth* (1948); R.M. Brown, *P.T. Forsyth: Prophet for Today* (1952).

Forsythia, also called GOLDEN BELL, genus of the olive family (Oleaceae), containing seven shrubby species native to eastern Europe and eastern Asia. In some species the yellow flowers borne along the stems appear before the leaves in early spring. The narrow leaves occasionally are three parted; the star-shaped flowers are four parted.

Forsythia
J.E. Downward—EB Inc.

Green-stem forsythia (*F. viridissima*), native to China, may grow to 3 metres (10 feet); it bears greenish-yellow flowers. Weeping forsythia (*F. suspensa*), also from China, has hollow, pendulous stems about 3 m long and golden-yellow flowers. Common forsythia (*F. intermedia*), a hybrid between green-stem forsythia and weeping forsythia, has arching stems to 6 m and bright-yellow flowers. There also are variegated, dwarf, and many-flowered varieties.

Fort, Paul (b. Feb. 1, 1872, Reims, Fr.—d. April 20, 1960, Argenlieu), French poet and innovator of literary experiments, usually associated with the Symbolist movement.

At the age of 18, reacting against the Naturalistic theatre, Fort founded the Théâtre d'Art (1890–93), in which formalized backcloths and stylized performances were substituted for realistic settings and acting. He also founded and edited the review *Vers et Prose* (1905–14), which published the work of Paul Valéry and other important Symbolist writers. Between 1897 and 1924 Fort produced 30 volumes of ballads. His ballad stanzas were printed in the form of prose paragraphs to emphasize the importance of rhythm and assonance over rhyme, but they were not otherwise unconventional. That they presented no great difficulty to the reader is indicated by the fact that, in a referendum conducted by a newspaper in 1912, Fort was elected "prince of poets."

Fort, 1950
Lipnitzki—Viollet

Fort Archabault, also spelled FORT-ARCHAMBAULT (Chad): *see* Sarh.

Fort Benton, city, seat (1865) of Chouteau County, north central Montana, U.S., on the Missouri River. A famous American Fur Company outpost, it was founded (1846) as Ft. Lewis by Maj. Alexander Culbertson and was renamed in 1850 for Sen. Thomas Hart Benton of Missouri. As the head of steamboat river navigation, it became a boomtown as gold seekers and cattlemen, on their way west, used it as a supply point. With the building of the railroads, its importance as a transit point diminished. Cattle, sheep, and wheat are the economic mainstays. Ruins of the old fort are along the riverfront. Inc. 1883. Pop. (1980) 1,693.

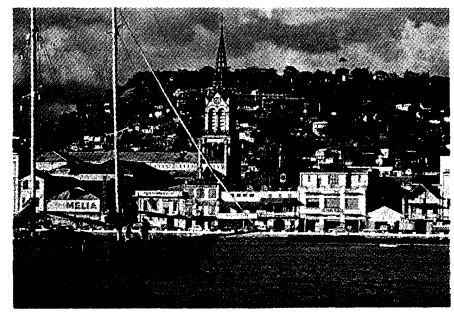
Fort-Chimo (Canada): *see* Kuujjuaq.

Fort Collins, city, seat of Larimer County, northern Colorado, U.S., on the Cache la Poudre River (the state's "Trout Route"), in the eastern foothills of the Rockies' Front Range at an altitude of 5,004 ft (1,525 m), 55 mi (89 km) north of Denver. The community developed after 1864 around a military outpost named for its commander, Lieut. William O. Collins of Fort Laramie, Wyo. The outpost was abandoned in 1872 but the settlement remained and, promoted by a town development company, grew with the arrival of the railroad and a highly successful sugar beet industry based on local irrigation and stimulated by a land grant college (now Colorado State University) established there in 1870. The city has large lamb-feeding operations, and agricultural and quarry-based industries supplemented by light manufactures and tourism. The city's Pioneer Museum preserves the first settler's cabin and mementos of the fort. Fort Collins is the headquarters of the Roosevelt National Forest, a few miles west; the Pawnee National Grassland is to the east. Inc. 1883. Pop. (1980) city, 65,092; metropolitan area (SMSA), 149,184.

Fort-Dauphin (Madagascar): *see* Faradofay.

Fort-de-France, capital of the French overseas *département* of Martinique, French West Indies, on the island's west coast at the northern entrance to the large Baie (bay) de Fort-de-France, at the mouth of the Rivière Madame. The city occupies a narrow plain between the hills and the sea but is accessible by road from all parts of the island. Formerly called Fort-Royal, it has been Martinique's capital since 1680. Until 1918, when its commercial growth began, Fort-de-France had an inadequate water supply, was partly surrounded by swamps, and was notorious for yellow fever. In 1839 it was partially destroyed by earthquake and in 1890 by fire. The swamps have now been drained, and extensive suburbs have spread, particularly eastward across the Rivière Monsieur toward Le Lamentin.

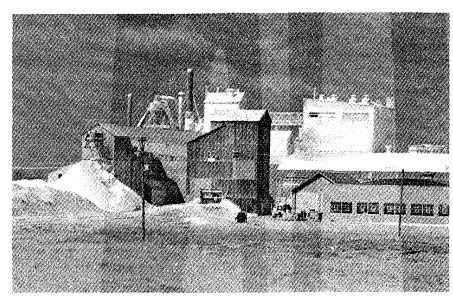
Fort-de-France is the French West Indies' largest town, chief port, and busiest commercial centre and has long sheltered the French fleet in the West Indies. Sugarcane, cacao, and rum are exported. Savane, a central park, has a statue of the empress Josephine, Napoleon's wife, who was born at Trois-Îlets on the south side of the bay. There are hot springs nearby. Pop. (1982) 97,649.



Fort-de-France, Martinique
Bradley Smith, New York

Fort de Kock (Indonesia): *see* Bukittinggi.

Fort Dodge, city, seat (1851) of Webster County, north central Iowa, U.S., at the juncture of the Des Moines River and Lizard Creek, 90 mi (145 km) northwest of Des



Gypsum processing plant, Fort Dodge, Iowa
Milt and Joan Mann from CameraMann

Moines. It originated around Fort Clarke, which was established in 1850 and was renamed the following year for Henry Dodge, U.S. senator from Wisconsin who had fought in the Black Hawk and other Indian wars. When the fort closed in 1853, Major William Williams bought the land and buildings; he laid out the town in 1854 and became its first mayor and postmaster. The community developed as a market-processing centre for the surrounding farmlands and gypsum-lime deposits.

The "Cardiff Giant," a famous hoax perpetrated by George Hull of Binghamton, N.Y., and H.B. Martin of Marshalltown, Iowa, was associated with Fort Dodge gypsum deposits. A five-ton block of gypsum was freighted to Chicago, where it was carved (1868) in the shape of a human figure and buried near Cardiff, N.Y. "Discovered" (1869) by well diggers, it was believed to be a 10-foot (3-metre) petrified prehistoric man until the hoax was exposed in the early 1900s by Othniel C. Marsh of Yale University.

The city's economy now centres on the meatpacking, gypsum, farm machinery, and chemical fertilizer industries. Fort Dodge Historical Museum, Stockade, and Fort has pioneer exhibits. Nearby are the John F. Kennedy Memorial Park, Kalsow Prairie, and Twin Lakes and Dolliver Memorial state parks. The main campus of Iowa Central Community College (1966) is in the city. Inc. city, 1869. Pop. (1988 est.) 26,747.

Fort Erie, town, Regional Municipality of Niagara, southeastern Ontario, Canada. It lies along Lake Erie and the Niagara River and is linked to Buffalo, N.Y., by the International Railway and Peace bridges. The fort, built by the British in 1764, was captured by American troops during the War of 1812. British efforts at recapture were repulsed, and the fort was abandoned (1814) and blown up. The fort was restored (1937–39) and was incorporated as a village in 1857. It became a town when it merged with Bridgeburg in 1932. Fort Erie is the site of a large horse-racing track and has steel, aircraft, automotive, paint, and pharmaceutical industries. Inc. town, 1932. Pop. (1986) 23,253.

Fort Frances, town, centre of the Rainy River district, western Ontario, Canada. It lies on the north bank of Rainy River (the Canada–U.S. boundary), opposite International Falls, Minn. Originating as a fur-trading post, Fort-Saint-Pierre, built near the present townsite in 1731, it was renamed Fort Frances in 1830 in honour of the wife of Sir George Simpson, general superintendent of the Hudson's Bay Company. The town's early growth was aided by commercial fishing and logging operations, its position on a trade route, and the building of a canal in the late 1870s that circumvented falls at the outlet of adjacent Rainy Lake.

A busy point of entry and centre of a popular hunting, fishing, and canoeing area, Fort Frances is still primarily a lumbering town, with milling operations in paper, pulp, and lumber dependent upon nearby hydroelectric developments. Inc. 1903. Pop. (1986) 8,870.

Fort George River (Canada): *see* Grande River, La.

Fort-Gouraud (Mauritania): *see* Fdérik.

Fort Jameson (Zambia): *see* Chipata.

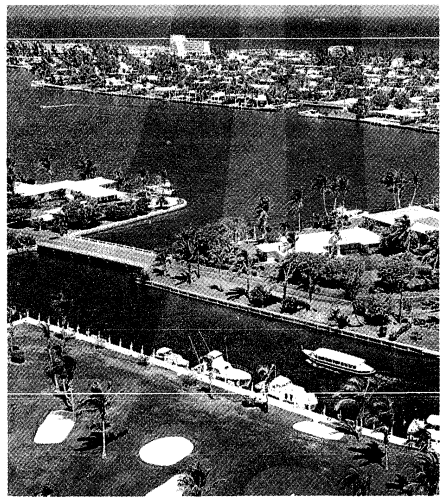
Fort Johnston (Malawi): *see* Mangochi.

Fort Kent, town, Aroostook county, northern Maine, U.S. It lies at the confluence of the St. John and Fish rivers, 56 miles (90 km) north-northwest of Presque Isle. It is a port of entry linked by international bridge to Clair, N.B. (Canada). Settled in 1829 by French Acadian refugees, it was incorporated in 1869 and took its name from Fort Kent, a blockhouse built in 1839. The community developed as a potato-processing, farming, and lumbering centre. It is the terminus of U.S. Highway No. 1 from Key West, Fla., and is a gateway to the wilderness-watershed areas of Maine's "Far North" with hunting, fishing, canoeing, and skiing facilities. The University of Maine at Fort Kent originated in 1878 as a normal school. Pop. (1986 est.) 4,740.

Fort-Lamy (Chad): *see* N'Djamena.

Fort Laperrine (Algeria): *see* Tamanrasset.

Fort Lauderdale, city, seat (1915) of Broward county, southeastern Florida, U.S. It lies along the Atlantic Ocean at the mouth of the New River, 25 miles (45 km) north of Miami. A fort, built there in 1838 during the Second Seminole War and named for its commander, Major William Lauderdale, gave its name to the town, which was established in 1895 and later developed as a shipping and commercial centre and residential resort. The Atlantic Intracoastal Waterway is connected to the city's Bahia Mar Yacht Basin and to the



Fort Lauderdale, Fla.
Joseph Brochas—Shostal/EB Inc.

city's deepwater port, Port Everglades, which is the deepest harbour on the Atlantic coast south of Norfolk, Va. Port Everglades is a port of entry and ranks with Jacksonville and Tampa in volume of cargo handled, largely tanker-borne fuel. Fort Lauderdale itself is interlaced with recreational waterways and has extensive boating facilities, which have given rise to a busy marine industry. The city's 6 miles (10 km) of beach traditionally receives an influx of many thousands of college students during winter and spring vacations. The city's educational institutions include Broward Community College (1960), Nova University (1964), and Fort Lauderdale College (1968). Inc. city, 1911. Pop. (1987 est.) city, 153,-051; (1988 est.) Fort Lauderdale-Hollywood-Pompano Beach PMSA, 1,187,000; Miami-Fort Lauderdale CMSA, 3,000,500.

Fort Lee, borough, Bergen county, northeastern New Jersey, U.S. It lies mainly along the Palisades on the west bank of the Hudson River at the west terminus of the George Washington Bridge opposite upper Manhattan, New York City. The community developed in about 1700 around Fort Constitution (later renamed Fort Lee). The Fort Lee Battle Monument marks the site of the fort, which was abandoned in 1776 after an unsuccessful attempt by General George Washington to stop the British fleet from sailing up the Hudson. The borough, now mainly residential, was from 1907 to 1919 an important centre of motion-picture production. Photographic-

Fort Lee Battle Monument, N.J.
Ernst A. Jahn

film processing remains one of its major industries. Inc. 1904. Pop. (1988 est.) 32,500.

Fort Macleod, town, southwestern Alberta, Canada. It liest along the Oldman River, 32 miles (52 km) west of Lethbridge. The fort, established there in 1874 by Colonel James F. Macleod, was the first headquarters of the North West Mounted Police (now the Royal Canadian Mounted Police); it has been reconstructed as a museum. The ensuing settlement became the first town in southern Alberta and was known as Macleod until officially renamed Fort Macleod in 1952. The town's economy is based on ranching, irrigated grain farming, dairying, and coal mining. At the Belly Buttes near Stand Off (south), the Blood Indians gather annually for their traditional Sun Dance. Inc. 1892. Pop. (1986) 3,123.

Fort McMurray, formally McMURRAY, town, northeastern Alberta, Canada, at the confluence of the Athabasca and Clearwater rivers. It originated as a North West Company fur-trading post (1790) known as Fort of the Forks, which was taken over by the Hudson's Bay Company (1821). Rebuilt in 1875, it was renamed Fort McMurray after a company factor, William McMurray. A gateway to the northwestern Canadian wilderness, the town has an airport and is connected by rail and highway with Edmonton, 270 miles (435 km) southwest. The town lies at the southern limit of navigation on the Mackenzie River–Great Slave Lake network, and the town is a busy port and transshipment centre in the summer months. To the north is the Great Canadian Oil Sands plant, which extracts oil from the Athabasca Tar Sands. Fort McMurray is the seat of Keyano College. Inc. town, 1948; city, 1980. Pop. (1986) 34,949.

Fort Manning (Malawi): *see* Mchinji.

Fort Matanzas National Monument, fort, on Rattlesnake Island, 14 miles (23 km) south of St. Augustine, northeastern Florida, U.S. Originating in 1569 as a wooden tower and completed in 1742, the fort is near the site of the slaughter of 300 French Huguenots by Spaniards under Pedro Menéndez de Avilés in 1565.

Fort Morgan, city, seat (1889) of Morgan county, northeastern Colorado, U.S., on a low plateau overlooking the South Platte River, 70 miles (113 km) northeast of Denver at an elevation of 4,240 feet (1,292 m). The site, on the Overland Trail, was originally occupied by a fort (established in 1864 and named for an American Civil War colonel, Christopher A. Morgan). The fort was abandoned in 1868, but the adjacent settlement prospered and developed as a processing and shipping centre for local produce including livestock, dairy products,

sugar beets, potatoes, beans, corn (maize), alfalfa, and small grain. After 1950, oil was exploited in the nearby Julesburg Oil Basin, and refineries became economically significant. Local manufactures include hand tools, irrigation pipes, and concrete products. Morgan Community College was opened in 1970. Pawnee National Grassland is to the north. Inc. town, 1887; city, 1908. Pop. (1984 est.) 9,005.

Fort Myers, city, seat (1887) of Lee county, southwestern Florida, U.S., on the broad Caloosahatchee River, 120 miles (193 km) south-southeast of Tampa. In 1839 a fort, later named for General Abraham Myers, was built

Fields of gladiolus near Fort Myers, Fla.
Shostal Assoc.—EB Inc.

to protect settlers from Seminole Indian raids. The city is the western terminus of the cross-state Okeechobee Waterway, linking the Atlantic Ocean and the Gulf of Mexico, and has a modest tourist trade. Largely dependent on agriculture, including citrus fruits and cattle, Fort Myers is the centre of a large-scale gladiolus and chrysanthemum industry and is the site of several large city housing developments for retirees. The winter home and laboratory of the inventor Thomas A. Edison is preserved as a museum, and the city holds an annual Pageant of Light (February) as a tribute to the inventor. The community college (1962) was also named after him.

Fort Myers Beach comprises a 7-mile (11-kilometre) strip on Estero Island, between Estero Bay and the Gulf, 15 miles (24 km) south of Fort Myers. Inc. 1905. Pop. (1987 est.) city, 40,709; (1986 est.) metropolitan area (MSA), 279,100.

Fort Payne, city, seat (1842) of DeKalb county, northeastern Alabama, U.S., in Big Wills Valley between Lookout and Sand mountains. Founded in 1836, it was named after Captain John Payne, a government agent involved in the forced removal of the Cherokee to the West. It was incorporated in 1889, during a mining boom (1889–92). Subsequently, agriculture, light industries, and tourism became the economic mainstays. Within the city is Manitou Cave (noted for its stalagmites and fossils). Nearby are Desoto State Park and the site of Will's Town, an Indian village where Sequoyah devised (1809) the Cherokee alphabet. Pop. (1987 est.) 11,829.

Fort Peck Dam, dam on the Missouri River, northeastern Montana, U.S. A Public Works Administration project completed in 1937, it provides flood control, improved navigation, and hydroelectric power. One of the world's largest earth-fill dams, it is 249 feet (76 m) high and 21,432 feet (6,534 m) long.

Fort Pierce, city, seat (1905) of St. Lucie county, southeastern Florida, U.S., on the Indian River (a lagoon connected to the Atlantic by inlets), 58 miles (93 km) north of West Palm Beach. The fort, built (1838–42) during the Seminole Wars, was named for Major (later Lieutenant Colonel) Benjamin K. Pierce (brother of President Franklin Pierce), who commanded a detachment. Permanent white settlement began in the 1860s around the fort site, and two fishing villages, Cantown and Edgartown, were established. In 1901 the three communities were merged and incorporated as the City of Fort Pierce. The federally maintained Port of Fort Pierce (on the Atlantic Intracoastal Waterway) is an economic asset. Commercial fishing, including shrimp, is significant, while the annual Sandy Shoes Festival (January) spotlights the cattle industry, agriculture, citrus groves, and recreation.

The city is the site of Indian River Community College (founded 1960), which merged with Lincoln Junior College in 1965. Since 1959 salvaging operations offshore have yielded large quantities of gold and silver coins, bullion, artifacts, and relics from a sunken Spanish "Silver Fleet," lost in 1715 during a hurricane. Pop. (1987 est.) 37,990.

Fort Pillow Massacre (April 12, 1864), in the American Civil War, Confederate slaughter of black Federal troops stationed at Fort Pillow, Tenn. The action stemmed from Southern outrage at the North's use of black soldiers. From the beginning of hostilities, the Confederate leadership was faced with the question of whether to treat black soldiers captured in battle as slaves in insurrection or, as the Union insisted, as prisoners of war. In 1864 Confederate Colonel W.P. Shingler ordered those in his command to take no more black prisoners.

In what proved the ugliest racial incident of the war, Confederate forces under General Nathan B. Forrest captured Fort Pillow on April 12, 1864, and proceeded to wipe out the black troops within; some were burned or buried alive. A Federal congressional investigating committee subsequently verified that more than 300 blacks, including women and children, had been slain after the fort surrendered. After the incident, black soldiers going into battle used the cry "Remember Fort Pillow!" Later in the year, the South agreed to treat blacks as prisoners of war.

Fort Portal, town, western Uganda, eastern Africa, situated at an elevation of about 5,000 feet (1,500 m) and overlooking the mountains of the Ruwenzori Range and the Mufumbiro volcanoes. Roads link it with Rubona, Kyenjojo, and Kyegegwa. It is an important market centre for cotton, peanuts (groundnuts), sesame, corn (maize), coffee, tobacco, castor-oil seeds, tea, tropical fruits, and vegetables. A number of tea estates are concentrated east of the town. Tea, coffee, vegetable oils, leather, fruit, dairy products, meat, cotton, grain, and tobacco are processed. Industrial products include beverages, textiles, furniture, paper, soap, confectionery, shoes, and metal goods. Fort Portal provides a base for mountaineering in the Ruwenzori Range and has the palace of the *omukama* ("king") of Toro. The Bwamba Pass, the Hot Springs of Bundibugyo, and the Ileri Forest are nearby points of interest. Pop. (1980 prelim.) 26,806.

Fort Qu'Appelle, also called THE FORT, town, southeastern Saskatchewan, Canada, on The Fishing Lakes of the Qu'Appelle River, surrounded by Indian reservations, 45 miles (72 km) east-northeast of Regina. It originated in 1864 as a Hudson's Bay Company fur-trading post, and an 1874 treaty whereby the Cree and Saulteaux Indians conceded a large portion of southern Saskatchewan to the white settlers was signed there. The completion of a survey in 1882 marked the beginning of settlement by a predominantly eastern Canadian (Anglo-Saxon) population. The town, named for the Qu'Appelle River, is a noted fur-farming centre and a market for a mixed-farming area. It is also the centre of a lake resort region and is the site of a provincial fish hatchery. Adjoining the local museum is an original log building of the Hudson's Bay Company. Inc. village, 1898; town, 1951. Pop. (1986) 1,915.

Fort Rixon, village, south-central Zimbabwe. It was founded as a British military post in 1896 during the Ndebele uprisings near the site of the Dhlo-Dhlo ruins. Prominent in local tradition, the ruins appear to be of 17th- or 18th-century origin, yielding Portuguese, Arab, and Jesuit relics. It is believed that Dhlo-Dhlo was a seat of the supreme chief of the Rozwi people before the arrival of the Ndebele. It is now an agricultural (corn [maize], tobacco) and ranching centre and the focus of gold-mining activities in the area.

Fort Rosebery (Zambia): *see* Mansa.

Fort-Rupert, formerly RUPERT HOUSE, village and trading post in Nouveau-Québec region, western Quebec province, Canada, on James Bay, at the mouth of the Rupert River. Founded in 1668 as the first Hudson's Bay Company post by the Médart Chouart, sieur de Groseilliers, it was at first called Fort-Charles and was the first European settlement in northern Canada. The fort was captured by the French in 1686 and remained under their control until 1713, during which period it was called Fort-Saint-Jacques. In 1777 the company post was reestablished, and it has been in operation ever since. Inc. village, 1978. Pop. (1980 est.) 850.

Fort Saint James, village, central British Columbia, Canada, on the southeastern shore of Stuart Lake at the confluence of the Stuart and Necoslie rivers, 70 miles (113 km) northwest of Prince George. One of the province's oldest communities, it originated as a trading post, established in 1806 by Simon Fraser and John Stuart for the North West Company. In 1821 it was taken over by the Hudson's Bay Company (when the two companies amalgamated) and made capital of the interior fur-trading district of New Caledonia (the forerunner of British Columbia). A Roman Catholic mission was founded there in 1842 by Bishop Modeste Demers. With the creation of the British Columbia colony in 1858, Fort Saint James lost its position as a centre of local government. The old fort buildings and a museum are preserved within a national historic park, and the mission church is still in use. The Necoslie Indian Reservation is adjacent to the village, which now serves as a supply base for prospectors, hunters, trappers, and fishermen. Lumbering and mining are local activities. Inc. 1952. Pop. (1986) 1,983.

Fort Saint John, city, eastern British Columbia, Canada, north of the Peace River, 45 miles (73 km) northwest of Dawson Creek. It originated with the building of a North West Company fort on the river's north bank in 1805. The Hudson's Bay Company assumed control in 1821; two years later the fort was destroyed in an Indian attack. Rebuilt in 1860 on the south bank of the river, it has since moved several times. The present fort, built at the beginning of the Sikanny Trail in 1925, formed the nucleus of the community of Fort Saint John, which was incorporated as a village in 1947. A service centre for a wide agricultural area, it expanded after the construction (1943) of the suspension bridge across the Peace River and the completion of the Alaska Highway during World War II. The discovery nearby in 1955 of vast oil and gas deposits has made Fort Saint John the oil capital of British Columbia. Inc. town, 1958; city, 1975. Pop. (1986) 13,355.

Fort Sandeman (Pakistan): *see* Zhob.

Fort Scott, city, seat of Bourbon county, southeastern Kansas, U.S., on the Marmaton

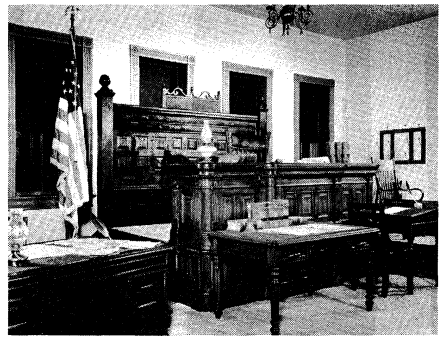
River near the Missouri border. The community grew up around a military outpost (1842) named for General Winfield Scott. After removal of the garrison (1855), Fort Scott was the scene of clashes between proslavery and antislavery factions. Some of the buildings erected during the American Civil War, when the fort was reactivated, remain. Fort Scott is now a railroad junction and a shipping point in a diversified farming area. Work clothes, cement, aluminum products, business forms, and calendars are made. Fort Scott Community College was established in 1919. Inc. 1860. Pop. (1984 est.) 8,746.

Fort Smith, southwestern region of the Northwest Territories, Canada. Formerly part of MacKenzie district, Fort Smith region was created in the early1970s by the territorial government. The region extends northward from the Alberta border to encompass Great Slave Lake and the eastern portion of Great Bear Lake and stretches eastward from the Yukon border to the upper branches of the Thelon River, north of central Saskatchewan. Largely a transition zone between boreal coniferous forest and Arctic tundra, it is characterized by the southern Mackenzie Mountains (west), the lowlands of the northward-flowing Mackenzie River (centre), and plateau and plains (east). Fort Smith region is the most populous and productive part of the Territories; its chief settlements, including Yellowknife (capital of the Northwest Territories), Hay River, and Fort Smith (the regional headquarters), are important mining towns. Fur trapping, lumbering, and tourism are other economic activities. American Indians (including Athapaskan-speaking Salvey and Dogrib and some Algonquian-speaking Cree) and Metis (people of mixed Indian, French, and Scottish ancestry) comprise about one-fourth of the region's population. Pop. (1986) 25,116.

Fort Smith, town, southern Fort Smith region, Northwest Territories, Canada, on the Slave River, at the Alberta border. It lies below the rapids, midway between the Athabasca and Great Slave lakes. The settlement originated in 1874 as a Hudson's Bay Company post and portage point and was named for Donald A. Smith (governor of the company), who later became Lord Strathcona. Fort Smith was the territorial administrative centre from 1911 until Yellowknife became the territorial capital in 1967. Fort Smith remains a regional government centre and is an important shipping point (especially for uranium concentrate). Wood Buffalo National Park (headquartered in Fort Smith) is close by. Two portage roads connect the town to Fitzgerald, Alta. (bypassing the Slave River rapids), and an all-weather highway links it with the village of Hay River, on Great Slave Lake, 140 miles (225 km) northwest. Inc. 1967. Pop. (1986) 2,460.

Fort Smith, city, northern district seat (1852) of Sebastian county, western Arkansas, U.S., on the Arkansas River at the Oklahoma state line. An army fort, established on the site (known as Belle Point to early French explorers) in 1817, was named for General Thomas A. Smith. The town was laid out in 1821, and its growth was sustained with the arrival of the railroad (1876). The U.S. Federal District Court for Western Arkansas was located in Fort Smith and had jurisdiction over the Indian Territory (now Oklahoma), home of the Five Civilized Tribes and also a refuge for outlaws. Judge Isaac C. Parker, known as a "hanging judge," successfully carried out the difficult task of enforcing federal law from 1875 to 1896. His courtroom has been restored as part of the Fort Smith National Historic Site.

Fort Smith is in the centre of an expanding



Judge Parker's courtroom, Fort Smith, Ark.
William R. Wilson—FPG/EB Inc.

industrial area (coal and natural-gas fields) and is one of the state's leading manufacturing cities. Westark Community College (1928) is there, with Fort Chaffee (now inactive) army base nearby. Inc. town, 1842; city, 1851. Pop. (1987 est.) 74,837.

Fort Stanwix, Treaties of (1768, 1784), cession by the Iroquois League of land in what are now western Pennsylvania, Kentucky, West Virginia, and New York, opening vast tracts of trans-Appalachian territory to white exploitation and settlement. Soon after the Proclamation of 1763 (*see* 1763, Proclamation of), which followed the last French and Indian War, British authorities recognized that the western boundary drawn at that time was both unrealistic and unjust to land-hungry white settlers and ambitious fur traders. Therefore, 3,400 Iroquois Indians gathered in November 1768 at Fort Stanwix (now Rome), N.Y., to sign a new treaty with British government agents, represented by Sir William Johnson. Beguiled by more than £10,000 worth of attractive gifts, the Iroquois agreed to cede land south and east of a line running from Fort Stanwix south to the Delaware, west to the Susquehanna (generally, south to its west branch), and westerly to the Allegheny, downstream to the Ohio and the Tennessee.

The southern portion of this cession was in fact beyond Iroquois territory, and the British were required to negotiate additional agreements with the Cherokee verifying the new boundaries in what is now West Virginia at the Treaty of Hard Labor (October 1768) and the Treaty of Lochaber (October 1770). These three treaties launched a new period of eager land speculation for Englishmen and Americans alike, accompanied by a stream of homesteaders who quickly poured into the Ohio River region.

The Second Treaty of Fort Stanwix (also called the Treaty with the Six Nations) came on the heels of the U.S. War of Independence, during which the powerful Iroquois had been considerably weakened by the American frontier campaign. Discouraged from further resistance, the Iroquois reluctantly agreed to redraw their eastern boundaries established in 1768. At a second meeting at Fort Stanwix (October 1784), they were persuaded to yield, in addition to a small section of western New York, a vast acreage of rich land in western Pennsylvania, representing one-fourth the total area of that state. Unfortunately, Iroquois relinquishment of claims to additional territory west of the Ohio was disputed by adjacent tribes, especially the Shawnee, leading to misunderstanding and bloodshed in that area for years to come.

Fort Sumter National Monument, site of the first engagement of the American Civil War, April 12, 1861, located on Sullivan's Island at the entrance to the harbour of Charleston, S.C. Construction of the fort (named for Thomas Sumter, a Revolutionary War patriot) began in 1829 and was still in progress in 1861. The national monument, established on April 28, 1948, also includes Fort Moultrie. Located on the mainland, Fort Moultrie was the site of an American victory against the British in the U.S. War of Independence (June 28, 1776), when the fort was called Fort Sullivan. The Seminole Indian leader Osceola is buried there.

When efforts at political compromise of the sectional conflict between North and South failed in early 1861, the seven Southern states that had already seceded claimed possession of all U.S. forts and arsenals within their territory. Only two forts remained under federal jurisdiction: Fort Pickens, Fla., and Fort Sumter, which was garrisoned by U.S. troops under Major Robert Anderson. Sumter was of no strategic value to the Union; it was incomplete, and its 60 guns pointed out to sea, but it assumed critical value as a symbol of national union. When President Abraham Lincoln took office in March 1861, he was faced with the Confederate demand for evacuation of the fort, which was threatened by other fortifications erected by South Carolina in the harbour area. Lincoln had either to attempt to resupply the fort, then in danger of being starved out, or to abandon it and accede to disunion. The president determined to prepare relief expeditions to both Fort Pickens and Fort Sumter; but, before the arrival of supplies, Confederate authorities demanded Fort Sumter's immediate evacuation. When this was refused, the South's batteries opened fire at dawn on April 12, and the fort was surrendered two days later. The shelling of U.S. property aroused and united the North, and Lincoln responded to the attack with a call for 75,000 volunteers for three months' service.

Fort Valley, city, seat of Peach county, central Georgia, U.S., just west of Warner Robins and Robins Air Force Base. Settled about 1836, the community developed after the railroad arrived in 1851 as a shipping and canning centre for an extensive peach-growing area. The city also has some light industry. Fort Valley State College was established there in 1895 as a high school for blacks. Inc. 1856. Pop. (1984 est.) 8,599.

Fort Victoria (town, Zimbabwe): *see* Masvingo.

Fort Walton Beach, city, Okaloosa county, northwestern Florida, U.S., at the west end of Choctawhatchee Bay (off the Gulf of Mexico), separated from the Santa Rosa Island beaches by Santa Rosa Sound, 40 miles (64 km) east of Pensacola. The fort was established during the Seminole Wars and named for Colonel George Walton, territorial secretary of West and East–West Florida (1821–26). The fishing village that grew around the fort evolved in the 1920s as a yachting centre. Created the Municipality of Fort Walton in 1937, it was reincorporated (1941) as a town and was rechartered in 1947 and again in 1953, when it was renamed the City of Fort Walton Beach. After 1950 it developed as a residential resort. A pre-Columbian Indian Temple Mound and Museum are there. The campus of Okaloosa-Walton Junior College (1964) is at nearby Niceville. Pop. (1987 est.) city, 23,572; metropolitan area (MSA), 145,300.

Fort Wayne, city, seat (1824) of Allen county, northeastern Indiana, U.S., at the confluence of the St. Marys and St. Joseph rivers where they form the Maumee River, 118 miles (190 km) northeast of Indianapolis. The waters, spanned by 21 bridges, divide the town into three parts. The place was prominent in frontier history. In the late 17th century the French built a trading post (later fort) at this natural stronghold on the site of Kekionga, once the chief town of the Miami Indians. It was attacked and taken by the English (1760) and Indians under Pontiac (1763). A log stockade constructed in 1794 by General "Mad" Anthony Wayne after the Battle

of Fallen Timbers, near what is now Toledo, Ohio (reconstructed 1975), gave the town its name.

The town's industrial growth began with the building of the Wabash and Erie Canal in the 1830s and was stimulated in the 1850s when the railroads came. Fort Wayne's easy access to raw materials and markets has encouraged the manufacture of a wide range of machinery including automotive and electrical equipment and parts, and diamond cutting tools. Fort Wayne is noted as a centre of higher learning, its institutions including Concordia Theological Seminary (1839), Fort Wayne Art Institute (1897), Fort Wayne Bible College (1904), Indiana Institute of Technology (1930), Indiana–Purdue Universities joint regional campus (1964), and St. Francis College (1890). The Lincoln National Life Foundation houses a large collection of Lincoln memorabilia.

John Chapman (Johnny Appleseed, pioneer orchard planter) is buried near the War Memorial Coliseum. Inc. town, 1829; city, 1840. Pop. (1988 est.) city, 178,214; Fort Wayne MSA, 367,400.

Fort William (Canada): *see* Thunder Bay.

Fort William, small burgh in Lochaber district, Highland region, Scotland. It lies at the northeastern end of Loch Linnhe and at the foot of Ben Nevis, which is Britain's highest mountain. The original fort, built in 1654 to keep the peace in the Highlands, was later ruined and, in 1690, rebuilt and named after the British monarch William III. The fort was dismantled in the 19th century to make room for the railway.

Fort William was the first town in Britain to light its streets entirely by hydroelectricity. Water from Loch Treig, conveyed by a 15-mile (24-kilometre) tunnel beneath Ben Nevis, provides power for an aluminum works. Other industries include cattle raising and distilling. Pop. (1981) 11,061.

Fort Worth, city, seat of Tarrant county, northern Texas, U.S. It lies at the confluence of the Clear and West forks of the Trinity River and it is the western part of the Dallas–Grand Prairie–Arlington–Fort Worth urban complex. Founded in 1849 by Major Ripley Arnold as a military outpost (although it was never a fort) against Comanche Indian raids, it was named for Major General William J. Worth, commander of U.S. troops in Texas at the time. After the army left in 1853, the town languished, but it revived in 1856 when, by popular vote, it displaced neighbouring Birdville as the county seat.

A stopover point for longhorn cattle drives on the Chisholm Trail in the early 1870s, Fort Worth became a cattle-shipping boomtown after the Texas and Pacific Railway arrived in 1876. Fort Worth subsequently became the meat-packing centre of the Southwest. Oil finds brought the petroleum-refining industry to the city in 1920, and in 1949 aircraft manufacturing began there.

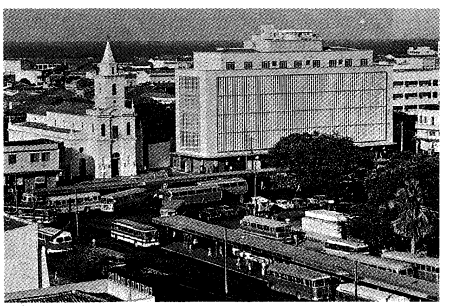
The city's economy, integrated with that of Dallas, is widely based. Its diversified industry includes the manufacture of aircraft, aerospace and electronic equipment and machinery. While still a cattle industry headquarters, Fort Worth is also a food processing, transportation, and wholesaling centre, and its oil business has remained vigorous.

It is the seat of Texas Christian University (1873), Texas Wesleyan College (1891), Southwestern Baptist Theological Seminary (1908), and Tarrant County Junior College (1965); the University of Texas at Arlington (1895) is just to the east, and Carswell Air Force Base is nearby. The city's Will Rogers Memorial Center embraces the Amon Carter Museum of Western Art (1961; housing a fine collection of Western U.S. paintings—notably those of Frederic Remington and Charles Russell) and the unique Kimbell Art Museum, built with semicircular vaults. The Tarrant County Convention Center (1968), spanning 14 downtown city blocks, is a major landmark. Recreational and other attractions include a zoo and aquarium, botanical gardens, several recreational lakes, and the combined Southwestern Exposition, Fat Stock Show and Rodeo (held in January). Inc. 1873. Pop. (1988 est.) city, 432,889; Fort Worth–Arlington PMSA, 1,290,900; Dallas–Fort Worth CMSA, 3,766,100.

Fort Worth Zoological Park and James R. Record Aquarium, municipally owned zoo and aquarium in Fort Worth, Texas, U.S. Opened in 1923, the 15-hectare (37-acre) zoo exhibits more than 2,000 specimens of some 500 species. The zoo's herpetarium has a very large collection of reptiles and has bred, among other such creatures, the endangered bog turtle. The zoo's large aviaries house many species of tropical birds.

An aquarium facility known as the James R. Record Aquarium was opened in 1954 as an extension of the zoo. The aquarium collection contains more than 3,000 specimens of 320 fishes and other aquatic species. A notable feature of the aquarium is a geographic presentation of various fish groups, which shows the species most likely to be found in a particular region of the United States or the world. The aquarium also has numerous innovative speciality displays.

Fortaleza, port city and capital, Ceará *estado* ("state"), northeastern Brazil. It lies at the mouth of the Pajeú River on a crescent-shaped indentation of the coastline. It originated as a small village adjoining a Portuguese fort (built as a defense against Indian attacks) and took the name of Villa do Forte da Assumpção in 1654. In 1810 it became the capital of Ceará captaincy and in 1823 was given city status and became the provincial (later state) capital under the name of Fortaleza Nova de Bragança.



Downtown Fortaleza, Braz.
Carl Frank—Photo Researchers/EB Inc.

The city has a modern appearance with wide avenues. Its harbour, long an open roadstead, has been protected and greatly improved by construction of a breakwater with port facilities at Mucuripe Point, 4 miles (6 km) east. The port's exports include sugar, coffee, cashews, lobsters, salt, rubber, cotton, carnauba wax, oiticica oil, rum, rice, *feijão* (beans), fruits, hides, and skins. Fortaleza's factories produce dyes, electroceramics, and styrofoam packing materials. Marine algae is processed there for use in fertilizers, stock feed, agar, and carrageenan. Highways link Fortaleza with Sobral, Recife, and Pernambuco, and an underwater telephone cable runs from Fortaleza to the Virgin Islands. The Baturité Railway connects Fortaleza and its port with fertile regions to the southwest and extends southeast to Patos, in Paraíba state.

Fortaleza is the seat of a bishopric (created in 1854) and of the Federal University of Ceará (1955) and the University of Fortaleza (1973). Pop. (1980 prelim.) 648,815.

Fortas, Abe (b. June 19, 1910, Memphis, Tenn., U.S.—d. April 6, 1982, Washington, D.C.), associate justice of the United States Supreme Court (1965–69). Nominated chief justice in 1968, he became the first nominee for that post since 1795 to fail to receive Senate approval. The following year he became the first Supreme Court justice to resign under threat of impeachment.

Fortas' father was a cabinetmaker, an Orthodox Jew who had immigrated to the United States from England. Fortas attended Southwestern College, Memphis, and graduated from Yale Law School in 1933, first in his class. He remained at Yale as assistant professor of law until 1937, when he accepted an appointment with the federal Securities and Exchange Commission. He held a number of government posts before entering private law practice in 1946. The law firm that he cofounded flourished, representing the Washington interests of many of the country's largest corporations. In 1963 Fortas successfully argued before the Supreme Court the case of *Gideon* v. *Wainwright,* which established the absolute right of the accused in criminal trials to counsel, regardless of ability to pay.

President Lyndon Johnson chose Fortas, an old and trusted friend, as his first appointee to the U.S. Supreme Court in 1965. Three years later he nominated him to replace the retiring Earl Warren, the liberal chief justice since 1953. The nomination of Fortas, who generally sided with the liberal court majority as an associate justice, was quickly assailed with charges ranging from "cronyism" on the part of Johnson to improper acceptance of fees for nonjudicial activities by Fortas. When the nomination came to the Senate floor, a filibuster ensued. Shortly afterward, Fortas requested that his name be withdrawn, and the president complied.

Fortas' financial involvement in the late 1960s with a financier subsequently imprisoned for securities violations appeared likely to precipitate impeachment proceedings in Congress, and Fortas resigned in 1969, returning to private practice.

Fortes, Meyer (b. April 25, 1906, Britstown, Cape Province, S.Af.—d. Jan. 27, 1983, Cambridge, Cambridgeshire, Eng.), British social anthropologist known for his investigations of West African societies.

After studying at the University of Cape Town in South Africa, Fortes received his Ph.D. in psychology from the London School of Economics and Political Science in 1930. In 1932 he turned from psychology to anthropology and studied under Bronisław Malinowski at the London School. During 1934–37 he worked in Ghana and, upon his return, was appointed lecturer in social anthropology at the London School. Subsequently, he was appointed research lecturer in African sociology at Oxford. He was professor of social anthropology at King's College, Cambridge, from 1950 to 1973.

Fortes's special interests were the political anthropology and kinship systems of various African tribes, especially the Tallensi. Most of his studies were conducted in nations along the Guinea coast of Africa. Among his major works are *The Dynamics of Clanship Among the Tallensi* (1945), *The Web of Kinship Among the Tallensi* (1949), *Kinship and Social Order* (1969), and *Time and Social Structure, and Other Essays* (1970).

Fortescue, Sir John (b. *c.* 1385, Norris, Somerset, Eng.—d. *c.* 1479, Ebrington, Gloucestershire), jurist, notable for a legal treatise, *De laudibus legum Angliae* (*c.* 1470; "In Praise of the Laws of England"), written for the instruction of Edward, prince of Wales, son of the deposed king Henry VI of England. He also stated a moral principle that remains basic to the Anglo-American jury system: It

is better that the guilty escape than that the innocent be punished.

Fortescue became chief justice of the King's Bench in 1442 and was knighted the following year. After the defeat of Henry VI's Lancastrian army at Towton, Yorkshire (March 29, 1461), he fled with Henry to Scotland, where Fortescue probably was appointed lord chancellor of the exiled government. From 1463 to 1471 he lived in France at the court of Henry's queen, Margaret of Anjou, where he helped to educate Prince Edward to rule England in the event of a Lancastrian restoration. Returning to England, he was captured at Tewkesbury, Gloucestershire, during the final defeat of the Lancastrians (May 4, 1471), submitted to the Yorkist king Edward IV, and was allowed to retire to his home.

Unusual for its time, *De laudibus* depreciates the Roman-derived civil law and eulogizes the English constitution, statutes, and system of legal education, while offering suggestions for reform. It was probably the first book about law written in a style so simple and lucid as to be comprehensible to the layman.

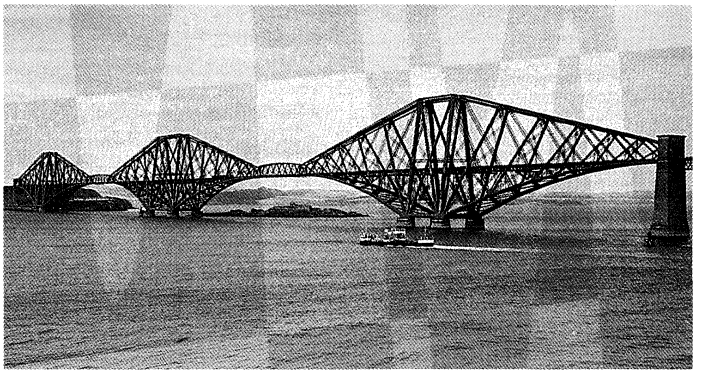
Forth, Patrick Ruthven, Earl of, EARL OF BRENTFORD, LORD RUTHVEN OF ETTRICK (b. c. 1573—d. Feb. 2, 1651, Dundee, Scot.), supreme commander of the Royalist forces of Charles I during the early phases of the English Civil Wars.

A descendant of the 1st Lord Ruthven (d. 1528) in a collateral line, he distinguished himself in the service of Sweden, which he entered about 1606. As a negotiator he was very useful to Gustavus Adolphus because of his ability to "drink immeasurably and preserve his understanding to the last," and he also won fame on the field of battle. Having taken part in the Thirty Years' War and been governor of Ulm, he left the Swedish service and returned to Scotland, where he was employed by Charles I. He defended Edinburgh Castle for the king in 1640, and, when the first Civil War broke out, he joined Charles at Shrewsbury. He led the left wing at the Battle of Edgehill (October 1642) and, after this engagement, was appointed general in chief of the Royalist army. For his services he was created Lord Ruthven of Ettrick in 1639, Earl of Forth in 1642, and Earl of Brentford in 1644. The earl compelled the Earl of Essex to surrender Lostwithiel and was wounded at both battles of Newbury. But his faculties had begun to decay, and in 1644 he was superseded in his command by Prince Rupert. After visiting Sweden on a mission for Charles II, Brentford died at Dundee. He left no sons, and his titles became extinct.

Forth, River, river and estuary in eastern Scotland, flowing from west to east from its headwaters on the eastern slopes of Ben Lomond to the Firth of Forth (the estuary), near Kincardine. The river has a short highland section and a longer lowland section, falling only 80 feet (25 m) in 55 miles (90 km). This stretch, called the Links of Forth, was the site of the famous Battle of Bannockburn, fought in 1314, during which English troops suffered a major defeat at Scottish hands. Near its tidal limit at Stirling, the Forth receives two important left-bank tributaries, the Allan and Teith. The Forth–Clyde Canal, completed in 1790, is now disused.

The firth stretches for 48 miles (77 km) from Kincardine (bridged in 1936) to the Isle of May, with a constriction at North and South Queensferry, which is spanned by the railway Forth Bridge (1890) and the Forth Road Bridge (1964).

Forth Bridge, railway bridge over the Firth of Forth, the estuary of the River Forth in Scotland. It was one of the first cantilever bridges and for several years was the world's longest span. Designed and built by Benjamin Baker in the late 1880s, its opening stirred controversy on aesthetic grounds, the poet and artist William Morris declaring it "the supremest specimen of all ugliness," a judgment greatly softened by the passage of time.



Forth railway bridge, Scotland
A.F. Kersting

Making use of the rocky isle of Inchgarvie in the middle of the deep firth as a foundation for one of three giant (1,350-foot [411-metre]) cantilevers (projecting members supported at only one end), Baker joined the cantilevers together with two suspended spans of 350 feet (107 m) each, making a total of 1,700 feet (518 m) of clear spans over either arm of the firth. The 12-foot- (4-metre-) diameter tubes forming the cantilevers, the roadway, and approach spans consumed the hitherto unheard-of quantity of 58,000 tons of steel. The cost of the bridge, extraordinary for its day, was £3,000,000 (about $15,000,000).

The Forth Road Bridge, completed in 1964, is a suspension structure with a main span of 3,300 feet (1,000 m).

Forth River, river in northern Tasmania, Australia, rising in the lakes district near Mount Pelion West in the Central Plateau. Fed by its principal tributaries, the Dove and Wilmot, it flows 60 miles (95 km) north to Port Fenton, its estuarine mouth on Bass Strait. Falling steeply over the plateau edge to the agricultural coastal plain, it is the central river of the Mersey–Forth power project. Water from Lake Mackenzie on the Fisher River and Rowallan Dam on the Mersey River is diverted west to the Forth above Lemonthyme power station. Downstream, a diversion tunnel enters from the Wilmot River (west). The combined flow is then impounded behind several dams, including the Cethana, Devils Gate, and Paloona. The total power generated exceeds 300,000 kilowatts.

fortification, in military science, works erected to strengthen a position against attack.

A brief treatment of fortification follows. For full treatment, *see* MACROPAEDIA: War, The Technology of.

Permanent fortifications include lasting forts and troop shelters; they are usually constructed of masonry, concrete, or stone. Field fortifications are those constructed when in contact with an enemy or when contact is imminent. They consist of entrenched positions for personnel, weapon emplacements, cleared fields of fire for weapons, and manufactured obstacles such as mines and barbed wire; and they also include the strengthening of available natural obstacles by utilizing felled trees, rocks, and other materials.

There are two chief reasons for fortifications: to obtain the greatest advantage from one's own strength and weapons and to prevent the enemy from using his resources to advantage. The defender is shielded by the protecting fortification, and the attacker is delayed or his impetus minimized by obstacles.

The defense of cities and trade centres, usually by high walls, has been important for centuries as a protection for their wealth. Permanent fortifications have also been established at strategic points along routes of invasion. Seacoast fortifications have normally been for protection against naval attack, though from a military standpoint they sometimes included protection from the land side. Field fortifications have been used in varying degrees since the time of the Greeks and the Romans. The citadel was the municipal fortress of the ancient world. It appeared in cities of Egypt, Greece, and the Roman Empire.

Obstacles have been utilized throughout history to prevent an enemy from coming to close quarters. The Romans depended upon protective walls and dry ditches in the republican era but later utilized ditches filled with water and spiked tree trunks set in the ground. Obstacles were of little value unless they were tied into the defense system. For instance, the concrete dragon's teeth of the German west wall of World War II were an inconsequential obstacle when no troops or defense guns were nearby. Bulldozers merely pushed dirt over them to create an elevated road, or engineers dynamited a path through them.

In ancient days, fortifications hindered the best attacking troops for months and even years. The medieval castle was almost impregnable until gunpowder gave artillery increased battering power. Even against artillery, the fortifications of World War I were able for a time to bear up successfully. In World War II new methods of combined attack made even the strongest permanent fortifications vulnerable. Field fortifications gave some help to the defense by channelizing enemy attacks, though at no time were they impregnable.

Historically, both permanent and field fortifications were strong against hand weapons and engines of war but required extensive modification after the arrival of gunpowder. In the age of the tank and airplane, permanent fortifications became inadequate, but field fortifications were able to compel some delay in enemy advances.

Fortín Ingavi (Paraguay): *see* Mayor Pablo Lagerenza.

Fortis, Alessandro (b. 1842, Forlì, Papal States [Italy]—d. Dec. 4, 1909, Rome), statesman, of strong republican views during the Risorgimento, the 19th-century unification of Italy. Later, under the monarchy, he held several governmental posts, including that of premier (1905–06).

Fortis fought as a volunteer with Giuseppe Garibaldi in 1866 and 1867. After the unification of Italy as a monarchy, he remained an ardent republican and was arrested on Aug. 2, 1874, for conspiring with the socialists to foment insurrection but was released five months later. In 1876 he urged the republicans to begin participating in the government. Elected a deputy in 1880, he drifted

to the right politically. He served as minister of agriculture (June 1898–May 1899), and when Giovanni Giolitti resigned as premier (February 1905), he named Fortis as his successor. Because he was considered Giolitti's pawn, Fortis had difficulty forming a government. In office he settled a rail strike by declaring railway workers to be civil servants who were not allowed to strike. He nationalized the railways and in so doing offered an exorbitant sum to the railway companies and was accused of corruption. His foreign policy favouring the Triple Alliance was also unpopular. Finally, by reducing import duties on Spanish wine he aroused opposition that toppled his government in February 1906.

Fortner, Wolfgang (b. Oct. 12, 1907, Leipzig—d. Sept. 11?, 1987, Heidelberg, W.Ger.), progressive composer and influential music teacher in Germany.

Fortner studied music and philosophy at the Leipzig Conservatory and the University of Leipzig, and at the age of 24 he went to Heidelberg as professor at the Institute for Evangelical Church Music. He later taught in Detmold and in Freiburg im Breisgau.

Besides concerti, orchestral works, chamber and church music, Fortner composed distinguished operas and music for the stage. His choral works and solo instrumental pieces also enjoyed success, especially in Germany. His early style was held to be much influenced by Baroque music; it is highly contrapuntal and melodically severe. Later his music expanded in emotional scope and power. The *Symphony* (1947), an aggressive, poignant work, exemplifies the composer's maturity. Its four movements abound in contrapuntal complexities, the resulting musical texture being harmonically and rhythmically very intense. The *Phantasie über B-A-C-H* for two pianos, nine solo instruments, and orchestra (1950) displays Fortner's skill with 12-tone technique. In the *Phantasie,* Arnold Schoenberg's original 12-tone system is modified to fit Fortner's virtuosic conception. Fortner's operas include two major works based on plays by Federico García Lorca: *Die Bluthochzeit* (*Blood Wedding,* first performed, 1957; incidental music to the same play, 1950) and *In seinem Garten liebt Don Perlimplin Belisa* (1962; *In His Garden Don Perlimplin Belisa Loves*).

Fortnum & Mason, Ltd., in London, department store that began as a grocery shop in 1707 and became famous for the variety and high quality of its food products. The store took on other lines of goods in the 1920s, opening new departments featuring fashionable clothes and other products. Stressing quality and serving the fashionable London carriage trade, Fortnum & Mason continued to devote its first floor to groceries, fresh fruit and flowers, and beverages.

Although the store has expanded considerably, its trademark remains its foodstuffs of high quality and variety. Its exotic delicacies are world-renowned. The famous Fortnum & Mason outdoor clock chimes the hours while figures representing William Fortnum and Hugh Mason, the founders, appear and bow to one another.

Fortrose, royal burgh (1455), district of Ross and Cromarty, Highland region, Scotland. It lies on the southeastern coast of the Black Isle peninsula, which juts into the North Sea. The free burgh was established by the union of Fortrose and Rosemarkie (about 1 mile [1.5 km] apart). Rosemarkie was the first seat of the bishopric of Ross, which was set up by David I in 1124, but a century later the bishopric moved to Fortrose, where a 14th-century cathedral was built in red sandstone. Fortrose is now a modest residential and resort settlement. Pop. (1981) 1,333.

Fortuna, in Roman religion, goddess of chance or lot who became identified with the Greek Tyche; the original Italian deity was probably regarded as the bearer of prosperity and increase. As such she resembles a fertility deity, hence her association with the bounty

Fortuna holding a cornucopia and a rudder, classical sculpture; in Vatican City

Alinari—Art Resource/EB Inc.

of the soil and the fruitfulness of women. Frequently she is an oracular goddess consulted in various ways regarding the future. Fortuna was worshiped extensively in Italy from the earliest times. At Praeneste her shrine was a well-known oracular seat, as was her shrine at Antium. Fortuna is often represented bearing a cornucopia as the giver of abundance and a rudder as controller of destinies, or standing on a ball to indicate the uncertainty of fortune.

Fortunatus, Venantius (Honorius Clementianus) (b. *c.* 540, Treviso, near Venice—d. *c.* 600, Poitiers, Aquitaine [now in France]), poet and bishop of Poitiers, whose Latin poems and hymns combine echoes of classical Latin poets with a medieval tone, making him an important transitional figure between the ancient and medieval periods.

Probably in fulfillment of a vow to St. Martin of Tours, Fortunatus crossed the Continent, visiting Metz, Paris, and Tours and forming friendships with churchmen and officials. In 567 he reached Poitiers, where Radegunda, former queen consort of Chlotar I, had founded a monastery. Impressed by her holiness and that of Agnes, the abbess, he became a priest and subsequently bishop of Poitiers.

The extant works of Fortunatus are the *Vita S. Martini,* written at the prompting of his friend Gregory of Tours; his prose biographies of saints (including the *Vita Radegundis*); and 11 books of poems (with an appendix of 34 poems). His early poems are courtly; they include addresses to bishops and officials, panegyrics, an epithalamium, epigrams, and occasional poems. While showing a pleasing facility, their dominant characteristic is a strongly rhetorical flavour. The influence of rhetoric persists in his religious poetry written at Poitiers (along with epigrams and epistles in his earlier vein), and it is especially effective in the poem celebrating the installation of Agnes as abbess. Of his six poems on the subject of the Cross, two are splendid hymns in which the religious note finds its noblest expression: these poems, the *Pange lingua* and the *Vexilla regis,* have been translated into English by John Mason Neale as "Sing My Tongue the Glorious Battle" and "The Royal Banners Forward Go."

Fortunatus is venerated as a saint in some Italian and French dioceses, where his feast day is celebrated on December 14.

fortune-telling, the forecasting of future events or the delineation of character by methods not ordinarily considered to have a rational basis. Evidence indicates that forms of fortune-telling were practiced in ancient China, Egypt, Chaldea, and Babylonia as long ago as 4000 BC. Prophetic dreams and oracular utterances played an important part in ancient religion and medicine.

Predictive methods of fortune-telling include astrology (interpretation of the movements of heavenly bodies as influences on earthly events), numerology, and the utilization of objects such as playing cards, tea leaves, crystal balls, dice, fire, water, and scattered salt. Fortune-telling as a process of character analysis can take such forms as graphology (study of handwriting), physiognomy (study of facial characteristics), phrenology (study of contours on the skull), and palmistry (study of lines on the palm of the hand). *See* divination.

Fortune Theatre, Elizabethan public playhouse in northern London, built in 1600 by Philip Henslowe to compete with Cuthbert Burbage's newly constructed Globe Theatre. Named after the goddess of fortune, whose statue stood over the front doorway, the Fortune resembled the Globe except that it was square and its timbers remained unpainted.

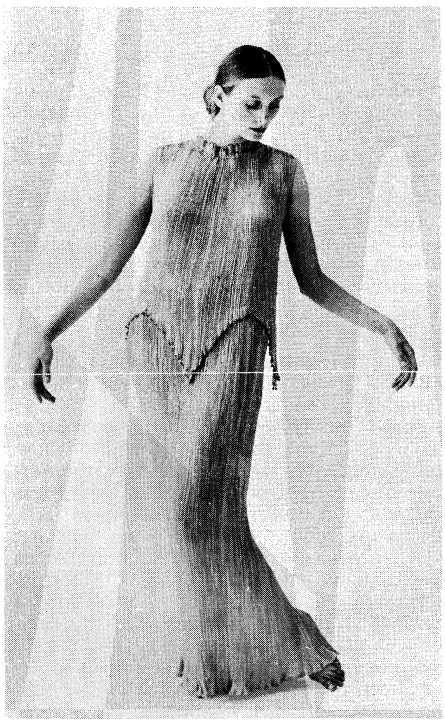
Henslowe's contract for the Fortune Theatre, which provides a detailed description of its specifications, is a primary source of information about the features and construction of Elizabethan playhouses. Henslowe, a speculator who also built the Rose Theatre in 1587 and the Hope Theatre in 1614, employed Peter Street, the same contractor who had built the Globe. What is known about the features of the Globe, therefore, is largely derived from Henslowe's contract for the Fortune. From these documents, theatre historians have learned that the theatre had a circular, open yard, approximately 55 feet (17 m) in diameter, surrounded by three tiers of galleries. The rectangular stage, which was 43 feet wide by 27½ feet deep (13 by 8.5 m), was covered by a roof. The contract also includes plans for the construction of gentlemen's rooms, twopenny rooms, and a tiring house, or dressing room. Henslowe paid £520 for the first Fortune Theatre and almost twice as much to have it rebuilt of brick after it burned down in 1621.

The Fortune opened in 1600 with a performance by the Admiral's Men, who continued to use it for many years. After the Puritans closed the public theatres in 1642, the Fortune was used occasionally for clandestine performances. One year after Charles II's return to England in 1660, the Fortune was torn down to accommodate the construction of 23 houses.

Fortuny (y de Madrazo), Mariano (b. May 11, 1871, Granada, Spain—d. May 3, 1949, Venice), painter, inventor, photographer, and fashion designer best-known for his dress and textile designs.

Fortuny was the son of a Spanish genre painter, Mariano Fortuny. His father died in 1874, and the boy was reared in Paris, where he studied painting with his uncle. In 1899 he moved with his mother to Venice, and he spent the rest of his life there. While painting he also became interested in photography and theatre set design. Influenced by the Arts and Crafts Movement, he learned to control all aspects of his designs; for the theatre he created innovative lighting techniques, and he invented his own fabric dyes and fabrics, as well as machinery for printing cloth. He held more than 20 patents for his inventions.

In about 1907 Fortuny's dress designs, many of them inspired by ancient Greek garments such as the tunic and the peplos, became extremely popular among the wealthy. The silk dresses that he designed were perhaps most remarkable for their subtle colouring and for the freedom of movement that they allowed. Some of these dresses were simple in execution, while others of similar design had hundreds of tiny pleats that ran from neck to foot. Fortuny drew inspiration for his many textile designs in cotton and velvet from a number of international sources; they are characterized by rich, sensuous colouring. Numerous examples of his work can be found in his former home—now the Fortuny Museum—in Venice.



Pleated silk Delphos dress with short tunic by Mariano Fortuny, 1912; photograph by Cecil Beaton for an exhibition at the Victoria and Albert Museum, London, 1971

Cecil Beaton photograph courtesy of Sotheby's London

Fortuny (y Marsal), Mariano (José María Bernardo) (b. June 11, 1838, Reus, Spain—d. Nov. 21, 1874, Rome), Spanish painter whose vigorous technique and anecdotal themes won him a considerable audience in the mid-19th century.

After four years at the Academy of Barcelona, Fortuny in 1858 won the Prix de Rome, which enabled him to complete his studies at Rome. In 1860 he was sent by provincial authorities to Morocco to paint the scenes of the war between Spain and the Emperor of Morocco. He soon returned to Spain but spent all of his remaining years in Rome, except for a year in Paris (1869–70). In Paris he entered into business relations with the noted art dealer Goupil; their association brought him large sums for his paintings and an international reputation.

Fortuny painted occasional large works, *e.g.*, the huge "Battle of Tetuan," based on an incident in the Moroccan campaign and a fine example of pictorial reportage, charged with action and energy. More characteristic, however, are his small genre paintings filled with fine detail, works that attempted to recapture the grace and charm of an imaginary 18th century scene.

Forty Martyrs of England and Wales, group of Roman Catholic martyrs executed by British authorities during the Reformation, most during the reign of Elizabeth I. An act of Parliament in 1571 made it high treason to question the Queen's title as head of the Church of England—thus making the practice of Catholicism an essentially treasonable act—and authorized the confiscation of the property of Catholics, many of whom fled to the Continent. In the ensuing persecution, 183 English Catholics were put to death between 1577 and 1603; altogether, some 600 Catholics died in the persecutions of the 16th and 17th centuries. Some were executed for offenses as trivial as obtaining a papal license to marry. Forty of these victims were canonized by Pope Paul VI in 1970 as representatives of all the martyrs. Many were priests or members of religious orders, but 59—including seven of those canonized—were lay Catholics. Their designated feast day, October 25, commemorates the date of their canonization.

Forty-seven Rōnin (Kabuki play): *see* Chūshingura.

forum, in Roman cities in antiquity, multipurpose, centrally located open area surrounded by public buildings and colonnades that served as a public gathering place. It was an orderly spatial adaptation of the Greek agora, or marketplace, and acropolis (*q.v.*).

In the laws of the Twelve Tables the word is used for the vestibule of a tomb; in a Roman camp the forum was an open place beside the praetorium, and the term was originally applied generally to the space in front of any public building or gateway.

In Rome itself the word forum denoted the flat and formerly marshy space between the Palatine and Capitoline hills (also called *forum Romanum*), which even during the regal period accommodated such public meetings as could not be held within the *area Capitolina.* In early times the *forum Romanum* was used for gladiatorial games and over the colonnades were galleries for spectators; there were also shops of various kinds. Under the Roman Empire, when the forum became primarily a centre for religious and secular spectacles and ceremonies, it was the site of many of the city's most imposing temples and monuments. Among the structures surviving in whole or in part are the Temple of Castor and Pollux, the Temple of the Deified Caesar, the Mamertine Prison, the Curia (Senate house), the Temple of Saturn, the Temple of Vesta, the Temple of Romulus, the Arch of Titus, the Arch of Septimius Severus, and the Cloaca Maxima.

Also during the imperial period a considerable number of new forums, the *fora civilia* (judicial) and *venalia* (mercantile), came into existence. In addition to the *forum Romanum*, the forums of Caesar and Augustus belonged to the former class, the *forum boarium* (cattle), *holitorium* (vegetable), etc., to the latter.

The 1st-century-BC architect Vitruvius stated that the ideal forum should be large enough to accommodate a large crowd but not so large as to dwarf a small one. He proposed a 3:2 length-to-breadth ratio. It is to this proportion that Trajan's Forum in Rome was erected early in the 2nd century AD. Commissioned by the emperor Trajan and designed by Apollodorus of Damascus, it measures approximately 920 by 620 feet (about 280 by 190 metres) and covers about 25 acres (10 hectares). Persons entered through a triple gateway into a colonnaded open space lined with merchants' booths. The forum is flanked by two semicircular, colonnaded exedrae. Opposite the gateway is the Basilica Ulpia, beyond which is Trajan's Column, carved with relief sculpture depicting Trajan's victories. The aesthetic harmony of this space has influenced many subsequent town planners.

In Pompeii, at the northeast end of the forum, there was a macellum (market) and shops for provisions, and on the east side a clothworkers' exchange; at Timgad in north Africa the whole of the north side of the forum was occupied by shops. The forum was generally paved, and, although on festal occasions chariots were driven through, it was not a thoroughfare and was enclosed by gates at the entrances, of which traces have been found at Pompeii.

Trajan's Forum, Rome, designed by Apollodorus of Damascus, early 2nd century

Fototeca Unione, Rome

forward policy, 19th-century British policy of defending the northwestern frontier of British India. It was intended to deal with the double threat of a Russian invasion and incursions from independent tribal territories.

The frontier question arose after the British conquest of Sind in 1843 and the annexation of the Punjab (Pañjāb) in 1849. John Lawrence (governor general, 1864–69) advocated the line of the Indus River and advised "masterly inactivity" toward the frontier tribes. The extreme forward school advocated "a scientific frontier running from Kābul through Ghaznī to Qandahār." This plan, tried by the governor general in 1876–80, led to the Second Anglo-Afghan War (1878–80) and was then abandoned as impracticable. The moderate forward school, led by Frederick Sleigh (later Earl) Roberts, looked to control of the tribal area between Afghanistan and British India. In 1893 it secured the Durand Line, which divided the tribal belt between the Afghans and British.

Foscari, Francesco (b. *c.* 1373—d. Oct. 31/Nov. 1, 1457, Venice), doge of Venice who led the city in a long and ruinous series of wars against Milan. His life story is the subject of the tragedy *The Two Foscari* by Lord Byron and of an opera by Giuseppe Verdi.

Foscari, portrait panel by Bastiani Lassaro, *c.* 1460; in the Musei Civici, Venice

By courtesy of the Musei Civici, Venice

Belonging to a prominent Venetian family, Foscari headed the Council of Forty (1401) and the Council of Ten (1405–13), Venice's ruling bodies, during the city's wars for territorial expansion. Soon after his election as doge in 1423, he made an alliance with Florence and began a war against the duke of Milan, Filippo Maria Visconti. The Venetians won Brescia in 1426, and a peace was reached in 1427. War resumed in 1431, and the subsequent Peace of Ferrara (1433) failed to settle the balance of power. A war with Bologna ended in a treaty in 1441 that increased Venetian territory, to which Ravenna was added shortly thereafter.

In 1443 he resumed the war with Milan. Even after Filippo Maria died, Foscari pursued the war. The greater part of northern Italy was ravaged, and no member of its complex system of alliances emerged as a clear victor. Finally, in 1454 the Peace of Lodi ended the hostilities, and the Italian League, including Venice, Florence, and Milan, was formed.

In the meantime, Constantinople had fallen to the Turks (1453). His attention on his Italian wars, Foscari had failed to prevent losses of Venice's eastern territory to the Turks.

After such blows to Venice's trade with the Orient, Foscari's enemies sought to depose him. They accused him, probably unjustly, of the murder of the Venetian admiral Piero Loredan. This accusation, together with the banishment of his son for suspected treason, forced Foscari's resignation on the formal demand of the Council of Ten (Oct. 23, 1457). Eight days later he was dead.

Foscolo, Ugo, original name NICCOLÒ FOSCOLO (b. Feb. 6 [Jan. 26, Greek calendar], 1778, Zákinthos, Greece—d. Sept. 10, 1827, Turnham Green, near London), poet and

Foscolo, detail of an oil painting by François-Xavier Fabre, 1818; in the Gallery of Modern Art, Florence

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novelist whose works articulate the feelings of many Italians during the turbulent epoch of the French Revolution, the Napoleonic Wars, and the restoration of Austrian rule; they rank among the masterpieces of Italian literature.

Foscolo, born of a Greek mother and a Venetian father, was educated at Spalato (now Split, Yugos.) and Padua, in Italy, and moved with his family to Venice in about 1793. There he moved in literary circles. In 1797 the performance of his tragedy *Tieste* ("Thyestes") made him famous.

Foscolo's early enthusiasm for Napoleon, proclaimed in his ode *A Bonaparte liberatore* (1797; "To Bonaparte the Liberator"), quickly turned to disillusionment when Napoleon ceded Venetia to Austria in the Treaty of Campo Formio (1797). Foscolo's very popular novel *Ultime lettere di Jacopo Ortis* (1802; *The Last Letters of Jacopo Ortis,* 1970) contains a bitter denunciation of that transaction and shows the author's disgust with Italy's social and political situation. Some critics consider this story the first modern Italian novel.

When the Austrians and Russians invaded Italy in 1799, Foscolo, with other Italian patriots, joined the French side. Made a captain in the Italian division of the French army after the defense of Genoa in 1800, he had commissions in Milan, Bologna, and Florence, where he found time to involve himself in many love affairs.

Finally Foscolo was sent to serve in France (1804–06). During that period he translated some classical works and Laurence Sterne's *Sentimental Journey* into Italian and wrote odes and sonnets.

In 1807 Foscolo returned to Milan and established his literary reputation with "Dei sepolcri" (Eng. trans., "Of the Sepulchres," *c.* 1820), a patriotic poem in blank verse, written as a protest against Napoleon's decree forbidding tomb inscriptions. In 1808 the poem won for its author the chair of Italian rhetoric at the University of Padua. When the chair was abolished by Napoleon the next year, Foscolo moved on to Milan. The satirical references to Napoleon in his tragedy *Aiace* (first performed 1811; "Ajax") again brought suspicion on him; in 1812 he moved to Florence, where he wrote another tragedy, *Ricciarda,* and most of his highly acclaimed unfinished poem, *Grazie* (published in fragments 1803 and 1818, in full 1822; "The Graces"). In 1813 Foscolo returned to Milan.

Napoleon fell the following year, the Austrians returned to Italy, and Foscolo, refusing to take the oath of allegiance, fled first to Switzerland and then in 1816 to England. Popular for a time in English society because he was an Italian patriot, Foscolo supported himself by teaching and writing commentaries on Dante, Boccaccio, and Petrarch for *The Edinburgh Review* and *The Quarterly Review.* He died in poverty. In 1871, with great national ceremony, his remains were moved from England and interred in Sta. Croce church, Florence.

Fosdick, Harry Emerson (b. May 24, 1878, Buffalo—d. Oct. 5, 1969, Bronxville, N.Y., U.S.), liberal Protestant minister, teacher, and author, who was pastor of the interdenominational Riverside Church in New York City (1926–46), preacher on the National Vespers nationwide radio program (1926–46), and a central figure in the Protestant liberal–fundamentalist controversies during the 1920s. Fosdick was an early practitioner of pastoral counselling and of the church's cooperation with psychiatry.

Ordained a Baptist minister in 1903, he was a minister at Montclair, N.J. (1904–15), and taught at Union Theological Seminary (1908–46). In 1919 he became associate pastor at the First Presbyterian Church, New York City. Crowds filled the church to hear his sermons, but conservative Protestants denounced him as a "modernist." His sermon "Shall the Fundamentalists Win?" (preached on May 21, 1922) caused an uproar and led to his resignation in 1925. Called to the Park Avenue Baptist Church within a few months, he requested construction of a larger, interdenominational church near Columbia University. Riverside Church was built with the aid of John D. Rockefeller, Jr., a trustee.

Fosdick was a prolific author of sermons, articles, and books. These include *The Manhood of the Master* (1913), *The Secret of Victorious Living* (1934), *On Being a Real Person* (1943), *A Faith for Tough Times* (1952), and *The Living of These Days, an Autobiography* (1956).

Foss, Lukas, original name LUKAS FUCHS (b. Aug. 15, 1922, Berlin), German-born U.S. composer, pianist, and conductor, widely recognized for his experiments with improvisation and aleatoric (chance) music.

He studied in Berlin and Paris and, after moving to the United States in 1937, with the composers Randall Thompson and Paul Hindemith and the conductors Serge Koussevitzky and Fritz Reiner. Foss published his first work at age 15, and in 1945 he became the youngest composer to win a Guggenheim Fellowship. In 1957, while professor of composition and orchestra director at the University of California at Los Angeles, he founded the Improvisation Chamber Ensemble, the vehicle of many of his experiments in aleatoric and stochastic (mathematical probability) music. From 1963 to 1970 he was conductor of the Buffalo Philharmonic Orchestra.

Foss, 1969

He founded (1963) and became director of the Center for Creative and Performing Arts at the State University of New York at Buffalo, and he was named music director and conductor of the Brooklyn Philharmonia (later Brooklyn Philharmonic) in 1971. He was appointed music director and Conductor of the Milwaukee Symphony Orchestra in 1981.

Foss's early works are Neoclassical—tonal and well-organized in harmony and counterpoint. Among these works are symphonic music (*Ode;* first performed, 1945), ballet (*Gift of the Magi;* 1945), concerti (*Second Piano Concerto;* 1951, rev. 1953; Music Critics' Award, 1954), opera (*Griffelkin;* commissioned by and first performed on NBC-TV, 1955), cantatas, and chamber music. His later chamber pieces (*Echoi,* 1963; *Elytres,* 1964) are avant-garde in their treatment of the ordering of musical events by means of chance operations and in the variety of controls over musical form—controls determined to a large extent by the performers during the actual performance. Later works include *Divertissement* for string quartet (1972), *Cave of the Winds* for wind quintet (1972), the orchestral work *Folksong* (1975), and *American Cantata* (1977) for tenor, soprano, two speakers, chorus, and orchestra.

fossa, also spelled FOUSSA (*Cryptoprocta ferox*), largest carnivore native to Madagascar, a catlike forest dweller of the civet family, Viverridae. The fossa grows to a length of about 1.5 metres (5 feet), including a tail about 66 centimetres (26 inches) long, and has short legs and sharp, retractile claws. The fur is close, dense, and grayish to reddish brown. Generally most active at night, the fossa is both terrestrial and arboreal. It usually hunts alone and commonly feeds on birds and lemurs but also preys on livestock. Many legends centre on the fossa; some, such as reports of its savagery, are probably much exaggerated.

Because of certain structural features, the fossa was formerly classified in the cat family (Felidae). Its common name sometimes leads to its confusion with the Malagasy civet, or fanaloka, *Fossa fossa.*

Fossano, town, Cuneo province, Piemonte (Piedmont) region, northern Italy, northeast of Cuneo (city). Fossano is the site of a 14th-century four-sided castle, which belonged to the princes of Acaia; its hospital and the Trinity Church were designed by Francesco Gallo in the 18th century. The town has mineral baths and is an agricultural and cattle-breeding

centre. Local industries include textiles, metallurgy, and chemicals. Pop. (1989 est.) mun., 23,104.

Fosse, Bob, byname of ROBERT LOUIS FOSSE (b. June 23, 1927, Chicago, Ill., U.S.—d. Sept. 23, 1987, Washington, D.C.), American theatre and motion-picture choreographer and director of musical plays.

The son of a vaudevillian, Fosse attended dance schools as a child and began dancing professionally at the age of 13. A chorus dancer in national tours and Broadway musicals between 1947 and 1953, he signed a contract with Metro-Goldwyn-Mayer in the latter year and danced and sang in three film musicals, including *Kiss Me Kate.* He returned the next year to Broadway, where he won his first Tony award for choreographing *The Pajama Game* (1954), becoming noted then and later for his clever, angular groupings of dancers and fresh, stylistically exaggerated staging. He then arranged the dances for several Broadway shows, winning Tony awards for *Damn Yankees* (1955), *Redhead* (1959), *Little Me* (1963), *Sweet Charity* (1966), *Pippin* (1972), and *Dancin'* (1978).

Fosse choreographed and directed the successful motion-picture musicals *Cabaret* (1972) and *All That Jazz* (1979). He also directed the nonmusical films *Lenny* (1974), based on the life of comedian Lenny Bruce, and *Star 80* (1983).

Fosse, Charles de La (French painter): *see* La Fosse, Charles de.

Fosse Way, major Roman road that traversed Britain from southwest to northeast. It ran from the mouth of the River Axe in Devon by Axminster and Ilchester (Lindinae) to Bath (Aquae Sulis) and Cirencester, thence straight for 60 miles (100 km) to High Cross (Venonae), where it intersected Watling Street, and on to Leicester (Ratae). After crossing the River Trent near Newark, it reached Ermine Street south of Lincoln (Lindum). It was probably laid as a military road along the temporary frontier reached in the Roman conquest before AD 47.

Fossey, Dian (b. Jan. 16, 1932, San Francisco, Calif., U.S.—d. Dec. 26, 1985, Rwanda), American zoologist who became the world's leading authority on the mountain gorilla.

Fossey trained to become an occupational therapist at San Jose State College and graduated in 1954. She worked in that field for several years at a children's hospital in Louisville, Ky. In 1963 she took a trip to eastern Africa, where she met the anthropologist Louis Leakey and had her first glimpse of mountain gorillas. She returned to the United States after her trip, but in 1966 Leakey persuaded her to return to Africa to study the mountain gorilla in its natural habitat on a long-term basis. To this end, she established the Karisoke Research Centre in 1967 and began a hermitlike existence in Rwanda's Virunga Mountains, which was one of the last bastions of the endangered mountain gorilla. Through patient effort, Fossey was able to observe the animals and accustom them to her presence, and the data that she gathered greatly enlarged contemporary knowledge of the gorilla's habits, communication, and social structure. Fossey recounted her observations in magazine articles and her book *Gorillas in the Mist* (1983). She obtained a Ph.D. degree in zoology from the University of Cambridge in 1974 and went on to teach at Cornell University, N.Y., while remaining involved with the Karisoke Research Centre. Fossey took increasingly drastic measures to protect the Virunga gorillas from both poachers and the neighbouring African farmers, and in 1985 she was murdered at her campsite.

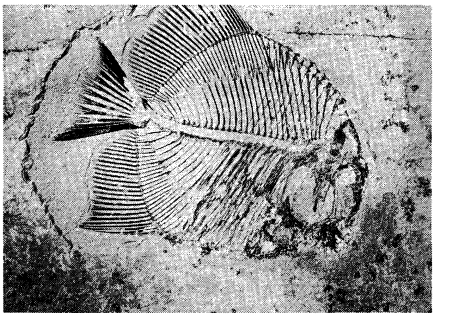
fossil, remnant, impression, or trace of an animal or plant of a past geologic age that has been preserved in the Earth's crust. The complex of data recorded in fossils worldwide, known as the fossil record, is the primary source of information about the history of life on Earth.

Only a small fraction of ancient organisms are preserved as fossils, and usually only organisms that have a solid and resistant skeleton are readily preserved. Most major groups of invertebrate animals have a calcareous skeleton or shell (*e.g.,* corals, mollusks, brachiopods, bryozoans). Other forms have shells of calcium phosphate (which also occurs in the bones of vertebrates), or silicon dioxide. A shell or bone that is buried quickly after deposition may retain these organic tissues, though they become petrified (converted to a stony substance) over time. Unaltered hard parts, such as the shells of clams or brachiopods, are relatively common in sedimentary rocks, some of great age.

The hard parts of organisms that become buried in sediment may be subject to a variety of other changes during their conversion to solid rock, however. Solutions may fill the interstices, or pores, of the shell or bone with calcium carbonate or other mineral salts and thus fossilize the remains, in a process known as permineralization. In other cases there may be a total replacement of the original skeletal material by other mineral matter, a process known as mineralization, or replacement. In still other cases, circulating acid solutions may dissolve the original shell but leave a cavity corresponding to it, and circulating calcareous or siliceous solutions may then deposit a new matrix in the cavity, thus creating a new impression of the original shell.

By contrast, the soft parts of animals or plants are very rarely preserved. The embedding of insects in amber and the preservation of the carcasses of Pleistocene-era mammoths in ice are rare but striking examples of the fossil preservation of soft tissues. Traces of organisms may also occur as tracks or trails or even borings.

The great majority of fossils are preserved in a water environment because land remains are more easily destroyed. Anaerobic conditions at the bottom of the seas or other bodies of water are especially favourable for preserving fine details, since no bottom faunas, except for anaerobic bacteria, are present to destroy the remains. In general, for an organism to be preserved two conditions must be met: rapid burial to retard decomposition and to prevent the ravaging of scavengers; and possession of hard parts capable of being fossilized.



Mesodon, macropterus, 13 × 16½ cm; in the Eichstätt Museum, West Germany
Lilly Stunzi, Zurich, New York

In some places, such as the Grand Canyon in northern Arizona, one can observe a great thickness of nearly horizontal strata representing the deposition of sediment on the seafloor over many hundreds of millions of years. It is often apparent that each layer in such a sequence contains fossils that are distinct from those of the layers that are above and below it. In such sequences of layers in different geographic locations, the same, or similar, fossil floras or faunas occur in the identical order. By comparing overlapping sequences, it is possible to build up a continuous record of faunas and floras that have progressively more in common with present-day life forms as the top of the sequence is approached.

The study of the fossil record has provided important information for at least four different purposes. The progressive changes observed within an animal group are used to describe the evolution of that group. Fossils also provide the geologist a quick and easy way of assigning a relative age to the strata in which they occur. The precision with which this may be done in any particular case depends on the nature and abundance of the fauna: some fossil groups were deposited during much longer time intervals than others. Fossils used to identify geologic relationships are known as index fossils.

Fossil organisms may provide information about the climate and environment of the site where they were deposited and preserved (*e.g.,* certain species of coral require warm, shallow water, or certain forms of deciduous angiosperms can only grow in colder climatic conditions).

Finally, fossils are useful in the exploration for minerals and mineral fuels. For example, they serve to indicate the stratigraphic position of coal seams. In recent years, geologists have been able to study the subsurface stratigraphy of oil and natural gas deposits by analyzing microfossils obtained from core samples of deep borings.

fossil fuel, any of a class of materials of biological origin occurring within the Earth's crust that can be used as a source of energy.

A brief treatment of fossil fuels follows. For full treatment of their formations, properties, and distribution, *see* MACROPAEDIA: Fuels, Fossil. For information on their recovery and processing, *see* Industries, Extraction and Processing.

Fossil fuels include coal, natural gas, petroleum, shale oil, and bitumen. They all contain carbon and were formed as a result of geologic processes from the remains of organic matter produced by photosynthesis hundreds of millions of years ago.

All fossil fuels can be burned with air or with oxygen derived from the air to provide heat. This heat may be employed directly, as in the case of a home furnace, or utilized to produce steam with which to drive a turbogenerator so that it can supply electricity. In still other cases, as, for example, gas turbines used in jet aircraft, the heat yielded by burning a fossil fuel can serve to increase both the pressure and the temperature of the combustion products to furnish motive power.

Since the late 18th century, fossil fuels have been consumed at an ever-increasing rate. Today, they supply nearly 90 percent of all the energy consumed by the industrially developed nations of the world. New deposits continue to be discovered, but the reserves of these principal fossil fuels remaining in the Earth are limited. The amounts that can be recovered economically are difficult to estimate and are in large part contingent on their assumed rate of consumption and future value, as well as on technological developments. For example, a coal bed must be no less than 60 cm (24 inches) thick and be buried no more than about 2,000 m (6,560 feet) to be mined economically with available equipment and techniques. Advances in technology, however, may make it possible to mine thinner beds at greater depths at reasonable cost, thereby increasing the amount of recoverable coal. Estimating remaining oil resources is equally difficult. However, as recoverable deposits of conventional (light-to-medium) oil become depleted, it is expected that heavy oil and syncrudes from tar sands and oil shales will be

exploited as sources of liquid petroleum on a wide scale.

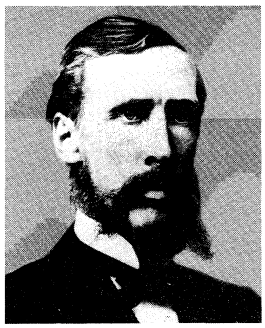
Fostat, al- (Egypt): *see* Fusṭāṭ, al-.

Foster, Abigail Kelley, *née* KELLEY, byname ABBY (b. Jan. 15, 1810, Pelham, Mass., U.S.—d. Jan. 14, 1887, Worcester, Mass.), American feminist, abolitionist, and lecturer.

Converted to the cause of abolition in the 1830s, Abby Kelley became active in the Lynn (Mass.) Female Anti-Slavery Society. In 1838 she joined the abolitionist leader William Lloyd Garrison in organizing the New England Non-Resistance Society. The next year she embarked on a long career as a political lecturer; her public addresses gained her nationwide fame and notoriety in an era when the presentation of political speeches by women to "mixed" audiences (of men and women) was the subject of controversy. Kelley's insistence on participating in the business affairs of the American Anti-Slavery Society in 1840 resulted in the splintering of that group when those opposed to women's public activities left the organization.

In 1845 she married Stephen Symonds Foster (died 1881), an abolitionist who joined her on the lecture circuit. In the 1850s she added the causes of temperance and women's rights to her speaking agenda. She and her husband refused to pay their taxes in the 1870s, claiming that she had been taxed without representation, since she could not vote.

Foster, Sir George Eulas (b. Sept. 3, 1847, Carleton county, N.B., Can.—d. Dec. 30, 1931, Ottawa), Canadian statesman who became prominent as minister of trade and



Sir George Foster

By courtesy of the Harriet Irving Library Archives, University of New Brunswick, Fredericton

commerce in the Sir Robert Laird Borden government (1911–20), which gained increasing recognition for Canada in international affairs. Foster founded the National Research Council in Canada and established the Dominion Bureau of Statistics.

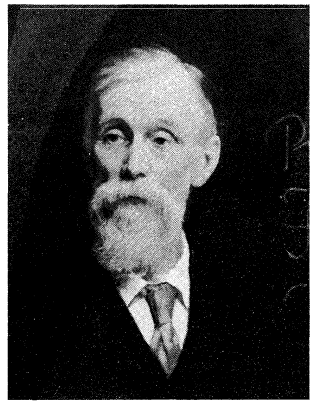
Foster entered politics after six years of teaching at the University of New Brunswick, Fredericton. In 1882 he was elected a Conservative member of the House of Commons. In the Sir John Macdonald government he became minister of marine and fisheries (1885) and minister of finance (1888–96). After World War I he served as a delegate to the peace conference and as chairman of the Canadian delegation to the first assembly of the League of Nations at Geneva. Foster became known as a strong believer in protection for Canadian industries and in preferential trade within the British Empire. He was knighted in 1914.

Foster, John W(atson) (b. March 2, 1836, Pike county, Ind., U.S.—d. Nov. 15, 1917, Washington, D.C.), diplomat and U.S. secretary of state (1892–93) who negotiated an ill-fated treaty for the annexation of Hawaii.

After service in the Union Army during the Civil War, Foster, a lawyer and newspaper editor in Evansville, Ind., was active in state Republican affairs. He served as minister to Mexico (1873–80), minister to Russia (1880–81), and minister to Spain (1883–85).

Appointed secretary of state by President Benjamin Harrison in 1892, Foster tacitly encouraged American interests in Hawaii in their revolt against Queen Liliuokalani and negotiated a treaty (1893) for the annexation of Hawaii (which, at the urging of his successor, Secretary of State Walter Quinton Gresham, was withdrawn from Senate consideration by the newly installed administration of President Grover Cleveland). Foster resigned in early 1893 in order to represent the United States in the Bering Sea controversy before an arbitration tribunal at Paris.

Foster, Sir Michael (b. March 8, 1836, Huntingdon, Huntingdonshire, Eng.—d. Jan. 28, 1907, London), English physiologist and educator who introduced modern methods of



Sir Michael Foster, detail of an oil painting by J. Collier, 1907; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

teaching biology and physiology that emphasize laboratory training.

Foster earned a medical degree from University College, London, in 1859 and was a protégé of the biologist T.H. Huxley. Foster became an instructor at University College in 1867 and went on to become a teacher (1870–83) and then the first professor of physiology (1883–1903) at the University of Cambridge. He greatly enlarged and modernized the teaching of biology at Cambridge, and under his leadership that school became a world centre for research into physiology. Indeed, many of the most eminent British biologists of the early 20th century were originally students of his. Foster's use of laboratory experimentation and research became standard in the teaching of the biological sciences in English universities.

Foster also cowrote several important textbooks with former students, and his *Textbook of Physiology* (1877) became a standard reference work. He founded the *Journal of Physiology* in 1878 and remained its editor until 1894. His own research, though overshadowed by his teaching activities, centred on determining whether the heartbeat depends solely on nerve discharges or whether the heart muscles have a capacity for rhythmic contraction independent of nervous influence.

Foster, Stephen (Collins) (b. July 4, 1826, Lawrenceville [now part of Pittsburgh], Pa., U.S.—d. Jan. 13, 1864, New York, N.Y.), American composer whose popular minstrel songs and sentimental ballads achieved for him an honoured place in the music of the United States.

Foster grew up on the urban edge of the Western frontier. Although formally untutored in music, he had a natural musical bent and began to write songs as a young boy. He absorbed musical influences from the popular, sentimental songs sung by his sisters; from black church meetings he attended with the family's servant Olivia Pise; from popular minstrel show songs; and from songs sung by black labourers at the Pittsburgh warehouse where he worked for a time.

In 1842 he published his song "Open Thy Lattice, Love." In 1846 he went to Cincinnati as a bookkeeper, returning to Pittsburgh in 1850 to marry Jane McDowell, a physician's daughter. In 1848 he sold his song "Oh, Susanna" for $100; together with his "Old Uncle Ned" it brought the publisher about $10,000. In 1849 he entered into a contract with Firth, Pond & Co., the New York publishers to whom he had previously given the rights for "Nelly Was a Lady." He was commissioned to write songs for Edwin P. Christy's minstrel show. The most famous, "Old Folks at Home" (1851), also called "Swanee River," appeared originally under Christy's name; Foster's name appeared on the song after 1879. In 1852 he made his only visit to the South.

Although he stated that his ambition was to become "the best Ethiopian [*i.e.,* Negro minstrel] song writer," he vacillated between composing minstrel songs (for which he is largely remembered) and songs in the sentimental "respectable" style then popular. He was never a sharp entrepreneur for his talents, and in 1857, in financial difficulties, he sold all rights to his future songs to his publishers for about $1,900. The profits from his songs went largely to performers and publishers.

In 1860, already struggling with sinking morale and alcoholism, he moved to New

Stephen Foster, 1859

By courtesy of the Foster Hall Collection, University of Pittsburgh

York City. His songs after that date are largely sentimental songs such as "Poor Drooping Maiden." His wife left him in 1861, except for a brief reconciliation in 1862. He spent the rest of his life in debt.

He left about 200 songs, for most of which he wrote the words as well as the music. They include "Camptown Races," "Nelly Bly," "My Old Kentucky Home," "Massa's in de Cold, Cold Ground," "Old Dog Tray," "Old Black Joe," "Jeanie with the Light Brown Hair," and "Beautiful Dreamer."

Foster, William Z(ebulon) (b. Feb. 25, 1881, Taunton, Mass., U.S.—d. Sept. 1, 1961, Moscow, Russian S.F.S.R.), American labour agitator and Communist Party leader who ran for the presidency in 1924, 1928, and 1932.

A militant union organizer from 1894, Foster joined the Industrial Workers of the World (1909), which aimed at achieving socialism through industry-wide labour organization. He came into national prominence as an American Federation of Labor leader in the bloody steel strike of 1919. In 1921 the Russian communists designated Foster's Trade Union Educational League (which he had founded in 1920) as the American branch of their Profintern (Red Trade Union International), thereby moving him into the American communist organization as a top leader. He was

a candidate three times for president, running on a platform that envisioned the ultimate demise of capitalism and the establishment of a workers' republic.

In 1932 Foster suffered a serious heart attack, and party leadership passed to coworker Earl Browder. When the international communist leadership indicated its dissatisfaction with Browder in 1945, Foster again became party chairman. In 1948 he was among the party leaders indicted for subversive activity, but, because of his precarious health, he was not brought to trial.

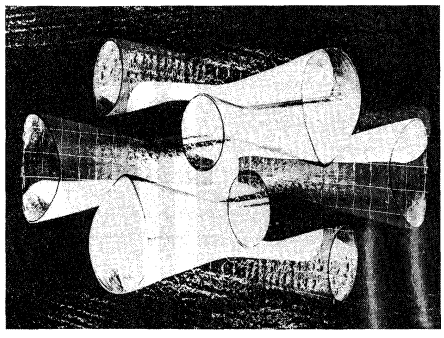
Foster's control of the party was endangered in 1956, when the Soviets' repudiation of Joseph Stalin and their suppression of the Hungarian Revolution caused an upheaval within the party. Foster, who steadfastly defended the Soviet leadership, was made chairman emeritus at the party's national convention in New York City (February 1957) and was thus, in effect, removed from power.

Fothergill, John (b. March 8, 1712, Wensleydale, Yorkshire, Eng.—d. Dec. 26, 1780, London), physician who was the first to record coronary arteriosclerosis (hardening of the walls of the arteries supplying blood to the heart muscle) in association with a case of angina pectoris.

Fothergill studied medicine at the University of Edinburgh and later became a highly successful London practitioner. His "Account of the Sore Throat Attended with Ulcers" (1748) was the first authoritative description of diphtheria. He popularized the use of coffee in England and promoted its cultivation in the West Indies. A friend of Benjamin Franklin, he collaborated with him on a plan for British reconciliation with the American colonies (1774).

Fothergilla, genus for about five species of deciduous shrubs of the witch hazel family (Hamamelidaceae) native to the southeastern United States and sometimes planted as ornamentals for their spring flowering and their fall colour. Their flowers lack petals but produce conspicuous white to yellow puffs of stamens (pollen-producing structures) in spring. The foliage is coarse in texture. All the species are also called witch alder, but especially *F. gardenii,* up to 1 m (3 feet) tall. The leaves of fothergillas turn brilliant shades of orange to crimson in autumn.

Fotoform, group of photographers in Germany after World War II. Headed by Otto Steinert (b. 1915), a physician who abandoned medicine for photography, the group reexplored the photographic techniques developed at the Bauhaus, the most advanced school of design in Germany between World Wars I and II. The first Fotoform exhibits in Milan and Cologne (both 1950) emphasized abstract form derived from patterns found in nature and from darkroom manipulation of the image. Photographs stressing abstract form had been unknown in Germany since the Nazis closed the Bauhaus in 1933, and the Fotoform exhibition was a sensation.



"Interchangeable Forms," negative montage by Otto Steinert, 1955

By courtesy of the Gernsheim Collection, the University of Texas at Austin

Steinert, however, felt that the format of the Fotoform shows had been too limited. At the group's remaining three exhibitions, which he titled "Subjektive Fotographie," he accepted any photograph, from the nonobjective photogram to literal reportage, that was aesthetically satisfying and bore the imprint of profound individual creativity. Nevertheless, most contributors continued to submit nonobjective photographs. Feeling that the once revolutionary style of Fotoform had become a rigid formula, Steinert abandoned Fotoform after the 1958 exhibition. The Fotoform style, however, continued to influence photographers and designers worldwide.

Fou-liang (China): *see* Ching-te-chen.

Foucault, Jean-Bernard-Léon (b. Sept. 18, 1819, Paris, Fr.—d. Feb. 11, 1868, Paris), French physicist who introduced and helped develop a technique of measuring the absolute velocity of light with extreme accuracy. He provided experimental proof that the Earth rotates on its axis.

Foucault was educated for the medical profession, but his interests turned to experimental physics. With Armand Fizeau, he began a series of investigations of light and heat. By 1850 he established that light travels slower in water than in air. In the same year he measured the velocity of light, finding a value that is within 1 percent of the true figure.

Foucault, engraving

Giraudon—Art Resource/EB Inc.

In 1851, by interpreting the motion of a heavy iron ball swinging from a wire 67 m (220 feet) long, he proved that the Earth rotates about its axis. Such a "Foucault pendulum" always swings in the same vertical plane, but on a rotating Earth, this vertical plane slowly changes, at a rate and direction dependent on the geographic latitude of the pendulum. For this demonstration and a similar one utilizing a gyroscope, Foucault received in 1855 the Copley Medal of the Royal Society of London and was made physical assistant at the Imperial Observatory, Paris. He discovered the existence of eddy currents, or "Foucault currents," in a copper disk moving in a strong magnetic field, constructed an improved mirror for the reflecting telescope, and in 1859 invented a simple but extremely accurate method of testing telescope mirrors for surface defects.

Foucault, Michel (Paul) (b. Oct. 15, 1926, Poitiers, Fr.—d. June 25, 1984, Paris), French structuralist philosopher noted for his examination of the concepts and codes by which societies operate, especially the "principles of exclusion" (such as the distinctions between the sane and the insane) by which a society defines itself.

The son of a physician, Foucault studied under the Marxist philosopher Louis Althusser at the École Normale Supérieure, Paris. He taught at the University of Clermont-Ferrand between 1960 and 1968 and then spent two years at the University of Paris-Vincennes. From 1970 until his death he was professor of the history of systems of thought at the Collège de France.

Foucault's early studies concerned the history of mental illness and society's response to it. Society's use of the concept of madness in the 17th century is the subject of his *Folie et Déraison: Histoire de la folie à l'âge classique* (1961; *Madness and Civilization*). In his book *Surveiller et punir: Naissance de la prison* (1975; *Discipline and Punish: The Birth of the Prison*) he examined the origins of the modern penal system. In these and other books, Foucault put forth the thesis that institutions such as asylums, hospitals, and prisons are society's devices for exclusion and that by surveying social attitudes in relation to these institutions, one can examine the development and uses of power.

Among Foucault's other works are *Les Mots et les choses: Une Archéologie des sciences humaines* (1966; *The Order of Things: An Archaeology of Human Sciences*) and *L'Archéologie du savoir* (1969; *The Archaeology of Knowledge*). His *Histoire de la sexualité,* 3 vol. (1976–84; *History of Sexuality*), which examined the history of Western attitudes toward sexuality since the ancient Greeks, confirmed his reputation as one of the leading French intellectuals of his day.

Foucault pendulum, relatively large mass suspended from a long wire mounted so that its perpendicular plane of swing is not confined to a particular direction and, in fact, rotates in relation to the Earth's surface. Jean-Bernard-Léon Foucault assembled (1851) in Paris the first pendulums of this type, one of which consisted of a 28-kilogram (62-pound) iron ball suspended from the dome of the Panthéon by a steel wire 67 m (220 feet) long and kept in motion by a mechanism. The rotation of the plane of swing of Foucault's pendulums was the first laboratory demonstration of the Earth's spin on its axis.

While any Foucault pendulum swings back and forth in a plane, the Earth rotates beneath it, so that relative motion exists between them. At the North Pole, latitude 90° north, the relative motion as viewed from the plane of the pendulum's suspension is a counterclockwise rotation of the Earth once every 24 hours; whereas the plane of the pendulum as viewed from the Earth looking upward rotates in a clockwise direction once a day. A Foucault pendulum always rotates clockwise in the Northern Hemisphere with a rate that becomes slower as the Equator is approached. Foucault's original pendulums at Paris rotated clockwise at a rate of more than 11° per hour, or with a period of about 32 hours per complete rotation. The rate of rotation depends on the latitude. At the Equator, 0° latitude, a Foucault pendulum does not rotate. In the Southern Hemisphere, rotation is counterclockwise.

The rate of rotation of a Foucault pendulum can be stated mathematically as equal to the rate of rotation of the Earth times the sine of the number of degrees of latitude. Because the Earth rotates once a day, or 360° every 24 hours, its rate of rotation may be expressed as 15° per hour, which corresponds to the rate of rotation of a Foucault pendulum at the North or South Pole. At latitude 30° north, for example, at Cairo or New Orleans, a Foucault pendulum would rotate at the rate of 7.5° per hour, for the sine of 30° is equal to one-half. The rate of rotation of a Foucault pendulum at any given point is, in fact, numerically equal to the component of the Earth's rate of rotation perpendicular to the Earth's surface at that point.

Fouché, Joseph, DUC (duke) D'OTRANTE (b. May 21, 1758?, Le Pellerin, near Nantes, Fr.—d. Dec. 25, 1820, Trieste), French statesman and organizer of the police, whose effi-

Fouché, engraving, 19th century
By courtesy of the Bibliotheque Nationale, Paris

ciency and opportunism enabled him to serve every government from 1792 to 1815.

Fouché was educated by the Oratorians at Nantes and Paris but was not ordained priest. In 1791 the Oratorian order was dissolved and Fouché became principal of their college at Nantes, joining the local Jacobin club and becoming its president. On Sept. 16, 1792, he was elected deputy to the Convention where he sided first with the Girondins. At Louis XVI's trial he voted for the King's death; thereafter he grew closer to the Montagnards.

After war was declared on England (February 1793) Fouché was sent on several missions to ensure the loyalty of the provinces. In October he was sent to Lyon to punish that city for rebelling against the Convention. The rebels were executed by the guillotine or by mass shootings (*mitraillades*), and beautiful buildings were destroyed. Fouché's role cannot be denied, but nonetheless, when the majority of the Committee of Public Safety, under pressure from Robespierre, began to criticize the massacres and "dechristianization," Fouché too supported moderation. After the execution of the Hébertists, he was recalled to the Convention (April 1794). In June he became president of the Jacobin society but abandoned it after Robespierre's attacks and amassed a hostile coalition that contributed to Robespierre's fall in July. Under the Directory (1795–99) Fouché was a Jacobin. After the coup d'etat of Sept. 4, 1797, had excluded the royalists from legislative councils, he was made an envoy to Milan and then to The Hague.

On July 20, 1799, he became minister of police and warmly supported Napoleon Bonaparte's coup d'etat of 18 Brumaire (Nov. 9, 1799). Thereafter he also organized the secret police. However, in August 1802 his ministry was suppressed because of his efforts to prevent the Senate from making Bonaparte consul for life. Fouché's departure from office disorganized the police, and the ministry was reestablished for him after his support of the Senate's proclamation of the empire. He was made count of the Empire (1808) and duc d'Otrante (1809). In June 1809 he became minister of the interior as well as of the police.

The prolonged wars and especially the Spanish rebellion made Fouché doubt the solidity of the empire, and from 1807 he began to intrigue, mainly with the royalists and with England. In July 1809, Fouché, on his own authority, ordered a levy of the national guard throughout France. This annoyed Napoleon, especially as the Parisian guard chose his enemies as leaders; and, when Fouché was denounced, Napoleon dismissed him in October. He was, however, made governor of the Roman states, but before leaving France his negotiations with England were discovered and he was disgraced. He lived at Aix-en-Provence for three years. In order to get him out of France, Napoleon made him governor of the Illyrian Provinces (1812), and after the occupation of these provinces by the Austrians, he was sent on a mission to Naples in which he seems to have played a double game with Napoleon and Joachim Murat, king of Naples.

After Napoleon's fall, Fouché returned to Paris in April 1814 but was ignored by Louis XVIII, against whom he therefore intrigued. When he was finally offered the Ministry of Police he refused, although he accepted it from Napoleon on his return from Elba. During the Hundred Days, Fouché recommended liberalism to Napoleon and kept on good terms with Louis XVIII and Austria. After Waterloo he made Napoleon agree to a second abdication and was elected president of a provisional government. Louis XVIII made him minister of police, but the ultraroyalists soon forced his resignation and he became minister plenipotentiary to Dresden. He was proscribed as a regicide on Jan. 5, 1816. He then lived in Prague, Linz, and Trieste.

Foucher, Simon (b. March 1, 1644, Dijon, Fr.—d. April 27, 1696, Paris), ecclesiastic and critical philosopher of the Cartesian school, the first to publish criticisms of the philosophical theories of Nicolas Malebranche. In *Critique de la recherche de la vérité* (1675; "Critique of the Search for Truth"), Foucher reasoned to contradictory conclusions from the suppositions of a philosophical system. Granting with Descartes that interaction between mind and matter obviously takes place, he added, however, that likeness is essential for cause–effect relationships—which implies (as against Descartes) that mind and matter cannot be essentially different; or, conversely, if Cartesian principles were strictly followed, mind and matter could not possibly interact. Foucher likewise contended that Malebranche logically made every truth a matter of faith and failed to refute the arguments of Skepticism. For Foucher, discovering a criterion of truth was the goal of philosophy. He saw special value in academic Skepticism and in a reasonable doubt in the search for truth.

Foucquet, Nicolas: *see* Fouquet, Nicolas.

fouetté en tournant (French: "whipped turning"), spectacular turn in ballet, usually performed in series, during which the dancer turns on one foot while making fast outward and inward thrusts of the working leg at each revolution. After a preparatory turn in place on one leg, the dancer bends the knee of the supporting leg and extends the working leg out straight to the side (second position, *en l'air*). The dancer then brings the working leg in so that the toe touches the knee of the supporting leg for the turn. The turn is executed on the ball of the foot (demi-pointe) or toe (pointe: women only). Modern choreographers may require as many as 32 *fouettés en tournant.*

Fougasse (cartoonist): *see* Bird, (Cyril) Kenneth.

Fougères, industrial town and tourist centre, northwestern France, in Ille-et-Vilaine *département,* Bretagne region, northeast of Rennes. Strikingly situated on a ridge dominating the winding valley of the Nançon River, the town, with its fortress, was of great military importance in medieval times. The castle (12th–15th century), at the frontier between France and Brittany, was completely destroyed in 1166 by King Henry II of England but was immediately rebuilt. It changed hands a number of times during the ensuing centuries; despite partial destruction, much of the castle remains, including the walls and 13 towers. Victor Hugo, Gustave Flaubert, and several other 19th-century French writers lived for a time at Fougères, which has frequently been described in the literature of that epoch. The town has picturesque old houses and two churches dating from the 15th to the 17th century. The main traditional manufacture is footwear and, more recently, precision machinery. Pop. (1982) 24,178.

Foula, one of the Shetland Islands, Scotland, located in the Atlantic, 16 mi (26 km) southwest of the largest island, Mainland. Rocky and exposed, it has an area of 4 sq mi (10 sq km). Its cliffs rise to 1,200 ft (400 m) and are inhabited by numerous seabirds, including the largest colony of great skuas in Great Britain. Foula can be isolated for long periods by bad weather. Common Scandinavian (Viking Norse) was spoken on the island until *c.* 1800. Pop. (1981) 39.

foulard, light silk fabric having a distinctive soft finish and a plain or simple twill weave. It is said to come originally from the Far East. In French the word *foulard* signifies a silk handkerchief.

The fabric, which is figured with a pattern printed in various colours, is used for dress material, handkerchiefs, scarves, and neckties. Fine textiles made from good-quality cotton yarn or man-made fibres are also sold as foulard and are used for the same purposes as the silk version.

Fould, Achille (b. Nov. 17, 1800, Paris—d. Oct. 5, 1867, La Loubière, Fr.), influential French statesman during the Second Republic (1848–52) and the Second Empire (1852–70). He combined liberal economic ideas with political flexibility, tempered by a belief in the necessity of repressing radical leftist leaders.

A member of an important Parisian banking family, Fould achieved notice in May 1848 with his pamphlet "Observations on the Financial Question Addressed to the National Assembly." He served as minister of finance three times under Pres. Louis-Napoléon Bonaparte (later Emperor Napoleon III) between 1849 and 1852 and then as the Emperor's minister of state in 1852–60 and minister of finance in 1861–67.

Fould was responsible for a number of financial innovations, including the policy of direct public loans to the government (in response to the cost of the Crimean War) and new budgetary procedures that extended legislative controls over expenditures. He directed the organization of the Paris Exposition of 1855, the reorganization of the Paris Opéra, and the completion of new wings to the Louvre. He also sponsored the end of protectionist tariff policies and the signing of a new commercial agreement with Great Britain (1860–61). His influence, prestige, and political power were so great that one informed contemporary called him the Emperor's "most important auxiliary."

Foulis, Robert (b. April 20, 1707, Glasgow—d. June 2, 1776, Edinburgh), Scottish printer whose work had considerable influence on the bookmakers of his time.

Foulis was the son of a brewer and qualified as a master barber. While working at that trade, he attended the lectures of the philosopher Francis Hutcheson at the University of Glasgow. Hutcheson befriended him and encouraged him to take up the trade of printing and bookselling.

In 1738 and 1739 Foulis and his brother Andrew visited France, returning each time with books which they sold at a profit in London. Robert began selling books in Glasgow in 1741 and shortly thereafter set up a press. He was appointed printer to the University of Glasgow in 1743, and in that year produced the first Greek book printed in Glasgow, the *Peri hermēneias* (in both Greek and Latin) of the pseudo-Demetrius Phalereus. Five years later he went into partnership with Andrew, and by 1775 they had produced more than 500 separate editions, including a Homer (4 vol., folio, 1756–58), Callimachus (small quarto,

1755), Thomas Gray's *Poems* (quarto, 1768), Herodotus, Thucydides, and Xenophon with Latin translations, and one of the first Scottish editions of Shakespeare. The Foulises' best works were distinguished by their excellent layout, legibility, and accuracy. Some of the credit for their achievement is attributable to the typefounder Alexander Wilson, but other printers used Wilson's types with undistinguised results, and his much-praised abandonment, in the folio Homer, of confusing ligatures and contractions was undertaken at Robert Foulis' insistence.

During a trip to the European Continent in 1751–53, Robert purchased a quantity of pictures and engaged teachers of drawing, engraving, and modeling. The university provided a gallery and studio, and the Glasgow Academy of Arts was opened in 1754. The venture proved premature, however; the brothers' resources were drained, and after Andrew's death (on Sept. 18, 1775) the academy had to be closed. Upon Robert's death, the printing business passed to his son, Andrew.

Foulques, also spelled FOULQUE (French personal name): *see under* Fulk, except as below.

Foulques DE TOULOUSE: *see* Folquet de Marseille.

Foulques, Gui (pope): *see* Clement IV.

Foumban, also spelled FOUMBAM, town, northwestern Cameroon, west-central Africa. It lies 140 miles (225 km) north-northwest of Yaoundé. It was the historic capital of the Bamum (Mum) kingdom; a palace there dates from the 18th century. Njoya (1889–1933), the most famous of the Bamum kings, established schools, invented a system of pictographic writing, and patronized the arts. The palace now houses the Foumban Museum of Bamum Art, containing examples of wood carving, realistic masks in copper and terracotta, and collections of bamboo and raffia furniture.

Local handicrafts are sold in Foumban, which is the most important centre for artisans in northwestern Cameroon. The town is also a collecting centre for coffee, cocoa, and tobacco sent by road to Douala for export. There are coffee-processing plants in the area and a chocolate factory at Koutaba, several miles west. Foumban is served by an airfield, a hospital, and a customs station. Pop. (1985 est.) 50,120.

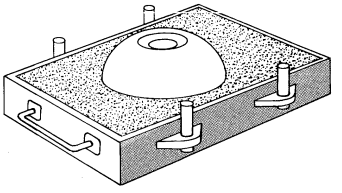
foundation, philanthropic: *see* philanthropic foundation.

founder principle, in genetics, the principle whereby a daughter or migrant population may differ in genetic composition from its parent population because the original founders of the daughter population were not a representative sample of the parent population. For example, if there were a town in which some of the inhabitants were blue-eyed and some brown-eyed, and if because of a bad winter or a religious dispute a small group of these people, who all happened to be blue-eyed, decided to move away and found their own town, then their descendants in the new town would all be blue-eyed and in this respect would differ from the inhabitants of the old town. Some similar case may account for the fact that the American Indians have no blood type B in the ABO system, although the Mongoloid geographical race, from which the American Indians presumably derived, has blood type B.

founding, the process of pouring molten metal into a cavity that has been molded according to a pattern of the desired shape. When the metal solidifies, the result is a casting—a metal object conforming to that shape. A great variety of metal objects are so molded at some point during their manufacture.

The most common type of mold is made of sand and clay; ceramics, sand with cement, metals, and other materials are also used for molds. These materials are packed over the face of the pattern (usually made of wood, metal, or resin) that forms the cavity into which the molten metal is to be poured. The pattern is removed from the mold when its shape is able to be retained by the mold material. Molds are usually constructed in two halves, and the two halves are joined together once the pattern has been removed from them. Pins and bushings permit precise joining of the two halves, which together are enclosed in a mold box. The metal is then poured into the mold through special gates and is distributed by runners to different areas of the casting. The mold must be strong enough to resist the pressure of the molten metal and sufficiently permeable to permit the escape of air and other gases from the mold cavity; otherwise, they would remain as holes in the casting. The mold material must also resist fusion with the molten metal, and the sand at the mold surface must be closely packed to give a smooth casting surface.

The making of patterns for foundries requires care and skill. Patterns are uniformly larger than the desired casting in order to compensate for shrinkage during drops of temperature and the liquid-to-solid phase change. Polystyrene foam patterns remain in the mold and evaporate upon contact with the poured metal; wax patterns are melted out of the mold prior to the pouring of the molten metal. Metal molds are used in that type of founding known as die-casting (*q.v.*). Often a hollow space is desired within the casting; in this case a core of fine sand is placed in one of the mold halves. Core boxes made of wood, metal, or resin are also used in this regard.



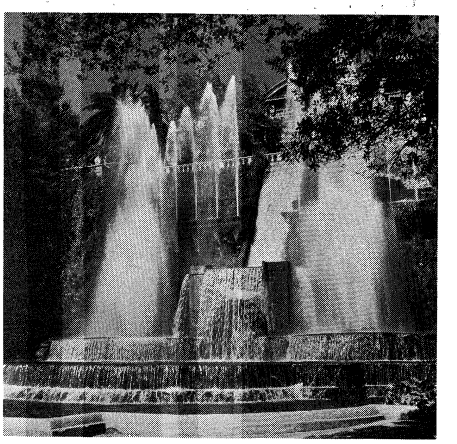
Mold box containing mold material and pattern

Modern foundries capable of large-scale production are characterized by a high degree of mechanization, automation, and robotics, and microprocessors allow for the accurate control of automated systems. Advances in chemical binders have resulted in stronger molds and cores and more accurate castings. Accuracy and purity are increased in vacuum conditions, and further advances are expected from zero-gravity casting in space.

fountain, in landscape architecture, an issue of water controlled or contained primarily for purposes of decoration, especially an artificially produced jet of water or the structure from which it rises.

Fountains have been an important element in the design of gardens and public spaces since ancient times. An early example is preserved in the carved Babylonian basin (*c.* 3000 BC) found at Tello, the ancient Lagash in Mesopotamia. An Assyrian fountain discovered in the gorge of the Comel River consists of basins cut in solid rock and descending in steps to the stream. Small conduits led the water from one basin to the other, the lowest of which was ornamented by two rampant lions in relief.

Greek. During the Aegean civilization, as in later Hellenic Greece, springs were frequently considered sacred and shrines were built around them, the water often emerging into artificial basins. In historic Greece, more



Water organ, Villa d'Este, Tivoli, Italy
O'Reilly—APA

highly developed fountains existed; both literary references and excavated remains abound. Some were surrounded by columns, as at Lerna. The city of Corinth was noted for its fountains, particularly the spring dedicated to the nymph Pirene. Greek fountains were utilitarian as well, being provided with ample draw basins and reservoir supply and often shaded by a portico.

Roman. In Roman civilization, water was distributed from each terminal reservoir, or *castellum,* to baths and large houses as well as to many public fountains that supplied the bulk of the population. Examples uncovered at Pompeii illustrate both types, the more decorative courtyard fountain of the aristocratic house and the utilitarian public-street fountain. The latter consisted of a simple rectangular stone basin with a small pedestal above it carved with a human or animal head from whose mouth water flowed. The lip of the basin was notched for overflow.

In addition to the above types, the Romans developed the nymphaeum, a purely decorative type of fountain that originated in Hellenistic times. Roman nymphaea became monumental pleasure houses, often in the shape of an exedra covered by a half dome. The details of the fountain proper varied from multiple-basis arrangements to the jet of water issuing from a sculptured figure.

In early Christian times, fountains were placed in the atrium court of the Christian basilica as symbols of purification—*e.g.,* Old St. Peter's, Rome. Similar courtyard fountains continued to be used in the monasteries of western Europe and the Byzantine Empire (*e.g.,* Cluny; Vatopedi on Mount Althos).

Medieval European. In the early Middle Ages in Europe, ornamental and architectural treatment of fountains passed out of use; wells furnished the greater part of the necessary water. From the 12th century, however, public fountains began to reappear, and the spring fountains received architectural treatment. The usual form of the latter consisted of a large basin reached by a descending stairway and covered over with a vault, sometimes enclosed and sometimes supported only on piers. The public fountains of the medieval towns usually had a polygonal or circular basin, occasionally lobed, in the centre of which rose a column or pier carrying a series of spouts. The architectural details are of infinite variety. Fountains were a peculiar feature of the communal building activities of the late Middle Ages, often commissioned by guilds. Few of these survive. A noteworthy example is the Schöne Brunnen at Nürnberg (1398), distinguished by its high, rich Gothic spirelet with many statues and ironwork railing.

The late Middle Ages developed decorative table fountains as extravagant toys. Also, contemporary Byzantine court versions of table fountains running with spiced wines are

recorded. Unfortunately no examples of this type have survived.

Islāmic. The fountains of Muslim countries are of great importance, especially the public drinking fountains, called sebeels. They are an institution in the East. A common type is the simple spout and basin enclosed within a graceful niche. The more ambitious designs take the form of a richly decorated pavilion.

Renaissance and Baroque. The Renaissance in Italy began a new phase of fountain design in which sculpture became prominent. A common type was a sequence of circular or polygonal basins on a vertical support topped by a fountain figure from which water spouted. Leonardo da Vinci designed fountains. During the following period of the Italian Baroque, fountains became complex compositions of basins, sculpture, and water display. Rome is noted for its many fountains of baroque design, notably the Fountain of the Rivers (1648–51) in the Piazza Navona by Giovanni Bernini and the Trevi fountain (completed 1762) by Niccolo Salvi. Such fountains dramatized the rebuilding of the city, its piazzas, and its churches, done under papal direction.

In addition to these public fountains, the Italian development included an enormous number of original villa garden fountains of spectacular and sometimes amusing designs. Trick effects were made possible by elaborate mechanical devices. For example, the water organ at the Villa d'Este, Tivoli (1549), played only when certain pavement stones were stepped on. The hillside location of most villas was utilized, upper fountains supplying the lower ones in turn, as at the Villa d'Este and the cascade at Villa Aldobrandini, Frascati.

Italian precedent set the design for monumental civic fountains and for ornamental garden fountains in northern and western Europe.

An early example of an ornamental fountain in France is the Fountain of the Innocents (1550) in Paris by Jea Goujon, an original work that does not follow Italian models. The Medici fountain in the Luxembourg Garden in Paris by Salomon de Brosse is a fine example of the niche type. The most spectacular and ambitious fountains in France are those of Versailles, part of the vast garden complex designed by André Lenôtre (1661). Large reflecting pools were part of the axial scheme, and fireworks often accompanied the fountain display. Hardly secondary to the artistic achievement was the engineering feat of supplying water in volume and pressure to run the numerous fountains at Versailles. Purely ornamental fountains continued to be popular in the 18th century as focal points for civic design in large cities and as decoration for royal palaces and country seats.

Modern. Chatsworth in England was noted for its fountains designed by Sir Joseph Paxton in the 19th century, especially the single jet of water 260 ft (80 m) high issuing from a formal reflecting pool. Elsewhere at Chatsworth, a false willow tree of copper rained water on the unsuspecting beneath its branches.

In the 19th and 20th centuries fountains did not lose their popularity, although quality and imagination is less evident. Expositions have provided occasion for ambitious fountain displays. Among the many examples are the Crystal Palace at Sydenham, London; the World's Columbian Exposition at Chicago, Ill. (1893), and the New York World's Fair of 1939. At the Festival of Britain, London (1951), a mobile water sculpture composed of pivotted receptacles was set in motion by changing points of gravity. When each receptacle was filled, it would overturn only to right itself and be filled again with water from above. Of permanent fountains, a fine modern example, although derivative in design, is the Buckingham Memorial Fountain in Chicago (1927) by Jacques Lambert.

fountain moss: *see* water moss.

Fouqué, Friedrich Heinrich Karl de La Motte, Baron (b. Feb. 12, 1777, Brandenburg—d. Jan. 23, 1843, Berlin), German novelist and playwright remembered chiefly as the author of the popular fairy tale *Undine* (1811).

Fouqué, detail from an engraving by F. Fleischmann after a painting by W. Hensel, 1818
Historia-Photo

A descendant of French aristocrats, Fouqué in his writings expressed heroic ideals of chivalry designed to arouse a sense of German tradition and national character in his contemporaries during the Napoleonic era. His ideas, based on the view of linguistic development first conceived by the philosopher J.G. Fichte, stressed the influence of the mother tongue in shaping the mind.

A prolific writer, Fouqué gathered much of his material from Scandinavian sagas and myths. His dramatic trilogy, *Der Held des Nordens* (1808–10; "Hero of the North"), is the first modern dramatic treatment of the Nibelung story and a precedent for the later dramas of Friedrich Hebbel and the operas of Richard Wagner. His most lasting success, however, has been the story of Undine, a water sprite who marries the knight Hildebrand to acquire a soul and thus become human but who later loses this love to the treacheries of her uncle Kuhleborn and the lady Berthulda. Although Fouqué's works were at first enthusiastically received, after 1820 they rapidly passed out of fashion. Fouqué died in poverty after belated recognition by Frederick William IV.

Fouquet, Charles (-Louis-Auguste): *see* Belle-Isle, Charles (-Louis-Auguste) Fouquet de, duc de Gisors.

Fouquet, Jean (b. *c.* 1420, Tours, Fr.—d. *c.* 1481, Tours), preeminent French painter of the 15th century.

"Joshua and the Fall of Jericho" from Flavius Josephus' *Antiquités judaïques,* manuscript illuminated by Jean Fouquet, *c.* 1474; in the Bibliothèque Nationale, Paris (Ms. Fr. 247)
By courtesy of the Bibliotheque Nationale, Paris

Little is known of Fouquet's early life, but his youthful work suggests that he was trained in Paris under the Bedford Master. His portrait of Charles VII (*c.* 1447; Louvre, Paris), though a panel painting, displays the use of brittle, incisive line characteristic of miniature painting. This work must have helped to establish his international reputation for, before 1447, he executed in Rome the portrait of Pope Eugenius IV. While in Italy he absorbed the progress that such painters as Masaccio, Fra Angelico, and Piero della Francesca had made in the handling of central perspective and foreshortening and in the rendering of volume.

Upon his return to Tours, Fouquet created a new style, combining the experiments of Italian painting with the exquisite precision of characterization and detail of Flemish art. For the royal secretary and lord treasurer, Étienne Chevalier, he executed between 1450 and 1460 his most famous works: a large *Book of Hours* with about 60 full-page miniatures, 40 of which are among the great treasures of the château of Chantilly; and the diptych from Notre Dame at Melun (*c.* 1450) with Chevalier's portrait (Staatliche Museen Preussischer Kulturbesitz, Berlin) on one panel and a Madonna with the features of Agnès Sorel, the King's mistress (Musée Royal des Beaux-Arts, Antwerp), on the other. Also to this period of the reign of Charles VII belong the two richly illuminated manuscripts of a French translation of Boccaccio's *De casibus virorum illustrium* ("On the Fates of Famous Men") and *De claris mulieribus* ("On Famous Women"), *Cas des nobles hommes et femmes malheureux* (1458, Bayerische Staatsbibliothek, Munich), and a copy of the *Grandes Chroniques de France* (Bibliothèque Nationale, Paris); and finally, the large altarpiece of the "Pietà" discovered in the church at Nouans, his only monumental painting.

In 1469 King Louis XI founded the Order of St. Michael, and Fouquet illuminated the statutes of the order (Bibliothèque Nationale, Paris). In 1474 he worked with the sculptor Michel Colombe on the design of the King's tomb and in the following year received the official title of royal painter. About the same time he completed the illustration of two volumes of a French translation of Josephus' *Antiquities of the Jews* (Bibliothèque Nationale, Paris), in which he broadened the range of miniature painting to include vast panoramas of architecture and landscape, making brilliant use of aerial perspective and colour tonality to achieve compositional unity. Fouquet's work consistently displays clear, dispassionate observation rendered with intricate delicacy and alternates accurate perspective with a flat, non-illusionistic sense of space.

Fouquet, Nicolas, Fouquet also spelled FOUCQUET (b. 1615, Paris—d. March 23, 1680, Pignerol, Fr.), French finance minister in the early years of the reign of Louis XIV, the last *surintendant* (as opposed to *contrôleur général*), whose career ended with his conviction for embezzlement.

Born the son of a wealthy shipowner and royal administrator, Fouquet was a supporter of the powerful Cardinal Mazarin and of the royal government during the turmoil of the Fronde (1648–53). He purchased the post of *procureur général* to the Parlement of Paris in 1650, and in 1653 he was appointed *surintendant des finances.* To aid Mazarin, who in return upheld him, Fouquet lent considerable sums to the treasury, making himself, in effect, banker to the King; his numerous financial operations, which he conducted in an irregular way (though not contrary to the usage of the times), made him extremely rich.

After Mazarin's death (March 1661), Jean-

Baptiste Colbert, Mazarin's personal *intendant* and closest confidant, sought to succeed Fouquet as finance minister by destroying his reputation with the King. Colbert revealed irregularities in Fouquet's accounts and denounced the financial operations by which he had enriched himself. Fouquet was arrested in September 1661, and his trial, which lasted three years, excited great public interest. Colbert suppressed the papers that would have proved Mazarin's personal responsibility for many of the financial transactions in question, but Fouquet defended himself cleverly, and public opinion turned in his favour. On Dec. 20, 1664, he was condemned to banishment,

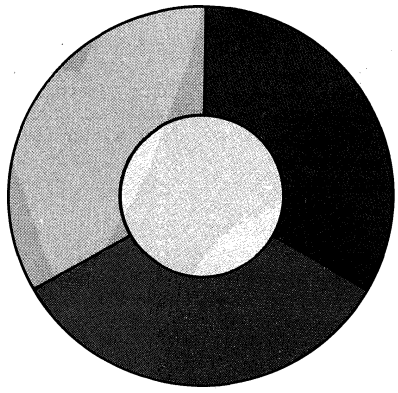
Fouquet, engraving by R. Nanteuil, 1661
By courtesy of the Bibliotheque Nationale, Paris

but Louis XIV "commuted" the sentence to life imprisonment. Fouquet was taken to the fortress of Pignerol, where he died just before a measure of clemency could be issued.

Fouquier-Tinville, Antoine-Quentin (b. June 10, 1746, Hérouel, Picardy, Fr.—d. May 7, 1795, Paris), French Revolutionary lawyer who was public prosecutor of the Revolutionary Tribunal during the Reign of Terror.

A friend and relative of the journalist Camille Desmoulins, Fouquier-Tinville early supported the Revolution and rose from minor legal offices to the rank of assistant public prosecutor of the criminal tribunal in Paris (1793). In March 1793 he was appointed public prosecutor of the Revolutionary Tribunal, and he became a dominant figure during the Reign of Terror. Hardworking and ruthless, he claimed to have prosecuted more than 2,400 counterrevolutionaries, including Marie-Antoinette, Desmoulins, the Girondins, and the Hébertists. After Robespierre's fall from power, the Thermidorians tried Fouquier-Tinville and sentenced him to the guillotine. In his unsuccessful trial defense, Fouquier-Tinville denied any personal acts of violence and claimed that he had merely obeyed the orders of the Revolutionary government's committees.

four-colour map problem, problem in topology, originally posed in the early 1850s and not solved until 1976, that required finding the minimum number of different colours required to colour a map such that no two adjacent regions (*i.e.,* with a common boundary segment) are of the same colour. Three colours are not enough, as can be seen in a map of four regions with each region contacting three other regions. It had been proved mathematically that five colours will always suffice; and no map had ever been found empirically on which four colours would not do. As is often the case in mathematics, consideration of the problem provided the impetus for the discovery of related results in topology and combinatorics. A similar problem had been solved for the seemingly more complicated situation of a map drawn on a torus (doughnut-shaped surface), where seven colours were known to be the minimum.



Four-colour map problem

The four-colour problem was solved in 1976 by a group of mathematicians at the University of Illinois, directed by Kenneth Appel and Wolfgang Haken, which after four years had completed an unprecedented synthesis of computer search and theoretical reasoning.

Appel and Haken created a catalog of 1,936 "unavoidable" configurations that must be present in any graph, no matter how large. Then they showed how each of these configurations could be reduced to a smaller one so that, if the smaller one could be coloured with four colours, so could the original catalog configuration. Thus, if there were a map that could not be coloured with four colours, they could use their catalog to find a smaller map that also could not be four-coloured, and then a smaller one still, and so on. Eventually this reduction process would lead to a map with only three or four regions that, supposedly, could not be coloured with four colours. This absurd result, which is derived from the hypothesis that a map requiring more than four colours might exist, leads to the conclusion that no such map can exist. All maps are in fact four-colourable.

The strategy involved in this proof dates back to 1879 when the British mathematician A.B. Kempe produced a short list of unavoidable configurations and then showed how to reduce each to a smaller case. Appel and Haken replaced Kempe's brief list with their catalog of 1,936 cases, each involving up to 500,000 logical options for full analysis. Their complete proof, itself several hundred pages long, required more than 1,000 hours of computer calculations.

four-eyed fish, either of two species of tropical American river fishes of the genus *Anableps* (family Anablepidae, order Atheriniformes). Four-eyed fishes are surface dwellers and have eyes adapted for seeing both above and below the water surface. The eyes are on top of the head, and each is divided into two parts, an upper half for vision in air, and a lower half for vision in water; hence, the common name. The fish grow to a maximum length of about 30 centimetres (one foot).

four-footed butterfly: *see* brush-footed butterfly.

Four Freedoms, a formulation of worldwide social and political objectives by U.S. President Franklin D. Roosevelt in the State of the Union message he delivered to Congress on Jan. 6, 1941. Roosevelt stated these freedoms to be the freedom of speech and expression, the freedom of every person to worship God in his own way, the freedom from want, and the freedom from fear. Roosevelt called for ensuring the latter through "a world-wide reduction of armaments to such a point and in such a thorough fashion that no nation will be in a position to commit an act of physical aggression against any neighbor—anywhere in the world."

4-H Club, one of an organization of clubs for youth aged 10 to 21 who engage in programs of "learning by doing." The clubs are found principally in the United States and Canada, though some 80 other nations have adopted the idea. The 4-H Club emblem is the four-leaf clover with the letter H on each leaf; the club colours are green and white. The name 4-H is suggested in the pledge:

I pledge
My Head to clearer thinking,
My Heart to greater loyalty,
My Hands to larger service, and
My Health to better living, for
My Club, my Community, and my Country.

The clubs originated among rural youth in the United States in the early years of the 20th century, the name 4-H Club being generally accepted by 1924. Adult supervisors in the United States are recruited and trained by the extension services of the land-grant colleges and universities, as well as the U.S. Department of Agriculture and county governments, which cooperate under provisions of the Smith-Lever Act of 1914 and subsequent acts of Congress and the state legislatures.

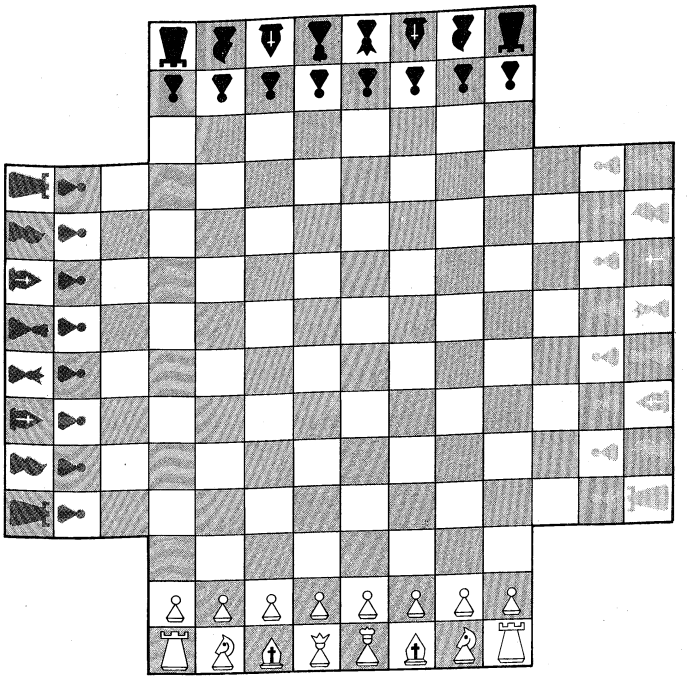
Four-H clubs are no longer limited to rural youth; enrollment is approximately 50 percent farm, 30 percent rural nonfarm, and 20 percent urban. Each local club—they vary in size but average 24 members—elects its own officers and plans and carries on its program with the guidance and instruction of one or more adult leaders, assisted by junior leaders. More than 50 different projects may be undertaken by 4-H members. For example, among agricultural activities that may be carried on in accordance with recognized approved practices are growing a field crop; raising a garden or a flock of poultry; purchasing, breeding, and caring for a sow and her litter of pigs; raising a dairy calf to maturity and building a dairy herd; feeding and fattening for market one or more beef steers; or running and maintaining tractors and other farm machinery. Typical projects developed for urban as well as rural youngsters are automotive care and safety; dog care and training; electrical and electronic work; indoor gardening; operation of power lawn equipment; and safety work. Projects in home economics include such basic activities as food preparation, sewing, and home furnishing.

A major annual event in the United States is the National 4-H Club Congress, to which members are named delegates as rewards for outstanding records of achievement in 4-H Club work. This event is conducted jointly by the cooperative extension service and the National Committee on Boys and Girls Club Work, Inc. The committee, which publishes *National 4-H News*, a monthly magazine, and provides incentives for meritorious 4-H work, is a privately supported voluntary group of citizens, incorporated not for profit.

Four-Handed Chess, board game, a variant of Chess played by four people in partnerships of two. The pieces generally move as in conventional Chess. Partners do not capture each other's pieces but do take those of their opponents and attempt to checkmate both opposing Kings.

In one form of the game, a conventional board is used, with each player controlling a King, Bishop, Knight, Rook, and four Pawns. The pieces begin in the corners of the board, with partners diagonally opposite one another. When one partner loses his King, the other takes command of his remaining forces. Play is roughly similar to that of Shaturanga, an ancient Indian predecessor of Chess.

In another form of the game, a special 160-



Four-Handed Chess

square board is used (a conventional board with three-row extensions of all four sides). Each player has a complete set of chessmen, and players on opposite sides of the board are partners. Pawns move one square only at all times, reverse direction upon reaching the allied last rank, and become Queens upon reaching an opponent's last rank (by capturing). A player must aid his partner's King, if it is threatened. If he cannot, the King may be removed and its companion pieces joined in defense of the partnership's remaining King. In another version, when a player is checkmated, his partner continues alone without the aid of the other's pieces, although they may not be captured or moved. If the checkmate is relieved, the player and his pieces may return to the game.

Four Horsemen, name given by the sportswriter Grantland Rice to the backfield of the University of Notre Dame's undefeated football team of 1924: Harry Stuhldreher (quarterback), Don Miller and Jim Crowley (halfbacks), and Elmer Layden (fullback). Supported by the Seven Mules and coached by Knute Rockne, they gained enduring football fame when the nickname appeared in Rice's report in the *New York Herald Tribune* describing Notre Dame's 13–7 victory over Army on Oct. 18, 1924. A photograph of the four, dressed in football uniforms and mounted on horses, caught the fancy of fans. The Four Horsemen and their teammates lost only 2 of 30 games played from 1922 to 1924.

The Four Horsemen:
(Left to right) Don Miller, Elmer Layden, Jim Crowley, and Harry Stuhldreher

By courtesy of the University of Notre Dame Sports Information Department

Four Masters of Anhwei, group of Chinese artists who were born and worked in Anhwei (also An-hui, or Hsin-an) Province in the 17th century (Ch'ing dynasty) and who, being somewhat remote from the traditional centres of Chinese painting, developed rather unusual styles. The Four Masters are generally identified as the little-known artists Sun

"The Coming of Autumn," hanging scroll by Hung-jen (1610–63), one of the Four Masters of Anhwei, Ch'ing dynasty, ink on paper; in the Honolulu Academy of Arts

Wilhelmina Tenney Memorial Collection, Honolulu Academy of Arts

I and Wang Chih-jui, and the famous artists Hung-jen (*q.v.*) and Ch'a Shih-piao. Two other well-known artists of Anhwei Province—Hsiao Yün-ts'ung and Mei Ch'ing—are often substituted for the former two artists. The landscape paintings of the masters of Anhwei Province often depict the somewhat peculiar landscape features of the province—especially Huang Shan (Yellow Mountain). Their style is commonly quite spare and even brittle, revealing a certain similarity to the reticent style of the 14th-century painter Ni Tsan (*q.v.*), one of a group of painters known as the Four Masters of the Yüan Dynasty (*q.v.*).

Four Masters of the Yüan Dynasty, Chinese painters who worked during the Yüan period (1206–1368) and were revered in the Ming dynasty and later as major exponents of the tradition of "literati painting" (*wen-jen-hua*; *[q.v.]*), which was concerned more with individual expression and learning than with outward representation and immediate visual appeal.

"A Quiet Life in a Wooded Glen," hanging scroll by Wang Meng (1308–85), one of the Four Masters of the Yüan Dynasty, ink and colour on paper; in the Art Institute of Chicago

By courtesy of the Art Institute of Chicago, Kate S. Buckingham Collection

Two of the Four Masters were Huang Kung-wang and Wu Chen (*qq.v.*), who, being of the earlier generation of artists in the Yüan, more consciously emulated the work of ancient masters, especially those pioneering artists of the Five Dynasties period such as Tung Yüan and Chü-jan (*q.v.*), who rendered landscape in a broad, almost Impressionistic manner, with coarse brushstrokes and wet ink washes. While these painters were also revered by the two younger Yüan masters, the restrained thinness of Ni Tsan (*q.v.*) and the almost embroidered richness of Wang Meng (*q.v.*) could not be more different from the work of the older Yüan masters.

Thus, with the Four Masters, all of whom were noted for their lofty personal and aesthetic ideals, the art of landscape painting shifted from an emphasis on close representation of nature to a personal expression of nature's qualities, with a new attention to the vocabulary of brush manipulation.

Four Noble Truths, Pāli CATTĀRI-ARIYA-SACCĀNI, Sanskrit CATVĀRI-ĀRYA-SATYĀNI, the essence of Buddhist religious doctrine, expounded by Gautama Buddha in his first sermon at the deer park near Benares (Vārānasi), India, shortly after his having attained Enlightenment. The four truths are: (1) that existence is suffering (*dukkha*); (2) that this suffering has a cause (*samudaya*); (3) that it can be suppressed (*nirodha*); and (4) that there is a way (*magga*) to accomplish this, the noble Eightfold Path (*q.v.*).

These four truths are universally recognized by Buddhist schools. The causes of suffering are expressed in a formula of 12 interdependent stages (the *paṭicca-samuppāda*) that form an infinitely repeating cycle of coming and becoming. The breaking of this cycle constitutes freedom from rebirth and the cessation of suffering.

four-o'clock, also called MARVEL-OF-PERU, or BEAUTY-OF-THE-NIGHT (*Mirabilis jalapa*), ornamental perennial plant, of the family Nyctaginaceae, native to tropical America. Four-o'clock is a quick-growing species up to one metre (three feet) tall, with oval leaves on short leafstalks. The stems are swollen at the joints. The plant is called four-o'clock because its flowers, from white and yellow to shades

Four-o'clock (*Mirabilis jalapa*)
A to Z Botanical Collection—EB Inc.

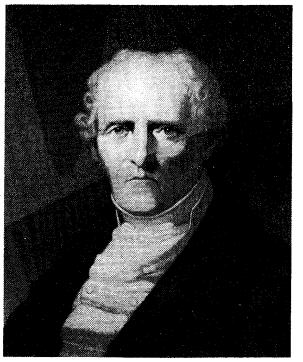
of pink and red, sometimes streaked and mottled, open in late afternoon (and close by morning).

Four Wangs, Chinese landscape painters, members of the group known as the Six Masters of the early Ch'ing period (*q.v.*).

Fourdrinier machine, device for producing paper, paperboard, and other fibreboards, consisting of a moving endless belt of wire or plastic screen that receives a mixture of pulp and water and allows excess water to drain off, forming a continuous sheet for further drying by suction, pressure, and heat. Calenders (rollers or plates) smooth the paper or board and impart gloss or other desired finish to the surface. The first machine to produce a continuous web (roll), the Fourdrinier machine was invented in France in 1799 by Louis Robert and was subsequently improved in England, where it was patented by Henry and Sealy Fourdrinier.

Fourier, (François-Marie-)Charles (b. April 7, 1772, Besançon, Fr.—d. Oct. 10, 1837, Paris), French social theorist who advocated a reconstruction of society based on communal associations of producers known as phalanges (phalanxes). His system came to be known as Fourierism.

While working as a clerk in Lyon, Fourier wrote his first major work, *Théorie des quatre mouvements et des destinées générales* (1808; *The Social Destiny of Man; or, Theory of the*



Charles Fourier, engraving by Samuel Sartain after a painting by Jean-François Gigoux
Culver Pictures

Four Movements, 1857). He argued that a natural social order exists corresponding to Newton's ordering of the physical universe and that both evolved in eight ascending periods. In harmony, the highest stage, man's emotions would be freely expressed. That stage could be created, he contended, by dividing society into phalanges.

The phalange, in Fourier's conception, was to be a cooperative agricultural community bearing responsibility for the social welfare of the individual, characterized by continual shifting of roles among its members. He felt that phalanges would distribute wealth more equitably than under capitalism and that they could be introduced into any political system, including a monarchy. The individual member of a phalange was to be rewarded on the basis of the total productivity of the phalange.

After inheriting his mother's estate in 1812, Fourier was able to devote himself exclusively to writing and refined his theories in *Traité de l'association agricole domestique* (1822; "Treatise on Domestic Agricultural Association") and *Le Nouveau Monde industriel* (1829–30; "The New Industrial World"). His emphasis on adapting society to human needs and on the wastefulness of the competitive capitalist system foreshadowed the ideas of Karl Marx.

Cooperative settlements based on Fourier's ideas were started in France and especially the U.S., among which the best known were the short-lived Brook Farm in Massachusetts (1841–46) and the North American Phalanx at Red Bank, N.J.

Fourier, (Jean-Baptiste-)Joseph, Baron (b. March 21, 1768, Auxerre, Fr.—d. May 16, 1830, Paris), French mathematician, known

Joseph Fourier, lithograph by Jules Boilly, 1823; in the Académie des Sciences, Paris
Giraudon—Art Resource/EB Inc.

also as an Egyptologist and administrator, who exerted strong influence on mathematical physics through his *Théorie analytique de la chaleur* (1822; *The Analytical Theory of Heat*). He showed how the conduction of heat in solid bodies may be analyzed in terms of infinite mathematical series now called by his name, the Fourier series. Far transcending the particular subject of heat conduction, his work stimulated research in mathematical physics, which has since been often identified with the solution of boundary-value problems, encompassing many natural occurrences such as sunspots, tides, and the weather. His work also had a great influence on the theory of functions of a real variable, one of the main branches of modern mathematics.

Fourier, the son of a tailor, first attended the local military school conducted by Benedictine monks. He showed such proficiency in mathematics in his early years that he later became a teacher in mathematics at the same school. The ideals of the French Revolution then swept him into politics, and more than once his life was in danger. When the École Normale was founded in 1794 in Paris, he was among its first students, and, in 1795, he became a teacher there. The same year, after the École Polytechnique was opened, he joined its faculty and became a colleague of Gaspard Monge and other mathematicians.

In 1798, with Monge and others, Fourier accompanied Napoleon on his expedition to Egypt. Until 1801 he was engaged in extensive research on Egyptian antiquities, gave advice on engineering and diplomatic undertakings, and served for three years as the secretary of the Institut d'Égypte, which Napoleon established in Cairo in 1798.

After his return to France, Fourier was charged with the publication of the enormous mass of Egyptian materials. This became the *Description de l'Égypte,* to which he also wrote a lengthy historical preface on the ancient civilization of Egypt. He was also appointed prefect (administrator for the national government and *département*) of the Isère *département,* a position he held from 1802 to 1814, with his headquarters at Grenoble. He showed great administrative ability, as in directing the drainage of swamps, while continuing his Egyptological and mathematical work. In 1809 Napoleon made him a baron. Following Napoleon's fall from power in 1815, Fourier was appointed director of the Statistical Bureau of the Seine, allowing him a period of quiet academic life in Paris. In 1817 he was elected to the Académie des Sciences, of which, in 1822, he became perpetual secretary. Because of his work in Egyptology he was elected in 1826 to the Académie Française and the Académie de Médecine.

Fourier began his work on the *Théorie analytique de la chaleur* in Grenoble in 1807 and completed it in Paris in 1822. His work enabled him to express the conduction of heat in two-dimensional objects (*i.e.,* very thin sheets of material) in terms of the differential equation

$$\frac{\partial u}{\partial t} = k\left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right]$$

in which u is the temperature at any time t at a point (x, y) of the plane and k is a constant of proportionality called the diffusivity of the material. The problem is to find the temperature, for example, in a conducting plate, if at time $t = 0$, the temperature is given at the boundary and at the points of the plane. For the solution of such problems in one dimension, Fourier introduced series with sines and cosines as terms:

$$y = \tfrac{1}{2}a_0 + (a_1 \cos x + b_1 \sin x) + (a_2 \cos 2x + b_2 \sin 2x) + \cdots$$

Such Fourier series, already occasionally used by Leonhard Euler and other 18th-century

mathematicians, but somewhat distrusted, received through Fourier their important position in modern mathematics. He also extended this concept into the so-called Fourier integral. Doubts of the validity of the Fourier series, which led later mathematicians to a fundamental renewal of the concept of real function, were resolved by P.G.L. Dirichlet, Bernhard Riemann, Henri Lebesgue, and others.

Fourier worked on the theory almost his entire life. He was also interested in the determination of roots of algebraic equations (the so-called theorem of Fourier). (D.J.S.)

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Biography. I. Grattan-Guinness, *Joseph Fourier, 1768–1830* (1972), is a magnificent study dealing with Fourier's mathematical physics and includes an exhaustive bibliography.

Fourier transform, in mathematics, a particular integral transform. As a transform of an integrable complex-valued function f of one real variable, it is the complex-valued function $\hat{f}$ of a real variable defined by the following equation

$$\hat{f}(\xi) = (2\pi)^{-1/2} \int_{-\infty}^{\infty} e^{-ix\xi} f(x)\, dx.$$

In the integral equation

$$f(y) = \int_{-\infty}^{\infty} K(x,y)\, F(x)\, dx,$$

the function $f(y)$ is an integral transform of $F(x)$, and $K(x,y)$ is the kernel. Often the reciprocal relationship is valid:

$$F(y) = \int_{-\infty}^{\infty} K'(x,y)\, f(x)\, dx.$$

See integral transform.

Fourierism, philosophy of social reform developed by the French social theorist Charles Fourier that advocated the transformation of society into self-sufficient, independent "phalanges" (phalanxes). One of several utopian socialist programs to emerge in the second quarter of the 19th century, Fourierism was transplanted to the United States by Albert Brisbane, who renamed it "Associationism."

Brisbane's ideas were popularized by Horace Greeley in the pages of the *New York Tribune,* and shortly thereafter a number of communal groups—phalanxes—were established. The best known was Brook Farm (*q.v.*), near Boston, founded by George Ripley in 1841. Brook Farm lasted until 1847, but the average duration of the nearly 50 other phalanxes in the United States was just two years.

Based on an agrarian-handicraft economy, the phalanx consisted of about 1500 people. Work was voluntary and goods produced were the property of the phalanx. But members were paid an hourly wage (the scale escalating according to the disagreeableness of the task), and private property and inheritance were permitted. Fourier's premise was that people could live harmoniously in a state of nature, free of government intervention. Transcendentalists found much to admire in Fourierism, and true believers predicted that eventually the entire world would be organized into phalanxes.

Fourneyron, Benoît (b. Oct. 31, 1802, Saint-Étienne, Fr.—d. July 31, 1867, Paris), French inventor of the water turbine.

The son of a mathematician, he graduated in the first class of the new Saint-Étienne engineering school in 1816. While working in the ironworks at Le Creusot, he studied a proposal advanced by his former professor, Claude Burdin, for a new type of waterwheel that Burdin named a "turbine." Though neither the Academy of Sciences nor the Society for the Encouragement of Industry accepted Burdin's paper, Fourneyron recognized its importance and undertook its realization. He built in 1827 a small, six-horsepower unit in which water was directed outward from a central source onto blades or vanes set at angles in a rotor.

By 1837 Fourneyron had produced a turbine capable of 2,300 revolutions per minute, 80 percent efficiency, and 60 horsepower, with a wheel a foot in diameter and weighing only 40 pounds (18 kilograms). Besides its more obvious advantages over the waterwheel, Fourneyron's turbine could be installed as a horizontal wheel with a vertical shaft. It achieved immediate international success, powering industry in continental Europe and in the United States, notably the New England textile industry. But the real significance of the invention did not emerge until 1895, when Fourneyron turbines were installed on the American side of Niagara Falls to turn generators for electric-power production.

Fourneyron perceived the potential of steam-driven turbines, but his attempts to make a satisfactory steam turbine were thwarted by the inadequacy of available materials and workmanship.

Fournier, Henri-Alban: *see* Alain-Fournier.

Fournier, Jacques (pope): *see* Benedict XII.

Fournier, Pierre-Simon (b. Sept. 15, 1712, Paris—d. Oct. 8, 1768, Paris), French engraver and typefounder particularly noted for decorative typographic ornaments reflecting the Rococo spirit of his day.

Trained as an artist, at 17 he went to work in a typefoundry, where he learned to cut punches and to engrave ornaments. He set up his own typefoundry in Paris in 1736. He designed many new characters, and the fame of his foundry spread beyond his native France. His *Table des proportions qu'il faut observer entre le caractères* (1737) was followed by several other technical treatises, including *Modèles de caractères* (1742), which presented his entire range of typefaces. His principal work is *Manuel typographique* (2 vol., 1764–66), the first volume of which deals with punch cutting and typefounding; the second is devoted largely to type specimens, with many pages of ornaments.

Foursquare Gospel, International Church of the: *see* International Church of the Foursquare Gospel.

Fourteen Points (Jan. 8, 1918), declaration by U.S. Pres. Woodrow Wilson during World War I outlining his proposals for a postwar peace settlement.

On Jan. 8, 1918, President Wilson, in his address to the joint session of the United States Congress, formulated under 14 separate heads his ideas of the essential nature of a post-World War I settlement. The text of the Fourteen Points is as follows:

1. Open covenants of peace, openly arrived at, after which there shall be no private international understandings of any kind but diplomacy shall proceed always frankly and in the public view.

2. Absolute freedom of navigation upon the seas, outside territorial waters, alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants.

3. The removal, so far as possible, of all economic barriers and the establishment of an equality of trade conditions among all the nations consenting to the peace and associating themselves for its maintenance.

4. Adequate guarantees given and taken that national armaments will be reduced to the lowest point consistent with domestic safety.

5. A free, open-minded, and absolutely impartial adjustment of all colonial claims, based upon a strict observance of the principle that in determining all such questions of sovereignty the interests of the populations concerned must have equal weight with the equitable claims of the government whose title is to be determined.

6. The evacuation of all Russian territory and such a settlement of all questions affecting Russia as will secure the best and freest coöperation of the other nations of the world in obtaining for her an unhampered and unembarrassed opportunity for the independent determination of her own political development and national policy and assure her of a sincere welcome into the society of free nations under institutions of her own choosing; and, more than a welcome, assistance also of every kind that she may need and may herself desire. The treatment accorded Russia by her sister nations in the months to come will be the acid test of their good will, of their comprehension of her needs as distinguished from their own interests, and of their intelligent and unselfish sympathy.

7. Belgium, the whole world will agree, must be evacuated and restored, without any attempt to limit the sovereignty which she enjoys in common with all other free nations. No other single act will serve as this will serve to restore confidence among the nations in the laws which they have themselves set and determined for the government of their relations with one another. Without this healing act the whole structure and validity of international law is forever impaired.

8. All French territory should be freed and the invaded portions restored, and the wrong done to France by Prussia in 1871 in the matter of Alsace-Lorraine, which has unsettled the peace of the world for nearly fifty years, should be righted, in order that peace may once more be made secure in the interest of all.

9. A readjustment of the frontiers of Italy should be effected along clearly recognizable lines of nationality.

10. The peoples of Austria-Hungary, whose place among the nations we wish to see safeguarded and assured, should be accorded the freest opportunity of autonomous development.

11. Rumania, Serbia, and Montenegro should be evacuated; occupied territories restored; Serbia accorded free and secure access to the sea; and the relations of the several Balkan states to one another determined by friendly counsel along historically established lines of allegiance and nationality; and international guarantees of the political and economic independence and territorial integrity of the several Balkan states should be entered into.

12. The Turkish portions of the present Ottoman Empire should be assured a secure sovereignty, but the other nationalities which are now under Turkish rule should be assured an undoubted security of life and an absolutely unmolested opportunity of autonomous development, and the Dardanelles should be permanently opened as a free passage to the ships and commerce of all nations under international guarantees.

13. An independent Polish state should be erected which should include the territories inhabited by indisputably Polish populations, which should be assured a free and secure access to the sea, and whose political and economic independence and territorial integrity should be guaranteed by international covenant.

14. A general association of nations must be formed under specific covenants for the purpose of affording mutual guarantees of political independence and territorial integrity to great and small states alike.

On Oct. 3–4, 1918, Prince Maximilian of Baden, the German imperial chancellor, sent a note, via Switzerland, to President Wilson, requesting an immediate armistice and the opening of peace negotiations on the basis of the Fourteen Points. Germans would later argue a "betrayal" when faced by the harsher terms of the Armistice and the Treaty of Versailles.

Fourth International (Socialist federation): *see* International, Fourth.

Fourth of July: *see* Independence Day.

foussa (mammal): *see* fossa.

Fouta Djallon, also spelled FUTA JALLON, mountainous region of west-central Guinea, western Africa. Consisting of a series of stepped sandstone plateaus with many picturesque trenches and gorges, it serves as the watershed for some of western Africa's greatest rivers. Fouta Djallon covers an area of 30,000 square miles (77,000 square km) and averages 3,000 feet (914 m) in elevation. Mount Loura, its highest point (4,970 feet [1,515 m]), rises near the town of Mali and is close to the source of the Gambia River. Also originating in the Fouta Djallon's central plateau are the headwaters of the Bafing (Sénégal), Koliba (Corubal), Kolenté (Great Scarcies), Kaba (Little Scarcies), and Konkouré rivers. The Fouta's eastern slopes feed various tributaries (including the Tinkisso) of the Niger River; and its extension to the extreme southeast, known as the Guinea Highlands (*q.v.*), contains the Niger's source.

The Fouta Djallon (whose name comes from its early Dialonke [Djallonke] inhabitants) was first organized as a separate political entity as a result of the Fulbe and Malinke jihad (Muslim holy war) led by Karamoko Alfa and Ibrahima Sori in the late 1720s. As a Muslim theocratic state, Fouta Djallon dominated both central and coastal Guinea until it became part of the French colony of Guinea. Timbo, 26 miles (42 km) northeast of Mamou, was the seat of the Fulani *almamys* (emirs) until its occupation by French troops in 1896. Modern Fouta Djallon is mainly inhabited by Muslim Fulani peoples who herd the tsetse-resistant Ndama cattle. The town of Labé is the chief trade centre.

Fouta-Toro, semidesert region lying northeast of Dakar in Senegal, western Africa. The Mauritanian and Senegalese banks of the Sénégal River are well-watered and fertile in this region. The thin, sandy clay of its interior featureless plains is infertile and porous. Water is found near the surface in only a few shallow depressions. This region was the site of several Fula states. Many of the Fulani people are nomads.

Fowey, English Channel port, Restormel district, county of Cornwall, England, standing on the west bank of the sheltered Fowey Estuary. It held a leading position among Cornish ports from the 14th to the 16th century, when tin was an important export. The modern revival of the port results from the export of china clay quarried locally at Saint Austell. Fowey has held a market since 1316. Pop. (1981) 2,216.

fowl, also called POULTRY, in animal husbandry, birds raised commercially or domestically for meat, eggs, and feathers. Chickens, ducks, turkeys, and geese are of primary commercial importance, while guinea fowl and squabs are chiefly of local interest.

A brief treatment of poultry follows. For full treatment, *see* MACROPAEDIA: Farming and Agricultural Technology.

Descended from the wild red jungle fowl of India, chickens belong to the species *Gallus gallus*. They have been domesticated for at least 4,000 years. Only in about 1800, however, did chicken meat and eggs start to become mass-production commodities. Modern high-volume poultry farms, with rows of cages stacked indoors for control of heat, light and humidity, began to proliferate in Great Britain around 1920 and in the United States after World War II. The females (mature hens and younger pullets) are raised for meat and for their edible eggs; farmers have developed numerous breeds and varieties to fulfill commercial requirements. Mature males (cocks, or roosters) have long been used for sport (now outlawed in many jurisdictions), but most immature males (cockerels) are castrated (in modern times usually chemically, with hormones that cause atrophying of the testicles) to become meat birds, called capons. Originally, meat production was a by-product of egg production. Only hens that could no longer produce enough eggs were killed and sold for meat. By the mid-20th century, however, meat production had outstripped egg production as a specialized industry.

Domestic ducks belong to the subfamily Anatinae of the waterfowl family Anatidae. The Muscovy duck (*Cairina moschata*) and wild mallard (*Anas platyrhyncos*) are believed to be the ancestors of all domestic ducks. The Muscovy duck was domesticated in Colombia and Peru by the pre-Columbian Indians. The mallard was domesticated in China about 2,000 years ago and has undergone numerous crossbreedings and mutations. The wild mallard's bright colours are still evident in the domestic Rouen and Indian Runner breeds. Technically, the term duck applies to the female, the male being called a drake. Duck raising is practiced on a limited scale in most countries, usually as a small-farm enterprise, although large flocks are bred in some areas of England, The Netherlands, and the United States. The American Poultry Association lists 12 domesticated breeds, divided into three classes: meat producing, egg producing, and ornamental. The White Peking, originally from China, is the most widely used because it is meaty, fast growing, and prodigious in egg production. Duck feathers are also of some value, though they have been largely replaced by synthetics. Eiderdown is still of wide commercial value for use in luxury quilts and pillows.

Turkeys, members of the family Meleagrididae (order Galliformes), are the largest game birds native to North America. The Aztec and Zuni Indians domesticated them for food and sacrifice and used their feathers for decoration. In 1519 the Spanish brought the Mexican species back to Europe. Turkeys began to be raised for meat on a wide scale after World War II. Generally speaking, male turkeys (called stags, or toms) reach market weight (26 pounds [12 kg]) in about 26 weeks, while hen turkeys mature earlier and rarely exceed 20–22 pounds.

Geese, members of the family Anatidae, are described as domesticated in the earliest biblical writings. Modern breeds are mostly descended from the greylag (*Anser anser*), a wild goose of northern Eurasia. Unlike its monogamous wild cousin, the domestic goose is polygamous and thus more productive for commercial uses. The largest and most popular domestic meat goose is the Toulouse. In Great Britain, geese of just under one year of age are popularly roasted as Christmas fare. A by-product of goose-meat production especially important in Europe is pâté de foie gras, a paste made from the enlarged and fatted livers of force-fed geese. Goose feathers and down provide high-quality insulation in quilts and pillows and, more recently, sleeping bags and coats.

Native to Africa and southern Madagascar, guinea fowl (*Numida*) belong to the family Numididae and are closely related to the chicken. Raised as a sideline on farms in many countries, their food conversion is poor, but they need little care or attention.

Squabs are immature pigeons, members of the family Columbidae. Squab production is carried on locally but is rare in most countries with established poultry industries.

Best known breeds of domesticated fowl

name and type	distribution	appearance	characteristics
chicken			
Australorp (eggs)	originally Australia, now also U.K.	black plumage, rather long back	breed includes Black Australorp variety
Cornish (meat and eggs)	U.K. and U.S.	very heavy for its size, compact body	Rock Cornish hens are killed at six weeks
Leghorn (eggs)	Mediterranean breed	stylish carriage, yellow beak and skin	numerous varieties
New Hampshire (meat)	developed in U.S.	blocky, medium-length body	bred from Rhode Island Red stock
Orpington (meat)	English breed	long, deep, well-rounded body	buff, black, white, and blue varieties
Plymouth Rock (meat and eggs)	developed in U.S.	long, fairly broad body	several varieties
Rhode Island Red (meat and eggs)	U.S. breed	red colour, long rectangular body	general-purpose breed
Sussex (meat)	English breed	long body, broad shoulders	excellent meat producer
Wyandotte (meat and eggs)	U.S. breed	round, low-set body with short back	several varieties
duck			
Aylesbury (meat)	English breed	white feathers and skin, orange feet	excellent meat producer
Indian Runner (eggs)	originally East Indies, now western Europe	orange feet and shanks, erect body	white, white penciled, fawn varieties
Khaki Campbell (eggs)	developed in England	colour is khaki and bronze	breed has set egg-production records
Muscovy duck (meat)	originally South America	long, low, white body, orange feet	numerous varieties, excellent meat producer
Pekin (meat)	chief U.S. commercial breed	yellow skin, orange shanks and feet	reaches market weight in eight weeks
turkey			
Beltsville Small White (meat)	developed in U.S.	white feathers, light-orange feet and legs	large proportion of white meat
Broad-Breasted Bronze (meat)	English breed, now in North America	dark-brown feathers, white bars on wings	exceptionally well-meated
other			
goose (meat, eggs, and feathers)	domestic breeds raised worldwide	long necks, similar plumage in both sexes	Toulouse, Embden, African varieties
Guinea fowl (meat)	raised worldwide	slaty plumage, speckled with white	raised on large scale only in Italy
squab (meat)	raised worldwide	immature pigeons	attain market size in about four weeks

Fowler, H(enry) W(atson) (b. March 10, 1858, Tonbridge, Kent, Eng.—d. Dec. 26, 1933, Hinton St. George, Somerset), English lexicographer and philologist whose works on the use and style of the English language had

far-reaching influence. He was a man of moral and intellectual strength whose wit and grace were evident throughout his writings.

Fowler was educated at Balliol College, Oxford (B.A. and M.A., 1886), and taught at Sedbergh School until 1899. He lived in London from 1899 to 1903, supporting himself with a small inheritance and the income from essays published in journals. He then moved to the Channel island of Guernsey and began his collaboration with his younger brother Francis George Fowler.

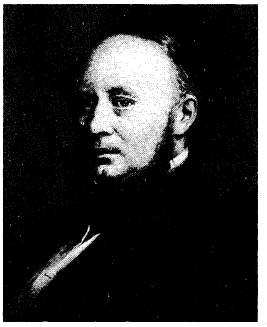
The brothers' first work was a four-volume translation, *The Works of Lucian of Samosata* (1905), followed by *The King's English* (1906) and *The Concise Oxford Dictionary of Current English* (1911). Their work was interrupted by military service during World War I; Francis George contracted tuberculosis and died of the disease in 1918. After the war H.W. Fowler returned to Guernsey and in 1924 published *The Pocket Oxford Dictionary of Current English.* The following year he moved to the village of Hinton St. George.

Fowler's major work, planned with his brother, was *A Dictionary of Modern English Usage* (1926). It is an alphabetical listing of points of grammar, syntax, style, pronunciation, and punctuation. The depth, style, and humour of the work have made it a classic of English philology. Among Fowler's other writings are a collection of essays, *If Wishes Were Horses* (1929), and a volume of poetry, *Rhymes of Darby to Joan* (1931).

Fowler, John (b. July 11, 1826, Melksham, Wiltshire, Eng.—d. Dec. 4, 1864, Ackworth, Yorkshire), English engineer who pioneered in the development of the steam-hauled plow. He began his career in the grain trade but later trained as an engineer. In 1850 he joined Albert Fry in Bristol to found a works to produce steam-hauled implements. Later, with Jeremiah Head, he produced a steam-hauled plow, which in winning the £500 prize (1858) offered by the Royal Society, fulfilled the society's dictum for a "steam cultivator" that would be an "economic substitute for the plough or the spade." He died of tetanus following an injury received after being thrown by a horse.

Fowler, Sir John, 1ST BARONET (b. July 15, 1817, Wadsley, near Sheffield, Yorkshire, Eng.—d. Nov. 20, 1898, Bournemouth, Hampshire), English civil engineer who helped design and build the underground London Metropolitan Railway and joint designer of the Forth Bridge in Scotland.

Fowler set up in London in 1844 as a consulting engineer, laying out many small railway systems later incorporated into the Manchester, Sheffield, and Lincolnshire railways. In 1860 he designed the Pimlico Railway Bridge across the Thames. He worked on most of the extensions of the metropolitan railway, noteworthy in being excavated from the surface and permanently covered rather than tunnelled, and designed and constructed many of its branch lines. He also designed and built a locomotive known as "Fowler's Ghost," for the railway. Later, he was an engineer for the deep-tunnelling "tube" system extensively adopted for London electric railways. He was also the engineer for the construction of Victoria Station. In 1866 he became president of the Institution of Civil Engineers.



Sir John Fowler, engraving by Thomas Oldham Barlow, 1868, after a portrait by Sir John Everett Millais; in the Science Museum, London

By courtesy of the Science Museum, London

After serving as general engineering adviser in Egypt to the khedive Ismāʿīl, he became, in 1875, a partner of Benjamin Baker in the design and construction of the great cantilever bridge over the Firth of Forth (1882–90). He was created a baronet in 1890.

Fowler, William A(lfred) (b. Aug. 9, 1911, Pittsburgh), American nuclear astrophysicist who, with Subrahmanyan Chandrasekhar, won the Nobel Prize for Physics in 1983 for his role in formulating a widely accepted theory of element generation. This theory, which Fowler developed with Sir Fred Hoyle, Margaret Burbidge, and Geoffrey Burbidge in the 1950s, suggests that in stellar evolution elements are synthesized progressively from light elements to heavy ones, in nuclear reactions that also produce light and heat. With the collapse of more massive stars, the explosive rebound known as supernova occurs; according to theory, this phase makes possible the synthesis of the heaviest elements.

Fowler also worked in radio astronomy, proposing with Hoyle that the cores of radio galaxies are collapsed "superstars" emitting strong radio waves and that quasars are essentially larger versions of these collapsed superstars.

More recently Fowler worked on relativistic effects in quasars and pulsars and studied neutrinos, subatomic particles released during nuclear reactions. Fowler was elected a fellow of several scientific societies and was awarded Columbia University's Barnard Medal (1965) and Vetlesen Prize (1973).

Fowles, John (Robert) (b. March 31, 1926, Leigh upon Sea, Essex, Eng.), English novelist whose works combine psychological probings—chiefly of sex and love—with an interest in the social and philosophical context of human behaviour. His first novel, *The Collector* (1963; filmed 1965), about a shy man who makes use of a gambling windfall to kidnap a girl and keep her captive in a hapless search for love, was immediately successful.

He graduated from Oxford in 1950 and taught in Greece, France, and Britain. A Greek island is the setting of his second novel, *The Magus* (1966, rev. 1977; filmed 1968). *The French Lieutenant's Woman* (1969; filmed 1981) is a love story set in Victorian England that richly documents the social mores of that time. His later novels include *Daniel Martin* (1977) and *Mantissa* (1982). Fowles has also written verse, a collection of short stories, and the text for several photographic studies.

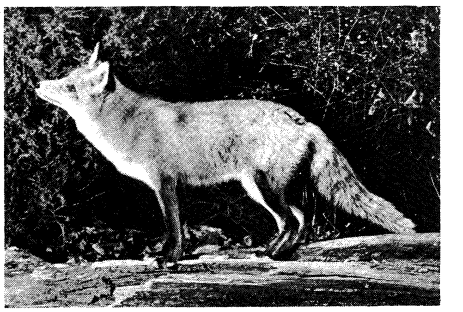
Fox, an Algonkian-speaking tribe of North American Indians who called themselves Meshkwakihug or Mesquakie (Red-Earth People); at the time they first met Europeans, they lived in the forest zone of what is now northeastern Wisconsin. Their permanent villages—near fields in which women cultivated corn (maize), beans, and squash—were occupied in summer; most Fox left the villages after the harvest to participate in communal winter bison hunts on the prairies. A peace chief and council of elders administered tribal affairs; important decisions were discussed by the entire tribe until disagreement ended. War parties rallied about men whose skill and reputation made them leaders. Families were grouped into clans that were mainly ceremonial organizations with members tracing their descent from a mythical founder through the male line. A major religious organization was the Midewiwin, or Grand Medicine Society, a secret society whose members were believed to be able to heal the sick and to enlist supernatural aid to ensure tribal welfare. Many ceremonies involved the use of sacred medicine bundles, which were collections of magical objects.

"Fox Warrior," painting by Henry Inman, 1832, from an original by an unknown artist; in the Peabody Museum of American Archeology and Ethnology, Harvard University

By courtesy of Peabody Museum, Harvard University, Cambridge, Mass.

Beginning about the 18th century the Fox warred against the French and then the English and, though unconquered, retreated to Illinois and then Iowa. They moved to Kansas in 1842, but later they returned to Iowa, where they purchased land in Tama County and where they reside today. The Fox have maintained their traditional community: clan and ceremonial organizations survive, and the Fox language is spoken in the home. They hold their land as a tribe, with an elected business council to handle funds and relations with the government.

fox, any of various members of the dog family (Canidae) resembling small to medium-sized, bushy-tailed dogs with long fur, pointed ears, relatively short legs, and narrow snouts. In a more restricted sense, the name refers to about ten species of true foxes (*Vulpes*), especially the red, or common, foxes, *V. vulpes* of the Old World and *V. fulva* (included with *V. vulpes* by some authorities) of the New World.



Red fox (*Vulpes vulpes*)

Karl H. Maslowski

Red foxes are widely held symbols of animal cunning and are the subject of a considerable amount of folklore. The native Old World form ranges over virtually all of Europe, temperate Asia, and northern Africa; the New World red fox inhabits most of North

America north of Mexico. Red foxes, with their coats of long guard hairs and soft, fine underfur, are typically a rich reddish brown with white-tipped tail and black ears and legs. Colour, however, is variable; the colour phases known as black and silver fox are found in North America, and the cross, or brant, fox is found in both North America and the Old World. Red foxes are generally about 90–105 centimetres (36–42 inches) long (about 35–40 cm of this being tail), stand about 40 cm at the shoulder, and weigh about 7 kilograms (15 pounds). Their preferred habitat is mixed farmlands and woodlots. Small mammals, chiefly mice and rabbits, as well as eggs, fruit, and birds (including some domestic fowl) comprise the diet; remains of larger animals usually indicate that the fox fed on carrion. Red foxes mate in winter; after a gestation period of about 51 days, one to ten helpless cubs are born in a den, which is commonly a burrow abandoned by another animal and enlarged by the parent foxes. The cubs remain in the den for about five weeks and are cared for by both parents throughout the summer.

Red foxes are hunted by man, one of their few enemies, for sport and fur. Fox pelts, especially those of silver foxes, are commonly produced commercially on fox farms. Wild red foxes, although they are often destroyed for raiding hen houses, are highly beneficial in controlling undesirable rodents.

The other members of the genus *Vulpes* and the varieties of red foxes include the following:

African sand fox: pale fox (see below).

Bengal fox (*V. bengalensis*), small gray fox common in southern Asia.

Black fox, colour phase of the red fox; sometimes also used as a common name for the fisher (*q.v.*).

Blanford's fox: hoary fox (see below).

Brant fox: cross fox (see below).

Chama (caama, cama, kama) fox: South African silver fox (see below).

Corsac (corsak) fox (*V. corsac*), small, steppe-dwelling fox of eastern Eurasia; coat yellowish brown or reddish brown.

Cross fox, yellowish brown colour phase of the red fox, having a cross-shaped black marking extending across the shoulders and down the back.

Hoary fox (*V. cana*), Eurasian species about 60 cm in length; coat gray above, white below.

Indian fox: Bengal fox (see above).

Kit fox (*V. macrotis*) and swift or plains kit fox (*V. velox*), large-eared pale foxes of western North American plains and deserts; possibly not separable as two distinct species; colour gray to yellowish brown with black-tipped tail; adult length about 40–50 cm without the 20–30-cm tail, weight about 1.5–3 kg; *V. macrotis*, smaller with larger ears; both forms live in burrows, feed on small animals (rodents, rabbits, insects); shy, uncommon, beneficial in rodent control.

Pale fox (*V. pallida*), yellow to brown desert fox of northern Africa.

Ruppell's fox (*V. ruppelli*), big-eared gray desert fox of northern Africa and southwestern Asia; sometimes also called fennec; length to 74 cm.

Samson fox, genetic mutant strain of red fox found in northwestern Europe; guard hairs lacking, underfur tightly curled.

Sand fox: Ruppell's fox (see above).

Silver fox, colour phase of the red fox having a variable amount of white or white-banded hairs in the black coat.

South African silver fox (*V. chama*), long-eared, gray-coated species of southern Africa, found particularly in the Kalahari Desert region; sometimes called fennec; length usually less than 60 cm.

Steppe fox: corsac fox (see above).

Swift fox: kit fox (see above).

Tibetan sand fox (*V. ferrilata*), short-eared, short-tailed central Asian fox with a yellowish coat.

For information about other foxes, *see* Arctic fox (includes blue fox); bat-eared fox; crab-eating fox; fennec; gray fox; South American fox.

Fox, Charles James (b. Jan. 24, 1749, London—d. Sept. 13, 1806, Chiswick, Devon, Eng.), Britain's first foreign secretary (1782, 1783, 1806), a famous champion of liberty, whose career, on the face of it, was nevertheless one of almost unrelieved failure. He

Charles James Fox, detail of an oil painting attributed to John Zoffany; in the Henry E. Huntington Library and Art Gallery, San Marino, Calif.

By courtesy of the Henry E. Huntington Library and Art Gallery, San Marino, California

conducted against King George III a long and brilliant vendetta; for this reason he was almost always in political opposition and, in fact, held high office for less than a year altogether. He achieved only two important reforms, steering through Parliament a resolution pledging it to abolish the slave trade speedily and, in the 1792 Libel Act, restoring to juries their right to decide not merely whether an allegedly libellous article had, in fact, been published but also what constituted libel in any given case and whether or not a defendant was guilty of it.

Early life. Fox was the third son of Henry Fox, afterward 1st Baron Holland, by his wife, Lady Caroline Lennox, daughter of the 2nd duke of Richmond. Through his mother he was descended from Charles II of England and Henry IV of France. He was educated at Eton and at Hertford College, Oxford, where he acquired an extensive knowledge of the classics, to which he remained devoted for the rest of his life. His father brought him up without the least regard for morality and encouraged him, while still a schoolboy, to acquire extravagant and dissolute habits. He lost vast sums at gambling, and in 1774 his father, just before his death, paid the young man's gambling debts to the amount of £140,000. Almost 20 years later political friends not only freed him from debt but settled on him a comfortable income. He then showed his gratitude by abandoning forever both racing and gambling.

Entry into politics. Fox was procured a seat in Parliament by his father in 1768. Two years later he was appointed a junior lord of the Admiralty but gave up his office in February 1772 in order that he might be free to oppose a bill (eventually the Royal Marriage Act) designed to prevent marriages of members of the royal family unless authorized by the king or ratified by the Privy Council. He reentered the government the following December as a junior lord of the Treasury, but the King, who already disliked him for his recent opposition, accused him of insubordination and dismissed him in February 1774.

Already a friend of Edmund Burke, he naturally gravitated into the Whig group and before long was their accepted leader in the Commons. He went into opposition just when the controversy with the American colonies was becoming acute. Believing that the colonial policy of the prime minister Lord North was unjust and oppressive, he opposed it with unrestrained violence, but he later admitted that the American war was popular in England. The series of disasters sustained by the British troops in America, culminating in the capitulation of the army led by Lord Cornwallis at Yorktown (October 1781), eventually brought down North's government (March 1782). The King had to call in a Whig ministry, of which Lord Rockingham became prime minister, and Lord Shelburne (later marquess of Lansdowne) colonial secretary; Fox became the first foreign secretary in English history.

Fox believed, erroneously, that the negotiations for peace with the Americans came within the province of the foreign secretary, and he wished to recognize the independence of the former colonies immediately and unconditionally. Shelburne wanted to withhold this recognition until the peace treaties with the European countries with which Britain had also been at war were ready for signature; and he maintained that, since the independence of America had not yet been formally recognized, he, as colonial secretary, had the right to conduct the negotiations. Fox, therefore, notified his intention to resign (June 30), but before he could implement it Rockingham died (July 1).

When the King offered the premiership to Shelburne, Fox and his friends maintained that it was for them, not for the King, to choose Rockingham's successor. This was unconstitutional; the King had the undoubted right to choose the minister. Fox and some of his friends at once resigned, but others remained to support Shelburne. The historian Sir George Otto Trevelyan described Fox's refusal to serve under Shelburne as the fatal and irreparable mistake of his life. Though his suspicions of Shelburne were far from groundless, they were exaggerated; moreover, Shelburne was in some respects the most enlightened statesman of his time.

The Fox–North coalition (1783). Fox always had a liking for coalitions; on Feb. 14, 1783, he joined with his old enemy North to eject the new government and accomplished his object 10 days later. Defending an action that was undoubtedly unpopular and damaging to his reputation, Fox maintained that it was wise and candid to end the hostility between North and himself now that its sole cause, the American war, was over.

After trying desperately for five weeks to withstand "the most unprincipled coalition the annals of this or any other nation can equal," the King had to grant it office (April 2). The Duke of Portland, a nonentity, became the nominal prime minister; Fox and North, the two secretaries of state. Although the King withheld from the ministers various customary marks of royal confidence, they had no difficulty in retaining the vote of the independent country gentlemen in the House of Commons. The new ministers did not improve their position at court by proposing to give the Prince of Wales (later George IV) an income of £100,000 a year. By remaining the intimate friend of this dissolute young man, who was detested by his father and who ostentatiously supported the coalition, Fox further outraged the King's feelings.

The coalition fell because of its India bill. Fox and North had no wish to evade their responsibility for ending a system of misgovernment in India that had alarmed and disquieted English statesmen of all parties. Their bill proposed to change the whole constitution of the East India Company, which effectively controlled British India, by transferring control of the company's territories, revenues, and commerce to seven commissioners who were to be nominated by the British government and removable only upon a vote of either house of Parliament. But vested interests took

alarm, and the House of Lords rejected the bill on December 17 after the King had made it known that he would consider as an enemy anyone who voted for it. The coalition was dismissed next day, and the young politician William Pitt (the Younger) accepted an invitation to form a government.

Fox increased his unpopularity by attacking the sovereign's right to choose his ministers and to appeal to the electorate to confirm his choice. Fox's opponents could now plausibly maintain that he would not even submit his case to the judgment of the nation. Many of the coalitions's supporters changed sides, and the dissolution of Parliament (March 1784) completed the discomfiture of the opposition, which found itself with only about 145 members in the new House of Commons. Fox himself, however, was reelected for the great popular constituency of Westminster, defeating the ministerial candidate.

Opposition to Pitt and Addington. Had he been even a little accommodating, Fox could have joined William Pitt's government on honourable terms in 1784, to the great advantage of the cause of reform. But his attacks on Pitt's proposed commercial concessions to Ireland in 1785 and on a commercial treaty made with France in 1787 damaged his reputation. He blundered again in 1788–89, when the King was temporarily insane, by supporting the claim of the Prince of Wales to the regency as a right—whereas Pitt maintained that Parliament alone had the right and competence to appoint a regent. Party interests, of course, were deeply involved in the constitutional dispute; the Prince's first act of power would have been to dismiss Pitt and bring in the Whigs.

Fox welcomed the outbreak of the French Revolution in 1789. War with Revolutionary France broke out in 1793, and a large part of the opposition, headed by Portland, went over to the government in 1794. The minority (50–60) adhering to Fox became one of the weakest oppositions ever known in England, and in about 1797 many opposition members even ceased to attend Parliament. Fox was dismissed from the Privy Council in 1798 for reaffirming in a public speech the doctrine of the sovereignty of the people; yet eight years later the King had to reinstate him without exacting any retraction of principle.

In 1795 Fox had secretly married Elizabeth Armitstead, with whom he had been living for many years and to whom he always remained devoted; the marriage was revealed only in 1802. In their country house, St. Anne's Hill, near Chertsey in Surrey, he indulged his tastes for classical literature and a rural existence and found there ample compensation for all the disappointments and stresses of public life. Mrs. Fox, who bore him no children, died on July 8, 1842.

Fox approved of the peace negotiations that resulted in the treaty signed at Amiens (1802) but spoke of the "shameful surrender of all our conquests" to Napoleon. He was critical of the ministry (1801–04) of Henry Addington (afterward Viscount Sidmouth) for its failure either to preserve the peace or to put the country into an adequate state of defense to meet Napoleon's invasion threat, which followed the renewal of war in 1803. Though his motion, virtually one of censure (April 23, 1804), was defeated by 256 votes to 204, Addington's government resigned a few days later.

Pitt now wished to form a coalition government on a broad base but failed to persuade George III to waive his objections to Fox as a minister (he would have been foreign secretary), though the King was prepared to give him a foreign mission. Fox, with his usual generosity, acquiesced in this proscription, said that he was too old (at 55) to care about office, and advised his friends to join the coalition; but both they and the followers of Lord Grenville (with whom they had recently collaborated) rejected the suggestion and went into opposition.

Last years. When Grenville became prime minister after Pitt's death on Jan. 23, 1806, the King's veto on Fox's appointment to office as foreign secretary disappeared without protest. During the earlier phase of the war against France, Fox had believed that the various European despots were fighting to destroy the newly won liberties of the French, and he had underestimated the bellicose spirit of France and the danger to England of French conquests. But by 1806 he had come to realize that France, under Napoleon, threatened Great Britain and the whole Continent.

By this time Fox's health was breaking down. Suggestions were made that he should take some less laborious office, or even that he should take a peerage to save him from the more exacting task of leading the House of Commons. Fox made his last speech in Parliament on June 19, 1806, and he died on September 13 in the Duke of Devonshire's house. He was buried in Westminster Abbey by the side of Pitt.

Assessment. Fox had a genius for friendship, and the secret of his political influence was the uncalculating generosity of his mind. His charm could overcome the hostility of even the most inveterate of his foes. As a statesman he had great and manifest failings. He was often governed by prejudice, and he was not a profound political thinker. Above all, he hated anything that savoured of oppression, and his attitude on various colonial issues showed his passionate determination that the peoples of the empire were no longer to be exploited. His approval of the French Revolution shattered his friendship with the statesman and political writer Edmund Burke; although privately Fox showed himself far from insensible to the horrors perpetrated by the French Republicans, he gave these feelings no adequate public expression and opposed the war with republican France as a crusade against freedom in the interests of despotism. At home the excessive power of the crown was, in his view, the great source of all the country's ills, and to the destruction of that overweening power he dedicated his life. He put forward the view, afterward accepted, that the crown must choose the prime minister from the party that commanded a majority in the House of Commons, irrespective of the sovereign's personal inclinations. Yet he was no democrat, despising public opinion if he considered it prejudiced and intolerant. He would never have countenanced the notion that property, the security of which was one of the prime preoccupations of both Whig and Tory parties, would be safe in a democratic society in which the propertyless voters would obviously be in a majority. In his view property was the true foundation of aristocracy, and a country best prospered whose government was in such hands.

Fox had a strong European sense and a deep feeling for the responsibilities of his own country as a member of a greater society with mutual obligations. It was because he held these large and generous views that his influence endured, inspiring such measures as the Reform Act of 1832. (A.As.)

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Fox, George (b. July 1624, Drayton-in-the-Clay, Leicestershire, Eng.—d. Jan. 13, 1691, London), English preacher and missionary and founder of the Society of Friends (or Quakers); his personal religious experience made him hostile to church conventions and established his reliance on what he saw as inward light or God-given inspiration over scriptural authority or creeds. He recorded the birth of the Quaker movement in his *Journal.*

Early life and activities. Fox was the son of a weaver in the English village of Drayton-in-the-Clay (now Fenny Drayton), Leicestershire. Probably apprenticed for a while to a cobbler, he may also have tended sheep, but there is little evidence of any adult business occupation or of much formal education. He always seemed to have a modest amount of money. He read extensively and wrote legibly. At the age of 18 he left home in search of satisfying religious counsel or experience and later reported in his *Journal* various personal religious experiences or direct revelations, which he called "openings," that corrected, in his estimation, the traditional concepts of faith and practice in English religious life.

His religious background was apparently Puritan rather than strict Anglican, but he himself reacted even further than the Puritans from the formalism and traditionalism of the established church. He placed the God-given inward light (inspiration) above creeds and scripture and regarded personal experience as the true source of authority. In his *Journal* he wrote,

> These things I did not see by the help of man, nor by the letter, though they are written in the letter, but I saw them in the light of the Lord Jesus Christ, and by his immediate Spirit and powers, as did the holy men of God, by whom the Holy Scriptures were written.

His negative attitude to ecclesiastical customs was matched by a similar attitude toward some political and economic conventions (*e.g.,* oaths, titles, and military service).

He began preaching to individuals or groups as he travelled on foot, first in the Midland counties of England, then in the northern counties, where groups of Seekers (a 17th-century Puritan sect) welcomed him and his message. Local congregations were established, gathered both by Fox and by many other itinerant men and women preachers, who were called Publishers of Truth. Thus came into being in the last years of the British Commonwealth (1649–60) the Society of Friends, as it was much later called, though its members were early nicknamed Quakers.

Fox had most success in winning adherents and fellow workers in the Lake District counties of Westmorland and Lancashire and later in Yorkshire, London, and other areas. He and his associates suffered public hostility and official constraint. They offended religious leaders both religiously and politically by their contradiction of the ministers in the churches (based on Fox's view that ministers "bred at Oxford or Cambridge" were not qualified to be spiritual leaders in the churches) and by their refusal to honour officials, to take oaths, or to pay tithes. Fox and his associates were often arrested and imprisoned. Fox, in fact,

suffered eight imprisonments between 1649 and 1673.

The restoration of the monarchy in 1660 led to special legislation against the Quakers and a widespread action against them. To meet this and other needs, George Fox encouraged local Quaker groups to organize into regular monthly and quarterly business meetings, which, with some central national meetings, became a permanent pattern of their church government. The continuing pressure was only intermittently relieved until the Toleration Act of 1689, shortly before Fox's death, gave relief to the Quakers.

Missionary work in England and elsewhere. In 1669 Fox made a missionary visit to Ireland, and on his return he married one of his early converts, Margaret Fell, the widow of Judge Thomas Fell of Swarthmore Hall, Ulverston, Lancashire, where Fox spent parts of the following years. In the years 1671 to 1673 he paid an important visit to the British colonies in the Caribbean and the North American mainland, strengthening and organizing the existing Quaker communities, especially in Maryland and Rhode Island. Shorter journeys in 1677 and 1684 took him to Holland (The Netherlands) and a few other parts of northern Europe. About 1675 he dictated a running summary of his life that, with supplementary material, was posthumously edited and published as his *Journal.* For most of the last 15 years of his life he lived as a boarder or visitor among friends in or about London, attending consultations and committees on practical questions, preaching at meetings for worship, and engaging in a wide correspondence with individual Friends or with congregations to whom he was known.

Throughout his life, Fox shared the contemporary practice of writing controversial pamphlets, scores of which were published. They dealt with social as well as theological questions but lacked stylistic attraction. Although he was quite familiar with the English Bible, he sometimes displayed a taste for subjects like history and grammar, in which he had little competence. He borrowed information occasionally from his learned friends.

He evidently was, as Thomas Carlyle (1795–1881) says, a man of enormous self-confidence, one who attracted rather than repelled. A magnetic personality, he was widely respected and admired by such men as William Penn, a man of culture and knowledge of the world, who left in writing an appreciation of Fox that is still the best summary of his character. His own *Journal* is naturally not entirely objective, but with its many details it forms the fullest account of the rise of Quakerism, as well as of Fox himself. It is partly due to Fox's own sense of the historic importance of the Quaker movement that much other early written material was recorded and preserved.

(H.J.C.)

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Fox, Henry: *see* Holland of Foxley, Henry Fox, 1st Baron.

Fox, Henry Richard Vassall: *see* Holland, Henry Richard Vassall Fox, 3rd Baron.

Fox, Richard (English bishop): *see* Foxe, Richard.

Fox, William, original name WILHELM FRIED (b. Jan. 1, 1879, Tulchva, Hung.—d. May 8, 1952, New York City), Hollywood motion-picture executive who built a multimillion-dollar empire controlling a large portion of the exhibition, distribution, and production of film facilities during the era of silent film.

Fox worked as a newsboy and in the fur and garment industry before investing in a Brooklyn nickelodeon. By 1913 he was one of the most powerful of the independent exhibitors and distributors and led their successful fight against the Motion Picture Patents Company, an attempted monopoly of the industry. In 1915 the Fox Film Corporation, the progenitor of the 20th Century-Fox studios, was formed.

Fox introduced organ accompaniment to the silent films shown in his theatres and pioneered in designing theatres for the comfort of the patrons. Through an adroit use of publicity, he developed Theda Bara, the first screen vamp, into a star. He was also famous for the 1927 news series *Movietone News,* the first commercially successful sound film.

Because of the expense of converting 1,100 theatres to sound equipment and the economic crisis of the early 1930s, Fox's empire crumbled. He declared bankruptcy in 1936 and in 1942 served a term in prison for obstructing justice. For the remainder of his life he lived quietly in Long Island, New York. Upton Sinclair wrote a biography of him, *Upton Sinclair Presents William Fox* (1933).

Fox, Sir William (b. Jan. 20, 1812, South Shields, Durham, Eng.—d. June 23, 1893, Auckland, N.Z.), author and statesman whose work for New Zealand self-government helped shape the Constitution Act of 1852, which established home rule for that country. He also served four short terms as New Zealand's prime minister (1856, 1861–62, 1869–72, 1873).

After emigrating to New Zealand in 1842, Fox became an agent for the New Zealand Company the following year and its principal agent in 1848. His lobbying in England (1851–52) was probably responsible for the addition of Taranaki to the five original provinces in the Constitution of 1852, which granted self-government. His account of the events leading up to the constitution, *The Six Colonies of New Zealand,* was published in 1851.

Fox reentered politics in 1861, concerned about the first Taranaki War (1860–61) between settlers and the native Maori. As colonial secretary and minister of native affairs (1863–64), he advocated a vigorous war effort against the Maoris and confiscation of their land, policies that brought him into conflict with the governor, Sir George Grey. He defended his government's actions in *The War in New Zealand* (1860; rev. ed., 1866). Although he acted as premier (1869–72), the colonial treasurer, Julius Vogel, held the real power. In his parliamentary career, Fox was most effective as head of the opposition rather than in leading the government. He resigned his seat in Parliament in 1875 and was knighted in 1879.

fox bat, also called FLYING FOX, any of numerous tropical Old World bats belonging to the family Pteropodidae (*q.v.*).

Fox Film Corporation: *see* 20th Century-Fox Film Corporation.

fox hunting, chase of the fox by horsemen with a pack of hounds. In England, the home of the sport, fox hunting dates from at least the 15th century. Opinion varies as to when it originated. In its inception, it was probably an adjunct to stag and hare hunting, with the same hounds used to chase each quarry.

Modern fox hunting took shape in the 19th century shortly after Hugo Meynell—the father of the modern English chase—started hunting; and it soon developed into a national upper-class pastime. Traditional procedure is still observed and the proper kit worn. A fox hunt is conducted by the master, and, in theory, all who take part in it do so at his invitation even when they pay for the privilege. The hounds, generally 15 to 20 couples (matched pairs), are controlled by the huntsman, who may be the master himself but who is generally the senior paid servant of the hunt. Two or three whippers-in assist in reconnaissance and in keeping the hounds together as a pack. Master, huntsman, and whippers-in take precedence over all other riders to hounds. The huntsman controls hounds by voice, his calls being known as cheers, and by his horn—a copper tube about eight inches long that produces two notes of great carrying and penetrating quality.

"Fox Chase," lithograph by Nathaniel Currier, 1846
By courtesy of the Library of Congress

A day's hunting begins with a meet, at which the followers join the hounds, acknowledge the master, and are frequently offered hospitality by one of their number who acts as host for the occasion. On the command of the master, hounds move off to draw (search) the covert, which may be woodland, a patch of gorse, or a field in which it is suspected that a fox may be. When the fox is found, the fact being signalled by the cry of hounds, notes of the horn, and the shout "Tally-ho," the hunt begins and ordinarily proceeds to the stage at which the fox is viewed, a moment signalled by a holloa, a high-pitched cry. If a kill follows, the brush (tail), mask (head), and pads (feet) of the fox may be given as trophies by the master to any followers whom he considers to deserve the honour. The body of the fox is then thrown to the hounds.

Fox-hunting uniform is usually a scarlet coat with white stock (cravat) and black velvet cap for the master, huntsman, and whippers-in. Followers of sufficient prestige are invited to wear scarlet, with the individual buttons of the hunt, and top hat (the velvet cap being strictly the prerogative of those actively engaged in the control of hounds, though by modern usage women also wear it). Other followers wear black coats, with top hats or bowlers. In the case of some ancestral hunts run by noble families, the uniform may be green, yellow, or gray instead of scarlet.

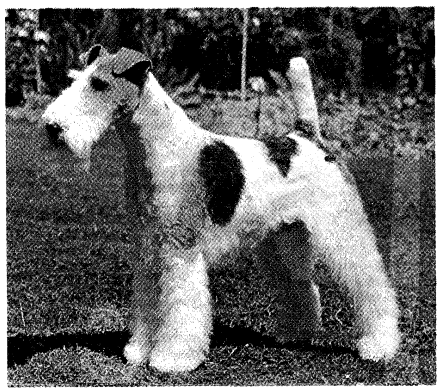
Also the entourage of a hunt includes grooms; second horsemen, who ride relief horses for the master, his staff, and leading followers; and earth stoppers, who are supposed to close up all earths, or fox dens.

Before World War I, fox hunting reached a zenith of popularity as an English field sport. Horse and hound breeding had arrived at a highly developed state, and hunting itself was well organized and regulated by the Master of Foxhounds Association. The sport of fox

hunting has surmounted a number of difficulties in the 20th century, notably changes in patterns of rural land ownership and use as great landowners were replaced by numerous small holders, proliferation of barbed-wire fences, shortages and other hardships caused by World Wars I and II, and some popular opposition on anti-cruelty and other grounds. Hunting continued, however, in the second half of the 20th century in England, Wales, Ireland, and parts of Scotland from November, when the harvest is gathered, until April, when new crops begin to grow. The sport is also practiced in similar season in some parts of the United States, Canada, New Zealand, and Australia.

fox shark, species of thresher shark (*q.v.*).

fox terrier, well-known breed of dog developed in England to drive foxes from their dens. The two varieties of fox terrier, wirehaired and smooth-haired, are structurally similar but differ in coat texture and in ancestry. The wirehaired variety was developed from a rough-coated black-and-tan terrier, the



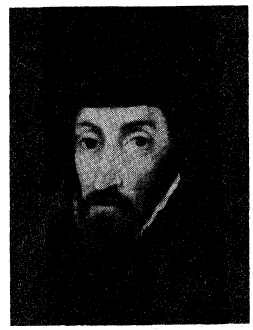
Wirehaired fox terrier
Sally Anne Thompson—EB Inc.

smooth from the beagle, greyhound, bull terrier, and a smooth-coated black-and-tan terrier. At one point, the two varieties were crossed, but this practice was discontinued. Both varieties are sturdily built, lively looking dogs with tapered muzzles and folded, V-shaped ears. They stand about 15 inches (37 to 39 centimetres) and weigh 15 to 19 pounds (7 to 8.5 kilograms). Predominantly white with black or black-and-tan markings, fox terriers are noted for having bold, energetic, and spirited natures.

fox-trot, ballroom dance popular in Europe and America since its introduction around 1914. Allegedly named for the comedian Harry Fox, whose 1913 Ziegfeld Follies act included a trotting step, the fox-trot developed less strenuous walking steps for its ballroom version. The music, influenced by ragtime, is in $\frac{4}{4}$ time with syncopated rhythm. The speed of the step varies with the music: half notes (minims) require slow steps; and quarter notes (crotchets), fast steps.

The fox-trot consists primarily of walking steps, chassés (step side, close step), and quarter turns. Couples usually hold each other in the traditional ballroom position, but numerous variations are done in other positions. Fox-trots for fast music include the one-step (one walking step to each musical beat) popularized by Irene and Vernon Castle shortly after the dance's inception and the peabody (with a quick leg cross).

Foxe, John (b. 1516, Boston, Lincolnshire, Eng.—d. April 18, 1587, Cripplegate, London), English Puritan preacher and author of *The Book of Martyrs*, a graphic and polemic account of those who suffered for the cause of Protestantism. Widely read, often the most valued book beside the Bible in the households of English Puritans, it helped shape popular opinion about Roman Catholicism for at least a century. The feeling of the English populace against Spain, important in the politics of the



John Foxe, detail of an oil painting by an unknown artist, 1587; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

age, was fanned by the book's description of the Inquisition. It dealt chiefly, however, with the martyrdom of English Protestants from the 14th century through the reign of Queen Mary I in Foxe's own time.

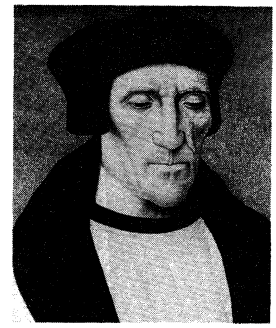
After studying at Oxford and holding a fellowship for seven years, he fell under suspicion of harbouring Protestant views more extreme than the authorities of his college would allow. He resigned and in 1547 moved to London, where he became tutor to the grandchildren of the Duke of Norfolk. He was ordained a deacon of the Church of England, at that time a battleground of traditional and reforming tendencies. Foxe worked for the Reformation, writing several tracts. He also began his account of martyrs but had carried it no further than 1500 when the accession of the Roman Catholic queen Mary I in 1553 forced him to flee overseas. In Strasbourg, Fr., he published his partly completed martyrology in Latin as *Commentarii rerum in ecclesia gestarum* (1554; "Commentaries on Affairs Within the Church"). He then went to Frankfurt, where he lent a moderating support to the Calvinistic party of John Knox, and thence to Basel, Switz., where he earned a meagre living by correcting proofs. At Basel he wrote a burning appeal to the English nobility to restrain the Queen from persecuting Protestants: *Ad inclytos ac praepotentes Angliae proceres;* ("To the Renowned and powerful Nobles of England," 1557). With the aid of manuscripts sent to him from England, he carried his account of the martyrs up to 1556 and had it printed in 1559, the year following the accession to the throne of the Protestant queen, Elizabeth I.

Foxe returned to London and devoted himself to the completion of his great work. Perusing official registers and using the memories of eyewitnesses, he enlarged his story. His English translation was printed in March 1563 under the title *Actes and monuments of these latter and perillous dayes.* It immediately acquired the popular name, *The Book of Martyrs.* In 1570 he produced his greatly improved second edition. This was the crown of his achievement; he made few changes in his third (1576) and fourth (1583) editions.

Foxe was ordained an Anglican priest in 1560, but having Puritan scruples he refused all offices, obtaining two church stipends that required no duties. He often preached, however, and a sermon delivered at Paul's Cross (*A Sermon, Of Christ Crucified* [1570]) had a wide sale. In the plague of 1563 he ministered to the victims and wrote a moving tract of consolation. When Anabaptists in 1575 and Jesuits in 1581 were condemned to death, Foxe wrote vehement letters to Queen Elizabeth and her councillors, begging reprieves.

Foxe's monument is his book. It has been criticized as prolix, carelessly edited, one-sided, sometimes credulous, but it is honest and strong in facts, preserving much firsthand material on the English Reformation unobtainable elsewhere.

Foxe, Richard, Foxe also spelled FOX (b. *c.* 1448, Ropsley, Lincolnshire, Eng.—d. Oct. 5, 1528, Wolvesley, Hampshire), English ecclesiastical statesman, one of the chief ministers of King Henry VII (ruled 1485–1509) and founder of Corpus Christi College, Oxford (1515–16).



Bishop Richard Foxe, detail of an oil on panel painting by Johannes Corvus, *c.* 1522; in the collection of Corpus Christi College, Oxford
By courtesy of the President and Fellows of Corpus Christi College, Oxford; photograph, M.R. Dudley

After receiving ordination into the priesthood Foxe became secretary in Paris to Henry Tudor, earl of Richmond, an exiled claimant to the throne. On Richmond's accession as King Henry VII, Foxe was made principal secretary of state and lord privy seal. He later became bishop of Exeter (1487–91), Bath and Wells (1491–94), Durham (1494–1501), and Winchester (1501–28).

Nevertheless, he neglected his ecclesiastical duties to concentrate on diplomacy. He negotiated the treaties and directed the diplomatic manoeuvres that minimized the aid given by the Scots, the French, and the Dutch to rival claimants to Henry's throne. In addition, he helped formulate and execute Henry's ruthlessly efficient financial policies.

After Henry VII's death in 1509 Foxe for a time remained in favour with the new ruler, Henry VIII. By 1511 he was, however, losing influence to Thomas Wolsey, who became Henry's chief minister. Foxe resigned from the government in 1516 and—by then nearly blind—spent the last years of his life administering his diocese.

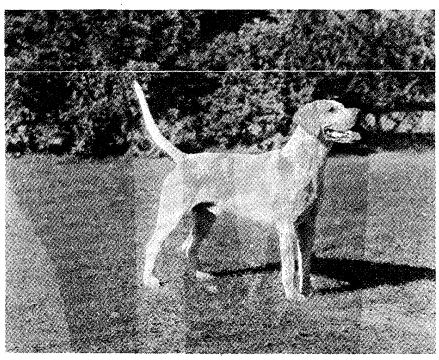
foxglove, any of 20 to 30 species of herbaceous plants of the genus *Digitalis* (family

Foxglove (*Digitalis*)
Derek Fell

Scrophulariaceae, *q.v.*), especially *D. purpurea*, the common, or purple, foxglove, which is cultivated commercially as the source of the heart-stimulating drug digitalis. Foxgloves are native to Europe, the Mediterranean region, and the Canary Islands, and they typically grow to a height of 45 to 150 centimetres (18 to 60 inches).

The plants produce alternating, ovate to oblong leaves toward the lower part of the stem, which is capped by a tall, one-sided cluster of pendulous, bell-shaped flowers, each of which may be up to 6½ centimetres (2½ inches) long. The flowers may be purple, yellow, or white and are often marked with spots within.

foxhound, either of two breeds of dogs, one English and one American, that are traditionally kept in packs for the centuries-old ride to hounds of fox-hunting sportsmen. The English foxhound is the product of long, careful breeding. It stands 21 to 25 inches (53 to 64 centimetres) and weighs 60 to 70 pounds (27 to 32 kilograms). It has a short coat, which is usually a combination of black, tan, and white.



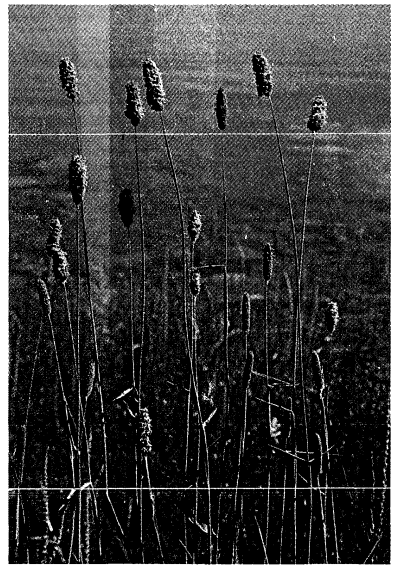
Foxhound
Sally Anne Thompson—EB Inc.

The American foxhound resembles the English in appearance and size but is more lightly built. It is the oldest breed of sporting dog in the United States and was developed from English foxhounds imported in 1650 and in later years. Various regional strains are found in the United States and are named after their developers; these include the Trigg, Walker, July, and Birdsong hounds. Both breeds of foxhounds have been bred to be strong, swift, and versatile dogs; they are seldom kept as house pets.

Consult the INDEX *first*

foxtail, any of the weedy grasses in the genera *Alopecurus* and *Setaria* of the family Poaceae. There are about 25 species of *Alopecurus,* distributed throughout the North Temperate Zone. Most species are perennial weeds, with dense, cylindrical, often brushlike, flower clusters that resemble foxes' tails. Meadow foxtail (*A. pratensis*), which is native to Eurasia, is used as a forage grass in northern North America; it stands 30 to 80 centimetres (about 12 to 30 inches) high and has a light-green flower cluster 7 cm long.

The genus *Setaria* (formerly called bristle grass) includes nearly 125 species of annual and perennial grasses, mostly of tropical Africa but found in warm areas of all the continents. The plants are taller than those of *Alopecurus,* with bristly flower clusters and flat, thin leaf blades. More than 40 species are found in North America. A few are forage grasses, as



(Top) meadow foxtail (*Alopecurus pratensis*); (bottom) foxtail millet (*Setaria italica*)
(Top) Ingmar Holmasen, (bottom) A to Z Botanical Collection—EB Inc.

plains foxtail (*S. macrostachya*). Foxtail millet (*S. italica*; *see* millet) is the only economically valuable species. Yellow foxtail (*S. lutescens* or *S. glauca*) and green foxtail (*S. viridis*), named for the colour of their bristles, are common in cornfields and disturbed areas. Bristly foxtail (*S. verticillata*), whose barbed bristles stick to animals and clothing, is also found in those places; the flower clusters from different plants may stick together, forming dense tangles. The name giant foxtail is applied to two weedy annuals: *S. faberi* and *S. magna.*

Foxx, Jimmie, byname of JAMES EMORY FOXX (b. Oct. 22, 1907, Sudlersville, Md., U.S.—d. July 21, 1967, Miami), U.S. professional baseball player, the second man in major league history to hit 500 home runs. (Babe Ruth was the first.) A right-handed hitter who played mostly at first base, Foxx appeared in his first major league game in 1925 and his last in 1945. He hit his first home run in 1927, reached the 500 mark in 1940, and finished with a total of 534 home runs. His career batting average was .325.

Foxx played for the Philadelphia Athletics of the American League from 1925 through 1935. In 1932 he hit 58 home runs, his highest single-season output. He was with the Boston Red Sox of the American League (1936–mid-1942), hitting 50 home runs and batting in 175 runs in 1938. Subsequently he played for Chicago and Philadelphia in the National League. In 1932, 1933, and 1938 Foxx was chosen the most valuable player in the American League. He was elected to the Baseball Hall of Fame in 1951.

Foxx, 1940
UPI—EB Inc.

Foy, Eddie, in full EDWIN FITZGERALD FOY (b. March 9, 1856, New York City—d. Feb. 16, 1928, Kansas City, Mo., U.S.), U.S. comedian famous on the vaudeville circuit in the late 19th and early 20th century.

As a child he sang and danced in the streets of New York and Chicago to help support his family. He gained his first professional recognition in the mining camps and cow towns of the West, beginning around 1878. He returned to Chicago in 1888 as the star comedian in variety shows and revues. Between 1904 and 1913 he played the leading comic roles in a series of musical comedies in New York City, among them *Piff! Paff! Pouf!* and *The Earl and the Girl.* He entered vaudeville in 1913 with a highly successful act that included his seven children and appeared with them in one motion picture. Foy retired in 1923 but returned to the stage in 1927 and died while on a farewell tour. His son Eddie Foy, Jr. (1905–83) was active in vaudeville, films, the musical and legitimate stage, and television.

Eddie Foy
Culver Pictures

Foy, Maximilien(-Sébastien) (b. Feb. 3, 1775, Ham, Fr.—d. Nov. 28, 1825, Paris), French military leader, writer, and statesman who rose through the ranks of the imperial army during the Napoleonic Wars (1800–15) and then emerged as a leading spokesman of the liberal opposition during the early years after the Bourbon Restoration (1815).

Foy served in the artillery and the infantry, attaining the rank of major in 1796, staff colonel in 1799, and brigadier general in 1808. He voted against the Consulate and against the Empire, but his exceptional military abilities kept him in the service of Napoleon's armies. He distinguished himself in the Rhineland and the Middle East and especially in less successful campaigns in Portugal and Spain. After Napoleon's final defeat at Waterloo (1815), Foy retired from military life and published what was to remain an incomplete *Histoire des guerres de la Péninsule* (1819; *History of the Peninsular War, Under Napoleon*). In 1819 he was elected to the Chamber of Deputies from the Aisne *département,* where he led the liberal opposition until his death.

Foy's liberalism, flair for oratory, and military reputation gained him a large popular following, and his funeral was the occasion of a demonstration against the Bourbons in which more than 100,000 persons participated. In 1826 a two-volume edition of his speeches, *Discours du général Foy,* was published.

foyer, intermediate area between the exterior and interior of a building, especially a theatre. Originally the term was applied only to that area in French theatres, comparable to the greenroom in English theatres, where actors relaxed when they were offstage. Because actors were accustomed to visits by friends during and after performances, such areas came to be large and handsomely decorated.

In older French opera houses there were three foyers: one each for the public, the ballet, and the singers. In the contemporary United States the foyer is simply the vestibule or entrance area of a theatre, and the name is also applied rather indiscriminately to lobbies of public buildings and apartment houses, and even to entryways of private homes.

Foyle, Lough, Irish LOCH FEABHAIL, inlet on the north coast of Ireland between the Inishowen Peninsula (mainly County Donegal, Ireland) to the west and the district councils of Limavady and Londonderry (until 1973 in County Londonderry), Northern Ireland, to the east and southeast. The lough is about 16 miles (26 km) long and varies in breadth from 1 to 10 miles (1.6 to 16 km). The narrowest points are at the southwestern end, where the River Foyle enters the lough, and at the northeastern end, opposite Magilligan Point. There are historic settlements on the western shore of the lough, which has been an important fishing area and passageway since early times.

Foyt, A(nthony) J(oseph), (Jr.) (b. Jan. 16, 1935, Houston, Texas, U.S.), versatile and successful American automobile racing driver, who won the Indianapolis 500 in 1961, 1964, 1967, and 1977, the first four-time winner.

A racer from the age of 17 and—unlike many drivers—an expert auto mechanic, he participated in his first Indianapolis race in 1958 and later in that year drove in the Monza (Italy) contest. He drove successfully in sports car and stock car racing. He was national champion stock car driver in 1968, 1978, and 1979.

F.P.A. (U.S. author): *see* Adams, Franklin Pierce.

Fra Mauro, crater on the Moon that appears to be heavily eroded, named for a 15th-century Italian monk and mapmaker. The site of the third manned lunar landing, the Apollo 14 mission in February 1971, is several miles north of the crater. About 80 km (50 miles) in diameter, Fra Mauro lies in Mare Nubium (the Sea of Clouds) at about 6° south latitude, 17° west longitude.

Fracastoro, Girolamo, Latin HIERONYMUS FRACASTORIUS (b. *c.* 1478, Verona, Republic of Venice [now in Italy]—d. Aug. 8, 1553, Caffi [now Affi], near Verona), Italian physician, poet, astronomer, and geologist, who proposed a scientific germ theory of disease more than 300 years before its empirical formulation by Louis Pasteur and Robert Koch.

At the University of Padua Fracastoro was a colleague of the astronomer Copernicus. As a physician, he maintained a private practice in Verona. He is best-known for "Syphilis sive morbus Gallicus" (1530; "Syphilis or the French Disease"), a work in rhyme giving an account of the disease, which he named. He made an intense study of epidemic diseases, and, while in the service of Pope Paul III at the Council of Trent (1545–63), he provided the medical justification for the removal of the council to the papal state of Bologna by pointing out the danger of plague in the north Italian town of Trent.

Fracastoro outlined his concept of epidemic diseases in *De contagione et contagiosis morbis* (1546; "On Contagion and Contagious Diseases"), stating that each is caused by a different type of rapidly multiplying minute body and that these bodies are transferred from the infector to the infected in three ways: by direct contact; by carriers such as soiled clothing and linen; and through the air. Although microorganisms had been mentioned as a possible cause of disease by the Roman scholar Marcus Varro in the 1st century BC, Fracastoro's was the first scientific statement of the true nature of contagion, infection, disease germs, and modes of disease transmission. Fracastoro's theory was widely praised during his time, but its influence was soon obscured by the mystical doctrines of the Renaissance physician Paracelsus, and it fell into general disrepute until it was proved by Koch and Pasteur.

Fracastoro, engraving
Giraudon—Art Resource/EB Inc.

fractal, in mathematics, any of a class of complex geometric shapes that commonly exhibit the property of self-similarity. Fractals are distinct from the simple figures of classical, or Euclidean, geometry—the square, the circle, the sphere, and so forth. They are capable of describing the many irregularly shaped objects or spatially nonuniform phenomena in nature that cannot be accommodated by the components of Euclidean geometry. The term *fractal,* derived from the Latin word *fractus* ("fragmented," or "broken"), was coined by the Polish-born mathematician Benoit B. Mandelbrot. Since its introduction in 1975, the concept of the fractal has given rise to a new system of geometry that has had a significant impact not only on mathematics but also on such diverse fields as physical chemistry, physiology, and fluid mechanics.

Although not all fractals are self-similar or at least not exactly so, most evince this property. A self-similar object is one whose component parts resemble the whole. This reiteration of irregular details or patterns occurs at progressively smaller scales and can, in the case of purely abstract entities, continue indefinitely, so that each part of each part, when magnified, will look basically like the object as a whole. In effect, a self-similar object remains invariant under changes of scale—*i.e.,* it has scaling symmetry. This fractal phenomenon can be readily seen in such objects as snowflakes and tree barks. All natural fractals of this kind, as well as some mathematical self-similar ones, are stochastic, or random; they thus scale in a statistical sense. Because fractal objects are irregular in shape, they do not possess the translational symmetry of Euclidean figures. (If any such figure is rotated about itself, it remains invariant.)

Another key characteristic of a fractal is a mathematical parameter called fractal dimension. This is the one characteristic of a fractal that remains the same regardless of how much the object is magnified or whether the angle of view varies. Unlike Euclidean dimension, fractal dimension is generally expressed by a noninteger—that is to say, by a fraction rather than by a whole number. Fractal dimension can be understood by considering a fractal curve. At each stage in its construction, the length of the perimeter of such a curve increases in the ratio of 4 to 3. The fractal dimension, D, denotes the power to which 3 must be raised to produce 4—*i.e.,* $3^D = 4$. The dimension that characterizes the fractal curve is thus log 4/log 3, or roughly 1.26. Fractal dimension reveals precisely the nuances of the shape and the complexity of a given non-Euclidean figure.

Fractal geometry with its concepts of self-similarity and noninteger dimensionality has been applied increasingly in statistical mechanics, notably when dealing with physical systems consisting of seemingly random features. For example, fractal simulations have been used to plot the distribution of galaxy clusters throughout the universe and to study problems related to fluid turbulence. Fractal geometry also has contributed much to computer graphics. Fractal algorithms have made it possible to generate lifelike images of complicated, highly irregular natural objects, such as the rugged terrains of mountains and the intricate branch systems of trees.

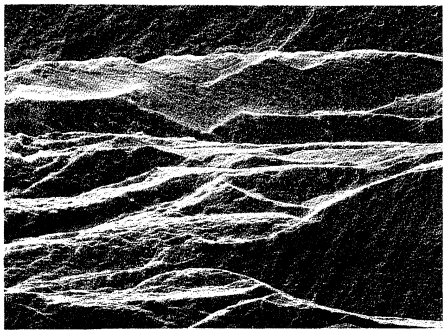
fractional reserve system, also called MINIMUM RESERVE SYSTEM, banking system followed by all modern banks in which less than 100 percent of bank deposits are held as reserves. The portion of the money not held as reserves is used to earn income by means of loans and investments; some of this portion eventually returns to the banking system as new deposits. Thus, the banking system is able to expand the money supply through the creation of new demand deposits.

Banks do not have unlimited freedom to expand deposits but must usually maintain required reserves, which may be held as currency or as deposits at the central bank. The ratio of the required reserves to a bank's total deposits may be set by custom or by law; use of legally required reserves appears to have originated in the United States.

The fractional reserve system is strengthened by the ability of banks to liquidate some of their assets quickly by calling in loans, selling short-term securities, or borrowing cash from the central bank.

fracture, in mineralogy, appearance of a surface broken in directions other than along

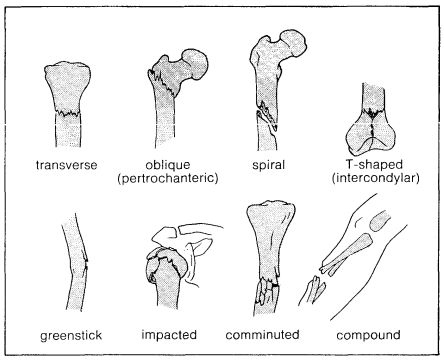
cleavage planes. There are several kinds of fractures: conchoidal (curved concavities resembling shells—*e.g.*, flint, quartz, glass); even (rough, approximately plane surfaces); uneven (rough and completely irregular surfaces,



Slate, a metamorphic rock, showing typical splintery fracture and thin layering (slightly larger than life size)
John H. Gerard

the commonest fracture type); hackly (sharp edges and jagged points and depressions—*e.g.*, most metals); and splintery (partially separated splinters or fibres—*e.g.*, jadeite). *See also* cleavage.

fracture, in pathology, a break in a bone, caused by stress. Certain normal and pathological conditions may predispose bones to fracture. Children have relatively weak bones because of incomplete calcification, and older



Types of fractures of bone
From *Dorland's Illustrated Medical Dictionary*, 24th edition (1965); reproduced by permission of W.B. Saunders Company, Philadelphia

adults, especially women past menopause, develop osteoporosis, a weakening of bone concomitant with aging. Pathological conditions involving the skeleton, most commonly the spread of cancer to bones, may also cause weak bones. In such cases very minor stresses may produce a fracture. Other factors, such as general health, nutrition, and heredity, also have effects on the liability of bones to fracture and their ability to heal.

A fracture is called simple (closed) when the overlying skin is not broken and the bone is not exposed to the air; it is called compound (open) when the bone is exposed. When a bone weakened by disease breaks from a minor stress, it is termed a pathological fracture. An incomplete, or greenstick, fracture occurs when the bone cracks and bends but does not completely break; when the bone does break into separate pieces, the condition is called a complete fracture. An impacted fracture occurs when the broken ends of the bone are jammed together by the force of the injury. A comminuted fracture is one in which the broken ends of the bone are shattered into many pieces.

The most common symptoms of fracture are pain and tenderness at the site, a sensation of grating or grinding with movement, and inability to use the limb or body part supported by the bone. Physical signs include deformity of the part, swelling in the region of the fracture, discoloration of the overlying skin, and abnormal mobility of the bone.

All fractures attempt to heal in the same fashion. The injured bone quickly produces new tissue that extends across the fracture line and joins the broken pieces together. At first this new tissue is soft and puttylike; later, bony and hard. While re-forming, the bone must be protected from weight bearing and movement between the fracture ends.

The major complications of fracture include failure to heal, healing in a position that interferes with function, and loss of function despite good healing. Failure to heal is frequently a result of infection. Because healing will not ordinarily take place until infection is brought under control, all procedures are aimed at combating infection at the site of injury whenever the possibility exists (as in compound fractures). Failure to heal may also result from severe destruction of bone, disruption of blood supply, or inadequate immobilization of the limb or body part involved; sometimes the cause cannot be determined. Healing is encouraged by cleansing of the fracture site, closure of the overlying broken skin by suture or skin graft, and reimmobilization; bone chips may be used to fill a gap in the fractured bone left by long infection or severe bone destruction. Healing in a poor position, or malunion, may occur when realignment has been improper or when injuries have destroyed large portions of the bone so that deformity must be accepted to salvage it. Sometimes the bone is refractured therapeutically so that proper alignment may be achieved. Injuries to the growth centres of bones in children cause malunion and subsequent growth in a deformed manner.

Fractures in joints present a particularly serious problem because the normally smooth surface of the joint may be destroyed. If the fracture heals in irregular alignment, the joint is likely to be permanently stiff and painful; osteoarthritis is a frequent complication in old age. Unless the surface of the joint can be accurately aligned by manipulation or traction, surgery is necessary. Loss of function may be caused by prolonged immobilization, by heavy scarring after severe injury or infection, or by injury to motor nerves.

fracture-dislocation, a severe injury in which both fracture and dislocation take place simultaneously. Frequently, a loose piece of bone remains jammed between the ends of the dislocated bones and may have to be removed surgically before the dislocation can be reduced. Immobilization must be longer than in a simple dislocation to permit healing of the fracture; chances for permanent stiffness or disability are greater than in uncomplicated dislocation or fracture.

Fraenkel-Conrat, Heinz L(udwig) (b. July 29, 1910, Breslau, Ger.), German-American biochemist who helped to reveal the complementary roles of the structural components of viruses (a "core" of ribonucleic acid [RNA] enveloped by a protein "coat"). In a series of experiments on the tobacco mosaic virus, he disassembled the virus into its noninfectious protein and nearly noninfectious nucleic acid components, and then, by recombining these components, succeeded in effecting the reconstitution of the fully infective virus. Studies of this reconstitution reaction led to the discovery that viral infectivity resides in the nucleic acid portion of the virus, which in the absence of the viral protein is broken down by RNA-splitting enzymes, or nucleases.

Fraenkel-Conrat studied medicine at Breslau (M.D., 1934) and then turned to biochemistry at the University of Edinburgh (Ph.D., 1936). He became a U.S. citizen in 1941. He worked for 10 years at the U.S. Department of Agriculture's Western Regional Research Laboratory and joined the faculty of the University of California, Berkeley, in 1958.

fragile-X syndrome, a chromosomal disorder associated with a fragile site on the end of the X chromosome. The major symptom of the syndrome is mental retardation.

The X chromosome is one of two sex chromosomes (the other being the Y chromosome). Males have one X and one Y chromosome; females have two X chromosomes. The male who receives the fragile-X chromosome will be affected by the syndrome, which is thought to be one of the major causes of mental retardation in males. About one-third of the females who receive one fragile-X chromosome show mild mental retardation; the remaining two-thirds, though intellectually normal, have a 50-50 risk of passing the defective chromosome on to each of their children.

Fragonard, Jean-Honoré (b. April 5, 1732, Grasse, Fr.—d. Aug. 22, 1806, Paris), French Rococo painter whose most familiar works, such as "The Swing" (*c.* 1766), are characterized by delicate hedonism.

Fragonard was the son of a haberdasher's assistant. The family moved to Paris about 1738, and in 1747 the boy was apprenticed to a lawyer, who, noticing his appetite for drawing, suggested that he be taught painting. François Boucher was prevailed upon to accept him as a pupil (*c.* 1748), and in 1752, Fragonard's elementary training completed, Boucher recommended that he compete for a Prix de Rome scholarship, which meant study under the court painter to Louis XV, Carle Van Loo, in Paris. On Sept. 17, 1756, Fragonard set off with other scholarship winners for the French Academy at Rome.

At the academy Fragonard copied many paintings, chiefly by Roman Baroque artists, and, with his friend the French painter Hubert Robert, made numerous sketches of the Roman countryside. When his scholarship ended in July 1759, he was allowed to remain in residence until, in late November, he met a wealthy amateur artist, the Abbé de Saint-Non, who was to become one of his chief patrons. Early in 1760 Saint-Non took Fragonard and Robert on a prolonged tour of Italy, where the two artists studied Italian paintings and antiquities and made hundreds of sketches of local scenery.

In 1761, after returning to Paris, Fragonard exhibited a few landscape paintings and the large "Coresus Sacrifices Himself to Save Callirhoe" at the Salon, where it was purchased for King Louis XV. Consequently,

"The Swing," detail, oil on canvas by Jean-Honoré Fragonard, *c.* 1766; in the Wallace Collection, London
By courtesy of the trustees of the Wallace Collection, London

the artist was commissioned to paint a pendant, or companion piece, granted a studio in the Louvre Palace, and accepted as an Academician. Nevertheless, after 1767 he almost ceased to exhibit at the salons, concentrating on landscapes, often in the manner of the 17th-century Dutch painter Jacob van Ruisdael ("Return of the Herd," Worcester); portraits; and decorative, semierotic outdoor party scenes ("The Swing") in the style of Boucher but more fluently painted. His admiration for Rembrandt, Peter Paul Rubens, Frans Hals, and a Venetian contemporary, Giovanni Battista Tiepolo, emerges in a large series of loosely and vigorously executed heads of old men, painted probably between 1760 and 1767 ("Head of an Old Man"), followed by a series of portraits (*c.* 1765–72) in a similar style and in which the sitters were real persons, but their fantastic costumes were emphasized rather than facial expressions.

In 1769 he married Marie-Anne Gérard from Grasse and shortly afterward received the accolade of fashion, when in 1770 he was commissioned by Mme du Barry to decorate her newly built Pavillon de Louveciennes, with four large paintings ("Progress of Love," Frick Collection, New York City), and in 1772 he received a somewhat similar commission from the notorious actress Madeleine Guimard. Neither was a success, the Louveciennes paintings probably being rejected as too Rococo for a totally Neoclassical setting.

A journey to the Low Countries perhaps in 1772–73 increased his admiration for Rembrandt and Hals and was reflected in his later portraits. A second visit to Italy followed in 1773–74. As before, he concentrated on drawing picturesque Italian landscape subjects rather than on painting. The return journey was taken through Vienna, Prague, and Germany. On his return to Paris, the family was joined by his wife's 14-year-old sister, Marguerite, with whom Fragonard fell passionately in love. Consequently, he turned his interests toward a new type of subject matter: domestic scenes inspired by Jean-Jacques Rousseau's moral philosophy or romantic novels ("The Happy Family") or scenes concerned with children's upbringing, in which his son Évariste (born 1780) frequently figures ("The Schoolmistress").

In the last years preceding the French Revolution, Fragonard turned finally to Neoclassical subject matter and developed a less fluent Neoclassical style of painting ("The Fountain of Love"), which becomes increasingly evident in his later works, particularly the genre scenes executed in collaboration with Marguerite Gérard ("The Beloved Child").

Fragonard's art was too closely associated with the pre-Revolutionary period to make him acceptable during the Revolution, which also deprived him of private patrons. At first he retired to Grasse but returned to Paris in 1791, where the protection of the leading Neoclassical painter Jacques-Louis David obtained for him a post with the Museum Commission, but he was deprived of this in 1797. He spent the rest of his life in obscurity, painting little. His death in 1806 passed almost unnoticed, and his work remained unfashionable until well after 1850.

Fragonard has been bracketed with Watteau as one of the two great poetic painters of the unpoetical 18th century in France. A prodigiously active artist, he produced more than 550 paintings, several thousand drawings (although many hundreds are known to be lost), and 35 etchings. His style, based primarily on that of Rubens, was rapid, vigorous, and fluent, never tight or fussy like that of so many of his contemporaries.

Although the greater part of his active life was passed during the Neoclassical period, he continued to paint in a Rococo idiom until shortly before the French Revolution. Only five paintings by Fragonard are dated, but the chronology of the rest can be fairly accurately established from other sources such as engravings, documents, etc. (F.J.B.W.)

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Frahm, Karl Herbert: *see* Brandt, Willy.

frambesia (disease): *see* yaws.

Frame, Janet, in full JANET PATERSON FRAME CLUTHA (b. Aug. 28, 1924, Dunedin, N.Z.), leading New Zealand writer of novels, short fiction, and poetry.

Frame was the daughter of an impoverished railway engineer and was educated in New Zealand. Her early memories of poverty, the deaths of two sisters, and several stays in psychiatric hospitals provided much of the impetus for her work. During her hospitalization, she read the classics voraciously and then began to write.

Her first book, *The Lagoon* (1951), was a collection of short stories expressing the sense of isolation and insecurity of those who feel they do not fit into a normal world. *Owls Do Cry* (1957), an experimental novel, expanded upon the theme of *The Lagoon.* Incorporating both poetry and prose and lacking a conventional plot, *Owls Do Cry* investigates the worth of the individual and the ambiguous border between sanity and madness. In all her novels, Frame depicts a society deprived of wholeness by its refusal to come to terms with disorder, irrationality, and madness.

Among her other novels are *Faces in the Water* (1961), *The Edge of the Alphabet* (1962), *Snowman, Snowman: Fables and Fantasies* (1963), *Scented Gardens for the Blind* (1963), *The Adaptable Man* (1965), *A State of Siege* (1966), *The Rainbirds* (1968), *Intensive Care* (1970), *Daughter Buffalo* (1972), and *Living in the Maniototo* (1979).

She wrote two volumes of memoirs, *To the Is-land* (1982) and *An Angel at My Table* (1984).

frame design, decorative treatment of frames for mirrors and pictures. Before the 15th century in Europe, frames hardly existed separately from their architectural setting and, with the altarpieces or the predellas they surrounded, formed an integral part of the decorative scheme of the church interior. Such frames were frequently burnished with gold leaf. During the 15th century, when paintings were more generally used as secular wall decorations and domestic furnishings, frames began to be designed independently of their surroundings.

A type of Italian picture frame with exuberant wood carving evolved during the Baroque period, remained fashionable for a long time, and has never been completely abandoned. Carved wood frames with a "swept" outline, introduced in the 17th century, remained popular in France throughout the reign of Louis XV. During the 1740s, English mirror frames in the heavy Palladian architectural style began to give way to more delicate designs that were much influenced by French Rococo examples.

During the Neoclassical period in the last third of the 18th century, both on the Continent and in England, there was a return to simpler outlines and a greater austerity in frame ornament. Composition and plaster frames became popular. After the first two decades of the 19th century, frame design for both mirrors and pictures became increasingly eclectic, many being based on styles of the previous century.

In the 20th century the trend has been toward an ever-increasing simplicity, to complement contemporary paintings, mirrors, and architecture. The use of plain, minimal-width frames, as well as materials such as metals and moulded plastic, reflects this movement. Ornamental molded frames, however, have retained their popularity in the 20th century for use with older paintings.

frame harp, musical instrument in which the neck and soundbox are joined by a column, or forepillar, which braces against the tension of the strings. It is one of the principal forms of harp and in modern times is found exclusively in Europe and among the Ostyak, a Finnish people of western Siberia.

Frame harps are known to have existed in Europe by the 9th century AD and in Ireland by the 8th. Their origin is not known; among many speculations are that they were brought to northern Europe by westward-migrating (possibly Celtic) tribes or that they developed indigenously.

Early medieval frame harps evolved in form, eventually developing an incurved neck and a deeply outcurved forepillar. Apparently they were normally strung with wire. By about 1400 this form was superseded by the so-called Gothic harp, having a taller, shallow soundbox; a short, less deeply curved neck; and a more slender, almost straight forepillar. By the 16th century this instrument normally had gut strings. The earlier form gave rise to the medieval Irish harp, or clairseach, the second to the modern orchestral (double-action pedal) harp.

Musician (centre) playing a frame harp in the orchestra of the court of René II, duke of Lorraine, detail of a miniature painting from a 15th-century psalter (musician at right playing a fiddle); in the Bibliothèque Nationale, Paris (MS. lat. 10491)

By courtesy of the Bibliotheque Nationale, Paris

Frame harps were also known in medieval China (considered there to be of European origin), ancient and medieval Syria, and, according to some scholars, occasionally elsewhere in the ancient Middle East.

frame of reference (physics): *see* reference frame.

frame story, overall unifying story within which one or more tales are related. In the single story, the opening and closing constitutes a frame. In the cyclical frame story—that is, a story in which several tales are related—some frames are externally imposed and only loosely bind the diversified stories. For example, the *Jātaka,* a treasury of about 550 ancient Indian folktales, is cast within a framework of Buddhist ethical teaching. *The Thousand and One Nights,* in which Scheherazade avoids death by telling her king-husband a story every night and leaving it incomplete, is another example of a frame story.

Other frames are an integral part of the tales, as in Boccaccio's *Decameron,* in which a group of 10 people fleeing the Black Death gather in the countryside and as an amusement relate 10 stories each; the stories are woven together by a common theme, the way of life of the refined bourgeoisie, who combined respect for conventions with an open-minded attitude to personal behaviour. In Chaucer's *Canterbury Tales,* too, the pilgrimage frame brings together the varied tellers of the tales, who emerge as vivid personalities and develop dramatic relationships among themselves and with their tales.

framed building, structure in which weight is carried by a skeleton or framework, as opposed to being supported by walls. The essential factor in a framed building is the frame's strength. Timber-framed or half-timbered houses were common in medieval Europe. In this type the frame is filled in with wattle and daub or brick. A modern lightweight wood-frame structure, the balloon-frame house with wood cladding, was invented in Chicago and helped make possible the rapid settlement of the western United States. The framed building enjoyed an extensive revival after World War II as the basic form of American suburban housing.

Steel and reinforced concrete are the most common materials in large contemporary structures. During the 19th century, brick or stone walls continued to bear loads, though cast-iron framing was sometimes used supplementarily, being embedded in walls or sometimes freestanding. True skeletal construction on a large scale was first achieved in Chicago by William Le Baron Jenney in the Home Insurance Company Building (1884–85). This building featured a frame of both iron and steel. In the 20th century reinforced concrete emerged as steel's main competitor.

The French architect Auguste Perret was the first to give external expression to a framed building (1903); he exposed as much as possible the reinforced-concrete framework of his buildings and eliminated most nonstructural elements. Contemporary architecture has done away with most traditional walls altogether by the use of metal and glass screens, or curtain walls, as exterior cladding.

Framingham, town, Middlesex county, eastern Massachusetts, U.S. It lies along the Sudbury River, 21 miles (34 km) west of Boston. Settled in 1650, it was incorporated in 1700 and derived its name from Framlingham, Suffolk, Eng. Framingham Center, just north of the downtown area, was the original village. Framingham's industrial development dates from 1835, with the utilization of local waterpower and the advent of the railroad. Textile mills and carpet manufacturing were important during the 19th century, but the town's diversified economy now also includes automobile assembly, printing and publishing, and the manufacture of computer components, machinery, hats, and rubber products. Framingham is the site of Shoppers' World, one of New England's first planned suburban shopping complexes. Framingham State College was founded in 1839 at Lexington and relocated in 1853. The State Reformatory for Women is in the town. Pop. (1986 est.) 63,890.

Frampton, Sir George James (b. June 16, 1860, London, Eng.—d. May 21, 1928, London), English sculptor and craftsman, the creator of some noted public monuments.

Frampton studied under W.S. Frith and at the Royal Academy schools, where he won a traveling studentship. In 1888–90 he studied in Paris under A. Mercié, by whom he was much influenced. At the beginning of the 1890s he was attracted by the Arts and Crafts Movement and experimented with decorative sculpture, using materials such as bronze, ivory, marble, and jewels combined in one work. His principal statues include those of Mrs. Alice Owen at Owen's School, Islington, London; Queen Victoria at Calcutta, India, at Leeds and Southport, Eng., and at Winnipeg, Man., Can.; and (all in London) Quintin Hogg in Langham place, Peter Pan in Kensington Gardens, and Edith Cavell in St. Martin's Lane. Frampton became a royal academician in 1902 and was knighted in 1908.

franc, originally a French coin but now also the monetary unit of a number of countries, notably France, Belgium, Luxembourg, Switzerland, most French and former Belgian overseas territories, and some African states. The name was first applied to a gold coin minted by King John II of France in 1360, which bore on one face the Latin legend *Johannes Dei gratia Francorum rex* ("John, by the grace of God, king of the Franks"). Because this coin also carried the figure of the king on horseback, it was known as the *franc à cheval* to distinguish it from another coin of the same value later issued by Charles V of France. This latter coin was called the *franc à pied* because it showed the monarch standing on foot under a canopy. During the 17th century the minting of gold francs ceased, but the name was freely applied by the French public to the new unit of exchange—the livre tournois, a gold coin subdivided into 20 sols. In 1795, to symbolize the political changes that followed the French Revolution, the republican government introduced a new franc currency. The first coin was a five-franc silver piece; gold coins worth 20 francs (napoleons) were coined in quantity later. The livre tournois, which was exchangeable into the new currency at a rate of 81 livres to 80 francs, continued to circulate in France until 1834.

The franc was formally established as the monetary unit of France in 1799 and made divisible into 10 decimos and 100 centimes; it has continued as the basis of the French monetary system ever since.

The Swiss franc was adopted by France's client state, the Helvetic Republic (made up of cantons of Switzerland) in 1799. The Belgian franc was adopted by Belgium in 1832, after independence. The Luxembourg franc was adopted in 1848 in place of the Dutch guilder.

Most of France's foreign colonies attained independence in the 1950s and early '60s, and many of the resulting Saharan and sub-Saharan African nations retained the name franc for their own basic monetary units. These countries, most of which formerly constituted French West Africa and French Equatorial Africa, became members of the Franc Zone; their currencies are linked to the French franc at a fixed rate of exchange and are freely convertible into that franc. The members of the Franc Zone also hold most of their financial reserves in the form of French francs.

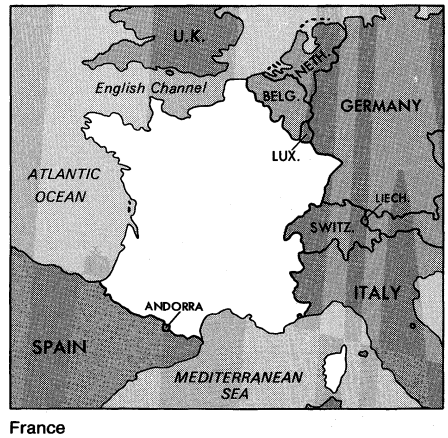
Franca, city, in the highlands of northeastern São Paulo *estado* ("state"), Brazil. It lies at 3,314 feet (1,010 m) above sea level. Known variously as Vila Franca del Rei and Vila Franca do Imperador, it was given town status in 1824 and was made the seat of a municipality in 1856. The city has one of the largest sugar refineries in Brazil; coffee, rice, corn (maize), cotton, and *feijão* (beans) are also grown locally. Industries in the city manufacture furniture, shoes, vehicles, chemicals, pharmaceuticals, and other products. Goods travel by rail and road to São Paulo city, 236 miles (380 km) south, and to other centres in São Paulo and neighbouring Minas Gerais states. Franca also has an airfield. Pop. (1980) 143,630.

France, officially FRENCH REPUBLIC, French FRANCE, or RÉPUBLIQUE FRANÇAISE, Europe's second largest country after the Soviet Union, with an area of 210,026 square miles (543,965 square km). The capital is Paris. France is bordered on the northeast by Luxembourg and Belgium, on the northwest by the English Channel, on the west by the Atlantic Ocean and the Bay of Biscay, on the south by Spain, Andorra, and the Mediterranean Sea, and on the east by Italy, Switzerland, and Germany. The island of Corsica in the Mediterranean is an integral part of France. The population of France in 1990 was estimated at 56,411,000.

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

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. Three main geological regions are distinguishable: the worn remains of the ancient mountains that make up the Hercynian massifs (the Ardennes, the Vosges, the Massif Central, and the Massif Armoricain); the northern and western plains (the Paris Basin, the Loire plains, the Aquitaine Basin, and the Alsace Plain); and the higher young fold mountains of the south and southeast, including the Pyrenees, the Jura, and the Alps, with the adjoining narrow Saône and Rhône plains. The Massif Central, the largest of the Hercynian massifs, covers an area of about 35,000 square miles (91,000 square km) and attains a height of 6,188 feet (1,886 m) at Puy de Sancy. The lowlands lie below 1,000 feet (300 m) and cover about two-thirds of France. The Paris Basin lies to the north and northwest of the Massif Central and is drained by the Seine River and its tributaries. The Pyrenees stretch for more than 280 miles (450 km), forming a natural barrier between France and Spain. The Jura Mountains, extending into Switzerland, are composed of folded limestones. They reach their highest elevation at Mount Neige (5,653 feet [1,723 m]) in France. The French Alps were formed in a series of foldings that lasted from the beginning of the Tertiary to the Quaternary period (from about 66.4 to 1.6 million years ago). Their highest point is Mont Blanc (15,771 feet [4,807 m]). Between these young mountains are the Saône and the



France

Rhône plains, which extend southward to the Rhône delta. West of the delta lies the featureless Languedoc coastal plain and to the east is the Côte d'Azur region, with its internationally known resort area, the French Riviera. The river systems of France are determined by a major divide that runs from the southern part of the Vosges in the northeast to the Massif Central in the south. Along this divide originate most of the westward-flowing rivers, including the Seine and the Loire.

France's climate is generally moderate, combining Atlantic, Mediterranean, and continental influences. Winters are generally mild outside the mountains and Alsace in northeastern France. The northwest is characterized by its low monthly temperature variation, Brest having an average temperature of 43° F (6° C) in January and 61° F (16° C) in July; by its extreme humidity and moderate rainfall (35 inches [900 mm]); and by the frequency of gale-force winds. The climate of the Paris Basin is a mixture of both maritime and continental influences. The average annual temperature is 53° F (11° C), and average annual precipitation is about 23 inches (585 mm) in Paris. The Mediterranean climate of the southeast is characterized by mild winters, heavy precipitation during autumn and spring, dry summers, and violent northerly winds called the mistral. Nice, which lies on the Mediterranean coast, has an average temperature of 47° F (8° C) in January and only a few days of frost. The average annual rainfall for most of the country is from 30 to 40 inches (760 to 1,000 mm), with the mountainous areas having more than 60 inches (1,500 mm) and often nearly 80 inches (2,000 mm) a year.

About three-fifths of the land is suitable for agriculture, and France has some of the world's best cereal-growing land. About one-half of the country's arable land is used for cereals, chiefly wheat and corn (maize), but also including barley and oats. Vines, fruits, and vegetables cover only a limited area but represent more than one-fifth of the total value of agricultural output. Forests cover approximately one-fourth of the land area.

After decades of exploitation of iron-ore deposits in Lorraine, France ranks among the world's leading producers of iron ore. It also has sizable reserves of tungsten, arsenic, diatomite, gypsum, magnesium, bauxite, lead, and zinc. It has limited reserves of petroleum, natural gas, and coal.

The people. The French consider themselves a single race and a single nation, but they are actually amalgams of ethnic strains that overlapped during centuries of invasions and migrations.

About three-fourths of the French people belong to the Roman Catholic church. Other religious groups of sizable numbers include Protestants of various denominations, Jews, and Muslims. A significant portion of the population is also atheist. French is the national and official language, spoken and taught everywhere and its integrity jealously guarded as government policy. Occitan, Basque, and German continue to be spoken in some areas, and there are many regional dialects of French. The birth rate is about average for Europe as a whole, which is about one-half the world average. The death rate is also about average for Europe, while the net migration is negligible. The largest cities are Paris, Marseille, Lyon, Toulouse, Nice, Strasbourg, Nantes, Bordeaux, and Saint-Étienne.

The economy. France has a developed, mixed economy in which both public and private sectors participate. Successive governments have promoted varied economic activities, which are determined by the country's national plans. Some nationalization of industry has taken place. The gross national product (GNP) is growing faster than the population, and the GNP per capita is about average for a developed, highly industrialized country.

Although France is the leading agricultural country in western Europe, the agricultural sector accounts for less than one-twentieth of the gross domestic product (GDP) and employs about one-twelfth of the work force. Government efforts to revitalize agriculture have involved the consolidation of farm units and greater emphasis on the use of fertilizers and irrigation. France is a major exporter of wine, dairy products, wheat, and tinned fruits and vegetables. The country's agricultural imports include fruits and vegetables and meat and meat preparations.

Roundwood production is among the highest in western Europe. The forests, however, remain largely unexploited. Despite the extent of France's coastline, the fishing industry remains relatively small. The principal fish landed are pollock, cod, tuna, halibut, sardine, and mackerel. A considerable quantity of shellfish, especially oysters, is also collected.

Production of coal, iron ore, and bauxite has been declining since the 1960s. The government offers extensive subsidies for modernization and diversification of production in the mineral industries.

France is one of the major economic powers of the world, ranking along with such countries as the United States, the Soviet Union, Japan, and Germany. Manufacturing accounts for approximately one-fourth of the GDP and employs slightly more than that proportion of the work force. Efforts to modernize and restructure French industry have been made difficult by a relative scarcity of very large firms and a preponderance of very small ones. The government owns certain large-scale industries and has actively encouraged mergers; subsidies have allowed selected French products to compete advantageously in world markets. Major manufactures include steel, motor vehicles, aircraft, mechanical and electrical products, textiles, chemicals and pharmaceuticals, and food products.

The government controls the generation and distribution of most electricity. Electricity in France has increasingly been generated by nuclear-power plants.

Services account for almost two-thirds of the GDP and employ more than one-half of the work force.

Public expenditures generally exceed revenues. Most banks and industries were nationalized by the socialist government elected in 1981, which also increased the minimum wage, expanded social-benefit programs, and rescheduled the income tax in favour of those with low incomes. Some banks and industrial enterprises were subsequently returned to the private sector, however.

France is one of the world's largest trading nations. Imports, composed largely of machinery, chemicals and chemical products, agricultural products, and fuels, tend to exceed exports. France remains a major exporter of automobiles, electrical machinery, and metal products. A large percentage of France's trade is with members of the European Community (EC), of which it was a founding member.

France has a highly developed transportation system with extensive highways, inland waterways, and railways. Since the early 1980s certain new lines have been opened in conjunction with the high-speed trains between Paris and other cities in France. Paris is also connected by rail to Geneva and Lausanne in Switzerland. Air France, one of the world's major airlines, provides extensive internal and external service.

Government and social conditions. France has a multiparty democracy dominated by a strong executive. The constitution of the Fifth Republic, adopted in 1958, vests executive authority in the president, who is elected to a seven-year term by popular vote. Article five of this document designates the president as arbiter and guardian of the constitution. The president appoints the prime minister and the executive minister, presides over the Council of Ministers, and also has the power to hold national referenda and to dissolve the National Assembly after consulting the prime minister and the president of the assembly. In times of national emergency, the president may assume full legislative and executive powers.

Legislative responsibility rests with the bicameral Parliament, which consists of a Senate and a National Assembly. The Senate, which possesses limited legislative power, has 321 members elected to nine-year terms by an electoral college. The National Assembly, France's principal legislative body, comprises 577 members elected to five-year terms by popular vote. The assembly can pass specific laws in such fixed areas as tax liability, nationalization of industries, and declaration of war; however, its authority to legislate is circumscribed in matters concerning national defense, education, finance, and social and economic programs. The prime minister is responsible for the determination of governmental policy and exercises control over the civil service and the armed forces. Several political parties dominate the competition for elective office in France: the Socialist Party, a moderately leftist group; the Gaullist Rally for the Republic, a moderately conservative party; the Union for French Democracy, a union of centrist parties; the right-wing National Front; and the left-wing French Communist Party.

There is a hierarchy of courts in the French judicial system. Civil cases are tried in higher and lower courts, criminal cases are tried in courts of correction, and minor offenses are tried in police courts. The administrative courts, which are under the control of the Council of State, examine cases on appeal. Public law and order are maintained by the police and the gendarmerie, the latter reporting to the minister of defense and having heavier duty in the rural areas.

France pursues a highly independent defense policy; the country belongs to NATO but does not participate in that organization's military structure. The French possess their own nuclear weapons force, consisting of strategic bombers, land-based missiles, submarine-launched missiles, and tactical warheads.

France's comprehensive system of social-welfare benefits covers most employed persons. It provides family allowances as well as old-age, disability, and survivor pensions and work-injury, unemployment, and maternity benefits. Insured residents are also reimbursed for part or all of their medical costs.

Health conditions compare favorably with those of other western European countries. France has a relatively low incidence of infectious disease and an adequate supply of both medical personnel and hospital beds. The country's infant mortality rate is comparatively low for Europe, while life expectancy at birth is a high 72 years for males and 80 years for females.

Education is free and compulsory for children between the ages of 6 and 16. At age 11, after five years of primary education, students enter the first cycle of secondary education. Upon graduation at age 15, students proceed to the second cycle, choosing between a two-year course leading to the *brevet d'études professionelles* and a three-year course leading to the *baccalauréat,* which is the minimum qualification for entry to higher education. France has many major universities, of which the most notable and renowned is the Sorbonne (founded *c.* 1257), and several prestigious *grandes écoles,* including institutes such as the École Polytechnique (1794), which has become the most important technical school in France.

The country's news media are free from direct government censorship. The media's de-

pendence on governmental subsidies and the existence of state representation in press and broadcasting councils, however, have sometimes had the effect of forcing journalists to engage in self-censorship.

Cultural life. The French enjoy a highly developed intellectual and artistic life. In literature, one of the most important elements of contemporary French cultural life, the intellectual and humanistic heritage of the past has not been lost. Modern writers continue to be influenced by such world-renowned figures as Michel de Montaigne, creator of the essay; the 17th-century dramatists Pierre Corneille, Molière, and Jean Racine; Jean de La Fontaine, the poet of the fables; and Voltaire, Denis Diderot, Victor Hugo, Charles Baudelaire, Gustave Flaubert, Marcel Proust, and many others.

European art was dominated by French artists from the 18th century to the mid-20th century; these individuals include such important and distinctive artists as Nicolas Poussin, Antoine Watteau, Jacques-Louis David, Jean-Auguste-Dominique Ingres, Eugène Delacroix, Pierre-Auguste Renoir, Claude Monet, Auguste Rodin, Edgar Degas, Berthe Morisot, and Georges Braque, among hosts of others. World cinema has been significantly influenced by such French directors as Jean Renoir, François Truffaut, and Jean-Luc Godard. Among prominent French composers have been Camille Saint-Saëns, Claude Debussy, and Maurice Ravel.

History. France has one of the most complete records of human history in all of Europe. Archaeological excavations have uncovered artifacts more than 100,000 years old, which with the long ensuing record indicate continuous settlement of the region from Paleolithic times.

About 1200 BC the Gauls, a predominantly Celtic people, began a southward and westward migration from the Rhine valley into what is now France and northern Italy. In about 600 BC Ionian Greeks established a trading colony at Massilia (now Marseille), the best known of a number of Ionian settlements that flourished for centuries in what is now southern France. The Romans began their conquest of Gaul in 121 BC, which Julius Caesar completed from 58 to 50 BC. Gaul became thoroughly Romanized during its years of Roman domination.

The decline of Rome left Gaul open to Germanic invasion. By the late 5th century AD the Salian Franks occupied the area north of the Loire River, the Visigoths held Aquitaine and Provence, and the Burgundians dominated the Rhône valley. It was the Salian Franks who, under the leadership of the Merovingians, gained hegemony over most of Gaul during the 6th century. By the 8th century, power had passed to the Carolingians, the greatest of whom was Charlemagne. In the early years of the 9th century, Charlemagne's empire encompassed most of western Europe, but his death brought its division. After 843 the westernmost lands of Charlemagne's empire became known as Francia Occidentalis. When the last Carolingian king died in 987, Hugh Capet was elected king of Francia Occidentalis. Though initially weak and ineffectual, the Capetian dynasty lasted until 1328, by which time the royal domains included most of modern France except Flanders, Brittany, Burgundy, and Aquitaine.

The throne passed to Philip VI of Valois in 1328, precipitating the struggle with England known as the Hundred Years' War (1337–1453). At its conclusion the Valois were firmly established as France's ruling family, and the English had lost all their French holdings except Calais. By the end of the 15th century both Burgundy and Brittany were in Valois hands, and France approximated its modern boundaries.

During the 16th century, Protestantism spread across France and led to a number of religious and civil wars. The wars between Protestants (Huguenots) and Roman Catholics culminated in the massacre of some 3,000 Huguenots in Paris on the eve of St. Bartholemew's Day in 1572. In the turmoil that followed, Henry IV of Navarre, a Protestant of the house of Bourbon, secured the throne but ultimately embraced Catholicism to ensure peace. His Edict of Nantes (1598) granted substantial religious toleration to the Huguenots.

The statecraft of such royal advisers as the cardinals Richelieu and Mazarin during the 17th century helped to make France the greatest power in Europe. The later Bourbon kings, notably Louis XIV, with his opulent palace at Versailles and his conception of himself as the Sun King, raised monarchical absolutism in France to new heights. But defeats in a series of costly foreign wars during the 18th century lost France several of its overseas territories and brought the country near bankruptcy. In 1789 revolution toppled the king, proclaimed the rights of man, and destroyed the ancien régime. The French Revolution took a bloody turn and ended in a weak government of five directors. It soon fell into the hands of Napoleon, who ruled France from 1799 to 1814, first as consul, then as emperor. Napoleon's far-flung military ventures ended in 1815 with his downfall. A limited monarchy was restored and, with the exception of a brief republican period (1848–52), lasted until 1871, when defeat in the Franco-German War (1870–71) brought about the creation of the Third Republic.

The French lost Alsace-Lorraine to the Germans in 1871, but it was returned at the conclusion of World War I. After Nazi Germany's invasion of France in 1940, a collaborationist regime was set up at Vichy, headed by Marshal Philippe Pétain. A resistance movement known as Free France was organized in Britain under the leadership of General Charles de Gaulle. France was liberated by Allied and Free French forces in 1944. Parliamentary democracy was restored to France under the Fourth Republic.

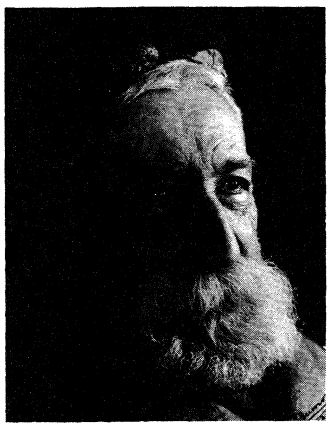
A costly war against nationalist guerrillas in Indochina and the rising nationalism in Algeria and other French colonies during the 1950s overwhelmed the Fourth Republic. In 1958 de Gaulle returned to public life. As president of the Fifth Republic, he presided over the dissolution of most of France's overseas colonies. In 1981 France elected its first Socialist president, François Mitterrand, who was reelected in 1988.

France, Air: *see* Air France.

Kings and presidents of France

Carolingian dynasty	
Charles I (Charlemagne, Kingdom of the Franks)	768–814
Louis I (Kingdom of the Franks)	840–843
Civil War	
Charles II (Kingdom of the West Franks)	843–877
Louis II (Kingdom of the West Franks)	877–879
Louis III (Kingdom of the West Franks)	879–882
Carloman (Kingdom of the West Franks)	879–884
Charles (III) (Charles III, Holy Roman Empire)	884–887
Robertian (Capetian) dynasty	
Eudes	888–898
Carolingian dynasty	
Charles III	893/898–923
Robertian (Capetian) dynasty	
Robert I	922–923
Rudolf (Raoul, or Rodolphe)	923–936
Carolingian dynasty	
Louis IV	936–954
Lothair (Lothaire)	954–986
Louis V	986–987
Capetian dynasty	
Hugh Capet (Hugues Capet)	987–996
Robert II	996–1031
Henry I (Henri)	1031–60
Philip I (Philippe)	1060–1108
Louis VI	1108–37
Louis VII	1137–80
Philip II (Philippe)	1180–1223
Louis VIII	1223–26
Louis IX (Saint Louis)	1226–70
Philip III (Philippe)	1270–85
Philip IV (Philippe)	1285–1314
Louis X	1314–16
John I (Jean)	1316
Philip V (Philippe)	1316–22
Charles IV	1322–28
Valois dynasty	
Philip VI (Philippe)	1328–50
John II (Jean)	1350–64
Charles V	1364–80
Charles VI	1380–1422
Charles VII	1422–61
Louis XI	1461–83
Charles VIII	1483–98
Valois dynasty (Orléans branch)	
Louis XII	1498–1515
Valois dynasty (Angoulême branch)	
Francis I (François)	1515–47
Henry II (Henri)	1547–59
Francis II (François)	1559–60
Charles IX	1560–74
Henry III (Henri)	1574–89
House of Bourbon	
Henry IV (Henri)	1589–1610
Louis XIII	1610–43
Louis XIV	1643–1715
Louis XV	1715–74
Louis XVI	1774–92
Louis (XVII)	1793–95
First Republic	
National Convention	1792–95
Directorate	1795–99
Consulate (Napoléon Bonaparte)	1799–1804
First Empire (emperors)	
Napoleon I (Napoléon Bonaparte)	1804–14, 1815
Napoleon (II)	1815
House of Bourbon	
Louis XVIII	1814–24
Charles X	1824–30
House of Orléans	
Louis-Philippe	1830–48
Second Republic (president)	
Louis-Napoléon Bonaparte	1848–52
Second Empire (emperor)	
Napoleon III (Louis-Napoléon Bonaparte)	1852–70
Third Republic (presidents)	
Adolphe Thiers	1871–73
Marie-Edmé-Patrice-Maurice, comte de Mac-Mahon, duc de Magenta	1873–79
Jules Grévy	1879–87
Sadi Carnot	1887–94
Jean Casimir-Périer	1894–95
Félix Faure	1895–99
Émile Loubet	1899–1906
Armand Fallières	1906–13
Raymond Poincaré	1913–20
Paul Deschanel	1920
Alexandre Millerand	1920–24
Gaston Doumergue	1924–31
Paul Doumer	1931–32
Albert Lebrun	1932–40
French State (État Français, or Vichy regime)	
Philippe Pétain	1940–44
Provisional government	1944–47
Fourth Republic (presidents)	
Vincent Auriol	1947–54
René Coty	1954–58
Fifth Republic (presidents)	
Charles de Gaulle	1959–69
Georges Pompidou	1969–74
Valéry Giscard d'Estaing	1974–81
François Mitterrand	1981–

France, Anatole, pseudonym of JACQUES-ANATOLE-FRANÇOIS THIBAULT, (b. April 16, 1844, Paris—d. Oct. 12, 1924, Saint-Cyr-sur-Loire, Fr.) writer, and ironic, skeptical, and urbane critic who was considered in his day the ideal French man of letters. He was elected to



Anatole France
H. Roger-Viollet

the Académie Française in 1896 and awarded the Nobel Prize for Literature in 1921.

The son of a bookseller, he spent most of his life around books. At school he received the foundations of a solid Humanist culture and decided to devote his life to literature. His first poems were influenced by the Parnassian revival of classical tradition, and, though scarcely original, they revealed a sensitive stylist who was already cynical about human institutions.

This ideological skepticism appeared in his early stories: *Le Crime de Sylvestre Bonnard* (1881; Eng. trans., 1890), a novel about a philologist in love with his books and bewildered by everyday life; *La Rôtisserie de la Reine Pédauque* (1893; *At the Sign of the Reine Pédauque*, 1912), which discreetly mocks belief in the occult; and *Les Opinions de Jérome Coignard* (1893), in which an ironic and perspicacious critic examines the great institutions of the state. His personal life underwent considerable turmoil. His marriage in 1877 to Marie-Valérie Guérin de Sauville ended in divorce in 1893. He had met Madame Arman de Caillavet in 1888, and their liaison inspired his novels *Thaïs* (1890; Eng. trans., 1891), a tale of a courtesan who becomes a saint, set in ancient Egypt, and *Le Lys rouge* (1894; *The Red Lily*, 1908), a contemporary love story set in Florence.

A marked change in France's work first appears in four volumes collected under the title *L'Histoire contemporaine* (1897–1901). The first three volumes—*L'Orme du mail* (1897; *The Elm-Tree on the Mall*, 1910), *Le Mannequin d'osier* (1897; *The Wicker Work Woman*, 1910), and *L'Anneau d'améthyste* (1899; *The Amethyst Ring*, 1919)—depict the intrigues of a provincial town. The last volume, *Monsieur Bergeret à Paris* (1901; *Monsieur Bergeret in Paris*, 1922), concerns the participation of the hero, who had formerly held himself aloof from political strife, in the Alfred Dreyfus affair. This work is the story of Anatole France himself, who was diverted from his role of an armchair philosopher and detached observer of life by his commitment to support Dreyfus. After 1900 he introduced his social preoccupations into most of his stories. *Crainquebille* (1903; *Crainquebille*, 1915), a comedy in three acts adapted by France from an earlier short story, dramatizes the unjust treatment of a small tradesman and proclaims the hostility toward the bourgeois order that led France eventually to embrace Socialism. Toward the end of his life, his sympathies were drawn to Communism. However, *Les Dieux ont soif* (1912; *The Gods are Athirst*, 1913) and *L'Île des Pingouins* (1908; *Penguin Island*, 1909) show little belief in the ultimate arrival of a fraternal society. World War I reinforced his profound pessimism and led him to seek refuge from his times in childhood reminiscences. *Le Petit Pierre* (1918; *Little Pierre*, 1920) and *La Vie en fleur* (1922; *The Bloom of Life*, 1923) complete the cycle started in *Le Livre de mon ami* (1885; *My Friend's Book*, 1913).

France has been faulted for the thinness of his plots and for his lack of a vital creative imagination. His works are, however, considered remarkable for their wide-ranging erudition, their wit and irony, their passion for social justice, and their classical clarity, qualities that mark France as an heir to the tradition of Denis Diderot and Voltaire.

France, Banque de, national bank of France, created in 1800 to restore confidence in the French banking system after the financial upheavals of the revolutionary period. Headquarters are in Paris.

The bank listed among its founding shareholders Napoleon Bonaparte, members of his family, and several leading personalities of the time. Founded partly with the aid of state funds, but mainly with private capital, the bank was closely connected with the state from the beginning. The French government claimed a participation in the control of the bank through the appointment of the governor and two deputy governors, while the shareholders were represented by a board of 15 regents elected by the 200 largest shareholders.

The bank was initially granted the exclusive privilege to issue bank notes in Paris for a period of 15 years; it was later authorized to establish discount offices in towns where commercial requirements made this necessary and was subsequently empowered to exercise its privileges, including the privilege of note issue, in the towns where discount offices were established. Its note issue privilege was extended to cover the whole of France in 1848 as a result of the transformation of nine provincial banks with note-issuing powers into branches of the bank. In 1946 the bank was nationalized, and its note issue privilege was extended for an indefinite period.

The bank performs all the normal central banking functions. Formally it shares these functions with the National Credit Council and the Banking Control Commission, but in practice it has primary responsibility for the formulation and implementation of monetary and credit policies and for the orderly functioning of the banking system. The National Credit Council, set up in 1945, is concerned with all matters relating to credit in the French economy. The Banking Control Commission, created in 1941, is responsible for overseeing the application of the regulations and controls of the banking industry.

France, Collège de, state-supported research institution and centre for adult education in Paris. Founded in 1530 by Francis I, it was originally the Collegium Trilinguae (College of Three Languages). It offers lectures by scholars chosen for eminence in their particular fields without reference to academic qualifications. Professorial chairs are not necessarily permanent, and fields of instruction are emphasized somewhat according to the trend of the times. The college does not grant degrees or certificates and requires neither matriculation nor fees. Distinguished lecturers, among others, have been Jules Michelet, Ernest Renan, Henri Bergson, Paul Valéry, and Claude Lévi-Strauss.

France, Reformed Church of: *see* Reformed Church of France.

France-Soir (French: "Evening France"), daily newspaper published in Paris, one of the city's greatest independent dailies. It was founded as an underground paper during the German occupation of France in World War II, and after the war it emerged as a journal of mass appeal. *France-Soir* has ranked among the country's—and the Continent's—leaders in circulation since its start. The paper has generally attracted readers by stressing sensational news rather than analysis in depth or editorial commentary on political developments. That approach gave it appeal among its basically working-class audience. Aggressive and imaginative in gathering and reporting news, *France-Soir* features lively, eye-catching headlines and numerous pictures. An illustration of its aggressive approach is its acquisition in 1969 of the exclusive right to publish the stories of the U.S. astronauts who were the first to walk on the moon. Like many other French newspapers, *France-Soir* brought members of its editorial staff into a form of partnership after World War II.

Frances OF ROME, SAINT, Italian SANTA FRANCESCA ROMANA (b. 1384, Rome—d. March 9, 1440, Rome; canonized 1608; feast day March 9), founder of the Oblate Congregation of Tor de' Specchi (Oblates of St. Frances of Rome), a community that, with the Olivetan Benedictines, works for the sick and the poor.

When she was only 13, Frances' parents married her to Lorenzo de' Ponziani, whose sister-in-law, Vannozza, helped Frances draft a rule of life for the new order. In the fierce civil strife caused by the Great Schism of the Western Church, the Ponzianis lost their fortune. While living in part of her ruined palace, Frances shared her last resources with the suffering people. With Lorenzo's approval, she founded (1425) the Oblates of Mary, known since 1433 as the Oblate Congregation of Tor de' Specchi. Upon her husband's death in 1436, she became its superior.

Francesca DA RIMINI, original name FRANCESCA DA POLENTA (d. 1283/84, Rimini, Romagna), daughter of Guido da Polenta, lord of Ravenna, whose tragic love affair with Paolo Malatesta is renowned in literature and art. Married to Gianciotto Malatesta (called "the Lame") for reasons of state, she was murdered by him when he discovered her in adultery with his brother Paolo (called "the Fair"), whom he also killed.

Dante was the first to make a literary reference to the tragedy; in Canto V of the *Inferno* he encounters the lovers Francesca and Paolo on the second circle. Their love and death have also been celebrated in plays by Silvio Pellico and Gabriele D'Annunzio, in operas by Hermann Götz and Rachmaninoff, and by many other writers, painters, and composers.

Francesca, Piero della (painter): *see* Piero della Francesca.

Francescatti, Zino, original name RENÉ-CHARLES FRANCESCATTI (b. Aug. 9, 1905, Marseille), U.S. virtuoso violinist known as a champion of contemporary violin music by such composers as Paul Ben-Haim, Virgil Thomson, and William Walton.

A child prodigy, he studied from age three with his mother, his only teacher. He made his debut at five, soloed successfully in Beethoven's *Violin Concerto* at 10, and was an established concert artist by his early 20s. From 1928 he toured widely in Europe and South America, making his U.S. debut in 1939 with the New York Philharmonic. Francescatti made many recordings and toured extensively in the U.S., Europe, and Israel.

Franceschini, Baldassare, also called IL VOLTERRANO (b. 1611, Volterra, Republic of Florence—d. 1689, Florence), Italian painter of the Baroque era.

At a very early age he started as an assistant to his father, a sculptor. From 1652 to 1660 he worked on paintings in the cupola of the Niccolini chapel in Sta. Croce, Florence. His performance during these years was his most notable. Among his best oil paintings of large scale is the "St. John the Evangelist" in the church of S. Chiara at Volterra. One of his last works was the fresco of the cupola of the Annunziata, Florence, which occupied him for two years around 1683.

Franceschini, Marcantonio (b. 1648, Bologna, Papal States—d. 1729, Bologna), Italian painter, a leading artist of the Bolognese school of the Baroque period.

Franceschini worked in Genoa, Modena, and Rome as well as in Bologna and worked extensively for patrons in Austria and Germany. He was made director of the Accademia Clementina in Bologna in 1721. Franceschini was the last important representative of the tradition of the Carracci; the works of Lodovico Carracci and Francesco Albani are the main sources of his style. His figures, brushwork, and colouring are unimaginative and unoriginal, but he had a gift for skillfully arranging an elaborate composition and considerable talent as a decorator. His paintings in both oils and fresco are numerous, though little known; the most famous frescoes, which were done for the church of Corpus Domini, Bologna (1687–94), were destroyed during World War II.

Francesco (Italian personal name): *see under* Francis, except as below.

Francesco DI CRISTOFANO: *see* Franciabigio.

Francesco DI GIORGIO, in full FRANCESCO MAURIZIO DI GIORGIO MARTINI OR DI MARTINO (baptized Sept. 23, 1439, Siena, Republic of Siena—d. 1502, Siena), early Italian Renaissance painter, sculptor, architect, and designer.

Remarkably versatile, a kind of Renaissance *homo universale*, Francesco combined the bold investigation of the Humanist scholars with the conservative lyricism of the Sienese school. His early works were manuscript illuminations, furniture panels, and two monumental altarpieces: the "Coronation of the Virgin" (1471) and "The Nativity" (1475), both works in the Pinacoteca Nazionale, Siena. The "Nativity" shows that Francesco was greatly influenced by Florentine artists of the period, especially Verrocchio.

Francesco is remembered chiefly as an architect and an architectural theorist. He translated Vitruvius and wrote an original work on architecture, *Trattato di architettura civile e militare*, which discusses city planning and military architecture, anticipating some of the architectural theories of the high Renaissance. By 1477 he was in the service of Duke Federico da Montefeltro, in Urbino, where he may have participated in the design and decoration of parts of the palace of Urbino, and built 136 military fortresses. His architectural masterpiece is Sta. Maria del Calcinaio, Cortona (commissioned 1484), which, however, is now greatly altered. As a sculptor he is best known for four bronze figures for the high altar of Siena cathedral (1489–97) and for a series of bronze reliefs showing Verrocchio's influence. (They have also been attributed to the young Leonardo da Vinci.) He also designed fortifications, battle machinery, and weapons and is thought to have originated the land-mine.

Franceville (Gabon): *see* Masuku.

Franceville, capital of La Passa *département* and of Haut-Ogooué province, southeastern Gabon, on the east bank of the Ogooué River, just south of its confluence with the Mpassa. The French explorer Pierre Savorgnan de Brazza founded it in 1880, and until 1946 it was a part of the Middle Congo Colony. It is now an active trading centre in a mining region. The exploitation of manganese at Mouanda and uranium at Mounana, both to the northwest, has greatly stimulated population growth and commerce in the area. Gold, a less important export, is mined southwest of the town, and coffee is a major cash crop in the region. Nearby Poubara is the site of a major power installation. Pop. (1970) 9,345.

Franche-Comté, planning region (French *région de programme*), encompassing the eastern French *départements* of Jura, Doubs, and Haute-Saône and the Territoire de Belfort. The capital is Besançon. The region has an area of 6,251 sq mi (16,189 sq km) and is bounded by the *départements* of Ain to the south, Saône-et-Loire, Côte-d'Or, and Haute-Marne to the west, and Vosges and Haut-Rhin to the north. Switzerland lies to the east. Franche-Comté means Free County and is the name given in the 12th century to the county of Burgundy. After the new kingdom of Burgundy emerged in 888, its kings secured very little control over the local counts in Cisjurane Burgundy; and, even after the kingdom of Burgundy passed to the Holy Roman emperor Conrad II in 1032, the control was intermittent or haphazard. Finally in 1127 a local count, Raynald III, refused to do homage to the German king Lothair II (later Holy Roman emperor). Lothair tried to set up a rival in Raynald's place, but after 10 years of conflict, Raynald was victorious. Thereafter, he was the *franc-comte* ("free count"; German *Freigraf*), and his territory became known as the Franche-Comté.

The succeeding two centuries were years of repeated female succession and dynastic changes. Finally, in 1384, the heiress Margaret of Flanders brought the countship to Philip II the Bold, duke of Burgundy, to whom she had been married in 1369. After the death of Charles the Bold in 1477, his heiress, Mary, married the Austrian archduke Maximilian I of Habsburg (later Holy Roman emperor). The Treaty of Arras (1482), however, ceded the Franche-Comté to the dauphin of France on his betrothal to Mary's daughter Margaret of Austria. When the dauphin became King Charles VIII, he broke this engagement and had to retrocede the Franche-Comté to Austria (Treaty of Senlis, 1493). For the next 185 years, the Franche-Comté was a Habsburg possession.

The Franche-Comté passed to the Spanish Habsburgs with the rest of the Burgundian inheritance through Charles V's partition of his dominions. Under Philip II of Spain, a forceful repression of the Protestants took place, and Henry IV of France, in his war against Philip, violated the Franche-Comté's neutrality. From 1598 to 1635 peace was maintained. The fact, however, that the country was a geographical link in the Spanish Habsburgs' encirclement of France made the French want to annex it. In Louis XIII's war against Spain, it was invaded and ravaged annually from 1636 to 1639, but in 1648, though the Franco-Spanish war went on, the Franche-Comté, as a fief of the Holy Roman Empire held by Spain, was included in the Peace of Westphalia.

Conquered in 1668 by the Great Condé in the War of Devolution but retroceded to Spain by the Peace of Aix-la-Chapelle (Aachen), the Franche-Comté was finally conquered for France by Condé in 1674, in the last of the so-called Dutch Wars. The annexation was recognized by the Peace of Nijmegen (1678), and it was made a French province.

The Franc-Comtois had violently opposed the French invaders, and pro-Spanish feeling lasted until the 18th century. In 1790, along with the rest of France, the Franche-Comté was broken up into *départements.*

Franche-Comté is dominated by the Jura Mountains (*q.v.*). The basin of the upper Saône River extends into Jura. Annual precipitation is high and forests cover much of Franche-Comté.

The region is sparsely populated. The population decreased by more than 16 percent between 1872 and 1946, as it did in much of rural France during that period, but has subsequently grown at a rate approaching the national average. Demographic recovery has favoured Doubs and the Territoire de Belfort over Jura and Haute-Saône, whose rural population has been depleted by emigration. More than one-third of the population is concentrated in the agglomeration of Besançon-Montbéliard-Belfort. Many factory workers continue to live in the villages and commute to work.

Animal husbandry centres on the mountains and dominates agriculture. The region is a leading producer of milk and cheese. Fruits are grown in the lowlands. Forestry remains an important industry. Other industries are highly developed as well and are concentrated along the Doubs River. Clocks and watches are manufactured in Basançon; the Peugeot automobile company has factories in Vesoul and Montbéliard. Other manufactures include textiles, chemicals, and woodwork. Saint-Claude in Jura produces fine pipes and polishes diamonds. Salt is mined in Jura around Salins-les-Bains and Montmorot. Highways and railways are concentrated in the valley of the Doubs River. Pop. (1982) 1,084,049.

Consult the INDEX *first*

Franchet d'Esperey, Louis-Félix-François (b. May 25, 1856, Mostaganem, Alg.—d. July 8, 1942, Albi, Fr.), marshal of France and one of the most effective French military leaders of World War I. He was responsible for driving Bulgaria out of the war, thereby opening the road to Vienna for the Allies.

Trained at Saint-Cyr, d'Esperey served during the prewar period in Algeria and Tunisia. At the outbreak of World War I, he commanded the I Corps at Lille. His successful leadership resulted in his being promoted to command the eastern army group (March 1916) and later the northern army group (January 1917). But after a defeat by the Germans on the Chemin des Dames (a road between the Aisne and Ailette rivers in the Aisne district of northern France) in May 1918, d'Esperey was sent to command the polyglot Allied armies in Macedonia. There he achieved the decisive victory (Sept. 15–29, 1918) that forced Bulgaria out of the war. He then led a bold thrust to the Danube, resulting in the collapse of demoralized German divisions hurriedly sent back from Russia and the surrender of Hungary. He was created a marshal of France in 1921 and was elected to the Académie Française in 1934.

Francia, original name FRANCESCO DI MARCO DI GIACOMO RAIBOLINI (b. 1450, Bologna—d. Jan. 5, 1517/18, Bologna), Italian Renaissance artist and the major Bolognese painter of the late 15th century. He was much influenced by such Ferrarese painters as Lorenzo Costa, Francesco del Cossa, and Ercole de' Roberti, but his later works clearly show the influence of the Umbrians, Perugino, and Raphael. Francia's mature style is seen in such works as his "Assumption" (1504) with its gentle landscape filled with picturesque rock formations and delicate trees in the Umbrian manner and elongated figures that recall those of Costa. Although a large number of repetitious Madonnas were produced in his workshop—*e.g.*, "The Madonna and Child and Two Angels" (Alte Pinakothek, Munich)—a few portraits, such as the "Portrait of Federico Gonzaga as a Boy" (1510; Metropolitan Museum

"Assumption" (lost in war), oil on wood by Francia, *c.* 1504; formerly in the Staatliche Museen, Berlin

By courtesy of the Staatliche Museen zu Berlin

of Art, New York City), reveal his most personal style, which has been called excessively refined.

Francia, José Gaspar Rodríguez de (b. Jan. 6, 1766, Asunción, Río de la Plata—d. Sept. 20, 1840, Asunción, Paraguay), dictator of Paraguay whose intensely personal rule and policy of self-sufficiency left the nation both isolated and without alternative political institutions.

Francia was trained in theology but turned to the practice of law. In 1811 he became secretary to the junta that had overthrown Spanish rule and in 1813 served as co-ruler. The next year he was elected dictator, and in 1816 he obtained the dictatorship for life.

Not content with freedom from Spain, Francia in 1813 declared independence from Argentina, though Paraguay's only tie to the outer world lay on the river route through Buenos Aires. Determined to keep his country independent, Francia forbade all river traffic to Argentina and banned all foreign commerce. Paraguay thus became a hermit nation; few people were permitted to enter or leave.

Francia, or "El Supremo," controlled the national revenues; fostered internal industries to make the nation self-sufficient; introduced modern methods of farming and livestock raising; and organized and equipped the army. He abolished the Inquisition, suppressed the college of theology, swept away tithes, and deprived the aristocracy of their privileges.

Francia was a frugal and honest ruler but unspeakably cruel. The nation survived at a primitive level of self-sufficiency but at a terrible cost in political liberty.

Franciabigio, also called FRANCESCO DI CRISTOFANO, FRANCESCO GIUDINI, or GIUDICI (b. 1482/83, Florence?—d. 1525, Florence), Italian Renaissance painter, best known for his portraits and religious paintings, whose style included early Renaissance, High Renaissance, and Proto-Mannerist elements. His early style is filled with movement and attention to descriptive detail, strongly reminiscent of 15th-century Italian painting. Later, he was attracted to the Florentine works of Raphael, as can be seen in his "Madonna del Pozzo" (*c.* 1508; Accademia, Florence). In the atrium of SS. Annunziata in Florence he painted the "Marriage of the Virgin" (1513) as a portion of a series in which Andrea del Sarto, a leading Florentine painter, was chiefly concerned. When the friars uncovered this work before it was quite finished, Franciabigio was so incensed that, seizing a mason's hammer, he struck at the head of the Virgin and some other heads, and the fresco, which would otherwise be his masterpiece in that method, was mutilated.

For a number of years, Franciabigio maintained a studio with Andrea del Sarto. Together with Andrea's student, Pontormo, they decorated the Medici villa at Poggio a Caiano, where Franciabigio's "Triumph of Cicero" displays his talent for narrative painting. Andrea's influence on Franciabigio may be seen in the dark, smoky background and the soft, dramatic lighting of the "St. Job Altar" (1516, Uffizi, Florence).

Francien *dialect,* Old French dialect from which modern standard French was derived. Originally the language of the Île-de-France region, of which Paris was a part, Francien became the national language of France as a consequence of the political and intellectual importance assumed by Paris in the 13th and 14th centuries. *See* French language.

Francis, name of rulers grouped below by country and indicated by the symbol •.

Foreign-language equivalents:

French	François
German	Franz
Hungarian	Ferenc
Italian	Francesco

AUSTRIA

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

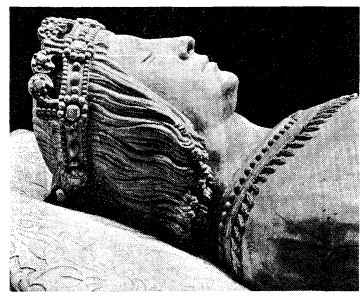
BOHEMIA

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

BRITTANY

• **Francis I** (b. May 11, 1414, Vannes, Fr.—d. July 19, 1450), duke of Brittany (from 1442), son of John V (or VI). He had his brother Gilles thrown into prison and put to death for allegedly spying for the English, with whom he warred (1449–50). The king of France intervened and expelled the English from Normandy.

• **Francis II** (b. June 23, 1435—d. Sept. 9, 1488, Couëron, Brittany), duke of Brittany from 1458, who succeeded his uncle, Arthur III; he maintained a lifelong policy of Breton independence in the face of encroachments by the French crown. The problems of Breton independence were magnified by the fact that Francis had no sons; the fate of his Breton lands would depend on the terms of the marriages he secured for his daughters.



Francis II, detail of a sculpture from his tomb by Michel Colombe (1430–*c.* 1512)

Giraudon—Art Resource/EB Inc.

Francis joined the League of the Public Weal against King Louis XI of France in 1465, invaded Normandy in 1467 on behalf of the dispossessed Charles de France (Louis XI's brother), and allied himself with King Edward IV of England in 1468. Forced to sign the Treaty of Ancenis with France (1468), he allied himself again with Edward in 1475, but once more had to come to terms with France. When Louis XI bought the House of Penthièvre's rights to the duchy of Brittany (1480), Francis in 1481 made yet another treaty with Edward, whereby his eldest daughter, Anne (later queen consort of France), was to marry the Prince of Wales.

When Francis' chief counsellor, Pierre Landais, provoked the hatred of the Breton nobles by his persecution of the chancellor Guillaume Chauvin, the nobles, with the support of Anne of Beaujeu, regent of France, had Landais hanged (1485). When Anne sent French troops into Brittany, however, the nobles rallied to the Duke's side. Defeated in 1488, Francis was forced to sign the Treaty of Le Verger, in which he undertook to contract marriages for his daughters Anne and Isabelle only with the French king's permission, thereby relieving France of the danger that Brittany might fall to some foreign power.

FRANCE

• **Francis I,** also called (until 1515) FRANCIS OF ANGOULÊME, French FRANÇOIS D'ANGOULÊME (b. Sept. 12, 1494, Cognac, Fr.—d. March 31, 1547, Rambouillet), king of France (1515–47), the first of five monarchs of the Angoulême branch of the House of Valois. A Renaissance patron of the arts and scholarship, a humanist, and a knightly king, he waged campaigns in Italy (1515–16) and fought a series of wars with the Holy Roman Empire (1521–44).

Francis I, portrait by Pierre Dumonstier, after a drawing by Jean Clouet; in the Bibliothèque Nationale, Paris

By courtesy of the Bibliotheque Nationale, Paris

Early years. Francis was the son of Charles de Valois-Orleáns, comte d'Angoulême, and Louise of Savoy. On the accession of his cousin Louis XII in 1498, Francis became heir presumptive and was given the Duchy of Valois. With his sister Marguerite, he was raised by his mother, who had been widowed at the age of 20 and whom he deeply revered; he knelt whenever he spoke to her. No one had as much power over him as these two women. Idolized, he grew up following his own whims, without discipline and more infatuated with chivalrous romances, songs, and violent exercise than with classical studies. He was greatly admired by the gay, young circle of his mother's cultured court for his athletic build and the elegance of his demeanour and manners. His need for female companions stemmed from this upbringing, as did his lack of realism and his chivalrous imagination.

Louis XII, distrustful of Francis, did not allow him to dabble in affairs of state but sent him off at the age of 18 to the frontiers, which had been attacked in force. There, Francis learned more about warfare and, being of a sensual nature, about the licentiousness of camp life than about how to govern the state or, even more, to govern himself. Shortly before his death, Louis XII married him to

Claude, his 15-year-old daughter. On Jan. 1, 1515, at the age of 20, Francis became king of France.

His quick and shrewd mind, his amazing memory, and his universal curiosity compensated for his inexperience. But, because he was outgoing and trusting and incapable of dissembling, he was always a bad politician. The pomp of the Reims coronation, the sumptuous cortege of the solemn entry into Paris, and the lavish feasts revealed his love of ceremony and also pleased the people of Paris, who had been disheartened by a long succession of morose and sickly sovereigns.

Promise of a great reign. Louis XII had left an army prepared to reconquer the Duchy of Milan. This ill-fated dream of recovering his great-grandmother Valentina Visconti's heritage—which had been lost, retaken, then lost again—fascinated Francis in his turn. Ambitious for glory and urged on by turbulent young nobles, he made sure of peace with his neighbours, entrusted the regency to his mother, and galloped off to Italy.

At the bloody Battle of Marignano, charging at the head of his cavalry, he defeated the reportedly invincible Swiss mercenaries of Duke Massimiliano Sforza and his ally Pope Leo X. After the victory, by his own wish, he was knighted by the captain who had fought most bravely: Bayard, the most famous chevalier of his time.

The Pope received his conqueror in Bologna. Surrounded by his glittering pontifical court and by his famous artists, he dazzled Francis with concerts, banquets, and theatrical performances. The Pope offered him a Madonna by Raphael and negotiated a concordat that returned to the Pope the benefices of the rich church of France, while the nomination of prelates was assigned to the King, who was desirous of strengthening his authority over a clergy grown too acquisitive and independent.

Buoyed up by a victor's prestige, the King spoke as a sovereign, using for the first time the formula of absolute power: "For such is our pleasure." Prosperity permitted him to grant a princely pension to Sforza, as well as to Leonardo da Vinci and other artists who brought masterpieces to his court. He also signed a perpetual peace treaty with the Swiss and bought back Tournai from Henry VIII of England. And, as a pledge of unalterable friendship, the first-born royal child, Princess Louise, was affianced to the Habsburg prince Charles, heir to the Netherlands and, at 16, the new king of Spain.

Everything forecast a great reign. Francis I formed a brilliant and scholarly court at which poets, musicians, and learned men mingled with rough noblemen from the provinces whom idleness was making dangerous. He welcomed lovely ladies at court, saying, "A court without women is a year without spring and a spring without roses." The arts, elegance, and chivalrous gallantry served to refine the licentious manners of the court.

The frail queen Claude, gentle and pious, bore a child each year. Francis respected her and sought her advice. In the meantime, he loved the dark-haired comtesse de Châteaubriant, without, however, foregoing nocturnal escapades with his childhood companions, who had now become his ministers and his favourites.

Francis toured France tirelessly, showing himself to people who had never seen a king. He was constantly travelling on horseback, winter and summer, whether well or ill. He became familiar with everything: men, roads, rivers, resources, and needs. During his travels, he emptied prisons, curtailed the abuses of judicial powers by the nobles, lavished largesse on the people, and provided games and processions for them, speaking to them in his grand manner, warmly and openly: "My friends, my beloved ones . . . ."

Popular, happy, the father of two sons, he was the most powerful sovereign in all Christendom when, in 1519, the German emperor Maximilian died. The election as emperor of Maximilian's grandson Charles spelled ruin for Francis I, for Charles, who was already king of Spain, now encircled France with his possessions.

Rivalry with Charles V. Nineteen years old, secretive, cool-headed, and a clever politician, the Emperor had his mind set on a universal monarchy. His chief obstacle was the King of France. A mortal hatred emerged from this rivalry, leading to 27 years of savage warfare, interrupted by truces that were invariably violated. In 1520, on the Field of Cloth of Gold near Calais, where both displayed unprecedented magnificence, Francis vainly sought an alliance with Henry VIII.

Hostilities between Charles V and France began in 1521 in the north and in the Pyrenees, while the two brothers of the King's mistress were losing Milan. The soldiers remained unpaid, and the army was disintegrating. The King, unconcerned, arose late, paid little attention to his council, and gave orders without seeing that they were carried out. Money disappeared into thin air. A few paymasters were hanged, though in vain.

In 1523 the King demanded the return to the French state, according to law, of the vast provinces that the great feudal duke Charles de Bourbon thought he had inherited from his wife. Incensed, Bourbon turned traitor and joined the Emperor's service, claiming that the French, weary of the prodigality of their sovereign, would rise up on an appeal from him. Commanding the imperial army, he invaded Provence, was driven back near Marseille, and withdrew toward Italy. Francis I was pursuing him when he learned of the death of his wife Claude, at the age of 24, exhausted from seven pregnancies. The death of his second daughter followed soon after. Meanwhile, the English and the Germans were advancing in the north. In vain, his mother begged him to return: "Our good angel has abandoned us. Your horoscope forecasts disaster!" At the Battle of Pavia in 1525, defeated and wounded, he was taken prisoner. "Madame, to inform you of the rest of my misfortune, I have nothing left to me save my honour and my life."

As the price for the King's freedom, the Emperor demanded one-third of France, the renunciation of France's claim to Italy, and restitution to Bourbon of his fiefs, with the addition of Provence. "I am resolved to endure prison for as long as God wills rather than accept terms injurious to my kingdom!" replied the King.

Imprisoned in a dismal tower in Madrid, the recluse composed melancholy poems, songs, and letters to his subjects, heartrending in their humility and their tender nobility. The mortifying defeat, the dangerous situation of his country, and the confinement aggravated his habitual migraines, the consequence of old wounds and of newly contracted syphilis. When he was struck down by an abscess in his head, his people, loyal in bad fortune as in good, prayed for him. The Archbishop of Tournon said a mass at his bedside, in the presence of his sister Marguerite, who had hastened to Madrid.

Decline and death. Although Francis finally recovered, he did not cease to suffer. His personality changed. Sudden reversals of mood, excesses of severity and clemency, inconsistencies in his statesmanship and in his personal behaviour marked him; his mind sometimes wandered.

The Emperor persisted in his exorbitant claims. Resigned to die in prison, the King abdicated in favour of his eldest son. France judged this abdication to be the worst possible move. The Dauphin was too young; the country was lost without its leader. No matter what the cost, he would have to return home. The French ambassadors, with nominal cooperation by the King, concluded the harsh Treaty of Madrid. He signed it in January 1526, declaring that the word and signature of an imprisoned knight were valueless and that it was beyond his power to dismember his kingdom. Still bedridden, he was betrothed by proxy to Eleanor, widow of the King of Portugal and sister of his jailer. The wedding was to seal the reconciliation of the two rulers and was to follow execution of the treaty. As a last condition, Francis had to deliver his two eldest sons, seven and eight years old, as hostages.

The surrendered provinces refused to divorce themselves from France. The Emperor, furious with the perjured King, held the children prisoner for four years. His army plundered Italy and captured Pope Clement VII. Francis could not openly engage in the war that was again flaring up everywhere against Charles V. Doomed to disavow his promises to his secret allies, he fled from their envoys, either going on hunting trips from forest to forest or travelling around the country, building fairy-like castles that he occupied only fleetingly and founding the free and secular Collège de France. Anne, duchesse d'Étampes, "the most beautiful of learned ladies, and the most learned of beautiful ladies," replaced Madame de Châteaubriant, more as a companion than mistress.

Their raging hatred impelled Charles and Francis to challenge each other to a duel, which was, however, prevented. During one of the King's relapses, his mother reached an agreement with Margaret of Austria, the Emperor's aunt, to stop this deadly struggle. The ensuing Treaty of Cambrai softened that of Madrid. In order to get his children back, Francis had to abandon his allies, give up Italy, and pay 2,000,000 gold crowns. His foolish expenditures had emptied the treasury, and the ransom was collected only with difficulty. Finally, however, the little princes were able to attend their father's political marriage to Eleanor in 1530.

In 1531 the King's mother succumbed to the plague. Marguerite, having married the King of Navarre, lived at some distance. The King, grown tragically old, in 1533 presided over the marriage of his second son, Henry, to Catherine de Médicis, the niece of Clement VII.

When religious strife broke out in France, the King—tolerant, an epicurean, an admirer of the Dutch Humanist Erasmus, and patron of the great satirist Rabelais, as well as a reader of Philipp Melanchthon, the Reformer—tried to moderate the growing fanaticism. Both his sister and his mistress supported the Reformation, whereas his ministers were zealous Catholics. But the Reformers were considered republicans, and the burnings at the stake began. For five years he delayed the extermination of the Waldensian sect, only signing the order without reading it when on his deathbed.

The war with Charles V was resumed in 1536. Bereavements within the family came in quick succession. The Dauphin died at the age of 18—poisoned by Charles V, it was believed. The third son, the most dearly loved, died of the plague. One of Francis' last diplomatic achievements was an alliance with the Turks against the Emperor.

Henry VIII, by turns friend or enemy, died in January 1547. Francis, younger by two years, still had time to found the port of Le Hâvre, to send Jacques Cartier to Canada, to reform the judicial system, and to decree the use of French in all legal documents.

Wasting away with fever, dying, he wandered from castle to castle, carried on a litter. Finally, on March 31, 1547, the knight-king died. Notwithstanding the personal afflictions of the last 20 years of his life, Francis was to

his countrymen and to the succeeding generation *le grand roi François.* (M.Vi.)

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• **Francis II** (b. Jan. 19, 1544, Fontainebleau, Fr.—d. Dec. 5, 1560, Orléans), king of France from 1559, who was dominated throughout his reign by the powerful Guise family.

Francis II, enamel by L. Limosin, *c.* 1560; in the Louvre, Paris
Cliche Musees Nationaux

The eldest son of Henry II and Catherine de Médicis, Francis was married in April 1558 to Mary Stuart, queen of Scots and niece of François, duc de Guise, and of Charles, cardinal of Lorraine. A sickly and weak-willed young man, Francis became a tool of the Guises, who saw an opportunity for power and a chance to break the Huguenot strength within the kingdom. To defeat the Guises, Louis de Bourbon, prince de Condé and Huguenot leader, planned the conspiracy of Amboise (March 1560), an abortive coup d'etat in which some Huguenots surrounded the Château of Amboise and tried to seize the King. The conspiracy was savagely put down, and its failure strengthened the power of the Guises. This in turn frightened Francis' mother, Catherine, who then tried to balance the situation by securing the appointment of the moderate Michel de L'Hospital as chancellor.

In the hopes of gaining peace and rehabilitating court finances, the States General was summoned, but Francis died soon after the session began at Orléans. His death temporarily ended the Guises' dominion and saved Condé, who had been sentenced to death for high treason. Francis was succeeded by his brother, Charles IX.

Germany/Holy Roman Empire

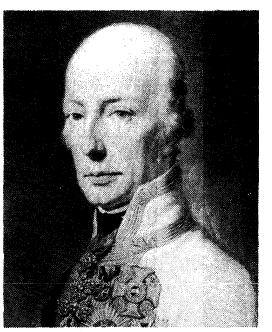
• **Francis I** (b. Dec. 8, 1708, Nancy, Duchy of Lorraine—d. Aug. 18, 1765, Innsbruck, Austria), Holy Roman emperor from Sept. 13, 1745; he was duke of Lorraine (as Francis Stephen) from 1729 to 1735 and grand duke of Tuscany from 1737. Although nominally outranking his wife, Maria Theresa, archduchess of Austria and queen of Hungary and Bohemia, the capable but easygoing Francis always was overshadowed by her strong personality.

From 1723 Francis, whose dynasty in Lorraine was closely connected with the Austrian Habsburgs, lived at the Viennese court of the Holy Roman emperor Charles VI. His marriage to Maria Theresa, who was Charles's heiress, took place on Feb. 12, 1736. Charles consented to it only on condition that Francis make the sacrifice required by the French in order to end the War of the Polish Succession, namely, the cession of Lorraine to Stanisław Leszczyński (Stanisław I), for whom the French had failed to secure Poland. In compensation, Francis was allowed to succeed the childless Gian Gastone, last of the Medici grand dukes of Tuscany. These arrangements were confirmed by the 1738 Treaty of Vienna.

When Maria Theresa succeeded Charles VI (Oct. 20, 1740), she immediately appointed her husband coregent. During the War of the Austrian Succession (1740–48), Maria Theresa, apprehensive for Francis' life, refused his repeated demands to be allowed to defend her inheritance by leading the Austrian Army. During the war he was elected Holy Roman emperor after the death of the emperor Charles VII (the elector Charles Albert of Bavaria), who was one of his wife's chief adversaries. The influence of Francis in government was inconsiderable except in economic matters. He is better remembered for his cultural interests. Maria Theresa mourned his death throughout the 15 years by which she survived him.

• **Francis II** (b. Feb. 12, 1768, Florence—d. March 2, 1835, Vienna), the last Holy Roman emperor (1792–1806) and, as Francis I, emperor of Austria (1804–35); he was also, as Francis, king of Hungary (1792-1830) and king of Bohemia (1792-1836). He supported the conservative political system of Metternich in Germany and Europe after the Congress of Vienna (1815).

Son of the future emperor Leopold II and Maria Luisa of Spain, Francis received his political education from his uncle, Emperor Joseph II, who disliked his nephew's unimaginative outlook and stubbornness but praised his application and sense of duty and justice. Ascending to the throne on the death of his father in 1792, Francis inherited the problems



Francis II, detail from an oil painting by Josef Kreutzinger, 1815
By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

raised by the French Revolution. An absolutist who hated constitutionalism in any form, he supported Austria's first coalition war against France (1792–97), sometimes taking the field himself, until forced to accept the Treaty of Campo Formio (1797), by which the empire lost Lombardy and the left bank of the Rhine. Again defeated by France (1799–1801), he elevated Austria to the status of an empire (1804) soon after Napoleon had made himself emperor of the French. After Austria took the field against Napoleon for the third time in 1805 and was again defeated, Napoleon dictated the dissolution of the Holy Roman Empire; Francis abdicated his title in 1806.

Thus, the ancien régime that had come to an end in France in 1789 ended in Germany also. The year 1809 saw Austria's fourth unsuccessful war against Napoleon, during which Francis, always distrustful of revolutionary or even popular movements, abandoned pro-Habsburg Tirolese rebels to France and Bavaria. Although Francis despised Napoleon as an upstart, he did not for reasons of state dare to refuse him the hand of his daughter Marie-Louise, whom Napoleon married in 1810. Francis himself was present at many of the battles of 1813–14, which finally destroyed the French emperor's power. After the Congress of Vienna (1815), Francis supported his chief minister, Metternich, in the conservative and restrictive policies that became known as the Metternich system. Repressing liberalism and reinstituting much of the power of the Roman Catholic Church lost under Joseph II, Francis was nevertheless a patron of the arts and sciences and he did not hesitate to introduce innovations, such as steamships on the Danube, or to show an interest in the development of railroads.

Kaiser Franz, by Victor Bibl, appeared in 1938.

Hungary

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

Tuscany

• **Francis (I),** original name FRANCESCO DE' MEDICI (b. March 25, 1541, Florence—d. Oct. 19/20, 1587, Poggio a Caiano, near Florence), second grand duke (*granduca*) of Tuscany, a tool of the Habsburgs and father of Marie de Médicis, wife of Henry IV of France.

He was appointed head of government in 1564 while his father, Cosimo I, was still alive; and he succeeded his father as grand duke in 1574. The title was not precisely legitimate since it had been bestowed by the pope (1569), but Francis obtained the grand ducal title from the emperor Maximilian II in November 1575. By subservience to the Habsburgs he won recognition of his dynasty's hereditary right to all his possessions in Tuscany; and he twice refused invitations to stand as a candidate for the Polish crown (1575 and 1587). He sponsored Bernardo Buontalenti's plan for developing Livorno (1577), which was to make it the greatest Tuscan port; he strengthened the fleet; and he opened several trading posts in the eastern Mediterranean.

A scholar and a keen student of chemistry, mechanics, and ballistics, Francis also continued his family's patronage of artists (notably Giovanni da Bologna) and was the first to house the Medici collection of paintings in the Uffizi Palace in Florence. His reign was tarnished, however, by domestic scandals: his brother Pietro murdered his own wife, the younger Eleanora de Toledo (night of July 9–10, 1576); his sister Isabella was murdered by her husband Paolo Giordano Orsini, duca di Bracciano (July 10, 1576); and Francis himself largely lives on in the romantic popular memory because of his love affair with Bianca Cappello. While he was still heir presumptive, he had taken this young patrician as his mistress—after she had been abandoned by the lover with whom she had fled from Venice. Nothing could ever deflect Francis from this passion—neither the marriage with Joanna of Austria, nor the reproaches of his family and of the Emperor, nor public censure. When Joanna died, after giving him three children, he married Bianca and had her solemnly

crowned in the Palazzo Vecchio. They died of malaria within a few hours of each other in 1587. Popular imagination, however, refused to believe this clinical account of their deaths. It was said that Bianca had prepared a poisoned tart intended for her brother-in-law Ferdinando (the future Ferdinand I), that Francis had eaten some of it by mistake, and that Bianca in desperation then ate some herself in order not to survive her lover and husband.

Two Sicilies

• **Francis I** (b. Aug. 14, 1777, Naples—d. Nov. 8, 1830, Naples), king of the Two Sicilies from 1825.

The son of Ferdinand I and Maria Carolina, Francis at first inclined toward liberalism. After the introduction of the constitution of 1812, which provided for a bicameral government along British lines, he was appointed *vicario*, or regent, of Naples. Francis sympathized with the Carbonari uprising of 1820; he opposed the decision of the Congress of Laibach (1821) to send Austrian troops to restore the absolutist monarchy in the Kingdom of the Two Sicilies. After witnessing the success of the reactionary forces in Naples, however, his outlook changed. After succeeding to the throne upon his father's death (Jan. 4, 1825), he disavowed his previous liberalism, becoming even more reactionary than his father. He disbanded the National Guard, requested an extension of Austrian garrisoning in the kingdom until 1827, and savagely repressed, with the aid of Guglielmo del Carretto, a revolutionary outbreak in Cilento (1828).

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

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• **Francis II** (b. Jan. 16, 1836, Naples—d. Dec. 27, 1894, Arco, Italy), king of the Two Sicilies from 1859 until his deposition in 1860, the last of the Bourbons of Naples.

He was the only son of Ferdinand II by his first consort, Maria Cristina of Savoy. Timid and suspicious, he was easily overruled in state and family councils. Upon his accession he rejected proposals made by Count Cavour that he should join Piedmont–Sardinia in the war against Austria and grant liberal reforms on its conclusion. Thoroughly alarmed by the invasion (May 1860) of Sicily by Giuseppe Garibaldi and the Thousand, Francis, acting on the advice of the French emperor Napoleon III, capitulated to the liberals in his kingdom (June 25, 1860); he restored the constitution of 1848, granted freedom of the press, and promised fresh elections. It was too late to save the monarchy, however, and on October 1–2 the Bourbon forces were defeated by Garibaldi on the Volturno River. Francis was deposed by the plebiscite of October 21–22, and on the fall of Gaeta (Feb. 13, 1861) to the Piedmontese he retired to Rome as the guest of Pope Pius IX. When Rome also fell (1870), he settled in Paris.

Francis Borgia, Saint: *see* Borgia, Saint Francis.

Francis de Sales, Saint: *see* Francis of Sales, Saint.

Francis of Angoulême: *see* Francis I *under* Francis (France).

Francis of Assisi, Saint, Italian San Francesco d'Assisi, baptized Giovanni, renamed Francesco, original name Francesco di Pietro di Bernardone (b. 1181/82, Assisi, Duchy of Spoleto—d. Oct. 3, 1226, Assisi; canonized July 15, 1228; feast day October 4), founder of the Franciscan orders of men and women and leader of the church reform movements of the early 13th century. His fraternal charity, consecration to poverty, and dynamic

Saint Francis of Assisi, detail of a fresco by Cimabue, late 13th century; in the lower church of S. Francesco, Assisi, Italy

Alinari—Anderson from Art Resource

leadership drew thousands of followers and made him one of the most venerated religious figures. He is (with Catherine of Siena) the principal patron saint of Italy.

Early life and career. Francis was the son of Pietro di Bernardone, a cloth merchant, and the lady Pica. Nothing certain is known of the family background. At Francis' birth, his father was away on a business journey to France, and his mother had him baptized Giovanni. On his return, Pietro di Bernardone changed the infant's name to Francesco; thus his full name was Francesco di Pietro di Bernardone. Francis learned to read and write Latin at the school near the church of S. Giorgio and later acquired some knowledge of the French language and literature, especially of the troubadours. He liked to speak French, although he never did so perfectly, and even attempted to sing in it. His youth does not seem to have been marked by serious moral lapses; nevertheless, an exuberant love of life and a general spirit of worldliness made him a recognized leader of the young men of the town.

In 1202 he took part in a war between Assisi and Perugia, was held prisoner for almost a year, and on his release fell seriously ill. After his recovery, he attempted to join the papal forces under Count Gentile against Frederick II in Apulia in late 1205; at Spoleto, however, he had a vision or dream that bade him return to Assisi and await a call to a new kind of knighthood. On his return, he began to give himself to solitude and prayer so that he might know the will of God for him.

Several other episodes make up what is called his conversion: a vision of Christ while he prayed in a grotto near Assisi; an experience of poverty during a pilgrimage to Rome, where, in rags, he mingled with the beggars before St. Peter's Basilica and begged alms; an incident in which he not only gave alms to a leper (he had always felt a deep repugnance for lepers) but also kissed his hand. One day at the ruined chapel of S. Damiano outside the gate of Assisi, he heard the crucifix above the altar command him: "Go, Francis, and repair my house which, as you see, is well-nigh in ruins." Taking this literally, he hurried home, gathered much of the cloth in his father's shop, and rode off to the nearby town of Foligno, where he sold both cloth and horse. He then tried to give the money to the priest at S. Damiano. Angered, his father first kept him at home and later brought him before the civil authorities. When Francis refused to answer the summons, his father called him before the Bishop. Before any accusations were made, Francis, "without a word peeled off his garments even down to his breeches and restored them to his father." Covered only by a hair shirt, he said: "Until now I have called you my father on earth. But henceforth I can truly say: Our Father who art in heaven." The astonished bishop gave him a cloak, and Francis went off to the woods of Mt. Subasio above the city.

Francis had renounced material goods and family ties to embrace a life of poverty. He repaired the church of S. Damiano, restored a chapel dedicated to St. Peter the Apostle and then restored the now-famous little chapel of St. Mary of the Angels (Sta. Maria degli Angeli), the Porziuncola, on the plain below Assisi. There, on the feast of St. Matthias, Feb. 24, 1208, he listened at mass to the Gospel account of the mission of Christ to the Apostles: "Take no gold, nor silver, nor money in your belts, no bag for your journey, nor two tunics, nor sandals, nor a staff; for the labourer deserves his food. And whatever town or villa you enter, find out who is worthy in it, and stay with him until you depart" (Gospel According to Matthew 10:9–11).

The Franciscan rule of life. Although he was a layman, Francis began to preach to the townspeople. Disciples were attracted to him, and he composed a simple rule of life for them. In 1209, when the group of friars (as the mendicant disciples were called) numbered 12, they went to Rome to seek the approval of Pope Innocent III, who, although hesitant at first, gave his oral approbation to their rule of life. This event, which according to tradition occurred on April 16, marked the official founding of the Franciscan order. The friars, who were actually street preachers with no possessions of any kind and with only the Porziuncola as a centre, preached and worked first in Umbria and then, as their numbers grew, in the rest of Italy.

The early Franciscan rule of life, which has not survived, set as the aim of the new life, "To follow the teachings of our Lord Jesus Christ and to walk in his footsteps." Probably no one in history has ever set himself so seriously as did Francis to imitate the life of Christ and to carry out so literally Christ's work in Christ's own way. This is the key to the character and spirit of St. Francis. To neglect this point is to show an unbalanced portrait of the saint as a lover of nature, a social worker, an itinerant preacher, and a lover of poverty.

Certainly the love of poverty is part of his spirit, and his contemporaries celebrated poverty either as his "lady," in the allegorical *Sacrum Commercium* (Eng. trans., *Francis and His Lady Poverty,* 1964), or as his "bride," in the fresco of Giotto in the lower church of S. Francesco at Assisi. It was not, however, mere external poverty he sought but the total denial of self (as in Letter of Paul to the Philippians 2:7).

He considered all nature as the mirror of God and as so many steps to God. He called all creatures his "brothers" and "sisters," and in his "Canticle of the Creatures" (less properly called by such names as the "Praises of Creatures" or the "Canticle of the Sun") he referred to "Brother Sun" and "Sister Moon," the wind and water, and even "Sister Death." His long and painful illnesses were nicknamed his sisters, and he begged pardon of "Brother Ass the body" for having unduly burdened him with his penances. Above all, his deep sense of brotherhood under God embraced his fellow men, for "he considered himself no friend of Christ if he did not cherish those for whom Christ died."

In 1212 Francis began a second order for

women that became known as the Poor Clares. He gave a religious habit, or dress, similar to his own to a noble lady of Assisi, later known as St. Clare (Clara) of Assisi, and then lodged her and a few companions in the church of S. Damiano, where she was joined by women of Assisi. For those who could not leave their families and homes he eventually (*c.* 1221) formed the Third Order of Brothers and Sisters of Penance, a lay fraternity that, without withdrawing from the world or taking religious vows, would carry out the principles of Franciscan life. As the friars became more numerous, the order extended outside Italy.

Probably in the late spring of 1212 Francis had set out for the Holy Land but was shipwrecked on the east coast of the Adriatic Sea and had to return. A year or two later, sickness forced him to abandon a journey to the Moors in Spain. In 1217 he proposed to go to France, but Cardinal Ugolino of Segni (later Pope Gregory IX) advised him that he was needed to direct the order in Italy. He did go to Egypt, where the crusaders were besieging Damietta, in 1219. He went into the camp of the Saracens and preached to the Sultan, who was impressed by him and gave him permission (it is said) to visit the holy places in Palestine.

News of disturbances among the friars in Italy forced Francis to return. There were 5,000 members of the men's order, and it was continuing to grow at a faster rate than any previous religious order; yet the order had little more than Francis' example and his brief rule of life to guide its increasing numbers. To provide someone to handle the order's practical affairs, Francis appointed Peter Catanii as his vicar; after Peter's early death in 1221 he chose Elias of Cortona. Francis asked Pope Honorius III for legislation introducing a year of probation (novitiate) for new friars and set about amplifying and revising the rule. After the new rule was approved by Honorius III in final form on Nov. 29, 1223, Francis tended to withdraw more and more from external affairs.

Francis' vision and the stigmata of the Crucified. In the summer of 1224 Francis went to the mountain retreat of La Verna (Alvernia), not far from Assisi, to celebrate the feast of the Assumption of the Blessed Virgin Mary (August 15) and to prepare for St. Michael's Day (September 29) by a 40-day fast. There he prayed that he might know how best to please God; opening the Gospels for the answer, three times he came upon references to the Passion of Christ. As he prayed one morning, about the time of the feast of the Exaltation of the Cross (September 14), suddenly he beheld a figure coming toward him from the heights of heaven. St. Bonaventure, general of the Franciscans from 1257 to 1274 and an important thinker of the 13th century, wrote:

> As it stood above him, he saw that it was a man and yet a Seraph with six wings; his arms were extended and his feet conjoined, and his body was fixed to a cross. Two wings were raised above his head, two were extended as in flight, and two covered the whole body. The face was beautiful beyond all earthly beauty, and it smiled gently upon Francis. Conflicting emotions filled his heart, for though the vision brought great joy, the sight of the suffering and crucified figure stirred him to deepest sorrow. Pondering what this vision might mean, he finally understood that by God's providence he would be made like to the crucified Christ not by a bodily martyrdom but by conformity in mind and heart. Then as the vision disappeared, it left not only a greater ardour of love in the inner man but no less marvelously marked him outwardly with the stigmata of the Crucified.

For the remainder of his life, Francis took the greatest care to hide the stigmata—marks resembling the wounds on the crucified body of Jesus Christ. After the death of Francis, Brother Elias announced the stigmata to the order by a circular letter. Later, Brother Leo, who was the confessor and intimate companion of the saint and who left a written testimony of the event, said that in death Francis seemed like one just taken down from the cross.

Francis lived two years longer, in constant pain and almost totally blind (he had contracted an eye disease in the East). Medical treatment at Rieti was unsuccessful, and after a stay at Siena he was brought back to Assisi, where he died at the Porziuncola. He was buried temporarily in the church of S. Giorgio, at Assisi. In 1230 his body was transferred to the lower church of the basilica that was being erected in his memory by Elias at the west end of the city. (I.C.B.)

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Early biographies. Thirteenth-century biographies include Thomas of Celano, *First and Second Life of St. Francis, with Selections from Treatise on the Miracles of Blessed Francis,* trans. by Placid Hermann (1963), writings dated, respectively, 1228–30, 1247, and *c.* 1253—composed by a friar who knew Francis personally; "The Legend of the Three Companions (1246)," in *St. Francis of Assisi: His Holy Life and Love of Poverty,* trans. by Placid Hermann (1964); St. Bonaventure, *The Greater Life of St. Francis, and the Shorter Life* (1260–62), trans. by Benen Fahey, with introduction and notes by Placid Hermann (1965), a theologian's approach to the saint, with some new material gathered from surviving companions. Fourteenth-century compilations abound; the following exist in English translations: *The Mirror of Perfection,* wrongly attributed to Brother Leo (trans. by Leo Sherley-Price, 1959; Everyman ed., 1963); The *Fioretti* or *Little Flowers of St. Francis,* ed. by Raphael Brown (1958), ed. by Leo Sherley-Price (1959), Everyman ed. (1963)—though full of legends and even falsifications, the work gives a certain insight into the Franciscan spirit of self-abnegation, love, and spiritual joy. A more complete listing and critical evaluation of the sources of the life of St. Francis, together with all important studies up to 1963, may be found in the appendixes to Omer Englebert, *Saint Francis of Assisi: A Biography,* 2nd ed. rev. by Ignatius Brady and Raphael Brown (1965).

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Francis OF MEYRONNES, French FRANÇOIS DE MEYRONNES, Latin FRANCISCUS DE MAYRONIS (b. *c.* 1285, Meyronnes, County of Provence—d. after 1328, Piacenza, Lombardy), Franciscan monk, one of the principal philosopher–theologians of 14th-century Scholasticism and a leading advocate of the subtle system of Realism proposed by the English Scholastic John Duns Scotus.

A student of Duns Scotus at the University of Paris, Francis became a master in theology in 1323 and lectured on the basic philosophical theology text of his day, the *Sentences* of Peter Lombard. He served as legate of Pope John XXII and in 1324 mediated peace negotiations between Charles IV of France and Edward III of England. About that same period he was invited to preach on sacramental theology before the papal court at Avignon, Fr.

Chief among Francis' philosophical writings are commentaries on Aristotle's *On Interpretation* and the *Categories,* and his own treatises *De Formalitatibus* ("On Formalities") and *De univocatione Entis* ("On the Univocity of Being"). His theological works include an important commentary on Peter Lombard's *Sentences,* the *Quaestiones quodlibetae* ("Miscellaneous Questions"), and a collection of tracts on disputed questions and political theories (one of which suggested a universal monarchy headed by the pope).

While supporting the Scotistic teaching that denied the reality of abstract natures or essences in material things, Francis nevertheless vigorously opposed the Nominalism of William of Ockham on the grounds that it did not admit the real existence of essence even as eternal idea. Moreover, he emphasized Scotus' voluntarism (the primacy of will over intellect), and attributed a greater role to the juridical element in the theological concepts of God, creation, and revelation. Representative of the Franciscan school of devotion, he also promoted the doctrine of the Virgin Mary, specifically the virgin birth, and the belief in the Immaculate Conception.

Because of his distinctive evolution of Scotism, a *Maronitae* (The Meyronnists) school of thought emerged and influenced 14th- and 15th-century Scholasticism. His collected works were edited in Venice in 1520.

Francis OF PAOLA, SAINT, Italian SAN FRANCESCO DE PAOLA (b. March 27, 1416, Paola, Kingdom of Naples—d. April 2, 1507, Plessis-les-Tours, Fr.; canonized 1519; feast day April 2), founder of the Minim Friars, a severely ascetic Roman Catholic order that does charitable work and refrains from eating meat, eggs, or dairy products. Francis was named patron of Italian seamen in 1943 by Pope Pius XII because many of the miracles attributed to him were related to the sea.

After spending a year at the Franciscan friary in San Marco, Italy, he became a hermit at 14 in a cave on the seacoast near Paola. Others joined him (*c.* 1435) to form his first friary of Hermits of St. Francis of Assisi, which he named (1492) Fratres Minimi (Least Brothers) to signify its humility. The rules of the order were similar to those of the Franciscans, only more arduous. After papal approval in 1474, the order spread through Italy to France, Spain, Germany, and Bohemia. The ailing King Louis XI of France induced Pope Sixtus IV to send Francis to him in his final days (1483). Successive monarchs built monasteries for Francis, keeping him in France until his death. By 1506, when Pope Julius II approved the definitive Minim rule, Francis had established a second order for nuns and a third for laymen. There were some 9,000 friars in the order at the peak of its influence in the 17th century. His relics were disinterred and burned by Huguenots in 1562.

Francis OF SALES, SAINT, also called FRANCIS DE SALES, French SAINT FRANÇOIS DE SALES (b. Aug. 21, 1567, Thorens-Glières, Savoy—d. Dec. 28, 1622, Lyon; canonized 1665; feast day January 24), Roman Catholic bishop of Geneva and doctor of the church, who was active in the struggle against Calvinism and cofounded the order of Visitation Nuns. He wrote the devotional classic *Introduction to a Devout Life* (3rd definitive edition, 1609), which emphasized that spiritual perfection is possible for people busy with the affairs of the world and not only, as many believed at the time, for those who withdraw from society. In 1923 Pope Pius XI named him patron saint of writers.

He was educated at the Jesuit college of Clermont in Paris (1580–88) and at Padua, Italy, where he received a doctorate in law (1591). After briefly practicing law he turned to religion and was ordained in 1593 at An-

necy, chief town of his native Savoy. The bishop's see of Geneva had been moved there in 1535 along with the monasteries expelled from Geneva during the Protestant Reformation. Francis began intense missionary work in Chablais, a district that had broken away from Savoy and had become Calvinist but had been regained by the duke of Savoy, Charles Emmanuel, an ardent Catholic. Under his protection, Francis rewon the bulk of the people of Chablais to Catholicism. Francis was consecrated bishop of Geneva on Dec. 8, 1602. In 1610, with St. Jane Frances de Chantal, he founded the Visitation of Holy Mary (the Visitation Nuns), which became principally a teaching order.

St. Francis of Sales, detail from an oil painting by an unknown artist, 1618
BBC, Hulton Picture Library

Francis was the first to receive a solemn beatification at St. Peter's, Rome (1661). In 1877 he became the first writer in French to be named doctor of the church. In addition to his spiritual works, his writings include controversies against Calvinists, letters, sermons, and documents on diocesan administration. A.J.M. Hamon's *Life of St. Francis de Sales* (2 vol.) appeared in 1925–29, followed by M. Henry Covannier's *Francis de Sales and His Friends* in 1964.

Francis XAVIER, SAINT: *see* Xavier, Saint Francis.

Francis, James Bicheno (b. May 18, 1815, Southleigh, Devon, Eng.—d. Sept. 18, 1892, Lowell, Mass., U.S.), British-born U.S. hydraulic engineer and inventor of the mixed-flow, or Francis, turbine (a combination of the radial- and axial-flow turbines) used for low-pressure installations.

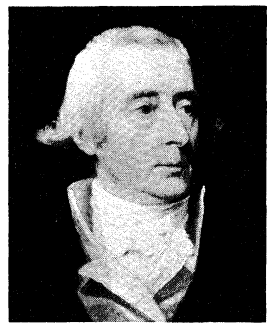
In 1833 he went to the U.S. and was hired by the engineer G.W. Whistler to help construct the Stonington (Conn.) Railway. Later, he joined a group in Lowell, called "Proprietors of the Locks and Canals on the Merrimack River," as a draftsman and at 22 became chief engineer of the company. In his 40 years of looking after the company's waterpower interests and acting as consulting waterpower engineer to factories, he contributed greatly to the rise of Lowell as an industrial centre.

He also investigated timber preservation (building a works for kyanizing and burnettizing timber), the testing and design of cast-iron girders, and fire protection systems. In addition to the Francis turbine, he is known for his formulas for the flow of water over weirs and many other hydraulic studies. An original member and president of both the Boston and the American societies of civil engineers, he wrote more than 200 technical papers and, although unschooled, was considered one of the foremost civil engineers of his time.

Francis, Lydia Maria: *see* Child, Lydia Maria.

Francis, Sir Philip (b. Oct. 22, 1740, Dublin—d. Dec. 23, 1818, London), English politician and pamphleteer, known as an antagonist of Warren Hastings, the first governor general of British India.

The son of a clergyman, he was educated in Dublin and London and held a variety of clerical posts in the government from 1756 to 1773. Francis may have written the *Letters of Junius,* a series of bitter lampoons against the



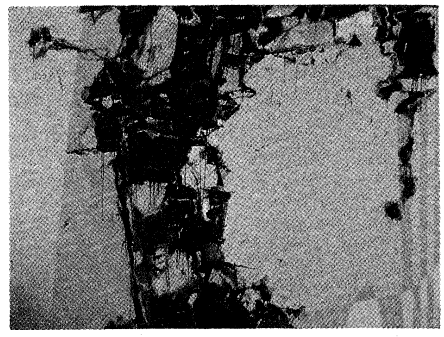
Sir Philip Francis, detail of an oil painting by J. Lonsdale; in the National Portrait Gallery, London
By courtesy of the National Portrait Gallery, London

government of King George III published by a London newspaper from 1769 to 1772, when he was a clerk in the war office.

In June 1773 the prime minister, Lord North, appointed him a member of the newly created four-man council that was to rule British possessions in India with Governor General Hastings. Francis led two of his colleagues in a struggle against Hastings; in part he coveted Hastings' job, but there were also differences between the two men on policy matters, including land-revenue collection. Although Hastings gained the upper hand by 1776—after two of the opposing councillors had died—Francis continued his attacks, and in 1780 the Governor General wounded him in a duel. Returning to England in 1781, Francis turned public opinion against Hastings with a series of anonymous pamphlets. He entered Parliament in 1784 and was the moving spirit behind Hastings' impeachment, begun in 1788. The acquittal of Hastings in 1795 embittered Francis deeply and led to his defeat in a parliamentary election. He served again in Parliament from 1802 to 1807, when he retired from politics. He was knighted in 1806.

Francis, Sam (b. June 25, 1923, San Mateo, Calif., U.S.), U.S. painter prominent in the second generation of Abstract Expressionists (artists who took an emotional approach to the conception and execution of their works).

He began painting while in a hospital after being wounded in World War II. From 1950 to 1957 he lived and worked in Paris, presenting his first one-man show there in 1955. He



"Middle Blue," oil on canvas by Sam Francis, 1957; in the Martha Jackson Gallery, New York City
By courtesy of the Martha Jackson Gallery, New York City

was commissioned to do murals for the Sofu School of flower arrangement in Tokyo (1957) and the Chase Manhattan Bank in New York City (1959). He won first prize in the third international biennial exhibition of prints held in Tokyo in 1962.

Francis' "Blue on a Point" (1958) exemplifies his style as a *tachiste* (French *tache,* "stain" or "spot"). His brilliant colours flow in soft forms over unpainted canvas, creating a loose, uncrowded effect.

Francis, Thomas, Jr. (b. July 15, 1900, Gas City, Ind., U.S.—d. Oct. 1, 1969, Ann Arbor, Mich.), U.S. microbiologist, epidemiologist, who isolated the viruses responsible for influenza A (1934) and influenza B (1940), and developed a polyvalent vaccine effective against both strains. He also did research that led to the development of antiserums for the treatment of pneumonia.

Francis received his medical degree from Yale University (1925) and worked at the Rockefeller Institute for Medical Research (1928–36), the Rockefeller Foundation (1936–38), and the medical school of New York University (1938–41). He then joined the School of Public Health of the University of Michigan. In 1954 he was appointed by the National Foundation for Infantile Paralysis to direct the large-scale field tests that led to the widespread use of the Salk vaccine against poliomyelitis.

Francis Ferdinand, ARCHDUKE OF AUSTRIA-ESTE, German FRANZ FERDINAND, ERZHERZOG VON ÖSTERREICH-ESTE (b. Dec. 18, 1863, Graz, Austria—d. June 28, 1914, Sarajevo, Bosnia-Hercegovina), Austrian archduke whose assassination was the immediate cause of World War I; he was the eldest son of the archduke Charles Louis, brother of the emperor Francis Joseph.

The death of the heir apparent, the archduke Rudolf, in 1889, made Francis Ferdinand

Francis Ferdinand, portrait by Oskar Brüch, 1913
By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

next in succession to the Austro-Hungarian throne after his father, who died in 1896. But because of Francis Ferdinand's ill health in the 1890s, his younger brother Otto was regarded as more likely to succeed, a possibility that deeply embittered Francis Ferdinand. His desire to marry Sophie, Gräfin (countess) von Chotek, a lady-in-waiting, brought him into sharp conflict with the Emperor and the court. Only after renouncing his future children's rights to the throne was the morganatic marriage allowed in 1900.

In foreign affairs he tried, without endangering the alliance with Germany, to restore Austro-Russian understanding. At home he thought of political reforms that would have strengthened the position of the crown and weakened that of the Magyars against the other nationalities in Hungary. His plans were based on the realization that any nationalistic policy pursued by one section of the population would endanger the multinational Habsburg empire. His relationship with Francis Joseph was exacerbated by his continuous pressure on the Emperor, who in his later years left affairs to take care of themselves but sharply resented any interference with his prerogative. From 1906 onward Francis Ferdinand's influ-

ence in military matters grew, and in 1913 he became inspector general of the army.

In June 1914 he and his wife were assassinated by the Serb nationalist Gavrilo Princip at Sarajevo; a month later World War I began with Austria's declaration of war against Serbia.

Francis Joseph, German FRANZ JOSEPH (b. Aug. 18, 1830, Schloss Schönbrunn, near Vienna—d. Nov. 21, 1916, Schloss Schönbrunn), emperor of Austria (1848–1916) and king of Hungary (1867–1916), who divided his empire into the Dual Monarchy, in which Austria and Hungary coexisted as equal partners. In 1879 he formed an alliance with Prussian-led Germany, and in 1914 his ultimatum to Serbia led Austria and Germany into World War I.

Francis Joseph, 1908

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

Early years. Francis Joseph was the eldest son of Archduke Francis Charles and Sophia, daughter of King Maximilian I Joseph of Bavaria. As his uncle Emperor Ferdinand I was childless, Francis Joseph was educated as his heir-presumptive. In the spring of 1848 he served with the Austrian forces in Italy, where Lombardy–Venetia, supported by King Charles Albert of Sardinia, had rebelled against Austrian rule. When revolution spread to the capitals of the Austrian Empire, Francis Joseph was proclaimed emperor at Olmütz (Olomouc) on Dec. 2, 1848, after the abdication of the emperor Ferdinand—the rights of his father, the archduke, to the throne having been passed over. Hopes of a revival of monarchist sentiments were raised by his radiant, youthful appearance.

Of all his mentors, the old chancellor Metternich probably exerted the most lasting influence on Francis Joseph. A more profound influence, however, was that of his wife, the duchess Elizabeth of Bavaria. He married her in 1854 and remained deeply attached to her throughout a stormy marriage.

Neo-absolutism, 1841–59. During the first 10 years of his reign, the era of so-called neo-absolutism, the Emperor—aided by such outstanding advisers as Felix, Fürst zu Schwarzenberg (until 1852), Leo, Graf von Thun, and Alexander, Freiherr von Bach—inaugurated a very personal regime by taking a hand both in the formulation of foreign policy and in the strategic decisions of the time. Together with Schwarzenberg, who had become prime minister and foreign minister in 1848, Francis Joseph set out to set his empire in order.

In external affairs Schwarzenberg achieved a powerful position for Austria; in particular, with the Olmütz convention of November 1850, in which Prussia acknowledged Austria's predominance in Germany. In home affairs, however, Schwarzenberg's harsh rule and the formation of an intolerant police apparatus evoked a latent mood of rebellion. This mood became more threatening after 1851, when the government withdrew the promise of a constitution, given in 1849 under the pressure of the revolutionary troubles. That retraction had long aftereffects and led to the Liberals' permanent distrust of Francis Joseph's rule. In 1853 there was an attempt on the Emperor's life in Vienna and in a riot in Milan.

After Schwarzenberg's death (1852), Francis Joseph decided not to replace him as prime minister and took a greater part in politics himself. Austria's mistaken policy during the Crimean War originated largely with the Emperor, torn between gratitude to Russia for its help in quelling a rebellion in Hungary in 1849 and the advantage the monarchy might derive from siding with Great Britain and France. The mobilization of a part of the Austrian Army in Galicia on the borders of Russia in retrospect turned out to have been a grave error. It gained no friends for Austria among the Western powers but lost considerable goodwill that Tsar Nicholas I had earlier harboured for Francis Joseph.

At home, neo-absolutism resulted in a civil service staffed by highly competent experts who tried to meet the Emperor's high standards but whose limitations nevertheless became increasingly obvious in 1859–60 as they attempted to deal with the empire's complex financial problems. Army expenditures had to be curtailed in 1859, when a series of ill-fated wars began that seriously shook Austria's military reputation. Moreover, the police regime proved to be impracticable in the long run. Thus the government made critical military decisions against a background of many unresolved problems in finances and home affairs. For many of these decisions, especially the unfortunate outcome of the war of 1859 against the Kingdom of Sardinia and the Empire of France, the Emperor was responsible. After provoking Austria into war, Count Cavour, the prime minister of Sardinia, planned to use the French Army to oust Austria from Italy. When the imperial commander in chief proved incapable, Francis Joseph himself took over the supreme command, but he could not prevent the defeat of Solferino (June 24, 1859). Dismayed by Prussia's demand that, as a condition of its intervention on the Emperor's side, the Austrian Army be placed under Prussian command, Francis Joseph hastily concluded the Peace of Villafranca in July 1859, under which Lombardy was ceded to Sardinia. Unreconciled to this settlement, Francis Joseph adopted a foreign policy that prepared the way for a passage at arms with Italy and Prussia, by which he hoped to regain for Austria its former position in Germany and Italy, as it had been established by Metternich in 1814–15.

The years of decision, 1859–70. The mood of crisis after the defeat of 1859 caused Francis Joseph to pay renewed attention to the constitutional question. A period of experiments—alternating between federalistic and centralistic charters—kept the country in a permanent state of crisis until 1867. The congress of princes at Frankfurt in 1863, for which the reigning heads of all German states assembled with the sole exception of the King of Prussia, was a high point in Francis Joseph's life. Yet the absence of the Prussian king demonstrated that Prussia no longer regarded Austria as the leading German power.

Francis Joseph had vainly tried to postpone the decision for predominance in Germany by entering into a comradeship-in-arms with Prussia in a war against Denmark in 1864. After their victory, squabbles arose between them, and war with Prussia became inevitable. The conclusion of an alliance between Italy and Prussia pointed up the dangerous possibility that both foreign-policy problems might have to be faced at the same time, yet Francis Joseph failed in his attempt to avoid an armed conflict at least with Italy. In June 1866 Austria concluded a possibly unique agreement with Napoleon III of France that stipulated that Austrian-held Venetia was to be given to the Kingdom of Sardinia regardless of the outcome of the impending war with Prussia. As the Emperor considered it incompatible with the army's honour to cede a province without fighting, war with Italy broke out despite the agreement. In later years, Francis Joseph characterized his policy of yielding territory with one hand while fighting for it with the other as honest but stupid, whereas the chancellor Friedrich, Graf von Beust, called the agreement the most shocking document that he had ever seen. Although its defeat in the war with Prussia that the Prussian prime minister Otto von Bismarck had forced on the unprepared monarchy caused Austria no territorial loss in the north, it nevertheless sealed Austria's expulsion from Germany. The victories gained by the Austrian Army in the south, moreover, could not prevent the loss of Venetia, so that Austria found itself expelled from Italy as well.

The appointment of the Saxon premier, Graf von Beust, as Austrian prime minister in 1867 shows that initially Francis Joseph was once again unwilling to accept the decision. Beust's cherished project of an Austrian-French-Italian alliance against Prussia did not materialize, however, and in 1870 the attitude of the Hungarian prime minister, Count Gyula Andrássy, coupled with the rapid military successes of Prussia, prevented Austria from joining in the Franco-German War at the side of France. Andrássy, appointed imperial foreign minister after Beust's dismissal in 1871, inaugurated the policy of close collaboration with Germany that later became the cornerstone of Francis Joseph's foreign policy.

The Hungarian compromise and the dual monarchy. The failure to achieve a federalist solution satisfactory to all nationalities had exacerbated relations among them. In 1867 it had become obvious that a compromise had to be made with the restive Hungarians. The newly appointed prime minister Beust was, however, insufficiently informed about conditions in the various parts of the Austrian Empire. The result was the *kaiserliche und königliche Doppelmonarchie,* the "imperial and royal Dual Monarchy" in which an Austrian and a Hungarian half coexisted in equal partnership. The compromise, however, gave the Hungarians considerable leverage to extend their influence. The losers were the Slav peoples, for the Bohemians (Czechs) and Poles did not share in the privileged position of the German Austrians in the Austrian, or western, half of the empire, while the Croats, Slovaks, and South Slavs had none of the prerogatives enjoyed by the Hungarians in the Hungarian, or eastern, half. With this preferred treatment, which Francis Joseph recognized as such, the multinational state had violated its inner law of the basic equality of all national groups. The individual crownland's relationship to the emperor, which in each case had been the result of a long historical evolution, was now replaced by the submission of the various nationalities to German-Austrian or Hungarian overlordship. Internal restlessness thus continued unabated. A final attempt at reform by which the Slavic languages were to be given equal status with Hungarian and German was vetoed by Francis Joseph under pressure from the German-Austrian nationalists. But, under the influence of the Viennese sociologist Albert Schäffle, the Emperor, who on the whole had little use for party politicians and their influence on public life, seems to have followed the continuing process of democratization in his empire with some sympathy.

The question of recognition and restoration of ancient Czech rights hobbled Austro-Hungarian foreign policy and poisoned domestic politics. Even more of a handicap was the

problem of the South Slavs. From 1867 on, the Hungarian-ruled Croatians found themselves subjected to a continuing process of Magyarization. Hungarian domination eventually turned Serbia, inhabited by fellow Slavs, into the Dual Monarchy's mortal enemy.

Francis Joseph, who wholeheartedly supported the *Ausgleich* (the Hungarian Compromise) as the constitution of the Dual Monarchy, failed to grasp the negative aspects of that highly complex document. Interested primarily in questions of foreign policy and military leadership, he paid too little attention to domestic affairs to understand the nationalities problem in all its gravity. In particular, he failed to see the connection between Austro-Hungarian internal affairs and their effect on the monarchy's relationship with Russia and on the political situation in the Balkans.

The Emperor's peace policy. Although Francis Joseph always considered foreign policy his own specialty, he was in effect guided by the ablest among his foreign ministers: Count Gyula Andrássy, Count Gusztáv Kálnoky von Köröspatak, and Count Aloys Lexa von Aehrenthal. Andrássy not only launched the alliance with Germany in 1879, but, by carrying out the occupation of Bosnia-Hercegovina, which Francis Joseph had advocated and the Congress of Berlin (1878) had sanctioned, he also gained the first great foreign-policy success of the empire in the Balkans. Francis Joseph defended the German alliance against all opposition. He was considerably more reserved toward Italy, which had joined Germany and Austria in the Triple Alliance in 1882, and Romania, with which Austria-Hungary had concluded a secret treaty in 1883; in fact, his reticence contributed to the eventual alienation of both of those allies.

The style of Francis Joseph's foreign policy was dynastic and personal. Just as he had contributed decisively to the creation of the League of the Three Emperors (Dreikaiserbund) by appearing in Berlin in 1873 by the side of Tsar Alexander II, he endeavoured also on later occasions to forestall potential conflicts with Russia through personal contacts, without realizing the fundamental nature of the antagonism between the two countries. On a visit to St. Petersburg in 1897 and again after Tsar Nicholas II's visit in 1903, he tried to delimit Austrian and Russian interests in the Balkans—a policy that was rashly jeopardized by Aehrenthal during the crisis leading to the annexation of occupied Bosnia-Hercegovina in 1908. By then, however, the days were long past when foreign policy was a matter of friendships between sovereigns; conflicts of interest, or for that matter pan-Slav propaganda, could no longer be neutralized on the dynastic level. Also, the emperor found it increasingly difficult to get along with his fellow sovereigns, many of them relatives, of the younger generation. Yet he seems to have appreciated the energetic, dashing, and optimistic manner of William II of Germany.

In the period 1908–14 Francis Joseph held fast to his peace policy in the face of warnings by the chief of the general staff, Franz, Count Conrad von Hötzendorf, who repeatedly advocated a preventive war against Serbia or Italy. Yet, without having fully thought out the consequences, he let himself in July 1914 be persuaded by Count Leopold Berchtold, the foreign minister, to issue the intransigent ultimatum to Serbia that led to World War I.

Assessment. Although he had been raised to be a soldier and wore a uniform all his life, Francis Joseph was no more a strategist than he was a statesman. He made up for this deficiency by the careful study of documents, by an extraordinarily retentive memory, and by being a shrewd judge of character. Invariably well informed and familiar with the reports of his envoys, he was to his civil servants an unequaled model of exactitude, devotion to duty, and justice. In his time Austria-Hungary was credited with having a civil administration that was as efficient as any in Europe. Having reserved for himself the control of foreign policy and of all matters bearing on the army, he stated repeatedly that this foreign policy was his own and that any criticism of it was in reality directed at himself. While loyal to his ministers, he refused to grant them any influence beyond the limits of their respective offices; once dismissed, a minister was no longer consulted on official business. This attitude, which many considered to be both ungrateful and ungracious, sprang in part from a punctiliousness that was hard to penetrate and rendered him incapable of true friendship. In the early decades of his reign, his correct but unapproachable bearing caused Francis Joseph to be respected but not really popular. Toward the end of his life, however, he became a universally revered man, a personality that for all its defects and insufficiencies held together the rotting structure of the multinational state.

Although a gentleman of irresistible charm in personal contact, Francis Joseph was greatly feared as the head of his house. His attitude toward his family was determined primarily by dynastic considerations. His own marriage had been a love match, and he remained devoted to his wife even after the marriage had been wrecked by her eccentricities. Her assassination, in Geneva on Sept. 10, 1898, saddened him profoundly. The tragedy of the heir apparent, the archduke Rudolf, who dramatically shot himself in a suicide love pact with a 17-year-old baroness at Mayerling on Jan. 30, 1889, was assuredly rooted in Rudolf's unstable character. Yet the emperor had contributed to his only son Rudolf's instability by giving him an unsuitable education, forcing him to marry Princess Stephanie of Belgium, and dealing with him in an altogether cold and uncomprehending manner. He treated his daughter-in-law with unforgiving harshness after her second, morganatic marriage, believing that family members who married beneath their station had committed a crime against the dynasty. Furthermore, Francis Joseph never became reconciled to the morganatic union of the next heir presumptive, Archduke Francis Ferdinand. His statements on receiving the report of the archducal couple's murder at Sarajevo, on June 28, 1914, show that he looked upon their fate as a token of divine retribution. These tragedies, which became public knowledge, were underlined by an unending series of sometimes heated family disputes in the course of which Francis Joseph forced the members of the House of Habsburg-Lorraine to conform to his own notion of an archduke's dignity and position. Yet this man who became ever lonelier as time went on could be a generous and amiable family father to his daughters and those members of the house who bowed to his wishes.

The only member of the immediate family with whom he had a closer relationship was his youngest brother, the archduke Louis Victor. While he was no more than correct in his attitude toward his brother, the talented and ambitious archduke Maximilian, he bears no blame for the tragedy that ended Maximilian's brief interlude as emperor of Mexico.

Having overcome the threat to its survival in 1848–49, Austria passed through a long metamorphosis with many ups and downs in the 68 years that Francis Joseph occupied the throne. His many mistakes were balanced by splendid achievements. The social legislation enacted by the prime minister Eduard, Count von Taaffe, during the 1880s, the new penal code of 1852, the trade regulations of 1859, and the commercial code of 1862 are all examples of a civil administration that was highly regarded throughout Europe. Those achievements bore the stamp of the Emperor's own silent devotion to duty. (K.O.v.A.)

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Franciscan, any member of a Christian religious order founded in the early 13th century by St. Francis of Assisi (*q.v.*). The members of the order strive to cultivate the ideals of the order's founder. The Franciscans actually consist of three orders. The First Order comprises priests and lay brothers who have sworn to lead a life of prayer, preaching, and penance. This First Order is divided into three independent branches: the Friars Minor (O.F.M.), the Friars Minor Conventual (O.F.M. Conv.), and the Friars Minor Capuchin (O.F.M. Cap.). The Second Order consists of cloistered nuns who belong to the Order of St. Clare (O.S.C.) and are known as Poor Clares (P.C.). The Third Order consists of religious and lay men and women who try to emulate Saint Francis' spirit by performing works of teaching, charity, and social service. Strictly speaking, the latter order consists of the Third Order Secular, whose lay members live in the world without vows; and the Third Order Regular, whose members live in religious communities under vow. Congregations of these religious men and women are numerous all over the Roman Catholic world. The Franciscans are the largest religious order in the Roman Catholic church. They have contributed a total of 98 saints and six popes to the church.

It was probably in 1207 that Francis felt the call to a life of preaching, penance, and total poverty. He was soon joined by his first followers, to whom he gave a short and simple rule of life. In 1209 he and 11 of his followers journeyed to Rome, where Francis received approval of his rule from Pope Innocent III. Under this rule, Franciscan friars could own no possessions of any kind, either individually or communally (*i.e.,* as the property of the order as a whole). The friars wandered and preached among the people, helping the poor and the sick. They supported themselves by working and by begging food, but they were forbidden to accept money either as payment for work or as alms. The Franciscans worked at first in Umbria and then in the rest of Italy and abroad. The impact of these street preachers and especially of their founder was immense, so that within 10 years they numbered 5,000. Affiliated with them were the Franciscan nuns, whose order was founded at Assisi in 1212, by St. Clare, who was under the guidance of St. Francis. Clare and her followers were lodged by Francis in the Church of San Damiano, where they lived a severe life of total poverty. They later became known as the Poor Clares or the Order of St. Clare.

During the first years of the Franciscans, the example of Francis provided their real rule of life, but, as the order grew, it became clear that a revised rule was necessary. After preparing a rule in 1221 that was found too strict, Francis, with the help of several legal scholars, unwillingly composed the more restrained final rule in 1223. This rule was approved by Pope Honorius III.

Even before the death of Francis in 1226, conflicts had developed within the order over the observance of the vow of complete poverty. The rapid expansion of the order's membership had created a need for settled monastic houses, but it was impossible to justify these if

Francis' rule of complete poverty was followed strictly. Three parties gradually appeared: the Zealots, who insisted on a literal observance of the primitive rule of poverty affecting communal as well as personal poverty; the Laxists, who favoured many mitigations; and the Moderates, or the Community, who wanted a legal structure that would permit some form of communal possessions. Something of an equilibrium was reached between these different schools of thought while St. Bonaventure was minister general (1257–74). Sometimes called the second founder of the order, he provided a wise, moderate interpretation of the rule. During this period the friars spread throughout Europe, while missionaries penetrated Syria and Africa. Simultaneously, the friars' houses in university towns such as Paris and Oxford were transformed into schools of theology that rapidly became among the most celebrated in Europe.

With the death of Bonaventure, the internal dissensions of the order flared up anew. The Zealots, who now became known as the Spirituals, demanded absolute poverty. Opposed to them were the Community, or the Conventuals, who stood for a more moderate community life adapted to the needs of study and preaching. Papal decisions favoured the Conventuals, and the Spirituals ceased to be a faction of importance in the order after 1325.

The latter part of the 14th century saw a great decline in the religious life of the friars. But throughout that century a series of reformers initiated groups of friars, known as Observants, living an austere life apart from the main body of Conventuals. Under the leadership of St. Bernardino of Siena and St. John of Capistrano, the Observants spread across Europe. Though several attempts were made to reconcile them with the Conventuals, the outcome was in fact a complete separation in 1517, when all the reform communities were united in one order with the name Friars Minor of the Observance, and this order was granted a completely independent and autonomous existence. It is estimated that in 1517 the Observants numbered about 30,000, the Conventuals about 25,000.

The union of the Observants was short-lived as several stricter groups arose. One of these reform groups, the Capuchins (*q.v.*), founded in 1525, was separated as the third branch of the Franciscan Order in 1619. The other groups were finally reunited to the Observants by Pope Leo XIII in 1897 with new constitutions and the official title Order of Friars Minor. All three branches of the Franciscans suffered in the French Revolution, but they revived during the 19th century.

The Franciscans have popularized several devotional practices in the Roman Catholic church. Among the best known are the Christmas crib, the Stations of the Cross, and the Angelus. Besides their traditional role of preaching, Franciscans have been active in the work of foreign missions and have made many contributions to the field of education and scholarship.

Franciscus DE MAYRONIS: *see* Francis of Meyronnes.

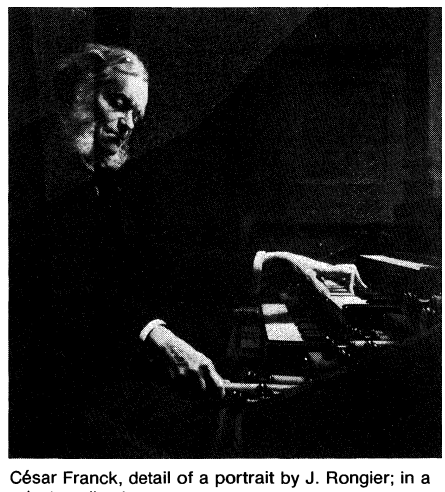
Francistown, town, eastern Botswana. It lies along the Tati River and is an administrative and commercial centre. Francistown is the site of the Dumela industrial complex. It lies in farming country on the country's main road and rail line. Air transport services link Francistown with Johannesburg and Lusaka, Zambia. Pop. (1988 est.) 49,396.

francium (Fr), heaviest chemical element of Group Ia in the periodic table, the alkali metal group. It exists only in short-lived radioactive forms. Natural francium cannot be isolated in visible, weighable amounts, for only about 30 grams (about one ounce) occurs at any time in the crust of the Earth. Marguerite Perey discovered francium (1939) while studying actinium-227, which decays by negative beta decay (electron emission) to an isotope of thorium (thorium-227) and by alpha emission (about 1 percent) into an isotope of francium (francium-223) that was formerly called actinium K (AcK) and is a member of the actinium decay series. Though the longest-lived isotope of francium, francium-223 has a half-life of only 21 minutes. Isotopes of francium with masses between 204 and 224 have been artificially prepared, and, because natural francium cannot be concentrated, it too is prepared by neutron irradiation of radium to produce actinium, which decays to produce traces of francium. The chemistry of francium can be studied only by methods designed for trace quantities. In all respects its observed behaviour, including valence of one, is that to be expected of an alkali element filling a place just below cesium in the periodic table of the elements.

atomic number	87
stablest isotope	(223)
valence	1
electronic config.	2-8-18-32-18-8-1 or (Rn) $7s^1$

Franck, César (Auguste) (b. Dec. 10, 1822, Liége, Neth.—d. Nov. 8, 1890, Paris, Fr.), Belgian-French Romantic composer and organist who was the chief figure in a movement to give French music an emotional engagement, technical solidity, and seriousness comparable to that of German composers. As a composer Franck did not reach his full powers until the last 10 years of his life (1880–90). His *Symphony in D Minor, Variations symphoniques, Piano Quintet in F Minor, String Quartet in D Major, Sonata in A Major for Violin and Piano,* and several organ pieces mark him as one of the most powerful French composers in the second half of the 19th century.

Franck was born of a Walloon father and a mother of German descent. He showed unmistakable musical gifts that enabled him to enter the Liège conservatory at the age of eight, and his progress as a pianist was so astonishing that in 1834 his father took him on a tour of towns, including Aix and Brussels, and a year later dispatched him to Paris, where he worked with the Bohemian composer Anton Reicha, then professor at the Paris Conservatory. In 1836 the whole family, including the younger son Joseph, who played the violin, moved to Paris, and in 1837 César Franck entered the Paris Conservatory. Within a year he had won a Grand Prix d'Honneur by a feat of transposition in the sight-reading test, and this honour was followed by a first prize for fugue (1840) and second prize for organ (1841). Although the boy should now normally have prepared to compete for the Prix de Rome, a prize offered yearly in Paris for study in Rome, his father was determined on a virtuoso's career for him and his violinist brother, with whom he gave concerts, and therefore removed him prematurely from the conservatory.



César Franck, detail of a portrait by J. Rongier; in a private collection

C. Caroly—J.P. Ziolo

In order to please his father and earn much-needed money, Franck gave concerts, the programs of which were largely devoted to performing his own showy fantasias and operatic potpourris, popular at that time. After 1840, when he turned his attention increasingly to the organ, his compositions became noticeably more serious, and three trios written at this time were to impress favourably the Hungarian composer Franz Liszt. A more ambitious work was the cantata *Ruth,* which had its first performance at the conservatory on Jan. 4, 1846.

Unwilling concert giving, a number of bad press notices, and the teaching needed to supplement his income took a physical toll of his powers. Only when he had finally asserted himself against what amounted to the unscrupulous exploitation of his gifts by his father could he achieve maturity and peace of mind. Franck fell in love with an actress with the professional name of Desmousseaux, whose real name was Félicité Saillot, but because both her parents also worked in the theatre, the family was regarded as unsuitable by the elder Franck, and his son was obliged to leave home some time before marrying her in 1848. After his marriage Franck's way of life changed little for his remaining 42 years. He earned his livelihood as an organist and teacher and led a simple, almost ascetic life.

In 1851 he was appointed organist to the Church of Saint-Jean-Saint-François and in 1858 to that of Sainte-Clotilde, where he was already choirmaster. From the organ loft of Sainte-Clotilde came the improvisations for which he was to become famous and also their elaboration in organ and choral works. This music, primarily the product of Franck's official profession, is all marked by the taste of the day, which was for a facile tenderness and saccharine sweetness in ecclesiastical music.

More important to Franck's career as a composer was his appointment as organ professor at the Paris Conservatory in 1872, which came to him as a surprise because he had indulged in none of the preliminary intrigue customary in such cases. His open-heartedness and lack of sophistication were to make him enemies among his colleagues as well as friends among his pupils. This enmity was increased by the fact that his organ classes soon became classes of composition, and his pupils not infrequently proved superior to those of the conventional composition professors.

The nucleus of a school of disciples had already been formed by the French composers Henri Duparc and Alexis de Castillon, who studied privately with Franck in the late 1860s, but only after the founding of the National Society of Music (Feb. 25, 1871) was a real future assured for the deeply serious, emotionally engaged, and technically well-founded music that Franck was interested in writing and communicating to his pupils. When Vincent d'Indy, a French composer, joined the group of Franck's pupils in 1872, he brought an enthusiasm, a propagandist zeal, and an exclusive personal devotion that played a large place in restoring Franck's confidence in his powers, naturally weakened by his failure as a virtuoso pianist and as a composer. With Ernest Chausson, Pierre de Bréville, Charles Bordes, and Guy Ropartz the Franck circle was complete in the early '80s, and subsequently d'Indy's very high claims (in his biography, *César Franck,* 1906) led for a time to the suspicion that Franck was "a creation of his own pupils."

The music that he wrote between 1880 and

his death in 1890 makes it clear that this is not true. Certainly his early years as performer and composer of virtuoso music left an indelible mark on his musical taste, which can be heard unmistakably in the last movement of the *Prélude, aria et final* for piano (completed 1887) and even momentarily in the *Variations symphoniques* (1885) for piano and orchestra. On the other hand, some of his weaker music represents an almost excessive reaction against superficiality and a cultivation of emotional intensity at all costs, drawing for the purpose on the examples of Franz Liszt, Richard Wagner, and, more remotely, Beethoven.

Franck died, partly as the result of a street accident, in 1890. The new seriousness of French music in the last quarter of the 19th century derived entirely from Franck and his pupils. Much has been made of his angelic sweetness and simplicity of character, his selflessness and innocence in the ways of the world. These traits are reflected in a blandness of manner, and they proved a handicap when Franck was faced with the necessity of producing strongly contrasting musical ideas, as in the oratorio *Les Béatitudes* (written during the 1870s and performed posthumously) and the symphonic poems *Le Chasseur maudit* (1882; *The Accursed Hunter*) and *Les Djinns* (1884). On the other hand, the violin sonata (1886) and the *Variations symphoniques* remain as all but perfect monuments of a warm and noble musical nature and a strong, thorough craftsmanship that have survived all changes of taste and emotional attitudes. (M. Du P.C.)

MAJOR WORKS. *Choral works. Ruth,* a biblical eclogue (1846); *Trois Motets* (1858); *Messe à troix voix* (1860); *Trois Offertoires* (1871); *Panis Angelicus,* for tenor, organ, harp, cello, and double bass (1872); *Rédemption* (1873); *Les Béatitudes,* oratorio in eight parts (1879).

Orchestral works. Five symphonic poems including *Les Éolides* (1876), *Le Chasseur maudit* (*The Accursed Hunter,* 1882), *Psyché* (1888), and *Les Djinns* (1884); *Variations symphoniques* (1885); *Symphony in D Minor* (1888).

Chamber music. Quintet in F Minor for Piano and Strings (1879); *String Quartet in D Major* (1889); *Sonata in A Major for Violin and Piano* (1886).

Organ. Six Pièces (1862); *Trois Pièces* (1878); *Trois Chorals* (1890).

Piano. Prélude, choral et fugue (1884); *Prélude, aria et final* (1887).

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Franck, James (b. Aug. 26, 1882, Hamburg—d. May 21, 1964, Göttingen, W.Ger.),

James Franck
Bavaria-Verlag

German-born U.S. physicist who shared the Nobel Prize for Physics in 1925 with Gustav Hertz for research on the excitation and ionization of atoms by electron bombardment, which demonstrated that an impinging electron must have a certain minimum energy to raise an atom from its ground state to an excited state.

Franck performed his prize-winning work at Göttingen, where he had been appointed professor of physics in 1920. In protest against Nazi policies he resigned his post and went to Denmark (1933). Arriving in the U.S. (1935), he was appointed professor at Johns Hopkins University, Baltimore, and in 1938 became professor of physical chemistry at the University of Chicago. Franck's researches in the fields of photochemistry and atomic physics included determinations from molecular band spectra of the energy involved in the dissociation of molecules. During World War II he worked on the development of the atomic bomb. He sought, however, to stop its use in warfare and suggested that it be exploded in an unpopulated area to reveal its power.

Franck, Sebastian (b. *c.* 1499, Donauwörth, Bavaria—d. *c.* 1542, Basel, Switz.), German Protestant Reformer and theologian who converted from Roman Catholicism to Lutheranism but, in eventually departing from Luther's views, emphasized a mystical attitude in place of dogmatic belief.

A fellow student of the Reformer Martin Bucer at Heidelberg, Franck was named a curate in the Roman Catholic diocese of Augsburg soon after 1516. About 1525 he joined the Lutherans at Nürnberg, giving up his curacy to become a preacher for the Reformation. In 1529, however, he produced a free version of Simon Fish's pamphlet *Supplycacyon of the Beggars,* in which Fish expressed vehemently anticlerical and anti-Lutheran views. Those attitudes had Franck's implicit support and reflect the beginnings of his movement away from Lutheranism. At Nürnberg he evidently came in contact with the Anabaptist Hans Denck's disciples, but he soon denounced Anabaptism as dogmatic and narrow. Despite the Anabaptists' unpopularity for their advocacy of adult rebaptism, Franck opposed the use of force to repress them. Increasingly at odds with Lutheran doctrines, dogmatism in general, and the concept of an institutional church, Franck moved in 1529 to Strassburg, then a centre of the spiritual movement in Protestantism. There he became a friend of the Reformer and mystic Kaspar Schwenckfeld, who furthered Franck's development as a fierce anti-dogmatician. Franck's major work, *Chronica: Zeitbuch und Geschichtsbibel* (1531; "Chronica: Time Book and Historical Bible"), is a wide-ranging anti-Catholic study of heresies and heretics.

After a short imprisonment for his views, Franck was expelled from Strassburg by civil authorities; he tried to make a living in Germany, first as a soap boiler at Esslingen. In 1533 he moved to Ulm, where he established himself as a printer, though he sent his own works to others for publication. One of these, *Die goldene Arche* (1538; "The Golden Ark"), asserted the extremely anti-dogmatic notion that Christians need know no doctrines beyond the Ten Commandments and the Apostles' Creed. Regarding the Bible as a book full of contradictions that veiled its true and eternal message, he considered dogmatic controversy meaningless and the sacraments mere playthings for the early church, which in his view was not yet truly led by the spirit.

Luther finally came to view Franck as a man who wanted to avoid both belief and commitment, and Lutherans at Ulm compelled Franck to leave in 1539. Moving to Basel, he wrote *Kriegsbüchlein* (1539; "Little War Book") in defense of pacifism. Denounced by his contemporaries for his apparent vacillation in matters of faith, Franck's reputation as a writer and philosopher has since been reaffirmed by modern critics. E. Teufel's *"Landräumig": S. Franck, ein Wanderer an Donau, Rhein und Neckar* appeared in 1954 and W.E. Peuckert's *Sebastian Franck* appeared in 1943.

Franck–Hertz experiment, in physics, first experimental verification of the existence of discrete energy states in atoms, performed (1914) by the German-born physicists James Franck and Gustav Hertz. They directed low-energy electrons through a gas enclosed in an electron tube. As the energy of the electrons was slowly increased, a certain critical electron energy was reached at which the electron stream made a change from almost undisturbed passage through the gas to nearly complete stoppage. The gas atoms were able to absorb the energy of the electrons only when it reached a certain critical value, indicating that within the gas atoms themselves the atomic electrons make an abrupt transition to a discrete higher energy level. As long as the bombarding electrons have less than this discrete amount of energy, no transition is possible and no energy is absorbed from the stream of electrons. When they have this precise energy, they lose it all at once in collisions to atomic electrons, which store the energy by being promoted to a higher energy level.

Francke, August Hermann (b. March 22, 1663, Lübeck—d. June 8, 1727, Halle, Brandenburg), Protestant religious leader, educator, and social reformer who was one of the principal promoters of German Pietism, a devotional revival of personal Christianity that reacted to academic Lutheranism.

Influenced by the religious enthusiasm movement of Philipp Jakob Spener, Francke

August Hermann Francke, engraving
BBC Hulton Picture Library

founded Pietist groups at the University of Halle, where he taught theology and Oriental languages (1695–1727). His religious society was criticized by traditional Lutherans for its biblical revivalism and social activism, particularly the founding (1695) at Halle of the Franckesche Stiftung (Francke Institute), which included a school for the poor, orphanage, medical dispensary, and publishing house. Dismissed by the established church, Francke later received the favour of King Frederick William I of Prussia, who, influenced by a visit to the institute (1713), initiated legislation for similar educational centres in his realm.

Francke, Meister (fl. early 15th century, Hamburg), influential German painter of altarpieces. His name occurs in a contract of 1424 for an altarpiece for a Hamburg church. Nine portions of this work are now in a museum at Hamburg. Besides these, few pictures can be ascribed to him with certainty. One at Leipzig and one at Hamburg are representations of "Christ as the Man of Sorrows." Meister Francke's style is that of a strong

"Man of Sorrows," panel from the English Pilgrimage Altar by Meister Francke, 1424; in the Hamburger Kunsthalle

By courtesy of the Hamburger Kunsthalle

personality, and attempts to relate it to other schools have failed. With feeling for the decorative value of colour and for two-dimensional design, he combined a realistic rendering of detail and a somewhat exaggerated expression of emotions. Numerous altarpieces in the north of Germany recall his style, and his influence must have been widespread.

Franco (antipope): *see* Boniface VII.

Franco, Francisco, in full FRANCISCO PAULINO HERMENEGILDO TEÓDULO FRANCO BAHAMONDE, byname EL CAUDILLO (the Leader) (b. Dec. 4, 1892, El Ferrol, Spain—d. Nov. 20, 1975, Madrid), general and leader of the Nationalist forces that overthrew the Spanish democratic republic in the Spanish Civil War (1936–39); thereafter until his death he was the head of the government of Spain.

Franco, 1970

Keystone

Life. Franco was born at the coastal city and naval centre of El Ferrol in Galicia (northwestern Spain). His family life was not entirely happy, for Franco's father, an officer in the Spanish Naval Administrative Corps, was eccentric, wasteful, and somewhat dissolute. More disciplined and serious than other boys of his age, Franco was close to his mother, a pious and conservative upper middle-class Catholic. Like four generations and his elder brother before him, Franco was originally destined for a career as a naval officer, but reduction of admissions to the Naval Academy forced him to choose the army. In 1907, only 14 years old, he entered the Infantry Academy at Toledo. Three years later he was graduated.

Franco volunteered for active duty in the colonial campaigns in Spanish Morocco that had begun in 1909 and was transferred there in 1912 at the age of 19. The following year he was promoted to first lieutenant in an elite regiment of native Moroccan cavalry. At a time in which many Spanish officers were characterized by sloppiness and lack of professionalism, young Franco quickly showed his ability to command troops effectively and soon won a reputation for complete professional dedication. He devoted great care to the preparation of his unit's actions and paid more attention than was common to the troops' well-being. Reputed to be scrupulously honest, introverted, and a man of comparatively few intimate friends, he was known to shun all frivolous amusements. In 1915 he became the youngest captain in the Spanish Army. In the following year he was seriously wounded by a bullet in the abdomen and was brought back to Spain to recover. In 1920 he was chosen to be second in command of the newly organized Spanish Foreign Legion, succeeding to full command in 1923. In that year he married Carmen Polo, by whom he had a daughter. During the crucial campaigns against the Moroccan rebels, the legion played a decisive role in bringing the revolt to an end. Franco became a national hero, and in 1926, at the age of 33, he was promoted to brigadier general. At the beginning of 1928 he was named director of the newly organized General Military Academy in Saragossa.

After the fall of the monarchy in 1931, the leaders of the new Spanish Republic adopted a sharply antimilitary policy, and Franco's career was temporarily halted. The General Military Academy was dissolved, and Franco was placed on the inactive list. Though he was an avowed monarchist and held the honour of being a Gentleman of the King's Chamber, Franco accepted both the new regime and his temporary demotion with perfect discipline. When conservative forces gained control of the republic in 1933, Franco was restored to active command; in 1934 he was promoted to major general. In October 1934, during the rising of Asturian miners who opposed the admission of three members of the right to the government, Franco was called in to quell the revolt. His success in this operation brought him new prominence. In May 1935 he was appointed chief of the Spanish Army's general staff, and he began the work of tightening discipline and strengthening military institutions, both seriously weakened by the republic's earlier antimilitary position.

No longer able to retain control of the country, the centre-right government was dissolved, and new elections were announced for February 1936. By this time the Spanish political parties had split into two factions: the rightist National Bloc and the leftist Popular Front. The left proved victorious in the elections, but the new government was unable to prevent the accelerating dissolution of Spain's social and economic structure. Although Franco had never been a member of a political party, the growing anarchy impelled him to appeal to the government to declare a state of emergency. His appeal was refused, and he was removed from the general staff and sent to an obscure command in the Canary Islands. For some time he refused to commit himself to a military conspiracy against the government, but as the political system disintegrated, he finally decided to join the rebels.

Franco's military rebellion. At dawn on July 18, 1936, Franco's manifesto acclaiming the military rebellion was broadcast from the Canary Islands, and the same morning the rising began on the mainland. The following day he flew to Morocco and within 24 hours was firmly in control of the protectorate and the Spanish Army garrisoning it. After landing in Spain, Franco and his army marched toward Madrid, which was held by the government. When the Nationalist advance came to a halt on the outskirts of the city, the military leaders, in preparation of what they believed was the final assault that would deliver Madrid and the country into their hands, decided to choose a commander in chief, or generalissimo, who would also head the rebel Nationalist government in opposition to the republic. Because of his military ability and prestige, a political record unmarred by sectarian politics and conspiracies, and his proved ability to gain military assistance from Hitler's Germany and Mussolini's Italy, Franco was the obvious choice. In part because he was not a typical Spanish "political general," Franco became head of state of the new Nationalist regime on Oct. 1, 1936. The rebel government did not, however, gain complete control of the country for more than three years.

Franco presided over a government that was basically a military dictatorship, but he realized that it needed a regular civil structure to broaden its support; this was to be derived mainly from the antileftist middle classes. On April 19, 1937, he reorganized the Falange (the Spanish Fascist Party) and made it the rebel regime's official political movement. While expanding the Falange into a more pluralistic group, Franco made it clear that it was the government that used the party and not the other way around. Thus, his regime became an institutionalized authoritarian system, differing in this respect from the Fascist party-states of the German and Italian models.

As commander in chief in the Civil War, Franco was a careful and systematic leader. He made no rash moves and suffered only a few temporary defeats as his forces advanced slowly but steadily; the only major criticism directed at him during the campaign was that his strategy was frequently unimaginative. Nevertheless because of the relatively superior military quality of his army and the continuation of heavy German and Italian assistance, Franco won a complete and unconditional victory on April 1, 1939.

The Civil War had been largely a sanguinary struggle of attrition, marked by atrocities on both sides. The tens of thousands of executions carried out by the Nationalist regime, which continued during the first years after the war ended, earned Franco more reproach than any other single aspect of his rule.

Franco's dictatorship. Although Franco had visions of restoring Spanish grandeur after the Civil War, in reality he was the leader of an exhausted country still divided internally and impoverished by a long and costly war. The stability of his government was made more precarious by the outbreak of World War II only five months later. Franco was at first shocked by Hitler's unprovoked assault on Catholic Poland and carefully avoided involvement in the war. His wartime diplomacy was perhaps Franco's ablest political achievement; it was marked by cold realism and careful timing. The evidence indicates that had Hitler ever been in a position to win a quick and total victory, Franco would have been willing to enter the conflict on Germany's side. As it was, his government remained relatively sympathetic to Hitler while carefully avoiding direct diplomatic and military commitment. After his interview with Franco in 1940 at Hendaye, Fr., Hitler is said to have remarked that he would "as soon have three or four teeth pulled" as go through another bargaining session like that.

The most difficult period of Franco's regime began in the aftermath of World War II, when his government was ostracized by the newly formed United Nations. He was labelled by

hostile foreign opinion the "last surviving Fascist dictator" and for a time appeared to be the most hated of Western heads of state; within his country, however, as many people supported him as opposed him. The period of ostracism finally came to an end with the worsening of relations between the Soviet world and the West at the height of the Cold War. Franco could now be viewed as one of the world's leading anti-Communist statesmen, and relations with other countries began to be regularized in 1948. His international rehabilitation was advanced further in 1953, when Spain signed a 10-year military assistance pact with the United States, which was later renewed in more limited form.

Franco's domestic policies became somewhat more liberal during the 1950s and '60s, and the continuity of his regime, together with its capacity for creative evolution, won him at least a limited degree of respect from some of his critics. Franco said that he did not find the burden of government particularly heavy, and, in fact, his rule was marked by absolute self-confidence and relative indifference to criticism. He showed marked political ability in gauging the psychology of the diverse elements, ranging from moderate liberals to extreme reactionaries, whose support was necessary for his regime's survival. He maintained a careful balance among them and largely left the execution of policy to his appointees, thereby placing himself as arbiter above the storm of ordinary political conflict. To a considerable degree, the opprobrium for unsuccessful or unpopular aspects of policy tended to fall on individual ministers rather than on Franco. The Falange state party, downgraded in the early 1940s, in later years became known merely as the "Movement" and lost much of its original quasi-Fascist identity.

Unlike most rulers of rightist authoritarian regimes, Franco provided for the continuity of his government after his death through an official referendum in 1947 that made the Spanish state a monarchy and ratified Franco's powers as a sort of regent for life. In 1967 he opened direct elections for a small minority of deputies to the Parliament and in 1969 officially designated the then 32-year-old prince Juan Carlos, the eldest son of the nominal pretender to the Spanish throne, as his official successor upon his death. Franco resigned his position of premier in 1973 but retained his functions as head of state, commander in chief of the armed forces, and head of the "Movement."

Franco was never a popular ruler and rarely tried to mobilize mass support. But after 1947 there was little direct or organized opposition to his rule. With the liberalization of his government and relaxation of some police powers, together with the country's marked economic development during the 1960s, Franco's image changed from that of the rigorous generalissimo to a more benign civilian elder statesman. The company of his six grandchildren and frequent hunting and fishing expeditions constituted the principal diversions of his later years. Franco's health declined markedly in the late 1960s, but advanced age brought no slackening of his self-confidence. He believed it within his power to bequeath to his country a stable continuation of his regime in an atmosphere of prosperity and accelerating modernization. (S.G.P.)

BIBLIOGRAPHY. The best biography of Franco is J.W.D. Trythall, *El Caudillo: A Political Biography of Franco* (1970). The two other principal biographies are Brian Crozier, *Franco: A Biographical History* (1967); and George Hills, *Franco: The Man and His Nation* (1967).

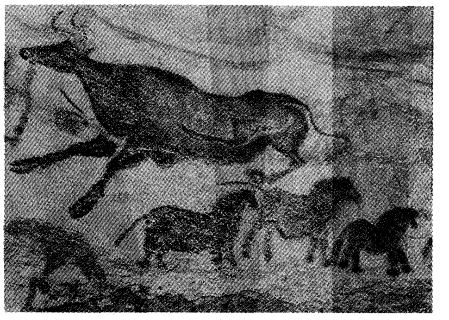
Franco-American Alliance (Feb. 6, 1778), agreement by France to furnish critically needed military aid and loans to the 13 insurgent American colonies, often considered the turning point of the U.S. War of Independence. Resentful over the loss of its North American empire after the French and Indian War, France welcomed the opportunity to undermine Britain's position in the New World.

Though maintaining a position of neutrality from 1775 to 1777, France was already secretly furnishing the American colonists with munitions and loans. As early as 1776, the Continental Congress had established a joint diplomatic commission—composed of Benjamin Franklin, Silas Deane, and Arthur Lee—to seek recognition and financial aid from the Bourbon monarchy. The colonists' victory at Saratoga (Oct. 17, 1777) was the show of strength needed to convince France that the revolutionaries would pursue the war to final victory. Hastening to act before British peace overtures of the Carlisle Commission could tempt the colonists, the French foreign minister, the Comte de Vergennes, succeeded in concluding the alliance the following February.

Two treaties were signed. The first, a treaty of amity and commerce, granted official recognition to the new country and encouraged Franco-American trade. The second treaty provided for a military alliance against Great Britain and also required recognition of absolute independence for the United States as a condition of peace. In addition, peace could be arrived at only by mutual French and U.S. consent. Finally, France renounced all territorial claims in North America east of the Mississippi and in Bermuda, and it agreed to guarantee whatever U.S. boundaries existed at the war's end in exchange for U.S. guarantees of French possessions in the West Indies.

The alliance greatly facilitated U.S. independence. The French fleet proceeded to challenge British control of North American waters and, together with troops and arms, proved an indispensable asset in the revolutionaries' victory at Yorktown, which ended the war. Later, however, the treaties proved embarrassing to the U.S., threatening to involve the country in the French Revolutionary wars. After several years of strained relations, France and the U.S. agreed to the Treaty of Morfontaine (Sept. 30, 1800) to abrogate both 1778 treaties.

Franco-Cantabrian school, the oldest and most complete of several traditions of Paleolithic (Old Stone Age) art that flourished in southwestern France and the northern Cantabrian Mountains region of Spain between about 40,000 and 10,000 BC. It is called a school because it maintained a coherent development and consistent approach over nearly 30,000 years, covering the two major artistic phases of the Late Paleolithic Period, the Aurignacian and the Magdalenian. It developed in huge limestone caves, such as those at Altamira (*q.v.*) and Lascaux (*see* Lascaux, Grotte de), that served as habitation for ancient hunters in central and southern France and northern Spain; and it consists of highly naturalistic small carvings and monumental paintings, engravings, and reliefs.



Aurignacian cave painting of a cow and horses, Lascaux, Fr.

Life, © 1959 Time Inc.

Perhaps because the availability of protected wall space inside the caves favoured the development of graphic arts, Franco-Cantabrian art emphasizes the linear over the plastic: sculpture in the round is rare; small carved figurines are freely incised with linear details; and the design of monumental art depends heavily on the rhythm of line and on flat, zonal areas of colour, even in the late Magdalenian phase, when volumes are well expressed. At the same time, the animals of the Franco-Cantabrian school are often lively, sometimes with an overpowering vitality. Magico-religious in inspiration, the art of the Franco-Cantabrian school consists almost entirely of large numbers of single, unrelated animals, which seem to have functioned as icons. Some may have played a role in dramatic rituals invoking success in the hunt and animal fertility.

Franco-Dutch War: *see* Dutch War.

Franco-Flemish school (music): *see* Franco-Netherlandish school.

Franco-German War, also called FRANCO-PRUSSIAN WAR (July 19, 1870–May 10, 1871), war that marked the end of French hegemony in continental Europe and the foundation of the Prussian-dominated German Empire.

Napoleon III, the French emperor, entered the war because his advisers told him that the French Army could defeat Prussia and that such a victory would restore his declining popularity in France. Otto von Bismarck, the Prussian chancellor, saw in Napoleon's ambitions an opportunity to bring the South German states into unity with the Prussian-led North German Confederation and build a strong German Empire. Diplomatic relations between the two countries were irritated earlier in July 1870 by an effort to secure the Spanish throne for Prince Leopold of Hohenzollern-Sigmaringen, who was related to the Prussian royal house. This move seemed to threaten France with a possible combination of Prussia and Spain directed against it. On July 14, Bismarck published a provocative message (the Ems telegram; *q.v.*), which accomplished its purposes of infuriating the French government and stimulating the clamour for war in both countries. France declared war five days later. Contrary to Napoleon's hopes, he received no support, while the South German states sided with Prussia.

The efficiency of the German offensive, planned and led by Gen. Helmuth von Moltke, contrasted with the inefficiency of the French mobilization. Within four weeks the Germans had bottled up a French field army under Marshal Bazaine in the fortress at Metz. His attempt to escape the German onslaught had been defeated earlier (*see* Mars-la-Tour and Gravelotte, Battles of). The main French Army, commanded by Marshal Mac-Mahon and accompanied by Napoleon, attempted to relieve Bazaine but was itself surrounded and trapped by the Germans at Sedan (*see* Sedan, Battle of) on August 31. On September 1 the French tried unsuccessfully to break out of Sedan, and on September 2, 83,000 French troops, with Napoleon and Mac-Mahon, surrendered.

French resistance was carried on against desperate odds by a new government of national defense, which assumed power in Paris on Sept. 4, 1870, and proclaimed the deposition of the emperor and the establishment of the Third Republic. On September 19 the Germans began to besiege Paris. Jules Favre, foreign minister in the new government, went to negotiate with Bismarck, but the negotiations were broken off when he found that Germany demanded Alsace and Lorraine. Léon Gambetta, the leading figure in the provisional government, organized new French armies in the countryside after escaping from besieged Paris

in a balloon. These engaged but could not defeat the German forces. Bazaine capitulated at Metz on October 27, and Paris surrendered on Jan. 28, 1871.

The armistice of January 28 included a provision for the election of a French National Assembly, which would have the authority to conclude a definite peace. This settlement was finally negotiated by Adolphe Thiers and Favre and was signed February 26 and ratified March 1. Between then and the conclusion of the formal Treaty of Frankfurt on May 10, 1871, the republican government was threatened by an insurrection in Paris, in which radicals established their own short-lived government, the Paris Commune. The Commune was suppressed after two months, and the harsh provisions of the Treaty of Frankfurt were then implemented: Germany annexed Alsace and most of Lorraine, with Metz; France was to pay a heavy war indemnity and cover the costs of the German occupation of France's northern provinces until the indemnity was paid. The major triumph of Bismarck's plans came on Jan. 18, 1871, when King William I of Prussia was proclaimed German emperor at Versailles, the former palace of the kings of France. Prussian domination of Germany was now ensured, and French influence among the states of Germany was ended.

There were two major side effects to the French defeat. The temporal power of the papacy, which had been maintained by Napoleon's troops since 1867, collapsed, and Italian troops entered Rome on Sept. 20, 1870. At the same time, the Russian government repudiated the naval terms of the Treaty of Paris (1856), which had limited its naval strength on the Black Sea and resumed an aggressive foreign policy in eastern Europe. The 40-year period between the Franco-German War and the beginning of World War I was marked by an extremely unstable peace between the major powers of Europe.

Franco-Netherlandish school, also called FLEMISH, FRANCO-FLEMISH, or NETHERLANDS SCHOOL, style of musical composition that dominated European music from *c.* 1450 to *c.* 1550 and so called because during that time most of the leading musicians were born or trained in the Netherlands, Flanders, and northern France. The music of the Franco-Netherlandish school is preeminently vocal, contrapuntal (built on interwoven melodic lines), and was later taken as the ideal of a cappella composition, although it was frequently accompanied by instruments.

The principal genres of the Franco-Netherlandish school included, in sacred music, the mass and, to a somewhat lesser extent, the motet; in secular music, the chanson, or French polyphonic (multipart) song, was dominant. With the masses of Jean d'Okeghem (*q.v.*) and the late works of Burgundian Guillaume Dufay (*q.v.*), four rather than three, voice parts became the norm; in the 16th century, writing in five and six parts became increasingly common. A texture of continuous, spun-out counterpoint was cultivated, varied at times by short chordal sections or passages in three and two voices. By the early 16th century, melodic imitation became common, particularly in the motet.

The mass was the most conservative of the three genres. Motets provided more outlet for expressiveness, and a certain humanism is evident in the careful setting of texts and in the evocation of the meaning of the words; but this was more typical of some composers than others and particularly of Josquin des Prez (*q.v.*), whose work has been noted as marking a transition between the late medievalism inherent in the mystical, often formally intricate sacred music of the previous generation of Franco-Netherlandish composers and the more earthly or human orientation of much later 16th-century music. In the chanson, with its rhythmic melodies of popular cast, there was considerable experimentation, and there evolved a chanson type in which popular elements were fused with contrapuntal techniques and which was marked by clear, short phrases and more "modern" harmonies.

The mid-16th century saw a development of national styles. The Netherlands tradition remained viable but was often given distinct national qualities, as in the motets of the Spanish composer Tomás Luis de Victoria (*q.v.*). Flemish composers such as Orlando di Lasso (*q.v.*) were adept practitioners of several national styles as well as of the international Netherlands style. Netherlands techniques were applied to German and Italian secular song, in Italy resulting in the madrigal, a genre that evolved far away from the Netherlands style and toward the oncoming Baroque era.

Franco-Provençal dialect, any of a group of Romance dialects spoken in eastern central France in a region roughly corresponding to Burgundy and in adjacent areas of Italy and Switzerland. Franco-Provençal is purely rural and nonstandardized, young speakers are few, and speech forms are heavily influenced by French, which has been the standard and urban language of the area for several hundred years. Franco-Provençal has no standard or literary language, and its regional and local dialects are extremely diversified; they may be classified into Lyonnais, Neuchâtelois, Dauphinois, Savoyard, and, in Italy, Valle d'Aosta dialect groups.

Linguistically, Franco-Provençal is midway between the Occitan (Provençal) and French languages in its grammar and sound system. In general, vowel sounds are similar to those of Occitan, while consonants conform more nearly to those of French. Except for a brief period when the (now extinct) Franco-Provençal dialect of Geneva was the official language of the Swiss Republic, Franco-Provençal has never had a standard or literary form. Literature is limited; the earliest written material recognized is the Alexander fragment, part of a poem, dating from the 11th or 12th century. There is some controversy as to whether this ought not to be considered a Provençal work with French influences.

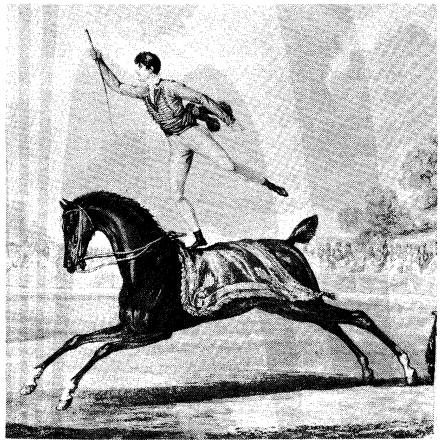
Franco-Prussian War: *see* Franco-German War.

Franco-Russian Alliance (1894): *see* Dual Alliance.

François (French personal name): *see under* Francis.

francolin, any of several species of popular game birds classified as partridges. *See* partridge.

Franconi, Antonio (b. Aug. 5, 1737, Udine, Rep. of Venice—d. Dec. 6, 1836, Paris), impresario considered the founder of the French circus and, with Philip Astley, the founder of the modern circus.



Franconi, detail of an engraving by Philibert-Louis Debucourt, after a painting by C. Vernet

H. Roger-Viollet

A member of a noble Venetian family, Franconi fled to France, where he stayed until 1756, after killing an opponent in a duel. Beginning his circus career as a lion trainer in Lyon, Fr., he next exhibited trained canaries in France and Spain and in 1773 staged a bullfight in Rouen. He became associated with Astley's Amphitheatre in Paris, and in 1793 he leased the theatre from Astley, renaming it the Amphithéâtre Franconi. Thereafter, Franconi concentrated on expanding and varying his spectacles, especially with trick riding (in which he himself had some skill). He subsequently built the Cirque Olympique de Franconi, management of which he transferred, in 1805, to his sons Henri and Laurent, who likewise gained reputations as notable circus men. His youngest son, Victor, established the first open-air hippodrome in Paris, where he developed a flamboyant circus that especially influenced the Ringling Brothers and Barnum & Bailey circuses in the United States.

Franconia, German FRANKEN, one of the five great stem, or *Stamm* (tribal), duchies—the other four being Saxony, Lotharingia (Lorraine), Swabia, and Bavaria—of early medieval Germany. Today it is divided between Rhenish Franconia, now located in the *Länder* (states) of Rhineland-Palatinate, Baden-Württemberg, and Hesse, and East Franconia, now in the *Länder* of Baden-Württemberg and Bavaria.

The Franks forcibly settled the region from the early 6th century AD, and in the early 8th century the Merovingian dynasty claimed it as a royal demesne (crown land). After the division of the Carolingian Empire under the Treaty of Verdun in 843, Franconia became the nucleus of the East Frankish (German) kingdom, and, when the Carolingian line died out, its duke became the first elected German king as Conrad I (911–918). In 919 the German crown passed to a Saxon dynasty. Franconia remained a royal demesne nurturing no strong ducal dynasty, and their tenure of it provided a support to German kings and Holy Roman emperors. By the 12th century, the name had come to refer only to East Franconia.

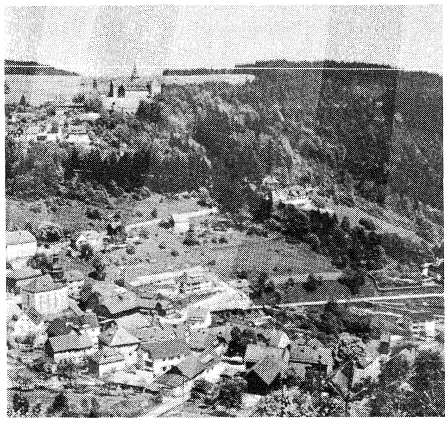
The church was always strong in the region, and its bishoprics included the archbishopric of Mainz (in Rhenish Franconia) and Bamberg and Würzburg (East Franconia). After the mid-13th century, the fragmentation of Franconia into secular and ecclesiastical principalities was accelerated. In 1340 these territories organized the *Landfriedensbund* (regional peace-keeping league), which served as the basis of the Franconian *Kreis* (circle, or administrative district) set up in the early 16th century.

In Napoleon's reorganization of Germany, the Franconian region was divided between the kingdoms of Bavaria and Württemberg and the Grand Duchy of Baden. King Louis I of Bavaria revived the use of the name in 1837 by creating the provinces of Upper, Middle, and Lower Franconia, which still form the northwestern corner of the present *Land* of Bavaria.

Franconia Notch, scenic pass between the towering peaks of the Franconia (east) and Kinsman (west) ranges in the White Mountains, northwestern New Hampshire, U.S. Located in Grafton County just north of North Woodstock it is about 8 mi (13 km) long. The Notch, an impressive example of glacial action, includes at its southern end The Flume, a narrow gorge 70 ft (21 m) deep which extends along the flank of Mt. Liberty (4,460 ft) and is accessible by steps and a boardwalk.

Other features are The Profile, also called the Great Stone Face and the Old Man of the Mountains, comprising ledges of granite (48 ft high) shaped like a face on the mountainside, 1,200 ft (365 m) above Profile Lake; and Cannon Mountain (4,200 ft), 5 mi (8 km) south of Franconia Village, with skiing facilities and an aerial tramway to its summit. Echo Lake, at the head of the Notch and surrounded on three sides by mountains, is noted for boating, fishing, and swimming. The Pemigewasset River rises in the Notch and follows the pass, from which it flows southward for 60 mi (95 km) to join the Winnipesaukee River to form the Merrimack. The area was made a state forest in 1925.

Franconian Forest, German FRANKENWALD, forested highland in extreme northeastern Bavaria *Land* (state), east-central Germany. It forms a physical and geological link between the highlands of the Fichtel Mountains and the Thuringian Forest. About 30 miles (50 km) long, the forest descends gently north and east toward the Saale River but more precipitously west to the Bavarian Plain. Its highest point is Mount Döbra (2,608 feet [795 m]). Along the centre lies the watershed between the Main and the Saale basins and between the Rhine and the Elbe systems. The principal tributaries of the Main rising in the forest are the Rodach and the Hasslach; of the Saale, the Selbitz. Small hamlets lie in clearings in the heath, bog, and woods of the Franconian Forest. The chief city is Hof, to the east. Kulmbach, Kronach, and Bayreuth lie to the west.



Lauenstein, a hamlet in the highlands of the Franconian Forest, Germany
Schuster—De Wys Inc.

Franju, Georges (b. April 12, 1912, Fougères, Fr.—d. Nov. 5, 1987, Paris), French motion-picture director noted for his short documentary films.

In 1932 Franju found work on the sets of Paris music halls while he studied theatre decor. Franju met Henri Langlois in 1934. In that year the two men directed the short *Le Métro,* and in the following year they started a film magazine and founded Le Cercle du Cinéma, a film club. Franju and Langlois founded the Cinémathèque Française (the French film archives) in 1937, and Franju served as executive secretary of the Fédération Internationale des Archives du Film (FAIF), the international federation of film archives, from 1938 to 1945.

In 1949 Franju established himself as a leading figure of the French cinema with the release of his documentary *Le Sang des bêtes* (*The Blood of the Beasts*), the subject of which is a Parisian slaughterhouse. It was followed by at least a dozen highly praised documentary shorts during the next decade, including *Hôtel des Invalides* (1951), *Monsieur et Madame Curie* (1953), *Le Saumon atlantique* (1955; "The Atlantic Salmon"), and *Notre Dame—Cathédrale de Paris* (1957). These documentaries are notable for their intensely personal expression and an emotionally complex presentation of their subjects. Franju's feature films after that—including *La Tête contre les murs* (1958; "Head Against the Wall"), *Judex* (1963), and *L'Homme sans visage* (1974; "The Man Without a Face")—were not as successful as his earlier works, but they do provide a picture of his anarchic and occasionally nihilistic world view.

Frank, member of a Germanic-speaking people who invaded the western Roman Empire in the 5th century AD. Dominating present-day northern France, Belgium, and western Germany, the Franks established the most powerful Christian kingdom of early medieval western Europe. The name France (Francia) is derived from their name.

The Franks emerged into recorded history in the 3rd century AD as a Germanic tribe living on the east bank of the lower Rhine River. At this time they were divided into three groups: the Salians, the Ripuarians, and the Chatti, or Hessians. These branches were related to each other by language and custom, but politically they were independent tribes. In the mid-3rd century the Franks tried unsuccessfully to expand westward across the Rhine into Roman-held Gaul. In the mid-4th century the Franks again attempted to invade Gaul, and in 358 Rome was compelled to abandon the area between the Meuse and Scheldt rivers (now in Belgium) to the Salian Franks. During the course of these drawn-out struggles the Franks were gradually influenced by Roman civilization. Some Frankish leaders became Roman allies (*foederati*) in the defense of the Roman frontier, and many Franks served as auxiliary soldiers in the Roman army.

The Vandals launched a massive invasion of Gaul in 406, and in the ensuing decades the Franks took advantage of the overstrained Roman defenses. They solidified their hold on what is now Belgium, took permanent control of the lands immediately west of the middle Rhine River, and edged into what is now northeastern France. The firm establishment of the Franks in northeastern Gaul by the year 480 meant that both the former Roman province of Germania and part of the two former Belgic provinces were lost to Roman rule. The small Gallo-Roman population there became submerged among the German immigrants, and Latin ceased to be the language of everyday speech. The extreme limit of Frankish settlement at this time is marked by the linguistic frontier that still divides the Romance-speaking peoples of France and southern Belgium from the Germanic-speaking peoples of northern Belgium, The Netherlands, and Germany.

In 481/482 Clovis succeeded his father, Childeric, as the ruler of the Salian Franks of Tournai. In the following years Clovis compelled the other Salian and Ripuarian tribes to submit to his authority. He then took advantage of the disintegration of the Roman Empire and led the united Franks in a series of campaigns that brought all of northern Gaul under his rule by 494. He stemmed the Alemannic migrations into Gaul from east of the Rhine, and in 507 he drove southward, subduing the Visigoths who had established themselves in southern Gaul. A unified Frankish kingdom in northern Gaul was thus established and secured. Clovis converted to Catholicism, and the mass adoption of orthodox Christianity by the Franks further served to unite them into one people. It also won them the support of the orthodox clergy and the remaining Gallo-Roman elements in Gaul, since most other Germanic tribes had adopted Arianism.

Clovis belonged to the Merovingian dynasty, so named for his grandfather, Merovich. Under Clovis' successors, the Merovingians were able to extend Frankish power east of the Rhine. The Merovingian dynasty ruled the Frankish territories until they were displaced by the Carolingian family in the 8th century. The Carolingian Charlemagne (Charles the Great, ruled 768–814) restored the western Roman Empire in cooperation with the papacy and spread Christianity into central and northern Germany. His empire disintegrated by the mid-9th century.

In succeeding centuries the people of the west Frankish kingdom (France) continued to call themselves Franks, although the Frankish element merged with the older population. In Germany the name survived as Franconia (Franken), a duchy extending from the Rhineland east along the Main River.

Frank, Anne, in full ANNELIES MARIE FRANK (b. June 12, 1929, Frankfurt am Main—d. March 1945, Bergen-Belsen concentration camp, near Hannover, Ger.), young Jewish girl whose diary records the two years that her family spent in hiding in Amsterdam to escape the anti-Semitic persecutions of the German Nazi movement.

Early in the Nazi regime of Adolf Hitler, Anne Frank's father, Otto Frank (1889–1980), a German businessman, took his wife and two daughters to live in Amsterdam. In 1941, after German forces occupied The Netherlands, Anne was compelled to transfer from a public to a Jewish school. Faced with deportation (supposedly to a forced-labour camp), the Franks on July 9, 1942, went into hiding with four other Jews in the back-room office and warehouse of the father's food-products business. A few Gentile friends smuggled in their food and other supplies, and they lived confined to their secret annex until Aug. 4, 1944, when the Gestapo, acting on a tip from Dutch informers, discovered them.

The family was transported to the concentration camp at Auschwitz in Poland, where Anne's mother died in 1945. Anne and her sister were transferred to Bergen-Belsen and died there of typhus. Otto Frank was found hospitalized at Auschwitz when it was liberated by Russian troops.

Friends who had searched the annex after the family's departure later gave Otto Frank the papers left behind by the Gestapo; among them he found Anne's diary. He had it published in 1947 as *Het Achterhuis* (Eng. trans., *The Diary of a Young Girl*). Precocious in style and insight, it traces her emotional growth amid adversity and records her assertion that "In spite of everything I still believe that people are really good at heart."

The diary has been translated into more than 30 languages and has been widely read. The Frank family's hiding place on the Prinsengracht Canal in Amsterdam has become a museum.

Frank, Hans (b. May 3, 1900, Karlsruhe, Ger.—d. Oct. 16, 1946, Nürnberg), German politician and lawyer who served as governor-general of Poland during World War II.

Frank fought in World War I, studied economics and jurisprudence, and in 1921 joined the German Workers' Party (which became the Nazi Party). He eventually became the party's chief legal counsel and Hitler's personal lawyer. After the Nazis came to power in Germany in 1933, Frank was appointed to a variety of important posts, including president of the Reichstag and minister of justice in the Nazi government.

After the German invasion of Poland in 1939, Frank was appointed governor-general, becoming the supreme chief of occupied Poland's civil administration. An enthusiastic proponent of Nazi racist ideology, Frank ordered the execution of hundreds of thousands of Poles, the wholesale confiscation of Polish property, the enslavement of hundreds of

thousands of Polish workers who were shipped to Germany, and the herding of most of Poland's Jews into ghettos as a prelude to their extermination. Frank remained as governor-general until the war's end, although Hitler stripped him of his other posts in 1942. He was captured by U.S. Army troops on May 4, 1945, and was indicted for trial before the International Military Tribunal at Nürnberg. He was found guilty of war crimes and crimes against humanity and on Oct. 1, 1946, was sentenced to hang.

Frank, Ilya Mikhaylovich (b. Oct. 23 [Oct. 10, Old Style], 1908, St. Petersburg, Russia—d. June 22, 1990), Soviet winner of the Nobel Prize for Physics in 1958 jointly with Pavel A. Cherenkov and Igor Y. Tamm, also of the Soviet Union. He received the award for his work in explaining the Cherenkov effect.

In 1934 Cherenkov discovered that light is emitted by charged particles traveling at very high speeds. This discovery resulted in the development of new methods for detecting and measuring the velocity of high-speed particles and became of great importance for research in nuclear physics. Frank and Tamm provided the theoretical interpretation of this effect in 1937.

Frank's work also includes collaboration with Cherenkov and Tamm in research on electron radiation, for which each was awarded the Stalin Prize in 1946. Frank also specialized in the study of gamma rays and neutron beams. He became head of the department of physics at the University of Moscow in 1944 and was made a member of the Academy of Sciences of the U.S.S.R. in 1946.

Frank, Jacob, original name JACOB LEIBOWICZ (b. 1726, in Berezanka or Korolowka, Galicia, Pol.—d. Dec. 10, 1791, Offenbach, Hessen [Germany]), Jewish false messiah who claimed to be the reincarnation of Shabbetai Tzevi (1626–76). The most notorious of the false messiahs, he was the founder of the antirabbinical Frankist, or Zoharist, sect.

Frank often traveled in the Balkans and there met followers of Shabbetai. An uneducated visionary, he appealed to many who awaited the resurrection of Shabbetai. In about 1751 he proclaimed himself the messiah and four years later, in Poland, formed a sect that held that certain elect persons are exempt from the moral law. This sect abandoned Judaism for a "higher Torah" (Jewish Law) based on the *Zohar,* the most important work in the Kabbala, the highly influential Jewish mystical movement in the medieval and Renaissance eras. Hence its members also called themselves Zoharists. Their practices, including orgiastic, sexually promiscuous rites, led the Jewish community to ban them as heretics in 1756. Protected by Roman Catholic authorities, who saw in them a means of converting the Jews, the Frankists debated with representatives of the rabbinate and claimed that the Talmud, the rabbinical compendium of law and commentary, should be discarded as blasphemous. They were also partly responsible for the revival of the canard that the Jews use Christian blood for Passover rituals.

In the meantime, to preserve his following, Frank publicly committed his supporters to mass baptism and was himself baptized in Warsaw, with Augustus III, king of Poland, acting as his godfather. The Frankists, however, continued their sectarian ways. As a result, the Inquisition imprisoned Frank in the fortress of Częstochowa (1760).

Freed by the conquering Russians in 1773, he eventually settled in Offenbach, dubbing himself baron. His many followers supported him in a manner befitting the nobility. Upon Frank's death, he was succeeded by his daughter Eve, who eventually spent all the money that the Frankists had given her, leading to her arrest for bankruptcy. She died in 1816. The sect deteriorated rapidly, and descendants of those members who were baptized merged with the Roman Catholic population.

Frank, Karl Hermann (b. Jan. 24, 1898, Karlsbad, Bohemia, Austria-Hungary [now Karlovy Vary, Czech.]—d. May 22, 1946, Prague, Czech.), German Nazi of the Sudetenland, the leader of Bohemia and Moravia who ordered the destruction of the Czech village of Lidice.

Frank was educated at the University of Prague and was a bookseller before he turned to politics. A Sudeten "irredentist," he agitated for the return to Germany of the German-speaking provinces of Czechoslovakia and joined the Sudeten German Party when it was first organized. Rising to the party directorate, he represented the Sudeten Germans in the Czechoslovak parliament (1935–38). After Adolf Hitler annexed the Sudetenland following the Munich agreement of 1938, the party was absorbed by the Nazis, and the following year Frank was named state secretary to the Reich protector for Bohemia and Moravia and concurrently held the rank of minister. After Reinhardt Heydrich, then Reich protector, was assassinated by Czechoslovak patriots in 1942, Frank ordered the execution of the male population of the villages of Lidice and Lezaky in retribution.

He surrendered to the U.S. Army near Pilsen on May 9, 1945. Convicted by a People's Court in Prague for the Lidice massacre as well as for other war crimes, he was hanged in the Pankrac Prison courtyard.

Frank, Leonhard (b. Sept. 4, 1882, Würzburg, Ger.—d. Aug. 18, 1961, Munich, W.Ger.), German Expressionist novelist and playwright who used sensationalism and a compact and austere prose to dramatize a favourite theme—the destruction of the individual spirit by bourgeois society.

After studying painting in Munich in 1904 and working as a commercial artist, Frank turned to literature. In 1914 his open opposition to World War I forced him to flee to Switzerland. The same year he published his first book, *Die Räuberbande* (1914; *The Robber Band*). The story of rebellious young boys who seek to create the ideal society but end up as "good citizens," it embodies the main theme of his writings—the humorous exposure and realistic portrayal of the narrowness of the middle classes. While in Switzerland he also published *Die Ursache* (1915; *The Cause of the Crime*), an attack on repressive educational systems, and *Der Mensch ist gut* (1917; "Man is Good"), a revolutionary denunciation of war.

Frank returned to Germany in 1918. His belief in the necessity of the overthrow of capitalism and the establishment of socialism was expressed in his novel *Der Burger* (1924; *A Middle-Class Man*) and in *Das ochsenfurter Männerquartett* (1927; *The Singers*). During the same period he wrote his masterpiece, *Karl und Anna* (1926; *Carl and Anna*), a realistic, if sentimental, account of a soldier who seduces his comrade's wife.

In 1933 Frank's books were banned and burned by the Nazis, and he emigrated again to Switzerland. From there he went to Paris, where in 1940 he was confined in an internment camp. After several escapes and reinternments, he fled to the United States. He returned to Germany in 1950 and two years later published his last important work, the thinly disguised autobiographical novel *Links, wo das Herz ist* (1952; *Heart on the Left*).

Frank, Robert (b. Nov. 9, 1924, Zürich, Switz.), one of the most influential photographers of the mid-20th century, noted for ironic renderings of American life.

Frank became a professional industrial photographer at the age of 22 and in the 1940s became a successful fashion photographer for *Harper's Bazaar* magazine in Paris. He felt, however, that the scope of the work was too limited. He abandoned fashion photography about 1948 and went to the United States and then to Peru to explore the expressive possibilities of the 35-mm camera.

After photographing in Europe in 1950 and 1953, Frank returned to the United States. There in 1955 and 1956 he made a series of photographs ultimately published as *The Americans* (1959), a photographic book with a text by the American novelist Jack Kerouac. Photographs such as "Chicago, 1956"

"Chicago, 1956," by Robert Frank
Robert Frank, from *The Americans*

in *The Americans* reveal Frank's mature style, which is characterized by bold composition and ironic, sometimes bitter, social commentary. Their publication established Frank as a major creative photographer.

After 1959 he turned primarily to cinematography. His first motion picture, *Pull My Daisy* (1959), was based on a play by Kerouac and featured the poets Allen Ginsberg, Gregory Corso, and Peter Orlovsky, as well as the painter Larry Rivers. *Pull My Daisy* was a critical success, but Frank's later films were not so well received.

Frankel, Zacharias (b. Sept. 30, 1801, Prague, Czech.—d. Feb. 13, 1875, Breslau, Ger. [now Wrocław, Pol.]), rabbi and theologian, a founder of what became Conservative Judaism.

After graduation from the University of Budapest in 1831, Frankel served as rabbi in several German communities, becoming chief rabbi of Dresden in 1836. During this period he developed a theology that he called positive-historical Judaism. It differed from Orthodoxy in its acceptance of scientific and historical research and in its willingness to make some liturgical changes. It differed from Reform Judaism in that it sought to maintain traditional customs and adhere to the national aspects of Judaism.

In 1854 he was chosen president of the newly organized Jewish theological seminary at Breslau, which became and remained one of the most important modern European institutions for the training of rabbis until the Nazi period. Through the faculty and students of Breslau seminary, Frankel's viewpoint became highly influential in central Europe. In the 20th century it took root in the United States, where, under the name of Conservative Judaism, it

attained its greatest growth. Frankel's first major work, *Die Eidesleistung der Juden* (1840; "Oath-Taking by Jews"), attacked discrimination against Jews who testified in courts in Saxony. It effectively helped disprove the notion that Jews were untrustworthy in swearing oaths. Frankel also published *Vorstudien zur Septuaginta* (1841; "Preliminary Studies in the Septuagint"), in which he, the only major 19th-century Jewish scholar who wrote on the Septuagint (the first Greek version of the Old Testament), sought to show the necessary connection between Talmudic and Septuagintic exegesis. It is considered a classic work. Two works in Hebrew, *Darke ha-Mishnah* (1859; "Introduction to the Mishna") and *Mebo ha-Yerushalmi* (1870; "Introduction to the Palestinian Talmud"), were major contributions to Jewish religious thought.

Franken (German duchy): *see* Franconia.

Frankenstein, in full FRANKENSTEIN; OR, THE MODERN PROMETHEUS (1818), a novel by Mary Wollstonecraft Shelley in which she invented what was to become the best-known monster in motion pictures. A combination

Boris Karloff as the monster in the motion picture *Frankenstein,* 1931

© Universal City Studios, Inc.; photograph, Brown Brothers

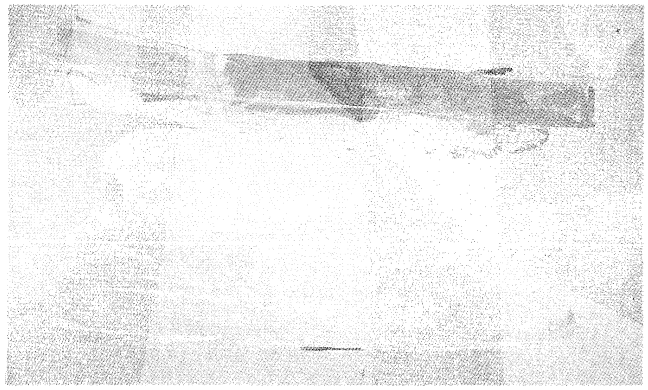
of Gothic romance and science fiction, the book tells the story of Victor Frankenstein, a Swiss student of occult sciences who creates an artificial man from pieces of corpses, brings his creature to life, and eventually loses his life because of the creature. The name Frankenstein has become popularly attached to the monster itself who, though it initially seeks affection, ultimately turns out to be an impulsively violent creature.

The first Frankenstein film was produced by Thomas Edison in 1910. Two German films, *The Golem* (1914) and *Homunculus* (1916), dealt with a similar theme derived from Jewish folklore. The Hollywood film *Frankenstein* (1931), with Boris Karloff as the monster, was based as much on *The Golem* as on Shelley's novel. This film was a great success and was followed by dozens of variations on the Frankenstein story in films such as *Bride of Frankenstein* (1935) and *Frankenstein Conquers the World* (1969), a Japanese-made version. The character of the monster has also been used as a vehicle for easy humour—as in *Abbott and Costello Meet Frankenstein* (1948) and Mel Brooks's *Young Frankenstein* (1974).

Frankenthal, city, Rhineland-Palatinate *Land* (state), southwestern Germany. It lies just northwest of Mannheim. First mentioned as Franconodal, a fishing settlement, in 772, it was the site of a powerful Augustinian monastery from 1119 until it passed to the Palatinate in 1562 and was settled by Dutch Protestant refugees. It was chartered in 1577. Although it suffered heavily in the Thirty Years' War and was devastated in 1689, it recovered to become famous for the porcelain manufactured there from 1755 to 1794. Severely damaged in World War II, Frankenthal has been rebuilt. Notable landmarks are the ruins of the 12th-century abbey church and two town gates dating from 1772. The city's economy now relies largely on chemicals and metalworking. Pop. (1989 est.) 45,408.

Frankenthaler, Helen (b. Dec. 12, 1928, New York City), American Abstract Expressionist painter whose brilliantly coloured canvases have been much admired for their lyric and emotional qualities.

Her father, Alfred Frankenthaler, was a New York Supreme Court justice. She studied under the Mexican painter Rufino Tamayo in high school; at the Dalton School, New York City; and under the Cubist painter Paul Feeley at Bennington College, Bennington, Vt. After graduation in 1949, she returned to New York City, where she was impressed by the works of Arshile Gorky and Jackson Pollock. Frankenthaler joined the group of young artists that became known as the second generation of Abstract Expressionists. Her first one-woman show was held in New York City in 1951. In one of her major early works, the seminal "Mountains and Sea" (1952), she created diaphanous colour by means of thinned-down oils that she allowed to soak into the raw (unprimed) canvas. This technique, known as the stain technique, was in strong contrast to the use of impasto that characterized most Abstract Expressionist painting, and it seriously influenced the colour-field painters Morris Louis and Kenneth Noland. In the early 1960s Frankenthaler began to use acrylics, and the areas of raw canvas began



"Ocean Desert," acrylic on canvas by Helen Frankenthaler, 1975; in the Museum of Fine Arts, Boston

By courtesy of the Museum of Fine Arts, Boston; gift of Mildred and Herbert Lee

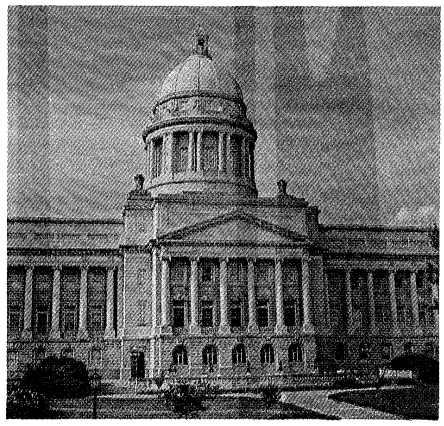
to assume much greater spatial significance. Her later exhibitions included lithographs and works on paper. Although not abstractions of nature, many of her paintings, such as "Ocean Desert" (1975), embody a strong feeling of landscape.

From 1958 to 1971 she was married to the American painter Robert Motherwell.

Frankenthurn, Paul, Freiherr Gautsch von: *see* Gautsch von Frankenthurn, Paul, Freiherr.

Frankenwald: *see* Franconian Forest.

Frankfort, the capital (since 1792) of Kentucky, U.S., and seat of Franklin County. It was founded in 1786 on the Kentucky River by General James Wilkinson. Frankfort is a corruption of Frank's Ford, after Stephen Frank, a frontiersman killed (1780) in an Indian skirmish at a local fording place on the



State Capitol, Frankfort, Ky.

Art Resource—EB Inc.

river. Twice during Frankfort's early history the capitol was burned, and at both times the larger cities of Louisville, 50 miles (80 km) west, and Lexington, 26 miles (42 km) southeast, attempted to usurp the seat of state government; Frankfort was retained, however, because of its central location. During the American Civil War it was occupied briefly (1862) by Confederate general Braxton Bragg. The city was flooded in 1937 and suffered widespread damage.

Frankfort is a trading centre for the Bluegrass region, producing tobacco, corn (maize), and Thoroughbred horses. Its manufactures include bourbon whiskey, candy, furniture, electronic parts, machinery, and textiles. Kentucky State University (1886) was originally founded for blacks. The State Capitol (1910) is crowned by a lantern dome 212 feet (65 m) high. Historic buildings include the Old Capitol (1827–30) now housing the Kentucky Historical Society, Liberty Hall (*c.* 1796), and the Orlando Brown House (1835). The graves of pioneer Daniel Boone and his wife Rebecca are in the Frankfort Cemetery. Inc. city, 1839. Pop. (1986 est.) 26,838.

Frankfort, Henri (b. Feb. 24, 1897, Amsterdam—d. July 16, 1954, London), American archaeologist who completed a well-documented reconstruction of ancient Mesopotamian culture, established the relation between Egypt and Mesopotamia, and discovered much new information on both civilizations.

Frankfort's university studies in history, hieroglyphics, and archaeology were complemented by excavations in Egypt (1922) and travel through the Balkans and the Middle East (1922, 1924–25). From this period he produced *Studies in Early Pottery of the Near*

Frankfort, 1934

By courtesy of the Oriental Institute, the University of Chicago

East, 2 vol. (1924–27). After directing excavations in Egypt at Abydos, Tell el-Amarna, and Armant (1925–29), he led the expedition of the Oriental Institute (University of Chicago) to Iraq (1929–37) and published *Cylinder Seals: A Documentary Essay on the Art and Religion of the Ancient Near East* (1939).

As professor at the University of Chicago and head of the Warburg Institute of the University of London (1938–54), he brought his far-reaching humanistic interests to bear on comparative studies of Egypt and Mesopotamia. He approached archaeological materials with keen regard for anthropological, aesthetic, and philosophical problems as well as rare understanding of religious phenomena. Other works include *Kingship and the Gods: A Study of Ancient Near Eastern Religion as the Integration of Society and Nature* (1948), *Ancient Egyptian Religion: An Interpretation* (1948), and *The Art and Architecture of the Ancient Orient* (1954).

Frankfurt, in full FRANKFURT AN DER ODER, until 1990 a *Bezirk* (district) of eastern East Germany, created in 1952 from the eastern part of the former Brandenburg *Land* (state). The district had an area of 2,774 square miles (7,185 square km). Bordered on the east by the Oder River, it was drained by the Spree and west-bank tributaries of the Oder and was served by the Oder-Spree and Oder-Havel canals. The *Bezirk* comprised sandy or morainic plateaus deeply cut by narrow valleys and troughlike depressions (*Urstromtäler*). Agriculture and forestry utilize a large proportion of the land surface, and market gardening is important in the west around Berlin. Industry in the district suffered heavy damage in World War II but expanded extensively in the postwar years, particularly with the construction of an oil refinery at Schwedt and a huge iron and steel complex at Eisenhüttenstadt. The principal towns besides Frankfurt an der Oder (the capital) were Fürstenwalde, Eisenhüttenstadt, and Schwedt. Pop. (1989 est.) 713,764.

Frankfurt am Main, English FRANKFORT ON THE MAIN, largest city of Hesse *Land* (state), Germany, on the canalized Main River about 19 miles (30 km) above its confluence with the Rhine at Mainz.

There is evidence of Celtic and Germanic settlements in the city dating from the 1st century BC, as well as Roman remains from the 1st and 2nd centuries AD. The name Frankfurt ("Ford [Passage, Crossing] of the Franks") probably arose about AD 500, when the Franks drove the Alemanni south, but the first written mention of Franconofurt stems from Charlemagne's biographer, Einhard, in the late 8th century. The Pfalz (imperial castle) was the residence of the East Frankish Carolingians in the 9th century, and the first imperial election in Frankfurt took place in 856.

It was a free imperial city from 1372 until 1806. Frankfurt then became the seat of government for the prince primate of the Confederation of the Rhine and, in 1810, capital of the Grand Duchy of Frankfurt created by Napoleon. From 1815, when Napoleon fell, it was again a free city and, from 1816 to 1866, the seat of the German Bundestag (Federal Diet) and the capital of Germany. After the war of 1866, Frankfurt was annexed to Prussia, ending its free-city status. The old city was mostly destroyed in World War II, and after 1945 many modern structures were built. Historical landmarks include the Eschenheimer Tor (1426–28), a 155-foot (47-metre) tower; the red sandstone cathedral, dedicated to St. Bartholomew in 1239; and the Römer, the city's ancient town hall.

International trade fairs have been held in Frankfurt since 1240, and the city is now a leading commercial and financial centre. There is an important stock exchange (1585), and Frankfurt was the site from which the Rothschild family started its international banking empire. The book and automobile fairs are popular events, but there are many other fairs throughout the year. Manufactures include machinery, chemical and pharmaceutical products, printing materials, leather goods, and foodstuffs. The city is an important inland shipping port and the hub of railway and road traffic. The Rhein–Main airport nearby is one of the busiest in Europe.

Among the city's attractions are the Städel Art Institute, the Senckenberg museum of natural history, the Liebighaus museum of sculpture, the restored home of the poet Goethe, and the Goethe museum and library. Johann Wolfgang Goethe University (1914) is one of the largest in Germany. Pop. (1989 est.) 625,258.

Frankfurt am Main City Zoological Garden, German ZOOLOGISCHER GARTEN DER STADT FRANKFURT AM MAIN, byname FRANKFURT ZOO, municipal zoological garden in Frankfurt am Main, Ger. It was founded in 1858 by the Frankfurt Zoological Society. Because the original site of the zoo was not large enough to allow for the expansion of the collection, in 1874 the zoo was relocated to its present 34.5-acre (14-hectare) site. The city of Frankfurt took over financial support of the zoo during World War I. Much of the grounds and collection were destroyed in 1944 during Allied bombing raids. The zoo was reopened the following year, and the rebuilding task continued through the 1950s under the direction of the noted zoologist Bernhard Grzimek.

Today, more than 4,750 specimens representing in excess of 600 species are exhibited at the Frankfurt Zoo. The zoo's Exotarium contains an aquarium, a reptile hall, and an insect house. The zoo was among the first in Europe to successfully breed the okapi, black rhinoceros, and bongo antelope. It was also the site of the only known twin birth of lowland gorillas in captivity. The zoo maintains the studbook for this particular species.

Frankfurt an der Oder, city, Brandenburg *Land* (state), eastern Germany, on the west bank of the Oder River opposite the Polish town of Słubice, which before 1945 was the Frankfurt suburb of Dammvorstadt. An early medieval settlement of Franconian colonists and traders, Frankfurt was chartered in 1253 and joined the Hanseatic League in 1368. In 1379 it received the right to free navigation on the Oder, and, later, its fairs became important. A university, founded there in 1506, was transferred to Cottbus from 1516 to 1539; dissolved during the Thirty Years' War and later reestablished by Frederick William of Brandenburg, the Great Elector, it was finally removed to Wrocław (German: Breslau) in 1811.

Frankfurt was besieged by Soviet forces and seriously damaged in World War II but was afterward reconstructed. Notable landmarks include the 15th-century Church of St. Mary (Marienkirche), the town hall (remodeled 1607–09), the Church of St. Nicholas (Nikolaikirche), the old university buildings, and the Kleisthaus, which is now a memorial to the poet Heinrich von Kleist and which contains a large library.

Frankfurt is a busy road and rail transit point for trade with eastern Europe, and it has an inland harbour on the Oder about 6 miles north of its junction with the Oder-Spree Canal. Machinery, furniture, foodstuffs, shoes, and textiles are manufactured. Pop. (1989 est.) 87,863.

Frankfurt National Assembly, formally GERMAN NATIONAL ASSEMBLY, German FRANKFURTER NATIONALVERSAMMLUNG, or DEUTSCHE NATIONALVERSAMMLUNG (May 1848–June 1849), German national parliament that tried and failed to create a united German state during the liberal Revolutions of 1848.

A preliminary parliament (*Vorparlament*) met in Frankfurt am Main in March 1848 at the instigation of liberal leaders from all the German states (including Austria), and it established a committee of 50 to prepare for the election of a national assembly (*Nationalversammlung*). The elections were duly held, though the electoral laws and methods varied considerably from state to state, and on May 18 the National Assembly met in the Church of St. Paul (Paulskirche) in Frankfurt. The success of the moderate liberals in the elections to the diets of the individual states and to the Frankfurt Assembly, together with the defeat of a radical rising in southwestern Germany in April, led liberals all over Germany to hope that a constitution for a united Germany might emerge without difficulty.

The Frankfurt National Assembly devoted a great deal of its time to the discussion of general principles and of the basic human rights that it was necessary to guarantee in the new united Germany. But it also had to decide on immediate practical problems, such as the nature of the executive power and Germany's territorial extent. As a temporary answer to the first problem the Archduke John, an uncle of the Austrian emperor Ferdinand and the most liberal-minded member of the Habsburg family, was appointed regent on June 29, and a government was formed under Charles, prince of Leiningen, the half brother of Queen Victoria. Yet it soon became clear that the executive appointed by the Frankfurt Assembly had no power except such as was granted to it by the individual states. The Frankfurt Assembly attempted to take over the conduct of a war with Denmark concerning the duchies of Schleswig and Holstein; but Prussia, ignoring the assembly, abruptly concluded the war in August. This decision became a source of such dissatisfaction at Frankfurt that Leiningen was forced to resign on Sept. 5, 1848. He was succeeded by Anton von Schmerling, a moderate liberal from Austria, who held office until December, when he was in turn succeeded by Heinrich von Gagern.

Meanwhile, Prussia's Frederick William IV had lost all patience with the liberals and turned increasingly toward ultraconservative advisers; and, in Austria, the emperor Ferdinand had abdicated in favour of his nephew Francis Joseph, who likewise relied on conservative ministers. The reestablishment of conservative governments in the two great states of Germany was inevitably reflected in the discussions of the Frankfurt Assembly about the nature of the sovereign power in Germany and its territorial extent. By the end of 1848 the assembly had completed its discussions about the basic rights to be included in the constitution, and in January 1849 the proposed constitution was circulated to the individual states for their comments without any decision having been taken about the person or nature of the central executive. The second

reading was concluded and the constitution adopted on March 27. The final decision was that the executive power should be in the hands of a hereditary emperor, although to obtain this the radicals had to be soothed with the promise of universal suffrage. The next stage was to elect an emperor.

Meanwhile, the territorial extent of the new Germany had been partially decided by the proclamation of a new Austrian constitution on March 4. By this, the Austrian Empire was treated as a single whole, and it was made clear that either the whole empire or none of it would have to enter the new Germany. This was a blow to all those south German and Austrian liberals who had hoped for a "great German" (*grossdeutsch*) settlement that would include at least the German provinces of Austria; and it meant that the initiative passed to those who believed in a "little German" (*kleindeutsch*) settlement under Prussian leadership. Accordingly, when the election of an emperor took place in the National Assembly on March 28, 290 votes were cast for Frederick William against 248 abstentions. On April 3 the king received a deputation headed by Eduard Simson, the president of the assembly, which came to offer him the crown. The offer was refused. Frederick William was too deeply conservative to receive a German imperial crown from any hands except those of the other German princes. Prussia also rejected the proposed constitution.

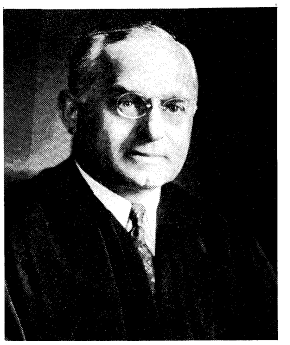
Without the support of either Prussia or Austria, the Frankfurt Assembly could not now survive. By May, Gagern's ministry had broken up, and the majority of the deputies were ordered home by the governments of their respective states. The rump that remained was forced to move to Stuttgart and was finally dispersed on June 18 by Württemberg troops and police. The Frankfurt Assembly and the revolutions that had inspired it were over.

frankfurter, also called WIENER, or (in the United States) HOT DOG, highly seasoned sausage, traditionally of mixed pork and beef. Frankfurters are named for the city of their origin in Germany, where they were sold and eaten at beer gardens.

Frankfurters were introduced in the United States in about 1900 and quickly came to be considered an archetypal American food. The first so-called hot-dog stand, selling the sausages as a sandwich on what was to become the standard long hot-dog bun, was opened at Coney Island, New York, in 1916. The hot dog remained popular in the United States throughout the 20th century, being especially associated with barbecues, picnics, and athletic events.

Frankfurters are sold ready-cooked and lightly smoked, either loose, vacuum-packed, or canned, to be heated by grilling, steaming, or gentle, brief boiling (frying makes them tough). The German and Austrian frankfurter also is known as a *würstchen,* or "little sausage," and many varieties of these sausages exist. In Germany and Austria, frankfurters are eaten warm with sauerkraut and cold, if lightly smoked, with potato salad. Nutritionally, the typical American frankfurter is about 55 percent water, 28–30 percent fat, and 12–15 percent protein. In addition, most commercially marketed frankfurters contain nitrates or nitrites of sodium or potassium, which prevent the growth of the botulism-causing bacterium, *Clostridium botulinum,* and preserve the meat's characteristic reddish colour, which would otherwise be lost in processing. These additives became controversial in the late 1970s, when nitrites were shown to react with secondary amines, in foods and in the systems of test animals, to produce potentially carcinogenic nitrosamines.

Frankfurter, Felix (b. Nov. 15, 1882, Vienna—d. Feb. 22, 1965, Washington, D.C.), associate justice of the United States Supreme Court (1939–62), a noted scholar and teacher of law, who was in his time the high court's leading exponent of the doctrine of judicial



Frankfurter

By courtesy of the Library of Congress, Washington, D.C.

self-restraint. He held that judges should adhere closely to precedent, disregarding their own opinions, and decide only "whether legislators could in reason have enacted such a law."

A U.S. resident from the age of 12, Frankfurter was educated at the City College of New York and at the Harvard Law School, where he later taught (1914–39). He served as assistant to Henry L. Stimson when Stimson was U.S. attorney for the Southern District of New York (1906–09) and secretary of war under President William Howard Taft (1911–13). Frankfurter's influence on President Franklin D. Roosevelt was largely responsible for Stimson's return (1940) as head of the War Department during World War II. He was legal adviser to President Woodrow Wilson at the Paris Peace Conference (1919). During the immediate postwar period he was one of the most active U.S. Zionists, and he helped to found the American Civil Liberties Union (1920). He delivered blistering attacks on the conviction of Nicola Sacco and Bartolomeo Vanzetti—in which he was encouraged by U.S. Supreme Court Justice Louis Brandeis under a secret arrangement that was not revealed until 1982, when their correspondence was published. Brandeis, from his appointment in 1916 until 1939, when Frankfurter himself joined the court, corresponded frequently with Frankfurter, sending him a yearly stipend for legislative research and for such politico-social actions as the defense of Sacco and Vanzetti.

When Franklin D. Roosevelt became president (1933), Frankfurter, who had advised him during his term as governor of New York, advised him on New Deal legislation and other matters. He was appointed by Roosevelt to the Supreme Court on Jan. 5, 1939. Concerned more with the integrity of government than with the victims of legal injustice, Frankfurter evinced toward federal and state legislative action a hands-off attitude similar to that of his friend Justice Oliver Wendell Holmes. His insistence on freedom of expression was partly offset by his disinclination to uphold the civil liberties of political radicals, especially members of the U.S. Communist Party during the "witch hunt" of the 1950s. In *Sweezy* v. *New Hampshire* (1957), however, he upheld a claim of academic freedom by a socialist college professor subjected to a state investigation.

Frankfurter's belief that decent government depends in part on procedural safeguards for criminal suspects occasionally conflicted with his policy that the Supreme Court should defer to other branches of the federal government and to the states. In the criminal case of *Wolf* v. *Colorado* (1949), for example, he spoke for the court in condemning illegal seizure of evidence by state officials, but he ruled that the "due process of law" clause of the 14th Amendment (1868) to the U.S. Constitution did not require a state court to exclude evidence unlawfully obtained. (The Supreme Court repudiated this theory in 1961.) In his last major opinion, a 64-page dissent in *Baker* v. *Carr* (1962; the first of a series of legislative reapportionment cases in the 1960s), he unsuccessfully asserted that inequitable representation in legislatures is a "political controversy" not subject to the federal judicial power.

Frankfurter retired in 1962. In July 1963 President John F. Kennedy awarded him the Medal of Freedom. Among his books are *The Business of the Supreme Court* (1927; with James Landis); *Mr. Justice Holmes and the Supreme Court* (1938); *The Case of Sacco and Vanzetti* (2nd ed., 1954); and *Felix Frankfurter Reminisces* (1960).

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Frankfurter Allgemeine Zeitung (German: "Frankfurt General Newspaper"), abbreviation FAZ, daily newspaper published in Frankfurt am Main, one of the most prestigious and influential in Germany.

FAZ was created after World War II by a group of journalists who had worked on the highly respected *Frankfurter Zeitung* before the war. The earlier paper was suppressed by Adolf Hitler in 1943, and under the Allied occupation forces another paper, the *Allgemeine Zeitung,* was started. When control of the press was turned over to the new West German government in 1949, *Frankfurter Allgemeine Zeitung* began publication, pledging truth, objectivity, and fair treatment of opposing viewpoints.

FAZ was the first West German daily of truly national scope, and it quickly won a reputation for responsible reporting. Its sober makeup and sparing use of illustrations give it a serious appearance consonant with its approach to world and national news.

The staff considers the paper's editorial policy to be centrist, but it is widely accounted conservative because of its championship of private enterprise. More than 10 percent of its readers are in other countries of Europe and abroad.

frankincense, also called OLIBANUM, aromatic gum resin containing volatile oil valued in ancient times in worship and as a medicine and still an important incense resin. Frankincense is obtained from trees of the genus *Boswellia,* family Burseraceae, particularly varieties *B. frereana, B. bhaw-dajiana,* and *B. carteri* found in Somalia and in the Hadhramaut region in the southern Arabian Peninsula. Incisions are made in the trunks of the trees, and the frankincense exudes as a milklike juice that hardens on exposure to air.

Frankincense was used by the ancient Egyptians in their religious rites. It constituted part of the Jewish incense of the sanctuary and is frequently mentioned in the Pentateuch. Pliny the Elder described the characteristics of good-quality frankincense and mentioned it as an antidote to hemlock poisoning. Avicenna recommended it for a wide range of bodily ailments. In China and elsewhere in the East, it was used as both an internal and an external remedy, but, according to modern Western medical theory, it has no special value. Frankincense is used in incense and fumigants and as a fixative in perfumes.

The hardened gum resin, gum thus, from

which spirits of turpentine is produced, is sometimes called common, or American, frankincense.

Frankland, Sir Edward (b. Jan. 18, 1825, Churchtown, Lancashire, Eng.—d. Aug. 9, 1899, Golaa, Nor.), English chemist who was one of the first investigators in the field of structural chemistry.

Frankland
BBC Hulton Picture Library

While apprenticed to a druggist, Frankland learned to perform chemical experiments. Subsequent studies took him to laboratories at the University of Marburg, where he took his Ph.D. (1849). He became the first professor of chemistry at Owens College, Manchester (1851), and succeeded Michael Faraday as professor of chemistry at the Royal Institution of Great Britain, London (1863). In 1865 he began 20 years of service at the Royal School of Mines.

Research beginning about 1850 led him to the idea that an atom of an element can combine only with a certain limited number of atoms of other elements. He thus established a theory of valency (1852), which became the basis of modern structural chemistry.

Appointed a member of the second royal commission on the pollution of rivers (1868), he brought to light an enormous amount of information on the contamination of rivers and on water purification. In 1868 he cooperated with Joseph Norman Lockyer in the studies that led Lockyer to recognize the existence of helium in the Sun's atmosphere. Frankland was knighted in 1897.

Franklin, unofficial state (1785–90) of the United States of America, comprising the eastern portion of what is now Tennessee and extending to "unclaimed" lands to the west.

The short-lived state was established mainly as a result of North Carolina's cession of its western lands to the United States. Settlers in the isolated mountain wilderness, deserted and largely ignored, formed an association that would make and administer laws. They also required an active militia because they were open to Indian attack. When North Carolina acted to rid itself of the unwanted burden of protecting these remote settlements, the settlers elected delegates who met to discuss the establishment of a new state. Patterning their state constitution on that of North Carolina, the Franklanders (as they called themselves) elected officers who would act under the leadership of John Sevier. Personal rivalries and other factors led to the dissolution of the Franklin union, and, when the federal government in 1790 brought into being the Southwest Territory, it effectively reorganized the area, and the Franklin administration ended.

Franklin, city, seat of Venango county, northwest Pennsylvania, U.S., at the junction of French Creek and the Allegheny River, 70 miles (113 km) north of Pittsburgh. The site was early occupied by the Indian village of Venango and after 1750 by forts of the French (Fort-Machault), the British (Fort Venango), and the Americans (Fort Franklin). The U.S. fort, erected in 1787, was named for Benjamin Franklin; a town, laid out in 1795, developed around it. Franklin was the site of Pennsylvania's third oil gusher when in 1860 James Evans, a blacksmith, dug a well for water and found oil instead. Within two years Franklin, with nearby Oil City, emerged as the hub of an oil region producing more than 2,000,000 barrels annually. The boom lasted until about 1900, when the oil-production centre shifted to the American Southwest. Among those attracted by the boom was the magnate John D. Rockefeller; John Wilkes Booth, the assassin of Abraham Lincoln, was the owner of one of the early Franklin wells, and his memorabilia is displayed in the Venango County Museum.

The petroleum industry continues to dominate the city's economy. Manufactures include metals and metal products, oil-well and railroad equipment, and pumps. Inc. borough, 1823; city, 1868. Pop. (1984 est.) 8,094.

Franklin, city, seat of Williamson county, central Tennessee, U.S., on the Harpeth River, 20 miles (32 km) south-southwest of Nashville. Settled in 1799 and named for Benjamin Franklin, it is known for the bloody American Civil War battle fought there on Nov. 30, 1864. Confederate forces under General John B. Hood made a frontal attack on a Union army entrenched by the river under General John Schofield. The Union troops sustained 2,500 casualties and retreated across the river to Nashville, but not before inflicting heavy losses on the Confederates—more than 6,000 dead, including six generals (Adams, Carter, Cleburne, Gist, Granbury, and Strahl). The battle marked the failure of Hood's Tennessee campaign and the disintegration of his army a few weeks later at Nashville. Carter House (1830), which served as the Union command post, commemorates the battle and displays Civil War relics. The Confederate Cemetery remains a grim reminder of the carnage.

The town has survived as a centre for diversified farming (corn [maize], tobacco, wheat, and cheese) with hardwood-timber and phosphate-mining interests. Pop. (1986 est.) 18,-701.

Franklin, Aretha, byname QUEEN OF SOUL (b. March 25, 1942, Memphis, Tenn., U.S.), American gospel and blues singer-composer who was one of the first performers in "soul music" to achieve widespread popularity with white audiences.

Franklin's family moved to Detroit when she was two years old. Her father was a well-known revivalist preacher, and his church attracted many famous black singers. The Franklin home was host to such luminaries as Mahalia Jackson, James Cleveland, B.B. King, and Dinah Washington.

At the age of 12 she made her first recording, and, after graduating from high school, she decided to become a professional singer. At first she performed only on the gospel and "chitlin" circuits, as the type of music she sang, a combination of gospel, jazz, and blues, had usually been presented to white audiences only in a more diluted form by white singers. In 1967 Franklin became a major singer in the popular-music field with the release of several songs that became hits—"I Never Loved a Man," "Baby, I Love You," and "Respect," the last of which became something of an anthem for the civil-rights movement. For a number of years she was a major force in popular music, winning several Grammy awards and appearing frequently on television.

Franklin, Benjamin, pseudonym RICHARD SAUNDERS (b. Jan. 17 [Jan. 6, Old Style], 1706, Boston—d. April 17, 1790, Philadelphia), American printer and publisher, author, inventor and scientist, and diplomat, who is probably best remembered for his role in separating the American colonies from Great Britain and in helping to frame both the Declaration of Independence and the U.S. Constitution. By the time he began his diplomatic career, Franklin had invented the Franklin stove, bifocal spectacles, and the lightning rod. He had made a small fortune from his various business ventures and contributed to science with his experiments in electricity.

A brief account of the life and works of Benjamin Franklin follows. For a full biography, *see* MACROPAEDIA: Franklin.

The 10th son of 17 children of a soap and candlemaker, Franklin ended his formal education at the age of 10. At 12 he was apprenticed to his brother, a printer, and he worked at that trade first in Philadelphia and later in London. In about 1729 he became the printer of paper currency for the colony of Pennsylvania and some of the other colonies. At that time he began publication of the *Pennsylvania Gazette,* a colonial newspaper, and *Poor Richard's,* a series of almanacs in which he printed numerous proverbs praising prudence, industry, and honesty. Franklin promoted the establishment of such public services as a fire department, a lending library, and an academy that grew to be the University of Pennsylvania. In 1748 he gave up the management of his publications to devote himself to science, but in 1753 he served as deputy postmaster general in charge of the mails in all the northern colonies.

Franklin spent the years from 1757 to 1762 in London representing the colony of Pennsylvania in a dispute over the lands held by the Penn family. In 1764 he was sent back to London, and in March 1775, aware that there might be war between the colonies and Great Britain, he left England. Back in Philadelphia he served as a delegate to the Second Continental Congress, in which he helped draft the Declaration of Independence. In 1776 Franklin went to France to seek military and financial aid for the colonies. There he became a hero to the French people, the personification of the unsophisticated nobility of the New World. At the close of the Revolutionary War, Franklin was one of the diplomats chosen to negotiate peace with Great Britain, and, although his proposal for a one-chamber national legislature was rejected, he was instrumental in achieving the adoption of the U.S. Constitution.

Franklin, Sir John (b. April 16, 1786, Spilsby, Lincolnshire, Eng.—d. June 11, 1847, near King William Island, British Arctic Islands [now Northwest Territories, Can.]), English rear admiral and explorer whose ill-fated expedition (1845) is credited with having proved the existence of the Northwest Passage, a Canadian Arctic waterway connecting the Atlantic and Pacific oceans.

Franklin entered the Royal Navy at the age of 14, accompanied Matthew Flinders on his exploratory voyage to Australia (1801–03), and served in the battles of Trafalgar (1805) and New Orleans (1814). He commanded the *Trent* on Captain David Buchan's Arctic expedition of 1818, which sought to reach the North Pole.

From 1819 to 1822 Franklin conducted an overland expedition from the western shore of Hudson Bay to the Arctic Ocean, and he surveyed part of the coast to the east of the Coppermine River in northwestern Canada. After his return to England he published *Narrative of a Journey to the Shores of the Polar Sea, in the Years 1819, 20, 21 and 22* (1823).

On a second overland expedition to the same region (1825–27), Franklin led a party that explored the North American coast westward from the mouth of the Mackenzie River, in northwestern Canada, to Point Beechey, now in Alaska. A second party followed the coast eastward from the Mackenzie to the Coppermine. These efforts, which added new knowledge of about 1,200 miles (1,932 km) of the northwest rim of the North American coast-

line, were described in *Narrative of a Second Expedition to the Shores of the Polar Sea, in the Years 1825, 1826, and 1827* (1828). Knighted in 1829, Franklin served as governor of Van Diemen's Land, now Tasmania, from 1836 to 1843.

Franklin's search for the Northwest Passage began on May 18 or 19, 1845, when he sailed

Sir John Franklin, engraving by G.R. Lewis, 1824

By courtesy of the trustees of the British Museum; photograph, J.R. Freeman & Co. Ltd.

from England with two ships, the *Erebus* and the *Terror,* carrying 138 officers and men. The vessels were last sighted by a Scottish whaler north of Baffin Island at the entrance to Lancaster Sound on July 25 or 26. In 1847, when no word had been received, search parties were sent out. For twelve years, various expeditions searched for the explorers, but their fate was not known until 1859. In that year, a final search and rescue mission, sent in 1857 by Franklin's second wife, Lady Jane Franklin, and headed by Captain Francis Leopold McClintock, reached King William Island, south and west of Lancaster Sound. Found there were skeletons of the vessels' crews and a written account of the expedition through April 25, 1848.

Having ascended the Wellington Channel, in the Queen Elizabeth Islands, to 77° N, the *Erebus* and the *Terror* wintered at Beechey Island (1845–46). Returning southward along the western side of Cornwallis Island, they passed through Peel Sound and Franklin Strait. In September 1846 they became trapped in the ice in Victoria Strait, off King William Island (about midway between the Atlantic and Pacific oceans). By June 1847, Franklin and 24 others had perished there. The ships, crushed by ice, were deserted on April 22, 1848, and the survivors tried to head south across the North American mainland to the Back River. An old Eskimo woman told McClintock of how the starving men fell down and died as they walked. Franklin himself never proved the existence of the Northwest Passage, but a small party from his expedition reached Simpson Strait, which connected with the western coastal waters previously visited by Franklin.

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Franklin, Rosalind (Elsie) (b. July 25, 1920, London—d. April 16, 1958, London), British scientist who contributed to the discovery of the molecular structure of deoxyribonucleic acid (DNA), a constituent of chromosomes that serves to encode genetic information.

Franklin studied physical chemistry at Newnham College, Cambridge, graduating in 1941. She then joined the British Coal Utilisation Research Association, where she contributed to studies that explained the absorption properties of coals. From 1947 to 1950 she worked with Jacques Mêring at the Laboratoire Centrale des Services Chimiques de l'État in Paris, studying X-ray diffraction technology. That work led to her research on the structural changes caused by the formation of graphite in heated carbons—work that proved valuable for the coking industry and for atomic technology.

In 1951 Franklin joined the Biophysical Laboratory at King's College, London. There she applied X-ray diffraction methods to the study of DNA. She is credited with discoveries that established the density of DNA, its helical conformation, and other significant aspects.

From 1953 to 1958 Franklin worked in the Crystallography Laboratory at Birkbeck College, London. While there she completed her work on coals and on DNA and began a project on the molecular structure of the tobacco mosaic virus. She collaborated on studies showing that the ribonucleic acid (RNA) in that virus was embedded in its protein rather than in its central cavity and that this RNA was a single-strand helix, rather than the double helix found in the DNA of bacterial viruses and higher organisms.

Franklin published about 40 technical papers.

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Franklin-Bouillon Agreement: *see* Ankara, Treaty of.

Franklin Institute, in Philadelphia, Pa., one of the foremost American science and technology centres. Founded in 1824, the institute embraces the Bartol Research Foundation, the Franklin Research Center, the Franklin Institute Research Laboratory, Inc., the Franklin Institute Science Museum and Planetarium, and the Benjamin Franklin National Memorial.

The institute hosted the first International Electrical Exhibition in the United States (1884). It also offered the first public demonstration of transcontinental telephony (1916). Named after Benjamin Franklin, the institute moved into its present building in the early 1930s. The same structure houses the Benjamin Franklin Memorial, opened in 1938; it displays a 21-foot (6-metre) marble pedestal and statue of Franklin. It has a vast technical library on science and technology.

Franklin stove, type of wood-burning stove invented by Benjamin Franklin (*c.* 1740); it was used to warm frontier dwellings, farmhouses, and urban homes for more than 200 years (*see* stove).

franklinia, also called FRANKLIN TREE (*Franklinia,* or *Gordonia, alatamaha*), small tree of the tea family (Theaceae), native to the southeastern United States. It was first identified in 1765 by the botanist John Bartram along the Altamaha River near Fort Barrington, Georgia, and named in honour of Benjamin Franklin. The tree or small shrub is now known only in cultivation, no longer being found in the wild. It grows up to 9 m (30 feet) in height, has large leaves, and produces large, nearly stalkless, cupped white flowers from midsummer to frost. All the franklinias now in existence were propagated from the seeds and plant collected by Bartram.

The franklinia is sometimes known as mountainbay (*Gordonia alatamaha*) because of its similarities to loblolly-bay (*G. lasianthus*).

frankpledge, system in medieval England under which all but the greatest men and their households were bound together by mutual responsibility to keep the peace. Frankpledge can be traced back to the laws of King Canute II the Great of Denmark and England (d. 1035), who declared that every man, serf or free, must be part of a hundred, a local unit of government, that could put up a surety in money for his good behaviour. By the 13th century, however, it was the unfree and landless men who were so bound. While a freeholder's land was sufficient pledge, the unfree had to be in frankpledge, generally an association of 12, or in tithing, an association of 10 householders. Frankpledge existed more commonly in the area under the Danelaw, from Essex to Yorkshire, whereas tithing was found in the south and southwest of England. In the area north of Yorkshire, the system does not appear to have been imposed.

Franks, Sir Augustus Wollaston (b. March 20, 1826, Geneva—d. May 21, 1897, London), the first keeper (curator) of British and medieval antiquities and ethnography at the British Museum (1866–96), who greatly enriched its collections through careful acquisition and the donation of his own vast and valuable collections.

Franks's early life was spent on the European continent, mainly in Rome and Geneva. Educated at the University of Cambridge (B.A., 1849; M.A., 1852), he worked first for the Royal Archaeological Institute. Assistant in the antiquities department of the British Museum (1851–66), he became the foremost authority on British medieval antiquities and an expert on post-Roman art, pottery, glass, and the material culture of early man. He also sought to make the collection of Japanese and Chinese porcelain as comprehensive as possible. His friendliness won the good will and benefactions of many collectors, including banker-ethnologist Henry Christy, whose large collection entered the museum in 1883. Franks did much to classify and arrange the museum collections and published many catalogs, guides, and papers. He was knighted in 1894.

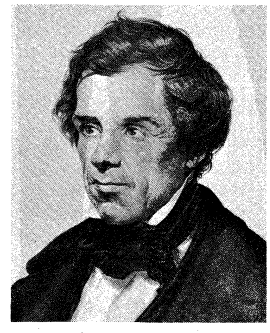
Franks Casket: *see* Wayland the Smith.

Franschetti-Klein syndrome (congenital disorder): *see* mandibulofacial dysostosis.

Franscini, Stefano (b. Oct. 23, 1796, Bodio, Switz.—d. July 19, 1857, Bern), Swiss statesman and reformer whose maxim "Democracy is not so much respect for the vote of the majority as for the thought of the minority" expresses his faith in education and in the importance of public opinion.

Franscini was born of a peasant family and in 1819 went to the seminary at Milan. At the age of 23 he became a teacher, but in 1829 he returned to the Ticino, where he fought to set up a liberal regime (1830). He was secretary to the new government until 1848, when he became a member of the government of Switzerland, serving until his death.

In the Ticino he did much for state education: as a member of the confederation he supported the establishment of a federal polytechnic and was the first to compile statistics in Switzerland. He educated himself on the works of Montaigne, Adam Smith, Jeremy Bentham, and Melchiorre Gioia and was a liberal and humanitarian. He was the first to develop in the people of the Ticino a sense of



Franscini, mezzotint after a lithograph by Vincenzo Vela

By courtesy of the Bibliotheque Nationale Suisse, Bern

duty and a realization of the need to collaborate with the other Swiss cantons.

In *La svizzera italiana* (1837), *Statistica della svizzera* (1827), *Annali del Canton Ticino* (published 1953), and numerous minor works, he showed himself to be a lucid and honest writer on political and social problems, often disappointed in the people whom he was trying to educate to a sense of impartial justice, but steadfast in his own love for his country.

Františkovy Lázně, German FRANZENBAD, spa town, Západočeský *kraj* (region), Czechoslovakia, on a flat plateau, near the German border. Since medieval times, it has been known for its springs, which are rich in carbon dioxide and Glauber's salt (a sulfate of sodium) and some of which are radioactive. In the 16th century, the alchemist Paracelsus attempted to analyze the waters, and barrels of water from the best-known spring, Frantisek Spring, were sold in nearby Cheb; but not until the end of the 18th century did Františkovy Lázně become established as a spa. Named in 1793 for Francis II, the last Holy Roman emperor, it became a town in 1865. It owes much of its reputation to a rich sulfurous-ferric mud (cut from the moor at nearby Soos) that is used for mud baths and mud packs in the treatment of gynecological disorders. Prior to 1939, its inhabitants were almost entirely German, but the resettled population is mainly Czech. Pop. (1970) 4,777.

Franz (German personal name): *see under* Francis, except as below.

Franz, Robert (b. June 28, 1815, Halle, Saxony [Germany]—d. Oct 24, 1892, Halle), German musician who is considered to have been one of the foremost composers of songs in the tradition of Franz Schubert and Robert Schumann.

Franz studied organ at Dessau (1835–37). Later he returned to Halle, where he became a friend of Wilhelm Osterwald, many of whose poems he set to music. About the time he published his first songs (1843) he began to become deaf; nonetheless, he became organist at the Ulrichskirche, then conductor of the city's Singakademie, and, finally, musical director at Halle University, where he was made a doctor of music in 1861. Increasing deafness and nervous disorders caused him to retire in 1868, and he was supported for the rest of his life by a singer, Arnold von Pilsach. Franz Liszt, Joseph Joachim, and other prominent musicians arranged concerts for his benefit in 1872. In his later years Franz arranged works by Johann Sebastian Bach, George Frideric Handel, Wolfgang Amadeus Mozart, and Schubert.

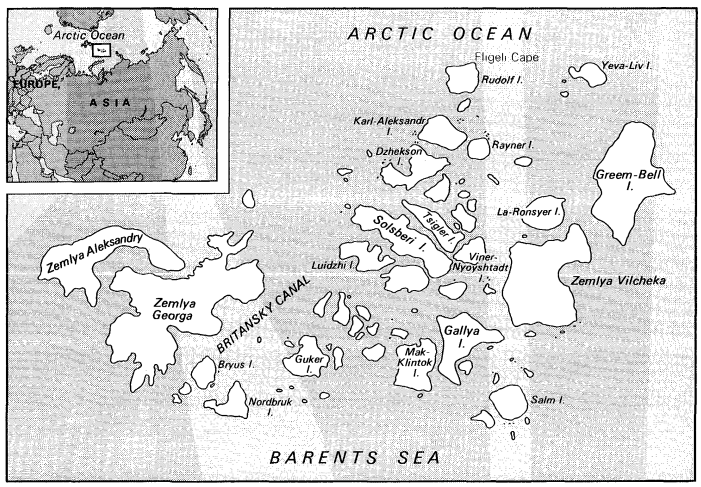
His songs, of which there are about 350, are remarkable for their sensitive musical prosody. About a quarter are to texts by Heinrich Heine. Most of his songs are strophic, with the music repeated after each verse, and were written for a mezzo-soprano of limited range. Among them are "Lullaby," "Stormy Night," and "Dedication." He also wrote a few choral and religious works.

Robert Franz
By courtesy of the Royal College of Music, London

Franz Ferdinand: *see* Francis Ferdinand, archduke of Austria-Este.

Franz Josef Land, Russian ZEMLYA FRANTSA-IOSIFA, archipelago of 191 islands in the northeastern Barents Sea, the northernmost territory of the Soviet Union. It falls administratively into Arkhangelsk *oblast* (province) of the Russian Soviet Federated Socialist Republic. The islands, with a land area of 6,229 square miles (16,134 square km), consist of three groups. The easternmost includes Rudolf Island, whose Fligeli Cape is the northernmost point in the Soviet Union, and the large islands of Zemlya Vilcheka and Greem-Bell (Graham Bell). This group is separated from the central group, which contains most of the islands, by the Avstriysky (Austrian) Strait. The western group, divided from the rest of the archipelago by the Britansky (British) canal, contains two large islands, Zemlya Georga (the largest, with an area of about 1,120 square miles [2,900 square km]) and Zemlya Aleksandry.

Franz Josef Land is mainly low-lying; the highest point, on Viner-Nyoyshtadt Island, reaches 2,034 feet (620 m). It comprises a series of lowland plateaus, 85 percent of whose surface is covered by ice. Geologically the islands are formed from marine deposits from the Early and Middle Jurassic epochs (208 to 163 million years ago); these deposits are covered by thick basaltic crusts. Elsewhere there are Late Cretaceous deposits (97.5 to 66.4 million years ago) with occasional lignite (brown coal) also overlain by basalt. During the Early Jurassic, Franz Josef Land was a single landmass; it was dislocated during the Quaternary period (1.6 million years ago to the present) by severe faulting. As a result, the straits between the islands are often extremely deep, up to 1,650 feet (500 m) deeper than the surrounding Barents Sea.



Franz Josef Land

The climate of the archipelago is severe, the average winter temperature being −8° F (−22° C), the average summer temperature 35° F, though summer temperatures of up to 54° F have been recorded. Vegetation consists primarily of lichens, mosses, and about three dozen species of Arctic flowering plants. Fauna include polar bears and the Arctic fox, with numerous bird species, of which perhaps 15 nest in the islands. Marine fauna include the walrus, seal, and bearded seal.

Franz Josef Land was discovered by an Austro-Hungarian expedition under Julius von Payer and Karl Weyprecht in 1873; it was named after the Austrian emperor. The Soviet Union annexed the islands in 1926 and maintains permanent weather stations there.

Franz Joseph (Austrian emperor): *see* Francis Joseph.

Franzén, Frans Mikael (b. Feb. 9, 1772, Uleåborg, Swedish Finland [now Oulu, Fin.]—d. Aug. 14, 1847, Härnösand, Swed.), Finnish-Swedish poet, a forerunner of the Romantic movement in Sweden.

Franzén, oil painting by J.G. Sandberg, 1828; in Gripsholm Castle, Sweden
By courtesy of the Svenska Portrattarkivet, Stockholm

Franzén studied at Åbo, Fin., where, in 1798, he became professor of philosophy. After the annexation of Finland by Russia, Franzén went to Sweden (1811). In 1831 he was appointed bishop of Härnösand, where he lived until his death.

Franzén was a master of a new poetic style in Swedish literature. William Shakespeare, John Milton, and Thomas Gray made a deep impression on him. His work consists chiefly of simple, idyllic lyrics, and his best poems embody the imaginative spirit of the Romantic era.

Frascati, town and episcopal see, Roma *provincia,* Lazio (Latium) *regione,* central Italy, on the northern slopes of the Alban Hills (Colli Albani), 16 miles (21 km) southeast of Rome.

The town of Frascati seems to have arisen on the site of a large villa in the 9th century and expanded after the destruction in 1191 of the ancient city of Tusculum (*q.v.*), 1.5 miles (2.4 km) northeast, whose inhabitants sought refuge there. A medieval papal possession, it has been a favourite summer residence of the Roman nobility since the Renaissance; notable villas include the Falconieri, Torlonia, Lancellotti, Aldobrandini, and Mondragone. The cathedral contains a memorial to Charles Edward the Young Pretender (the last serious Stuart claimant to the British throne), whose body rested there for a time; his brother Henry Stuart, cardinal duke of York, was bishop

of Frascati and left a library, the Biblioteca Eboracense. During World War II the town was the German army headquarters of Field Marshal Albert Kesselring and suffered severe damage from Allied bombings. Restorations of the churches and villas have been carried out wherever possible. Linked with Rome by railway and bus service, Frascati is residential in character and is mainly concerned with tourism and wine production. Pop. (1981 prelim.) mun., 18,998.

Frasch, Herman (b. Dec. 25, 1851, Gaildorf, Württemberg—d. May 1, 1914, Paris), U.S. chemist who devised the sulfur mining process named in his honour. The Frasch process, patented in 1891, was first used successfully in Louisiana and in east Texas. It made possible the exploitation of extensive sulfur deposits otherwise obtainable only at prohibitive expense.

Emigrating to the U.S. in 1868, Frasch worked as a chemist in Philadelphia and Cleveland, and in 1885 he organized the Empire Oil Company, Petrolia, Ont. For this firm he devised a method (also called the Frasch process) of removing sulfur from crude oil. He also patented processes for manufacturing white lead, sodium carbonate, and carbon for the filaments in electric light bulbs. The Union Sulphur Company, of which he was president, became the world's leading sulfur-mining firm.

Frasch process, method of mining deep-lying sulfur invented by the German-born U.S. chemist Herman Frasch; it consists of forcing superheated water, above the temperature at which sulfur melts (about 116° C, or 241° F) into the deposit. The liquid sulfur, which is more than 99 percent pure, is pumped to the surface. The liquid mixture of sulfur and water brought up is discharged into bins, where the sulfur is allowed to solidify.

Frasch first successfully mined sulfur by this process at Sulfur Mine, Louisiana, in 1894. In 1895 the Union Sulphur Company was organized with his help to produce Frasch-process sulfur. Other companies soon began production from deposits located near the Gulf of Mexico in Texas and Louisiana.

Fraser (of North Cape), Bruce Austin Fraser, 1st Baron (b. Feb. 5, 1888, Acton, near London—d. Feb. 12, 1981, London), British admiral in World War II and chief of the naval staff (1948–51).

Fraser entered the Royal Navy in 1902 and served as a gunnery officer in World War I. He continued his interest in gunnery after the war and in 1933 became director of naval ordnance. At the start of World War II he was controller of the navy and was in large part responsible for directing its expansion during the 1939–41 period. Fraser then became commander in chief of the Home Fleet and was chiefly concerned with the protection of convoys to the U.S.S.R. On Dec. 26, 1943, aboard his flagship "Duke of York," he fought and sank the German battleship "Scharnhorst" off Norway's North Cape in an engagement conducted largely at night with the aid of radar. As admiral in 1944 he was appointed commander in chief of the British Pacific fleet and on Sept. 2, 1945, signed the Japanese surrender papers for Great Britain in Tokyo Bay.

Fraser was made a peer in 1946 and admiral of the fleet in 1948, and from 1948 to 1951 he was first sea lord of the Admiralty.

Fraser, Dawn (b. Sept. 4, 1937, Balmain, near Sydney), Australian swimmer, the first woman swimmer to win gold medals in three consecutive Olympics Games (1956, 1960, 1964). From 1956 to 1964 she broke the women's world record for the 100-metre freestyle race nine successive times. Her mark of 58.9 seconds, established on Feb. 29, 1964, at North Sydney, was unbroken until Jan. 8, 1972, when Shane Gould, a fellow Australian, achieved 58.5 at Sydney.

In the 1956 Olympic Games in Melbourne, Fraser captured gold medals in the 100-metre freestyle event and in the 400-metre freestyle relay race. She repeated her triumph in the 100-metre freestyle in the 1960 and 1964 Games, in Rome and Tokyo respectively, and added silver medals in the 400-metre freestyle (1956), the 400-metre freestyle relay (1960, 1964), and in the 400-metre medley relay (1960). Her performances in the 1964 Olympics were especially noteworthy because she had been injured seriously in an automobile accident in March of that year.

In 1957 Fraser won the United States women's freestyle championship at 110 yards (nearly equivalent to 100 metres). In addition to her unusually long-lived world record for 100 metres, she set world standards (all broken by the early 1970s) in freestyle swimming at five other distances up to 220 yards. Her autobiography, *Below the Surface* (Australian title *Gold Medal Girl*), written with Harry Gordon, was published in 1965.

Fraser, (John) Malcolm (b. May 21, 1930, Nareen, Vic., Australia), Australian politician and leader of the Liberal Party, who served as prime minister of Australia from 1975 to 1983.

Fraser attended Magdalen College, Oxford, and was elected a Liberal member of Parliament in 1955. He held cabinet posts in the coalition government of the Liberal and National Country (since 1982 National) parties as minister for the army (1966–68), as minister for education and science (1968–69, 1971–72), and as minister for defense (1969–71).

In March 1975 Fraser won the leadership of the Liberal Party, and in November he was named prime minister after the Labor government—which had been in power since 1972—had been dismissed; his appointment received electoral approval in December, when the Liberal and National Country parties won by large majorities, and he set up another coalition government. As prime minister Fraser attempted to curb inflation by such orthodox measures as trimming government spending and discouraging union demands for large wage increases. He was also a firm supporter of Australia's defense commitments within the ANZUS Pact alliance. Fraser's government was again successful in elections held in 1977 and 1980, but it was defeated by the Labor Party in an election held in March 1983. Fraser immediately resigned as party leader and shortly thereafter resigned his seat in Parliament.

Fraser, Peter (b. Aug. 28, 1884, Fearn, Ross, Scot.—d. Dec. 12, 1950, Wellington, N.Z.), statesman, labour leader, and prime minister (1940–49) whose leadership during World War II increased New Zealand's international stature.

While working in London in 1908, Fraser joined the Independent Labour Party, but unemployment led him to emigrate to New Zealand in 1910, where he worked on the wharves in several ports and was active in union organizing in Auckland and in the harshly repressed Waihi and Wellington strikes of 1912–13. He helped organize the Social Democratic Party in 1913 and its successor, the Labour Party, in 1916. He was imprisoned for sedition (1916–17) when he opposed conscription for World War I.

Peter Fraser

By courtesy of the High Commissioner for New Zealand

In 1918 he entered Parliament, and soon became secretary of the Labour Party. When Labour came into power in 1935, he became minister of education, health, marine, and police. He was responsible for legislation that revised the educational system, especially at the secondary level, and for the Social Security Act (1938), which created a national health service and improved pensions.

Fraser succeeded Michael Joseph Savage as prime minister in 1940 and led the country's mobilization for war. He won a voice for New Zealand in Allied military strategy in the Pacific and presided over a successful wartime price stabilization program organized by his minister of finance, Walter Nash. As one of the architects of the United Nations (1945) and a contributor to the UN Charter, Fraser was a spokesman for the rights of small nations, arguing unsuccessfully both against veto power for the great powers and for guaranteed aid to nations facing aggression.

Union unrest and discontent with economic controls and with Fraser's legislation for peacetime conscription led to Labour's defeat in 1949 after 15 years in office. Fraser then led the opposition in Parliament until his death the following year.

Fraser, Simon: *see* Lovat, Simon Fraser, 11th Lord.

Fraser, Simon (b. 1776, Bennington, N.Y.—d. April 19, 1862, St. Andrews, Canada West), Canadian fur trader and explorer who discovered the Fraser River in British Columbia.

Fraser, whose Loyalist father had died in a war prison in Albany, N.Y., moved with his family to Canada in 1784. He was apprenticed as a clerk to the North West Company in 1792 and was made a partner of the fur company in 1801. In 1805 he was put in charge of operations of the partnership west of the Rockies and set out to cross them in search of better trading routes, especially an outlet to the Pacific. He built a post at Trout Lake (Fort McLeod) west of the mountains and in 1806 embarked upon a second journey, to explore the Columbia River. After building a post at Fraser Lake, he continued down the Fraser River (mistakenly assuming it to be the Columbia); he reached its mouth in 1808 and found the treacherous, turbulent river entirely unsuitable for trade. He also realized that its latitude was far north of the Columbia.

In 1810 Fraser assumed charge of the Athabasca department. At this time, the North West Company was meeting competition from the Hudson's Bay Company, whose new head, Lord Selkirk, was introducing settlers into the Red River Valley in the North West Company's trading territory. Fraser, who took charge of the Red River department in 1811, was arrested by Selkirk in 1817 for alleged participation in a June 1816 attack against settlers, known as the Seven Oaks massacre. He and four others were sent to Montreal for trial, but all were acquitted. In 1818 he retired to a farm and mill in the township of Cornwall, in present Ontario.

Fraser Canyon, deep chasm cut by the Fraser River in British Columbia, Canada, between Lytton and Yale. The river there flows through wild, rugged, spectacular scenery, including mountains rising more than 3,000 ft (914 m). Hell's Gate is in this section of the river. As part of a transportation improvement program since 1955, the Alexandra North Arch

was constructed in Fraser Canyon. North of Hope, the canyon has seven highway tunnels, up to 2,000 ft long, cut through solid rock.

Fraser Island, also called GREAT SANDY ISLAND, island off the southeastern coast of Queensland, Australia, separated from the mainland and the port of Maryborough by Hervey Bay and Great Sandy Strait. About 75 mi (120 km) long, it has an area of 625 sq mi (1,620 sq km). Sand hills rise to nearly 800 ft (250 m), and there are numerous freshwater lakes stocked with fish. The southwestern part of the island is a tourist resort. Part of Fraser Island has been a forest reserve since 1908, about one-fourth of the island was declared a national park in 1971, and in 1976 Great Sandy National Park was named and extended so that it now occupies one-third of the island. It yields kauri and hoop pine, blackbutt, and satinay timber (similar to California redwood). Sand mining was carried out on the island until 1977, when the Commonwealth government banned exports of the mineral sands. The island was sighted in 1770 by Capt. James Cook, who believed it to be a promontory; the first landing was made by Matthew Flinders in 1802. It was named for Capt. James Fraser, who, with several of his party, was killed there by Aborigines in 1836.

Fraser River, major river of western North America, draining a huge, scenic region of some 92,000 sq mi (238,000 sq km) in central British Columbia. About 70 percent of the region drained is over 3,000 ft (900 m) high, and human exploitation of this rather isolated area has been relatively recent and often dramatic, involving pioneer explorers and the lure of elusive gold deposits. The natural beauties of the river course (particularly its spectacular canyon section) and the surrounding countryside have nevertheless remained relatively unspoiled. The river was named for Simon Fraser, who first descended it to the sea in 1808. The Cariboo gold rush, which began in 1858, took place in the Fraser River Basin.

From its source in Yellowhead Lake on the British Columbia–Alberta border, the Fraser flows 850 mi (1,368 km) to its mouth on the Strait of Georgia. From its mountain source, the river's course is initially northwestward, descending by gentle gradients along the Rocky Mountain trench. Near latitude 54° N the river makes a great bend southward to traverse the Interior Plateau and then the Coast Mountains. Entrenchment and gradients increase progressively downstream, and through the Coast Mountains the raging waters traverse a canyon about 5,000 ft deep. Below this canyon the Fraser turns westward to flow placidly across an alluvial plain to its debouchment near Vancouver, B.C. The Thompson River, which enters the Fraser about 145 mi from its mouth, is the most important of numerous tributaries, many of which rise in extensive mountain lakes. Navigation is important only in the tidal estuary where New Westminster serves deep-sea ships.

The economy of the Fraser River Basin is based mainly on forestry. Coniferous forests cover most of the Interior Plateau, except in the dry, southern valleys, which are covered with narrow strips of grassland on the lower slopes. Prior to 1940 small sawmills cut a little lumber along the three railway lines that crossed the basin. After 1950, however, the northward extension of the Pacific Great Eastern Railway (subsequently called the British Columbia Railway) and the improvement of highway facilities increased the accessibility of the forests; and the merging of smaller companies, together with the introduction of pulp mills, consuming chips and small trees, heightened the utilization of forest resources. Forest products are either transported to Vancouver for overseas markets or are taken eastward by rail to central Canada and the midwestern United States. The turbulent Fraser River itself is not actually used in the forestry industry, even for the transport of logs to the sawmills.

Agriculture has not developed greatly within the river basin, except for cattle ranching on the grasslands and upper level parklands in the Chilcotin Plateau, west of the Fraser River, and the Nicola Valley, south of the Thompson River. Ranching was established in the 1860s to supply the gold mining camps and then, after gold mining declined, to supply meat to the growing city of Vancouver.

The Fraser River is the major producer of salmon in British Columbia, and its tributaries and headwater lakes are the spawning grounds of several species of salmon. These salmon ascend the river in late summer to spawn and then go downstream the following year to spend the next two or three years in the ocean. Because of these migratory habits, salmon fishing takes place mainly off the Fraser River mouth, and only Indians have fishing rights in the river basin itself. Hydroelectric exploitation of the system may eventually threaten salmon migration.

Frasers Hill (West Malaysia): *see* Bukit Fraser.

Frasnian Stage, standard, worldwide division of Devonian marine rocks and time, the lower of the two generally recognized stages of the Upper Devonian (the Devonian Period began about 395,000,000 years ago and lasted about 50,000,000 years). The Frasnian was named for exposures studied in the region of Frasnes, Belg., and is characterized by rocks that include the fossil ammonoid genus *Manticoceras.* In the type area of Frasnes, the Frasnian consists of shales and limestones interbedded with marls. The strata are rich in fossils: the brachiopod genera *Spirifer, Athyris, Atrypa, Rhynchonella,* and *Orthis* are common in the limestones, whereas ammonoids abound in the shales. The Frasnian is represented in Great Britain, where the Saltern Cove Beds are noted for their rich fossil faunas (goniatite cephalopoda). Important Frasnian sections occur in Germany; the Soviet Union, where coralline limestones, marls, and sandstones with a rich and diverse fauna predominate; Australia, where volcanic rocks are also present; and North America, where the stage is well developed in the northeastern states.

Fratellini FAMILY, European circus family best known for the Fratellini Brothers, a clown trio—Paul, François, and Albert (respectively, b. 1877—d. 1940; b. 1879—d. 1951; b. 1886—d. 1961)—whose wit, charm, and superb acting techniques were widely admired and brought about a resurgence of interest in the circus in post-World War I Paris.

Their father, Gustavo Fratellini (1842–1905), a Florentine follower of Giuseppi Garibaldi, was a circus trapeze artist and acrobat, and their elder brother, Louis (1867–1909), worked as a clown with Paul. François and Albert also began their careers as a pair. When Louis died in 1909 he left a family without support and Paul without a partner. To solve both problems the remaining brothers formed a unique triple act: François retained his traditional role as the elegant, pompous, white-faced clown; Albert, the hapless, ragged *Auguste,* designed grotesque new makeup with high black brows, an exaggerated mouth, and a bulbous red nose (a makeup style that influenced countless subsequent clowns); and Paul joined the act in a new role, the *notary,* with little makeup and a comic style midway between his brothers'.

The Fratellinis toured Europe and Russia before joining the Cirque Medrano in Paris during World War I. By 1923 they were the toast of Paris, admired by the general public and by such intellectuals as the playwrights Raymond Radiguet and Jean Cocteau, both of whom created characters based on the Fratellinis.

Many of the Fratellini Brothers' children also became circus performers, notably Paul's son Victor (1901–79) and Victor's daughter Annie (1932–), who continued the family tradition as successful clowns in France. Albert's memoirs, *Nous, les Fratellini,* appeared in 1955.

fraternity and sorority, in the United States, social, professional, or honorary societies, for males and females, respectively. Most such organizations draw their membership primarily from college or university students. With few exceptions, fraternities and sororities use combinations of letters of the Greek alphabet as names.

The basic function of the social fraternity is to serve as a collegiate "home" and dormitory for its members, but the emphasis varies from school to school. At some universities Greek-letter societies are the nucleus of campus political and social life, while at others fraternities and sororities are barely tolerated or barred altogether. During the student unrest of the late 1960s, criticism of such societies was especially widespread, and many were forced to close for lack of pledges. More recently, however, with the rising cost of university education, fraternities and sororities have returned to favour because they are able through communal living to keep the cost of room and board at a minimum.

The membership of professional fraternities is limited to students and faculty members engaged in a particular field of specialization. Membership qualifications are broader than for the social groups and emphasize activities designed to develop professional competency rather than social life. The first professional fraternity was Kappa Lambda (1819, for medical students).

Perhaps the leading honorary society today is Phi Beta Kappa, which began as a social fraternity at William and Mary College, Williamsburg, Va., in 1776. Membership is now based on general scholarship and is open to both men and women. The oldest social fraternity still in existence as such is Kappa Alpha, begun in 1825 at Union College, Schenectady, N.Y.

Fratres Arvales (Roman brotherhood): *see* Arval Brothers.

Fratres Militiae Christi: *see* Brothers of the Sword, Order of the.

fraud, in law, the deliberate misrepresentation of fact for the purpose of depriving someone of a valuable possession. Although fraud is sometimes a crime in itself, more often it is an element of crimes such as obtaining money by false pretense or by impersonation.

European legal codes and their derivatives often broadly define fraud broadly to include not only intentional misrepresentations of fact, clearly designed to trick another into parting with valuable property, but also misunderstandings arising out of normal business transactions. Thus, any omission or concealment that is injurious to another or that allows a person to take unconscionable advantage of another may constitute criminal fraud. In Anglo-American legal systems, this latter type of fraud may be treated as deceit, subject to action in civil rather than criminal law.

A common type of criminal fraud is the obtaining of property by giving a check for which there are insufficient funds in the signer's account. Another is the so-called confidence game (*q.v.*), which involves not only a misrepresentation of fact but also the betrayal of confidence induced by the offender in the victim. The fraud of impersonation is the false representation by one person that he is another or that he occupies the position of another. *See also* embezzlement; theft.

Frauenfeld, capital (since 1803) of Thurgau canton, northern Switzerland, on the Murg River, close to its junction with the Thur River, northeast of Zürich. First mentioned in 1246, it was founded by the count of Kyburg and the abbot of Reichenau on land belonging to the abbot. Frauenfeld (Field of Our Lady) passed to the Habsburgs in 1264 and was seized by the Swiss Confederates (Eidgenossen) in 1460, later becoming the seat of the federal Diet from 1712 to 1798. Two great fires (1771 and 1788) destroyed the whole town except the 13th-century castle (now housing the cantonal museum), one house, and the Evangelical church, with 14th-century stained-glass windows. A road and rail junction, Frauenfeld produces textiles, metal products, and food preserves. The population is German speaking and about three-quarters Protestant. Pop. (1983 est.) 18,583.

Frauenlob, byname of HEINRICH VON MEISSEN (b. *c.* 1260, Meissen, Thuringia—d. Nov. 29, 1318, Mainz, Franconia), late Middle High German poet. He was the original representative of the school of middle-class poets who succeeded the knightly minnesingers, or love poets, adapting the minnesinger traditions to poems dealing with theological mysteries, scientific lore, and philosophy. His nickname, meaning "extoller of ladies," supposedly derives from his championship of the title *Vrowe* (lady) over *Wip* (woman) in a contest with a rival poet.

Well-educated and extremely precocious—a record exists of his participation in a poetic debate at 13—he became a wandering court minstrel, dwelt for some time in Prague, and settled in Mainz (*c.* 1312), where he founded the first meistersinger school. Though it is unlikely that this school had the rigid structure of the meistersinger *Singschulen* of the 15th century, the strained ingenuity and mannered conceits that characterize Frauenlob's verses make him the true model of the meistersingers. His best known poem, *Marienleich* ("Mary's Song"), is an impressive display of virtuosity in which the Virgin is praised in complex language that combines traditional religious imagery, double meanings, and esoteric philosophical allusions.

Fraunhofer, Joseph von (b. March 6, 1787, Straubing, Bavaria—d. June 7, 1826, Munich), German physicist who first studied the dark lines of the Sun's spectrum, now known as Fraunhofer lines. He also was the first to use extensively the diffraction grating, a device that dispenses light in much the same way a prism does. His work set the stage for the development of spectroscopy.

Fraunhofer, detail of an engraving
Historia-Photo

Fraunhofer worked as an optician at the Untzschneider Optical Institute at Benedictbeuern, near Munich, of which he became manager in 1818. While measuring the light-bending properties of various kinds of glass, he noticed dark lines in the light spectrum of a sodium flame and continued looking for such lines in the spectra of other elements. He plotted hundreds of spectral lines, and by measuring their wavelengths he found that the relative positions of the lines in the spectra of elements are constant, whether the spectra are produced by the direct rays of the Sun or by the reflected light of the Moon and planets, by a gas, or by a heated metal in the laboratory.

Fraunhofer lines, in astronomical spectroscopy, any of the dark (absorption) lines in the spectrum of the Sun or other star, caused by selective absorption of the Sun's or star's radiation at specific wavelengths by the various elements existing as gases in its atmosphere. The lines were first observed in 1802 by the English physicist William Hyde Wollaston but are named for the German physicist Joseph von Fraunhofer, who from about 1814 plotted more than 500 of them and designated the brightest by the letters *A* through *G*, a system of identification still in use. About 25,000 Fraunhofer lines are now known to exist in the solar spectrum, between the wavelengths of 2,950 and 10,000 angstroms. (One angstrom equals 10^{-8} centimetre.)

fravashi, in Zoroastrianism, the preexisting external higher soul or essence of a person (according to some sources, also of gods and angels). Associated with Ahura Mazdā, the supreme divinity, since the first creation, they participate in his nature of pure light and inexhaustible bounty. By free choice they descend into the world to suffer and combat the forces of evil, knowing their inevitable resurrection at the final glory. Each man's *fravashi,* distinct from his incarnate soul, subtly guides him in life toward the realization of his higher nature. The saved soul is united after death with its *fravashi.* Cosmically, the *fravashis* are divided into three groups—the living, the dead, and the yet unborn. They are the force upon which Ahura Mazdā depends to maintain the cosmos against the demon host. Protecting the empyrean (sacred fire), they keep darkness imprisoned in the world.

In the popular religion, the *fravashis* of the righteous dead and of ancestors are invoked for protection. In the Parsi festival Fravartigan, the last 10 days of each year, each family honours the *fravashis* of its dead with prayers, fire, and incense.

fraxinella: *see* gas plant.

Fray Bentos, capital, Río Negro department, western Uruguay. Founded in 1859, Fray Bentos became important when the first large-scale meat-packing plant in Uruguay was established there in 1861. The industry grew rapidly and, with the expansion of refrigeration and cold-storage facilities, Fray Bentos developed a significant share of the nation's meat-packing trade, exporting the produce of its stock-raising hinterland. The city has a television station. Its modern port is the deepest on the Uruguayan side of the Uruguay River. The Puerto Unzué bridge, built in 1969 by a United States firm, and an Argentine-Uruguayan company, has facilitated trade between Uruguay and Argentina. Fray Bentos has rail, road, and air connections with Montevideo. Pop. (1975 prelim.) 19,569.

Frazer, Sir James George (b. Jan. 1, 1854, Glasgow—d. May 7, 1941, Cambridge, Eng.), English anthropologist, folklorist, and classical scholar, best remembered as the author of *The Golden Bough.*

From an academy in Helensburgh, Dumbarton, Frazer went to Glasgow University (1869), entered Trinity College, Cambridge (1874), and became a fellow (1879). In 1907 he was appointed professor of social anthropology at Liverpool, but he returned to Cambridge after one session, remaining there for the rest of his life.

Frazer, 1933
T & R Annan & Sons, Ltd., Glasgow

His outstanding position among anthropologists was established by the publication in 1890 of *The Golden Bough; a Study in Magic and Religion* (reissued in 12 vol., 1907–15; abridged edition in 1 vol., 1922). The underlying theme of the work is Frazer's theory of a general development of modes of thought from the magical to the religious and, finally, to the scientific. His distinction between magic and religion (magic as an attempt to control events by technical acts based upon faulty reasoning, religion as an appeal for help to spiritual beings) has been basically assumed in much anthropological writing since his time. Although the evolutionary sequence of magical, religious, and scientific thought is no longer accepted and Frazer's broad general psychological theory has proved unsatisfactory, it enabled him to synthesize and compare a wider range of information about religious and magical practices than has been achieved by any other single anthropologist.

The Golden Bough directed attention to the combination of priestly with kingly office in the "divine kingships" widely reported from Africa and elsewhere. According to Frazer, the institution of divine kingship derived from the belief that the well-being of the social and natural orders depended upon the vitality of the king, who must therefore be slain when his powers begin to fail him and be replaced by a vigorous successor.

In making a vast range of primitive custom appear intelligible to European thinkers of his time, Frazer had a wide influence among men of letters; and, though he travelled little himself, he was in close contact with missionaries and administrators who provided information for him and valued his interpretation of it. His other works include *Totemism and Exogamy* (1910) and *Folk-Lore in the Old Testament* (1918). He was knighted in 1914.

Frazier, E(dward) Franklin (b. Sept. 24, 1894, Baltimore—d. May 17, 1962, Washington, D.C.), U.S. sociologist whose work on the black family, the black bourgeoisie, and the black position in the business community effectively defined the nature of black problems and offered innovative solutions.

Frazier took his B.A. from Howard University (1916) and his M.A. in sociology from Clark University (1920). His graduate studies on blacks brought him a fellowship to the New York School of Social Work (1920–21), which was followed by an American-Scandanavian Foundation grant which took him to Denmark to study folk high schools and the Cooperative Movement (1921–22). As an instructor in sociology at Morehouse College (1922–24), Atlanta, he organized the Atlanta University School of Social Work (for blacks), later becoming its director, but he had to leave Atlanta after publishing "The Pathology of Race Prejudice" in *Forum* (1927).

He received a fellowship from the University of Chicago (1927), where he took his Ph.D (1931). Publication of his thesis, *The Negro Family in Chicago* (1932), sustained the university's interest in his work on the black

E. Franklin Frazier

Schomburg Center for Research in Black Culture, The New York Public Library, Astor, Lenox and Tilden Foundations

family. He taught at Fisk University (1929–34) and then at Howard University (from 1934). He served as director of the Division of Applied Social Sciences UNESCO (1951–53), where he worked on the Tension and Social Change Project, assessing the interactions between people of different races and cultures and the effect of these interactions on each community. His writings include *The Negro Family in the United States* (1939), among the first sociological works on blacks researched and written by a black. He also wrote *Negro Youth at the Crossways* (1940) and *Race and Culture Contacts in the Modern World* (1957), which dealt with African studies.

Frazier, Joe, byname of JOSEPH FRAZIER (b. Jan. 12, 1944, Beaufort, S.C., U.S.), American world heavyweight-boxing champion from Feb. 16, 1970, when he knocked out Jimmy Ellis in five rounds in New York City, until Jan. 22, 1973, when he was beaten by George Foreman at Kingston, Jam.

After winning the Olympic Games heavyweight championship in 1964 in Tokyo, Frazier, a resident of Philadelphia, began his professional career in August 1965. In 1967 Muhammad Ali lost universal recognition as champion because he had refused to submit to U.S. military conscription. On March 4, 1968, in a title bout sanctioned by the New York State Athletic Commission and similar bodies in other states, Frazier knocked out Buster Mathis in 11 rounds. The following month, Ellis won a championship tournament (in which Frazier declined to participate) approved by the World Boxing Association. Frazier successfully defended his New York title four times before defeating Ellis.

On March 8, 1971, Frazier scored a 15-round decision over former champion Ali. Including this triumph, Frazier had, until his defeat by Foreman, won all 27 of his professional bouts, 23 by knockout. He retired in 1976 but staged an unsuccessful comeback attempt in 1981. A chunky man (5 feet 11 inches, 205 pounds) with an aggressive style and a powerful left hook, he was likened to an earlier heavyweight champion, Rocky Marciano.

Fréchet, (René-)Maurice (b. Sept. 2, 1878, Maligny, Fr.—d. June 4, 1973, Paris), French mathematician known chiefly for his contribution to real analysis. He is credited with being the founder of the theory of abstract spaces, which generalized the traditional mathematical definition of space as a locus for the comparison of figures; in Fréchet's terms, space is defined as a set of points and the set of relations in which those points are involved.

Fréchet was professor of mechanics at the University of Poitiers (1910–19) before moving to the University of Strasbourg, where he was professor of higher calculus (1920–27). Joining the faculty of the University of Paris, he served as lecturer on the calculus of probabilities (1928–33), professor of general mathematics (1933–35), professor of differential and integral calculus (1935–40), and professor of the calculus of probabilities (1940–48).

In addition to his pioneering work on the theory of abstract spaces, Fréchet studied topology (the branch of mathematics dealing with the properties of a geometric figure that remain unchanged upon elastic deformation) and contributed notably to statistics and to differential and integral calculus.

His major works include *Les Espaces abstraits* (1928; "Abstract Spaces"); *Récherches théoriques modernes sur la théorie des probabilités* (1937–38; "Modern Theoretical Researches on the Theory of Probabilities"); *Les Probabilités associées à un système d'évenements compatibles et dependants* (1939–43; "The Probabilities Associated with a System of Compatible and Dependent Events"); *Pages choisies d'analyse générale* (1953; "Chosen Pages of General Analysis"); and *Les Mathématiques et le concret* (1955; "Mathematics and the Concrete").

Fréchette, Louis-Honoré (b. Nov. 16, 1839, Lévis, Que.—d. May 31, 1908, Montreal), preeminent French-Canadian poet of the 19th century, noted for his patriotic poems.

Fréchette studied law at Laval University, Quebec, and was admitted to the bar in 1864. Discharged as a journalist for liberal views, he went to Chicago (1866–71). There, he wrote *La Voix d'un exilé* (1866–68; "The Voice of an Exile"), a poem attacking the political and clerical dealings in Quebec in that period of Canadian confederation and voicing a patriotic idealization of the French republic. Returning to Lévis in 1871, Fréchette entered politics, representing that city in the federal House of Commons (1874–78) and from 1889 until his death acting as clerk of the provincial Legislative Council in Quebec City.

Fréchette made literary history when *Les Fleurs boréales* (1879; "The Northern Flowers") and *Les Oiseaux de neige* (1879; "The Snow Birds") were awarded the Prix Montyon in 1880, the first time the work of a Canadian had been honoured by the French Academy.

Fréchette

By courtesy of the Archives Nationales du Quebec

A controversial representative of liberal nationalism, Fréchette then wrote *La Légende d'un peuple* (1887; "The Story of a Race"), his famous cycle of poems that was an epic chronicle of Canadian history. Other works include *Poésies choisies* (1908; "Selected Poems"); the prose stories in *Originaux et détraqués* (1892; "Eccentrics and Lunatics") and *Le Noël au Canada* (1899; *Christmas in French Canada*); the dramas *Félix Poutré* (1871), *Papineau* (1880), and *Véronica* (1908); and the polemical *Lettres à Basile* (1872).

freckle, also called EPHELIS, plural EPHELIDES, a small, brownish, well-circumscribed, stain-like spot on the skin, occurring most frequently in red- or sandy-haired individuals. In genetically predisposed individuals who have been exposed to the ultraviolet radiation of sunlight, production of the pigment melanin increases in the pigment cells of the skin (melanocytes); the number of melanocytes does not increase. Freckles do not form on surfaces that have not been exposed to the sun. The freckles usually appear after the age of five and tend to fade somewhat in adults. Apart from avoiding sunlight, there is no known way of preventing them. They may, on occasion, be confused with pigmented nevi.

freckled duck (*Stictonetta naevosa*), rare Australian waterfowl, characterized by dark dots scattered over its metallic-gray plumage; in breeding season the drake's bill turns red. The freckled duck is a surface feeder. It lacks alarm calls, courtship display, and demonstrative pair bonds. It may constitute a separate tribe, Stictonettini, family Anatidae (*q.v.*; order Anseriformes). The duck has been classified as endangered by the Australian government, which has taken measures to protect it.

Fredegarius (fl. 7th century AD), the supposed author of a chronicle of Frankish history composed between 658 and 661. All the extant manuscripts of this chronicle are anonymous, and the attribution of it to "Fredegarius" dates from the edition of it by Claude Fauchet in 1579. The author set a fairly detailed history of his own times in the framework of a universal chronicle, drawing, for early Merovingian times, on information derived from the *Historia Francorum* of Gregory of Tours, which ends at the year 591, three years before Gregory's death. After 584 the so-called Fredegarius is an original source for events in the Frankish kingdoms until 642. Though written in barbarous Latin and excessively dull, it is of great importance because the author was writing of contemporary happenings and the chronicle is almost the sole literary source for this period. Differing hypotheses have been put forward concerning the nationality and career of the author; most students of the text consider him to be of Burgundian origin, but some suggest that he spent much of his life in Austrasia or at any rate that his sympathies were with the Austrasian mayors of the palace; others believe that he became an important official at the Neustrian court of Clotaire II.

Fredegund, French FRÉDÉGONDE (d. 597, Paris), queen consort of Chilperic I, the Merovingian Frankish king of Soissons.

Originally a servant, Fredegund became Chilperic's mistress after he had murdered his wife and queen, Galswintha (*c.* 568). Galswintha, however, was also the sister of Brunhild, the wife of Chilperic's half-brother Sigebert I, king of the eastern kingdom of Austrasia. Galswintha's murder engendered a violent animosity between Fredegund and Brunhild and an irreconcilable feud of more than 40 years' duration between the respective families. Fredegund was certainly responsible for the assassination of Sigebert in 575 and made attempts on the lives of Guntram (her brother-in-law and the king of Burgundy), Childebert II (Sigebert's son), and Brunhild.

After the mysterious assassination of Chilperic (584), Fredegund seized his riches and took refuge in the cathedral at Paris. Both she and her surviving son, Chlotar II, were at first protected by Guntram, but, when he died in 592, Childebert II, who had taken over his throne, attacked Chlotar, albeit unsuccessfully. From Childebert's death (595) until her own, Fredegund intrigued on Chlotar's behalf against Brunhild, who sought to rule through Childebert's sons, Theodebert II of Austrasia and Theodoric II of Burgundy. Ruthlessly murderous and sadistically cruel, Fredegund can have few rivals in monstrousness.

Frederic, Harold (b. Aug. 19, 1856, Utica, N.Y., U.S.—d. Oct. 19, 1898, Henley-on-Thames, Oxfordshire, Eng.), American jour-

nalist, foreign correspondent, and author of several historical novels.

Interested at an early age in photography and journalism, Frederic became a reporter and by 1882 was editor of the *Albany Evening Journal*. In 1884 he went to London as the correspondent for *The New York Times*. He remained there for the rest of his life. In 1884 he made a hazardous tour investigating outbreaks of cholera in southern France and Italy. In 1891 he visited Russia to investigate the persecution of the Jews.

His historical novels range from the American Revolution (*In the Valley*, 1890) to the American Civil War (*The Copperhead*, 1893, and *Marsena and Other Stories*, 1894). Of

Frederic, engraving

By courtesy of the Library of Congress, Washington, D.C.

his New York State novels, *The Damnation of Theron Ware* (1896; English title *Illumination*), the story of the decline and fall of a Methodist minister, brought him his greatest fame. Three other novels, *March Hares* (1896), *Gloria Mundi* (1898), and *The Market Place* (1899), are about English life.

Fredericia, city and port, Vejle *amtskommune* (county commune), eastern Jutland, Denmark, on the Little Strait, there bridged to Fyn (Funen) island. Founded and chartered in 1650 by Frederick III as a fortress to defend Jutland, it enjoyed special privileges, including freedom of worship and exemption from taxes. After a destructive siege in 1849, the Danes drove off the allied Prussians and Schleswig-Holsteiners, leading to a truce; the original earthen ramparts remain, and the common grave of the defenders is in the cemetery of Trinitatis Church (1689). In contrast to other Danish cities, all streets in the old part of Fredericia are laid out in a grid. Still a garrison town, Fredericia is a rail junction and exports silverware, frozen fish, textiles, tobacco, and machinery. The establishment of an oil industry in the 1960s extended the city's industrial base. It is the site of the annual Danish industries fair. Pop. (1985 est.) city, 28,198; (1986 est.) mun., 45,803.

Section of the earthen ramparts surrounding Fredericia, Den.

Le-Be

Frederick, name of rulers grouped below by country and indicated by the symbol •.

Foreign-language equivalents:

Czech	Bedřich
Danish	Frederik
German	Friedrich
Italian	Federico
Norwegian	Frederik
Swedish	Fredrik

Bohemia

• **Frederick I:** *see* Frederick V (Palatinate).

Brandenburg

• **Frederick I** (b. between August and November 1371, Nürnberg [Germany]—d. Sept. 20, 1440, Cadolzburg, near Nürnberg), elector of Brandenburg from 1417, founder of the Brandenburg line of Hohenzollern.

He was the second son of Frederick V, burgrave of Nürnberg. After his father's death, in 1398, he obtained Ansbach and, in 1420, on the death of his elder brother John, the principality of Bayreuth. In 1410 Sigismund, younger son of the Holy Roman emperor Charles IV, had appointed Frederick his representative in the election for the German throne, authorizing him to cast the Brandenburg vote. Frederick succeeded in having Sigismund elected German king and as a reward was appointed a governor of Brandenburg (July 8, 1411). He was formally given the electorate and margravate by Sigismund in 1417. In 1425 Frederick handed over the control of Brandenburg to his eldest son, John the Alchemist, returned to Franconia, and devoted the rest of his life to imperial affairs. Active in the negotiations with the Hussites as a champion of religious moderation, he helped bring about the pacts of Prague (1433) and Iglau (1436). He took part in the election of Frederick III as German king in 1440.

• **Frederick III:** *see* Frederick I (Prussia).

Denmark

• **Frederick I** (b. Oct. 7, 1471, Denmark—d. April 10, 1533, Gottorp, Schleswig), king of Denmark (1523–33) and Norway (1524–33) who encouraged Lutheranism in Denmark but maintained a balance between opposing Lutheran and Roman Catholic factions. This equilibrium crumbled after his death.

The younger son of Christian I, king of Denmark and Norway, Frederick divided the duchies of Schleswig (now in Germany and Denmark) and Holstein (now in Germany) in 1490 with his older brother John, who succeeded to the Danish throne in 1481. After failing to win sovereignty over half of Norway and parts of Denmark, Frederick settled in Gottorp, where he reformed the territory's administration. He remained hostile to King John and to the king's son Christian II, who succeeded to the Danish throne in 1513.

Frederick accepted an offer of the crown from the Jutland nobles who led a revolt against Christian II in 1522. He was crowned the following year and carefully attempted to appease both the higher nobles and the peasants. He was also accepted as king of Norway in 1524 but continued to live in Gottorp, claiming his Danish revenues were inadequate.

Although Frederick at first agreed with the Catholic nobles to fight the Lutheran "heresy," he gave increasing support to Lutheran preachers in Denmark, particularly to Hans Tavsen, who became the king's chaplain. His pro-Lutheran policy, which increased his popularity among the peasants, was probably designed to increase royal power at the expense of the Danish church.

Frederick I, detail of an oil painting by Jacob Binck, 1539; in Frederiksborg Castle, Denmark

By courtesy of the Nationalhistoriske Museum paa Frederiksborg

Frederick nevertheless retained the support of the Rigsråd (state council) against the exiled Christian II, who invaded Norway in 1531 and threatened to reclaim the Danish realm with the aid of the Holy Roman emperor Charles V. Frederick imprisoned Christian, reached a diplomatic settlement with Charles V, and maintained peace until his death. The Roman Catholic cause was clearly on the wane, however, and was thoroughly defeated in 1536.

• **Frederick II** (b. July 1, 1534, Haderslev, Den.—d. April 4, 1588, Antvorskov), king of Denmark and Norway (1559–88) who failed in his attempt to establish complete Danish hegemony in the Baltic Sea area in the Seven Years' War of the North (1563–70) but maintained enough control over the Baltic trade to guide Denmark to a period of prosperity in the later years of his reign.

Frederick II, detail from a portrait by Hans Knieper, 1581

By courtesy of the Nationalhistoriske Museum paa Frederiksborg, Denmark

After joining his uncles John and Adolphus, dukes of the Danish provinces of Schleswig and Holstein, in June 1559 in conquering the peasant republic of Dithmarschen (now in Germany), Frederick succeeded his father, Christian III, in 1559 as king of Denmark and Norway. His competition with Sweden for supremacy in the Baltic broke out into open warfare in 1563, the start of the Seven Years' War of the North. Frederick hoped to take over Sweden and resurrect the Kalmar Union of Denmark, Norway, and Sweden. He was unable to gain any military advantage in the war, however, and reluctantly signed the Peace of Stettin with Sweden in 1570. Sweden remained independent and shared control of Baltic coastal territories with Denmark.

In the postwar years of his reign, Frederick concentrated on rebuilding Denmark's damaged economy and defenses. His chief adviser, Peder Okse, taxed the nobles and successfully maintained the toll Denmark imposed on shipping through The Sound (Øresund) to the Baltic Sea, a route crucial to the economies of the major north European nations. The toll revenues provided a key support for the Danish economy, which then also benefited from reduced competition from the trading

centres of the Hanseatic League (a north German trading confederation). Maintaining Danish control of the Baltic waters, Frederick cleared pirates from the seas adjacent to Denmark and built Kronborg Castle at Elsinore to guard The Sound. Also a great patron of science and the arts, he granted the Danish astronomer Tycho Brahe the island of Ven, near Copenhagen, and gave him the means to found an observatory there.

• **Frederick III** (b. March 18, 1609, Hadersley, Den.—d. Feb. 9, 1670, Copenhagen), king of Denmark and Norway (1648–70) whose reign saw the establishment of an absolute monarchy, maintained in Denmark until 1848.

In his youth Frederick served successively as bishop coadjutor (*i.e.*, assistant bishop with the right of succession) of the German dioceses of Bremen, Verden, and Halberstadt. He commanded Danish forces in Schleswig-Holstein during Denmark's disastrous war with Sweden (1643–45) and succeeded to the throne shortly after the death (1648) of his father, Christian IV, agreeing to a charter that reduced the royal prerogatives.

Frederick III, detail from a portrait by Karel van Mander III

By courtesy of the Nationalhistoriske Museum paa Frederiksborg, Denmark

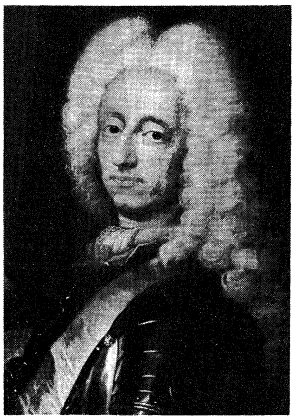
In 1655 the Swedish king Charles X Gustav went to war with Poland, and in 1657 Frederick launched an invasion of Sweden. His plans for regaining the Danish territories lost in 1645 were shattered when Charles suddenly seized the Danish province of Jutland and threatened Sjælland. Shortly afterward Frederick signed the Treaty of Roskilde (Feb. 26, 1658), by which Denmark ceded to Sweden the provinces of Skåne, Blekinge, and Halland, the island of Bornholm, and the Norwegian province of Trondheim.

Within five months Charles again invaded Denmark. The tide of the war turned in favour of Denmark when the inhabitants of Copenhagen resisted a Swedish siege. Assisted by a Dutch squadron, the Danish fleet was then able to drive the Swedes away from The Sound (Øresund), and by the Treaty of Copenhagen (1660) Denmark recovered Bornholm and Trondheim.

Frederick called a meeting of the Estates in September 1660 to meet the debts incurred in the war. The clergy and the townsmen forced the Rigsråd (state council) and nobility to give up their fiscal privileges, to negotiate with the King for a new constitution, and to recognize Frederick as hereditary sovereign, nullifying his royal charter. In January 1661 the government issued a decree conferring absolute power on the king. The new constitution was signed in November 1665, but the King's Law, or Kongeloven, written by Peder Schumacher, later Count Griffenfeld, confirming the king's absolute authority, was not made public until 1709.

With the aid of his adviser Hannibal Sehested, Frederick introduced sweeping reforms of the state administration. These included a reorganization of the government into five departments, or "colleges," with policy recommendations being made by the Privy Council, the memebers of which were usually selected from the heads of the colleges. The bourgeoisie gained greatly in power, buying the major part of the royal estates and, for the first time, holding important government positions.

• **Frederick IV** (b. Oct. 11, 1671, Copenhagen—d. Oct. 12, 1730, Odense, Den.), king of Denmark and Norway (1699–1730), who succeeded his father, King Christian V. He



Frederick IV, detail of an oil painting by Hyacinthe Rigaud; in Frederiksborg Castle, Denmark

By courtesy of the Nationalhistoriske Museum paa Frederiksborg, Denmark

continued the Danish efforts to sever the House of Gottorp's link with Sweden, but his first attempt to do so, in 1700 at the outbreak of the Great Northern War, was checked by Charles XII of Sweden. Frederick then accepted the Treaty of Traventhal (1700), but he reentered the war in 1709, and at the Peace of Frederiksborg (1720) Denmark obtained English and French guarantees for the sole possession of the Duchy of Schleswig by the Danish crown, though remaining administratively separate. At home the King introduced reforms. A local militia was instituted in 1701. Serfdom in Sjælland was partially abolished after 1702. On the crown estates Frederick reorganized defense measures and established 240 elementary schools. His private life, however, often aroused indignation. Having married Louise of Mecklenburg-Güstrow in 1695, he entered into two morganatic marriages during her lifetime. The second of these, in 1712, was with Anna Sophie, daughter of the chancellor, Conrad, Count Reventlow, and after Louise's death (1721), despite opposition within the royal family, he raised Anna Sophie to the dignity of queen.

• **Frederick V** (b. March 31, 1723, Copenhagen—d. Jan. 14, 1766, Copenhagen), king

Frederick V, detail from an oil painting by C.G. Pilo, 1751

By courtesy of the Nationalhistoriske Museum paa Frederiksborg, Denmark

of Denmark and Norway (1746–66) from the death of his father, Christian VI. The reign of this likable but ineffective king was marked by Danish neutrality in the Seven Years' War (1756–63) and a consequent improvement in the nation's foreign trade; by a narrow escape from war with Russia (1762); and by government-sponsored reforms in farming methods (from 1757, when an agricultural commission was established). In addition, the arts flourished without pietistic restraint. Real power was exercised in Frederick's name by two outstanding ministers, Adam Gottlob, Count Moltke, and J.H.E. von Bernstorff.

In 1743 Frederick married Louisa, a daughter of King George II of England. After her death (1751) the King in 1752 married Juliana Maria of Brunswick-Wolfenbüttel.

• **Frederick VI** (b. Jan. 28, 1768, Christiansborg Castle, Denmark—d. Dec. 3, 1839, Copenhagen), king of Denmark from 1808 to 1839 and of Norway from 1808 to 1814.

The son of the mentally incompetent king Christian VII and Queen Caroline Matilda, Frederick was reared largely by his father's stepmother, the queen dowager Juliana Maria, who, with her son Prince Frederick and Ove Höegh-Guldberg, virtually ruled Denmark until 1784. In April of that year the Crown Prince brought about changes in the government that transferred the real power to him.

Frederick VI, detail from a portrait by C.W. Eckersberg

By courtesy of the Nationalhistoriske Museum paa Frederiksborg, Denmark

Frederick supported reform measures to grant personal liberty and legal protection to the peasants and instituted several other social and economic reforms. Married in 1790 to Maria Sophia Frederica, daughter of the landgrave Charles of Hesse, Frederick acceded to the throne upon his father's death on March 13, 1808.

After his accession he inclined more to personal rule, and the cabinet's influence decreased. Initially neutral in the Napoleonic Wars, Frederick supported Napoleon after the English bombardment of Copenhagen in 1807. An indifferent diplomat, he supported Napoleon too long and failed to take advantage of Sweden's difficulties in 1809. At the Peace of Kiel (January 1814), he had to cede Norway to Sweden and Heligoland to England. In the lean years following the Congress of Vienna, Frederick proved himself an energetic, responsible, and upright "father of his country." Under the influence of the July Revolution of 1830 in France, Frederick, in 1834, set up four consultative provincial assemblies. This action marked the beginning of parliamentary life in Denmark.

• **Frederick VII** (b. Oct. 6, 1808, Amalienborg Castle, Denmark—d. Nov. 15, 1863, Glücksburg Castle), king of Denmark from 1848 who renounced absolute rule and adopted a representative government.

The son of the future king Christian VIII and Charlotte of Mecklenburg-Schwerin, Frederick in 1839 was appointed governor of the island of Fyn. As a crown prince, he had two unhappy marriages: first, in 1828, to his second cousin Wilhelmina Maria, a daughter of Frederick VI (dissolved in 1837); then, in 1841, to Caroline of Mecklenburg-Strelitz (dissolved in 1846).

Frederick VII, detail of an oil painting by D. Monies, 1847; in Frederiksborg Castle, Denmark

By courtesy of the Nationalhistoriske Museum paa Frederiksborg, Denmark

On Jan. 20, 1848, Frederick succeeded his father. After the popular demonstrations of March 1848, he appointed a Liberal ministry and on June 5, 1849, he signed the Danish constitution, which provided for a bicameral legislature. The constitutional issue, however, was overshadowed by the Schleswig-Holstein question. Frederick rejected a proposal for partitioning Schleswig (1848) and ceding the southern portion to Prussia. Instead, he incorporated it into the Danish state. The Schleswig Germans then sought and received Prussian aid in a rebellion against Danish rule, which Denmark put down between 1848 and 1850.

Frederick's third wife, Louise Christine Rasmussen, whom he married morganatically in 1850, sided with the Bondevenner (Friends of the Peasants Party). Frederick himself came increasingly into conflict with the National Liberals, who from 1854 held more Cabinet posts. The conflict centred on the succession to the throne (the childless King named Christian of Glücksburg as his successor) and around the constitutional problem of Frederick's favouring a joint constitution for all the lands under the crown.

Just two days before Frederick died, a joint constitution for Denmark and the Duchy of Schleswig was ratified by the Rigsråd, a decision that precipitated war with the German powers in 1864.

• **Frederick VIII** (b. June 3, 1843, Copenhagen—d. May 14, 1912, Hamburg), king of Denmark in 1906–12.

Frederick VIII, detail from a portrait by Otto Bache, 1911

By courtesy of the Nationalhistoriske Museum paa Frederiksborg, Denmark

Frederick served in the disastrous Danish–German War of 1864, which lost the duchies of Schleswig, Holstein, and Lauenburg for Denmark. He then assisted his father, Christian IX, in affairs of state. In 1907, as king, he formed a commission to draft a partial home rule bill for Iceland, but nothing came of it. Frederick VIII's popularity was based on his sincerity in politics, his congeniality, and his simple life-style.

• **Frederick IX** (b. March 11, 1899, Sorgenfri Castle, near Copenhagen—d. Jan. 14, 1972, Copenhagen), king of Denmark (1947–72) who gave encouragement to the Danish resistance movement against the German occupation during World War II and, along with his father, Christian X, was imprisoned by the Germans (1943–45). A highly popular monarch, he maintained the ties of affection between the people and the royal house.

The eldest son of the future king Christian X and Alexandrine of Mecklenburg-Schwerin, Frederick became crown prince in 1912 and joined the Danish Navy in 1917. He rose to the rank of commander by 1935 and in 1946 became rear admiral. He married Ingrid (also in 1935), the only daughter of the crown prince Gustaf Adolf of Sweden; their children were Margrethe, Benedikte, and Anne-Marie.

Frederick IX, detail from an oil painting by Johannes Glob, 1954

By courtesy of the Nationalhistoriske Museum paa Frederiksborg, Denmark

Frederick acted as regent for his father in 1942 and 1947 and succeeded to the throne on his father's death on April 20, 1947. In June 1953 he signed a new constitution that provided for female succession to the throne and reduced Parliament to one house. In 1964 his daughter Anne-Marie married King Constantine II of Greece, who was exiled in 1967. On his death in January 1972, Frederick was succeeded by his daughter Margrethe.

German Empire

• **Frederick III,** also called (until 1888) CROWN PRINCE FREDERICK WILLIAM, German KRONPRINZ FRIEDRICH WILHELM, in full FRIEDRICH WILHELM NIKOLAUS KARL (b. Oct. 18, 1831, Potsdam, Prussia—d. June 15, 1888, Potsdam), king of Prussia and German emperor for 99 days in 1888, during which time he was a voiceless invalid, dying of throat cancer. Although influenced by liberal, constitutional, and middle-class ideas, he retained a strong sense of the Hohenzollern royal and imperial dignity.

The son of the future king and emperor William I and Augusta of Saxe-Weimar-Eisenach, he was the first Prussian prince to attend a university; he received a thorough military education as well. In 1858 he married the British princess royal, Victoria (1840–1901; from 1888 called the "empress Frederick"). Despite the influence of his wife's liberal ideas, he favoured a strong central government and at times exceeded the prime minister and chancellor, Otto von Bismarck, in willingness to exert pressure on the allied German princes.

As crown prince from 1861, Frederick spent

Frederick III, 1884

By courtesy of the Staatsbibliothek, Berlin

27 years chiefly in waiting to do something. Thanks to his chief of staff, Leonhard von Blumenthal, he was a successful commander in the Danish War of 1864, the Seven Weeks' War of 1866, and the Franco-German War of 1870–71. Although Frederick supported Bismark in the war of 1866, in general the "blood and iron" aspects of Bismarck's domestic and international policies were alien to him.

In 1887 Frederick showed symptoms of cancer of the throat. Although the disease was correctly diagnosed as such by German doctors, the British specialist Sir Morell Mackenzie advised against an operation (scheduled for May 21, 1887, and cancelled). A tracheotomy in February 1888 was too late. The Crown Prince, who became emperor on March 9, by this time was able to do little. His only significant official act was to dismiss the minister of the interior, Robert von Puttkamer, an extreme conservative.

Frederick was succeeded by his son and heir, William II.

Germany/Holy Roman Empire

• **Frederick I,** byname FREDERICK BARBAROSSA (Italian: Redbeard) (b. *c.* 1123—d. June 10, 1190, Kingdom of Armenia), duke of Swabia (as Frederick III, 1147–90) and German king and Holy Roman emperor (1152–90), who challenged papal authority and sought to establish German predominance in western Europe. He engaged in a long struggle with the cities of northern Italy (1154–83),

Frederick I as a crusader with (right) Henry of Schäftlarn dedicating to him a copy of the *History of the First Crusade* by Robert of St. Remy; miniature from a manuscript in the Vatican Library (Vat. Lat. 2001)

By courtesy of the Biblioteca Apostolica Vaticana

sending six major expeditions southward. He died while on the Third Crusade to the Holy Land.

Early years. Frederick was the son of Frederick II, duke of Swabia, and Judith, daughter of Henry IX, duke of Bavaria, of the rival dynasty of the Welfs. After succeeding his father as duke of Swabia, Frederick was elected German king on March 4, 1152, in Frankfurt, succeeding his uncle, Emperor Conrad III. Frederick's contemporaries believed that, because he united in himself the blood of the Welfs and the Hohenstaufen, he would solve the internal problems of the kingdom. The announcement of his election, which he sent to Pope Eugenius III, made it plain that Frederick I was not ready to recognize the preeminence over the emperors that the popes had won during the quarrel over the right of investiture of bishops and abbots. Frederick, moreover, filled several vacant episcopal sees, thereby violating the Concordat of Worms of 1122. Nevertheless, he was to learn that he could not prevail against the papacy as easily as the earlier emperors, Otto I and Henry III, had done because the political balance of the West had changed. Under the powerful emperor Manuel I Comnenus, the Byzantine Empire had grown to be a political factor in the Mediterranean and in Italy. Southern Italy and Sicily were united in the Norman kingdom of Roger II. The cities of the Lombards, which had been little more than a nuisance to the earlier emperors, had now become invincible.

Frederick started his struggle for the old goal of the predominance of the Empire over the European monarchies with great political skill. By not recognizing the treaty of alliance between his predecessor, Conrad III, and Manuel I Comnenus of Byzantium against Roger II of Sicily, Frederick forced Pope Eugenius III to sign the Treaty of Constance (1153) with him because the Pope was more exposed to pressure from the Norman kingdom to the south as well as from Arnold of Brescia in Rome. Frederick promised not to make peace with the Roman commune, headed by Arnold (whom he hanged) or with the Normans without the agreement of the Pope. He also promised not to concede any Italian land to the Byzantine Emperor and, finally, to maintain the position of the papacy (*honor papatus*). Eugenius III, on his part, promised that Frederick would receive the imperial crown and that the rights of the empire would be maintained. When Manuel of Byzantium offered Frederick a Byzantine princess as wife and attempted to induce him to fight against the Norman kingdom, Frederick refused. The successor of Eugenius III, Pope Adrian IV, honoured the Treaty of Constance and crowned Frederick emperor on June 18, 1155, in Rome.

The German princes refused to give Frederick the support necessary to attack the Sicilian kingdom, which, under Roger's son William I (reigned 1154–66), was passing through a crisis. Although Manuel now formed an allegiance with the rebellious Norman barons, the city of Genoa, and the Pope, Adrian still would not accept the Byzantine offer of help against William I of Sicily. After William had brought his crisis to an end, he was able to force the Pope to sign the Concordat of Benevento in 1156 by which Adrian gave William Sicily and the Norman principalities on the mainland as far north as Naples and Capua and granted him special rights for the Sicilian church. This new treaty was in violation of the Treaty of Constance. Cardinal Roland (later Pope Alexander III) was supposed to explain the Pope's new policy to the princes and to the Emperor at the imperial Diet of Besançon 1157. A letter from the Pope, which was translated in an inflammatory manner by the imperial chancellor Rainald of Dassel, caused a critical argument between the papal delegation and the German princes over whether or not the empire was dependent upon the papacy. Adrian explained later that he meant the word *beneficium,* which had caused all the trouble, to mean benefit and not fief.

Attempt to regain imperial rights. In 1158, after Frederick had solved several decisive domestic problems (see below), he began his second campaign in Italy, seeking the complete restoration of the imperial rights. After laying siege to and conquering Milan, which had attempted to oppose him, Frederick opened the Diet of Roncaglia. The goal of this Diet was to define and guarantee the rights of the emperor, which would bring the empire an estimated 30,000 pounds of silver per year. Frederick attempted, beginning in 1158 and especially after 1162, not only to achieve the granting of these rights but also to put a systematic financial administration into effect. His goal was to reduce imperial Italy to a system of well-controlled castles, palaces, and cities, with the self-government of the cities controlled by imperial officials. What the Emperor saw as a restoration of the imperial rights, however, was considered by the cities as a curtailment of their freedom. A tax called the *fodrum* was levied on all the inhabitants of imperial Italy; in return the Italian nobles and communes were excused from service in Frederick's armies and were guaranteed his protection. A portion of the Italian money went to the German princes; this enabled Frederick to win their support without making too many political concessions to them in Germany. The ecclesiastical princes of the empire, however, still had to render full service for Italy; the archbishopric of Mainz suffered severe financial losses because Archbishop Christian was active for a long time in Italy as imperial legate. The Italian taxes allowed Frederick to enlist mercenaries (Brabantini) in order to free himself militarily, to a certain extent, from the fief holders. The money of Italy was not, however, the only motive of Frederick's Italian policy.

The Pope, as well as the cities, felt threatened by a tightly organized imperial state in Italy. In 1159 Cardinal Octavian was elected Pope Victor IV with the support of Frederick, and Cardinal Roland was elected Pope Alexander III in a tumultuous and disputed voting session. Alexander, supported by many cardinals, was also immediately recognized by William of Sicily as the true pope. At the council of 1160 in Pavia, convened by the Emperor, only Victor IV was present and was declared the rightful pope, thereby earning Alexander's hostility.

Relations with Pope Alexander III. Alexander III, one of the greatest lawyers of the church, wanted to found a papacy that would be independent of the Emperor; he excommunicated Frederick in 1160. France, England, Spain, Hungary, the Lombards, and even Emperor Manuel joined Alexander's party; Alexander retired to France in 1161, where he remained until 1165. John of Salisbury asked at that time: "Who made the Germans judges of the nations?" Barbarossa's attempt to persuade King Louis VII of France to try to heal the schism when they met at Saint-Jean-de-Losne on the Saône was of no avail. Alexander attempted to bring Frederick back into the church but with no success. At Alexander's urging, the Byzantine emperor Manuel Comnenus now prepared to form an alliance with France and was ready to recognize the Pope. In 1162 Milan was destroyed by Frederick.

When Victor IV died in 1164, Paschal III (reigned 1164–68) was quickly elected as the new imperial pope on the urging of Rainald of Dassel, perhaps against the will of the Emperor. Because of friction between Louis VII and Henry II of England and because the latter was embroiled in an argument with Thomas Becket, Barbarossa decided to form an alliance with Henry II. At the Diet of 1165 in Würzburg, Frederick swore not to recognize Alexander III. The promises made by the English delegates that Frederick's political wishes would be recognized were denied by Henry II, who preferred to keep Alexander under pressure, thus making things more difficult for Becket.

Following the death of William I of Sicily in 1166, Frederick felt that the time had come to strike a decisive blow against Alexander III, who had returned to Rome, and against Sicily. The Lombard League was formed to defend against the Emperor's fourth expedition to Italy. Frederick's expedition ended in disaster, however, when malaria broke out in his army. Rainald of Dassel died in Rome at this time, causing a change in the imperial strategy. When Frederick negotiated peace between Louis VII and Henry II and then sent the Bishop of Bamberg in 1170 to Alexander III and envoys to Byzantium, a détente resulted that even Alexander could not escape. In his fifth Italian campaign (1174) Frederick did not defeat the Lombards militarily, but they were forced to subject themselves to him in the Armistice of Montebello. Because Duke Henry the Lion of Saxony refused to come to his aid, however, Frederick lost the Battle of Legnano against the Lombards. He was now ready to deal with the Pope, and in 1176 they signed the Treaty of Anagni. In the Peace of Venice (1177) Barbarossa acknowledged Alexander III as the true pope. In front of the Church of St. Mark's, Barbarossa received the kiss of peace from the Pope. At Venice the imperial delegates had been able to improve the Emperor's position. Above all was the fact that, although a truce had been negotiated with the Lombards, they were not included in the peace treaty. A treaty with the Lombards was finally confirmed in the year 1183.

Barbarossa meanwhile had also initiated sweeping changes in his empire, where Duke Henry the Lion of Saxony was the strongest prince next to him. When Barbarossa took office, Henry had laid claim to Bavaria, the domain of the margrave Henry II Jasomirgott of Austria. Barbarossa bestowed Bavaria on Henry the Lion, and as compensation he elevated the margravate to a dukedom, with special rights. The Emperor also left the dukedom of Saxony and Mecklenburg under Henry the Lion's control, and in 1154 the Duke received the privilege of investing bishops in the colonial land east of the Elbe. The year 1158 was of great importance for the empire; Barbarossa founded the imperial territory of Pleissnerland (south of Leipzig), elevated Duke Vladislav II of Bohemia to king, and granted the Archbishop of Bremen important privileges, restoring the Bishop's lost political power. Also in 1158 Frederick promised to enfeoff Waldemar I the Great of Denmark—that is, make him his vassal with certain rights.

Meanwhile, Henry the Lion founded the cities of Munich and Lübeck (1158). The founding of Lübeck brought German merchants to the Baltic Sea. The Duke closed a contract between the Germans and the inhabitants of Gotland and sent envoys to Scandinavia and Russia. A trade agreement was closed in 1189 with Novgorod. About 1180 German merchants reached Riga; their advance was protected by Henry's conquest of Mecklenburg (1177). By 1148 Henry had the county and the town of Stade, the most important harbour on the Elbe, in his control.

Deposition of Henry the Lion. At the same time German colonists had settled in Brandenburg under the margrave Albert I the Bear and in Silesia. Barbarossa had restored the dependence of the Polish dukes during two expeditions to Poland in 1157 and 1172. Henry the Lion, the most powerful prince in northern Germany, made Brunswick his res-

idence. He had repeatedly challenged other princes in feuds, but Archbishop Wichmann of Magdeburg, Albrecht of Brandenburg, Landgrave Louis III of Thuringia, and Archbishop Rainald of Cologne offered repeated resistance. It is not completely certain that Duke Henry's refusal of aid to Frederick in 1176 was the sole cause of his downfall. Apparently his manifold breach of the peace of the land caused the Emperor to accuse him, to conquer Lübeck, and, in 1180, through a council of the princes in Gelnhausen, to depose him. Henry lost his dukedom; Westphalia was given to the Archbishop of Cologne, and Bavaria was granted to Otto of Wittelsbach. Henry, who was married to Mathilde of England, went in exile to King Henry II of England. As a result of Henry the Lion's trial, the feudal system was made a still stronger basis of the imperial constitution. Thereafter, only those princes who had received their land directly from the Emperor were admitted to the exclusive circle of imperial princes (*Reichsfürsten*). Barbarossa elevated the princes of Pomerania to dukes, and the counts of Andechs became the dukes of Merania (in the neighbourhood of Trieste). Steiermark became a dukedom. Another important measure of Barbarossa was the elevation of the Bishop of Würzburg to duke of Franconia in 1168.

Barbarossa had attempted to hold the increasing power of the princes in check. By 1152 he had found a solution for the area of Burgundy, which also belonged to the empire. He made Duke Berthold IV of Zähringen his representative for the dukedom of Burgundy as far as the Mediterranean and married Béatrix, the daughter of Count Rainald of Burgundy (1156). Barbarossa attempted to build his own imperial territory between the areas controlled by the princes. This territory was composed of castles, cities, landholdings, ministerial seats, and single rights that were more or less thickly scattered from Swabia to Thuringia. This large territory was ruled by imperial ministerials (*ministeriales imperii*). These men had great power because many of them belonged to the Emperor's circle. The most famous of them was Kuno of Münzenberg, whose castle is preserved in the Wetterau north of Frankfurt and who founded the town of Friedberg. The territorial "peace laws" belong to his efforts to keep the Emperor in power.

Chivalry gave Barbarossa's time a special stamp. He expressed his enthusiasm for knighthood as the ideal way of life at the festival of Pentecost at Mainz in 1184, where he dubbed his sons knights. This festival was surpassed by the "Diet of Jesus Christ" in 1188, when the margravate of Namur was transformed into an imperial principality. More important was Barbarossa's call to the Third Crusade in the spring of 1189 to free Jerusalem from Saladin's army, which had captured it in 1187. Before his departure he returned the former possessions of the Countess Mathilde of Tuscany, a part of the papal state, to the Pope. In 1190 the Emperor drowned while trying to cross the Saleph River.

Assessment. Frederick Barbarossa had attempted to continue the imperial policy of the rulers of the Saxon and Salian lines. His state was still founded upon the noble, the high noble, and above all the newly founded rank of the imperial servants. The imperial cities in Germany were governed by royal officials (*advocatis sculteti*), and the citizens had their part in the government. The cities played no role in politics. Frederick had to recognize that the church, after the quarrel of investiture, had become a firmly controlled institution, with its powers strictly defined by law. The church had joined itself to the struggle for freedom of the economically powerful states in upper Italy. Pope Alexander III was able to force the kings of Europe (especially Louis VII of France) not to enter into a political agreement with Barbarossa. Only Philip II Augustus of France signed a treaty with Barbarossa in order to free himself from the pressures created by the Anglo-Norman occupation on the mainland. There was no chance that a continuation and increase of the imperial policy in the territories controlled by the empire would have broken the power of the princes. Germany developed into a system of territorial states after Barbarossa's death, while France developed during the time of Philip II Augustus into a centralized monarchial state. Barbarossa had a strong feeling for law and imperial prestige. His steadfast opposition to the popes and to Henry the Lion made him the symbol of German unity in the romantic glorification of the 19th century. People since the 14th century believed he was sleeping in the imperial castle of Kyffhäuser and hoped for his return. A monument to him was erected there during the years 1890–96.

(H.Pa.)

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• Frederick II (b. Dec. 26, 1194, Jesi, Ancona, Papal States—d. Dec. 13, 1250, Castel Fiorentino, Apulia, Kingdom of Sicily), king of Sicily (1197–1250), duke of Swabia (as Frederick VI, 1228–35), German king (1212–50), and Holy Roman emperor (1220–50). A Hohenstaufen and grandson of Frederick I Barbarossa, he pursued his dynasty's imperial policies against the papacy and the Italian city states; and he also joined in the Sixth Crusade (1228–29), conquering several areas of the Holy Land and crowning himself king of Jerusalem (reigning 1229–43).

Early years. In 1196, Frederick, at the age of two, was elected king by the German princes at Frankfort. His father, however, failed in his attempt to gain the princes' support to make Frederick's succession hereditary. Just before embarking on a crusade to the Holy Land, Emperor Henry died in September 1197 after a brief illness, only 32 years old. Though the medieval Roman Empire was at the height of its strength, the Emperor's death brought it close to dissolution.

Frederick II, with a falcon, miniature from his treatise, *De arte venandi cum avibus;* in the Vatican Library (MS. Palat. Lat. 1071)

By courtesy of the Biblioteca Apostolica Vaticana, Rome

After the death of her husband, Empress Constance had young Frederick brought to Sicily, where in May 1198 he was crowned king of Sicily. Before her death later that year, Constance loosened the bonds that joined Sicily to the empire and to Germany by appointing Pope Innocent III her son's guardian as well as regent of the Kingdom of Sicily, which was already under papal suzerainty. In Germany two rival kings were elected, Frederick's uncle Philip of Swabia and Otto of Brunswick, as Otto IV.

Even the Pope, however, did not succeed in protecting Sicily from many years of anarchy. German and papal captains, local barons, and Sicilian Saracens, as well as the cities of Genoa and Pisa, fought for mastery of the country. The situation was not stabilized until the imperial chancellor conquered Palermo in November 1206 and governed in Frederick's name. In December 1208 Frederick, then 14, was declared of age.

In 1209 he married the much older Constance of Aragon, who brought him an urgently needed troop of knights with whose help he gained control of Sicily, defeated a conspiracy of the barons, and was partially successful in regaining the crown properties that had been lost during his minority. At this time his relations with the Pope began to show signs of strain.

Frederick's Sicilian efforts were seriously endangered when at the end of 1210 Otto IV invaded the realm on the mainland and in 1211 even threatened Sicily itself. Otto withdrew, however, when in September 1211 a number of German princes deposed him and elected Frederick king.

Before leaving for Germany in March 1212, Frederick had his one-year-old son Henry VII crowned king of Sicily and granted various privileges to the Holy See. Having rapidly conquered south Germany, where he met almost no opposition, Frederick was elected once again king of Germany by a large majority of princes at Frankfurt in December 1212 and crowned a few days later. In the same year he concluded an alliance with France against Otto, who was decisively defeated at the Battle of Bouvines in July 1214.

Consolidation of the empire. In April 1220 Frederick's nine-year-old son Henry VII was elected king by the German princes, thus negating Frederick's promise to Pope Innocent that he would relinquish control of Sicily in favour of Henry, for it meant that Sicily and Germany would eventually be united under one ruler. Although Frederick sought to exonerate himself with Pope Honorius III by claiming that the election had been held without his knowledge, he had to pay for it by surrendering extensive royal prerogatives to the German ecclesiastical princes.

Crowned emperor by the Pope in St. Peter's Church, in Rome, on Nov. 22, 1220, Frederick confirmed on the same day the legal separation of the empire from the Kingdom of Sicily while continuing the existing personal union. In addition, he granted important privileges to the Italian ecclesiastics and issued laws against heretics, and it seemed indeed that harmony had been reestablished between the Emperor and the Pope for some years to come. Frederick spent the following years consolidating his rule in Sicily. He broke the resistance of the barons to revocation of certain of their privileges and defeated the rebellious Saracens (1222–24), whom he later resettled in Apulia where they became his most faithful subjects, providing him with a loyal bodyguard immune against papal influence.

In addition to erecting a chain of castles and border fortifications, he had enlarged the har-

bours of his kingdom and established a navy and a fleet of merchant vessels. He instituted measures designed to bring trade under state control and make the manufacture of certain products the monopoly of the state. Finally, he created a civil service for which candidates were trained at the first European state university, in Naples, which he himself founded in 1224.

Years as a crusader. In the meantime, the Pope was reminding the Emperor of the crusading vows he had taken at his coronations in 1212 and 1220. Frederick, however, was inclined to postpone such a venture until the Italian problems had been resolved. He claimed the Kingdom of Jerusalem for himself through his marriage to Isabella (Yolande) of Brienne, the heiress of the titular king of Jerusalem, who had become his wife in 1225 after Constance had died in 1222. Before embarking for the Holy Land, Frederick convened an imperial diet for Easter 1226 in Cremona, in northern Italy, in order to reinforce certain imperial rights in Italy and to prepare for the crusade. The cities of Lombardy, however, reconstituted themselves, under the leadership of Milan, as the Lombard League, and not only sabotaged the diet at Cremona but effectively opposed Frederick's reorganization of northern Italy.

In September 1227, when Frederick was at last ready to embark from Brindisi for the Holy Land, an epidemic broke out among the crusaders. The new pope, Gregory IX, a passionate man who belonged to the intellectual world of Francis of Assisi—his personal friend whom he canonized as early as 1228—brushed aside Frederick's justification and excommunicated him for his failure to carry out the crusade.

In June 1228, ignoring the excommunication, Frederick set sail from Brindisi. In the Holy Land, following complex negotiations, he obtained Jerusalem, Bethlehem, and Nazareth from the Sultan al-Kāmil of Egypt. It was certainly the impact of Frederick's personality on the Arab world, and not armed might, that made this treaty possible. On March 18, 1229, the excommunicated emperor crowned himself king of Jerusalem in the Church of the Holy Sepulchre. This was the high point as well as the turning point of Frederick's conception of sovereignty. Eschatological prophecies concerning his rule were now made, and the Emperor considered himself to be a messiah, a new David. His entry into Jerusalem was compared with that of Christ on Palm Sunday, and, indeed, in a manifesto the Emperor, too, compared himself to Christ.

In the meantime, however, papal troops had penetrated into the Kingdom of Sicily. Frederick returned at once and reconquered the lost areas but did not in turn attack the Papal States. His diplomacy was rewarded: after the Treaty of San Germano (July 1230) he was absolved from excommunication the following month at Ceprano.

In August 1231, at Melfi, the Emperor issued his new constitutions for the Kingdom of Sicily. Not since the reign of the Byzantine emperor Justinian in the 6th century had the administrative law of a European state been codified. Frederick's codes contained many ideas that anticipated enlightened absolutism and the centralization of the state. During the same time, however, Frederick could not prevent his son, the German king Henry VII, from making a number of important concessions to the German princes. These concessions, confirmed by Frederick in 1232 at the diet of Cividale, strengthened the rule of the princes at the expense of the central power of the empire. These and other steps set back the development of communal self-government in Germany and furthered the independence of the principalities. In the meantime, relations between Frederick and Henry VII deteriorated steadily. Henry had been ruling independently in Germany since 1228, when in December 1234 he entered into an alliance with the Lombard League. This action amounted to high treason in the eyes of the Emperor. On Frederick's arrival in Germany, his son's rebellion collapsed; he died in a prison in Calabria in 1242.

His second wife having died in 1228, Frederick in July 1235 married Isabella of England. Shortly thereafter, he issued an edict of imperial peace, which also called for the appointment of a chief justice of the imperial court in order to protect the sovereign rights of the emperor from further erosion.

After some military successes in Lombardy against the Lombard League, the Emperor returned to Germany in 1236 to remove the rebellious duke Frederick of Austria and Styria from rule. In February 1237 he had his nine-year-old son Conrad IV elected king of Germany in Vienna. After several more months in Germany—it was to be his last visit—he descended into northern Italy. He defeated the Lombard League at Cortenuova, but, misjudging his strength, he rejected all Milanese peace overtures and insisted on unconditional surrender. It was a moment of grave historic importance when Frederick's hatred coloured his judgment and blocked all possibilities of a peaceful settlement.

Struggle with the papacy. Milan and five other cities held out, and in October 1238 he had to raise the siege of Brescia. In the same year the marriage of Frederick's natural son Enzio with the Sardinian princess Adelasia and the designation of Enzio as king of Sardinia, in which the papacy claimed suzerainty, led to the final break with the Pope. Gregory IX deeply distrusted Frederick both in religious and political matters: Frederick was supposed to have jested that Moses, Christ, and Muḥammad were three impostors who had themselves been hoodwinked; and in the political arena the Pope was fearful that the Papal States were about to be isolated and encircled, particularly because a pro-imperial party had been formed in Rome. Under the pretext that the Emperor intended to drive him from Rome, Gregory excommunicated Frederick for the second time on Palm Sunday, March 20, 1239. This was the beginning of the last phase of the gigantic struggle between the papacy and the empire; it ended with the death of the Emperor and the downfall of his house.

Frederick countered the excommunication with a number of important manifestos, most of them composed by Pietro della Vigna, a member of the imperial chancery, who had outstanding literary gifts. The manifesto emphasized that the cardinals were meant to participate in the leadership of the church, and Frederick even tried to evoke solidarity among the secular princes. He also, however, intensified his military activities in northern Italy. In order to finance his constantly growing need for arms, he instituted a thorough administrative reorganization of imperial Italy (among others, the formation of 10 vice regencies) and of the Kingdom of Sicily. In addition, he decreed the rigorous surveillance of the population. In central Italy he took the offensive, occupying the March of Ancona and the Duchy of Spoleto, and in February 1240 his army marched into the Papal States and threatened Rome. At the last moment, however, the Pope won the support of the Romans.

Following the defeat of a Genoese fleet bringing delegates for a papal council to Rome, more than 100 high-ranking ecclesiastics—cardinals and bishops among them—were taken as Frederick's prisoners to Apulia. This military victory proved, however, to be a political disadvantage: it provided material for propaganda depicting Frederick as an oppressor of the church.

While still encamped before Rome, Frederick received the news of Pope Gregory's death and thereupon withdrew to Sicily. In the meantime, the Mongols had invaded Europe. They were temporarily halted in the extremely bloody Battle of Liegnitz in Silesia on April 9, 1241, but probably only the sudden death of their leader, the great khan Ögödei, prevented further Mongol advances at that time.

Celestine IV's brief pontificate was followed by a long interregnum. When in 1243 Innocent IV was elected, Frederick, at the urging of the German princes and of King Louis IX of France, opened negotiations with the new pope. Agreement between the Pope and the Emperor seemed close on the evacuation of the Papal States, when in June 1244 Innocent fled the city. In Lyon he convened a council for 1245 and in July of that year deposed the Emperor, the obstacle to reconciliation apparently being the status of the Lombard communes.

The battle between the Emperor and the papacy then raged in full fury; on the papal side the Emperor was branded as the precursor of the anti-Christ; on the imperial side he was hailed as a messiah. The Emperor supported the contemporary demand that the church return to the poverty and saintliness of the early Christian community and again appealed to the princes of Europe to join in a defensive league against the power-hungry prelates. Most of the princes, however, remained neutral, and, although two successive German antikings received little support, the Emperor steadily lost ground in Germany.

In May 1247 Frederick's planned journey to Lyon in order to plead his own case before the papal council was interrupted by the revolt of the strategically placed city of Parma. In the wake of this debacle much of central Italy and the Romagna was lost. The following year the Emperor was to suffer further blows of fate; Pietro della Vigna, for many years the Emperor's confidant, was accused of treason and committed suicide in prison. In May 1249 King Enzio of Sardinia, Frederick's favourite son, was captured by the Bolognese and was kept incarcerated until his death in 1272.

The Emperor's position, both in Italy and—through the efforts of his son, Conrad IV—in Germany, was improving when he died unexpectedly in 1250. He was buried in the cathedral of Palermo near his first wife, his parents, and his Norman grandfather.

When the news of his death was published, all Europe was deeply shaken. Doubts arose that he was really dead; false Fredericks appeared everywhere; in Sicily a legend grew that he had been conveyed to the Aetna volcano; in Germany that he was encapsuled in a mountain and would return as the latter-day emperor to punish the worldly church and peacefully reestablish the Holy Roman Empire. Yet he was also thought to live on in his heirs. In fact, however, within 22 years after his death, all of them were dead: victims of the battle with the papacy that their father had begun.

Assessment. Frederick's character was marked by sharp contradictions, undoubtedly the result of his insecure and emotionally barren childhood. Enchanting amiability and gaiety were paired with cruelty; harshness and rigidity existed side by side with superior intelligence and a keen sense of reality; tolerance and intolerance went hand in hand; impulsive sensuality did not stand in the way of genuine piety; imbalance and inner discord pervaded his personality and his achievements.

Frederick cannot be considered the first modern man on the throne, nor a pioneer of the Renaissance, as some historians have maintained. Though his gifted personality heralded some of the intellectual trends of later times, he was, all in all, a man of the Middle

Ages. He had indeed had the good fortune to have grown up in Sicily in a mixed culture that uniquely combined elements of antiquity, Arabic and Jewish wisdom, the Occidental spirit of the Middle Ages, and Norman realism. The intellectual life of his court reflected this heritage. A courtly "republic of scholars," it nurtured and fostered the natural sciences as well as philosophy, poetry, and mathematics, and translations as well as original writing, both in Latin and in the vernacular. The pursuit of knowledge without special respect for traditional authorities was characteristic of Frederick and his court.

Witness to the intellectual vigour and distinction of Frederick himself and those around him are the content and style of his great legal codices and manifestos, many of them serving as examples to later generations; the edifices he erected, particularly the classic style of the Castello del Monte—a fusion of poetry and mathematics in stone; and, most outstanding, his own work *De arte venandi cum avibus,* a standard work on falconry based entirely on his own experimental research.

Frederick's concept of the emperor's function was rooted in the ideology of the late Greco-Roman period and the Judeo-Christian philosophy of the Middle Ages, emphasizing the sacredness and universal character of the office. In the light of it, Frederick claimed preeminence for the emperor over all other secular rulers—undoubtedly an ill-timed claim in an age when separate nation-states were developing. Thus, Frederick's policies, full of intellectual and political promise, were in actuality dogged by tragedy. (Gu.W.)

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• Frederick (III), byname FREDERICK THE FAIR, German FRIEDRICH DER SCHÖNE (b. *c.* 1286—d. Jan. 13, 1330, Gutenstein, Austria), German king from 1314 to 1326, also duke of Austria (as Frederick III) from 1308, the second son of the German king Albert I.

After his father's murder (1308) Frederick became the head of the House of Habsburg and duke of Austria but did not succeed him as king, the count of Luxembourg being elected instead, as Henry VII. Frederick and his brothers made a treaty with Henry at Speyer in 1309, whereby they renounced the Habsburg claim to Bohemia in return for a sum of 50,000 Marks. Frederick's quarrel with his cousin Louis IV of Upper Bavaria concerning the wardship of Henry III of Lower Bavaria ended with Frederick's defeat at Gammelsdorf on Nov. 9, 1313.

Henry VII's death (August 1313) led to a double election. Four electors chose Frederick as German king at Sachsenhausen, near Frankfurt, on Oct. 19, 1314, and he was crowned by the correct archbishop, namely the archbishop of Cologne, but at the wrong place, Bonn (instead of Aachen), on November 25. On the other hand, five electors chose Louis of Bavaria outside Frankfurt on October 20, and Louis was crowned at the correct place but by the wrong archbishop (Mainz) on November 25 likewise. The resultant war between the two rivals lasted nearly eight years. Finally, Frederick was decisively defeated by Louis on Sept. 28, 1322, at Mühldorf in Bavaria and was imprisoned in the castle of Trausnitz (Upper Palatinate). In March 1325 he was freed after taking an oath to recognize Louis as king and to see to it that his brother Leopold did so too. When he proved unable to do so he returned voluntarily to prison, though the Pope had freed him from his oath. In September 1325 Louis accepted Frederick as co-ruler, but after Leopold's death (February 1326) Frederick's power was confined to Austria.

• Frederick III (b. Sept. 21, 1415, Innsbruck, Austria—d. Aug. 19, 1493, Linz), Holy Roman emperor from 1452 and German king from 1440 who laid the foundations for the greatness of the House of Habsburg in European affairs.

Frederick III, engraving by Pieter Van Sompel, 1644, from a drawing by Pieter Soutman

By courtesy of the Bild-Archiv, Osterreichische Nationalbibliothek, Vienna

Frederick, the son of Duke Ernest of Austria, inherited the Habsburg possessions of Inner Austria (Styria, Carinthia, Carniola, and Gorizia) on his father's death in 1424. By 1439 he had become the senior member of the dynasty and the following year was elected German king; yet he was to be plagued by conflicts with his relatives and a powerful, rebellious nobility throughout his reign. As guardian of Ladislas Posthumus, son of his cousin the German king Albert II, Frederick attempted to exploit his ward's claims to the Bohemian and Hungarian thrones to his own advantage; but rebellious nobles forced him to release Ladislas prematurely (1452). On the boy's death in 1457, the House of Habsburg temporarily lost possession of both domains; Bohemia elected George of Poděbrady and Hungary elected Matthias I Corvinus as kings.

Revolts of the Austrian nobility, disputes with the German princes, and inability to carry out governmental reforms caused Frederick to withdraw almost completely from German affairs. This heightened German dissatisfaction and resulted in the rise of a number of claimants to the throne, including Frederick's own brother Albert VI. With Albert's death in 1463, however, and the cession of Tirol by Frederick's cousin Sigismund to Frederick's son Maximilian, the Austrian heritage, partitioned between two rival branches of the House of Habsburg in 1379, was once again united.

Frederick maintained somewhat better relations with the church. Travelling to Italy, he received the Lombard crown (1452) and, on March 19, 1452, became the last emperor to be crowned in Rome by a pope.

Frederick was never able to pacify the eastern borders of his realm. The Ottomans took Constantinople in 1453 and advanced into Styria and Carinthia, unopposed by the financially and militarily weak emperor. It was from his reign onward, however, that the Habsburgs saw themselves as Christian Europe's first line of defense against Islām, a role they were to play for more than three centuries. Frederick had to suffer the humiliation of seeing Matthias I Corvinus of Hungary conquer much of Austria and enter Vienna in 1485, but Matthias' death in 1490 allowed Frederick's son Maximilian to recapture Austria (1490–91).

Frederick's greatest achievement was marrying his son in 1477 to Mary, daughter of Charles the Bold, duke of Burgundy, a union that gave the House of Habsburg a large part of the Burgundian domains and made the Austrians a European power.

After 1486, when, on the insistence of the German princes, Maximilian became king of the Romans and co-regent, the Emperor assumed a less active role in affairs of state.

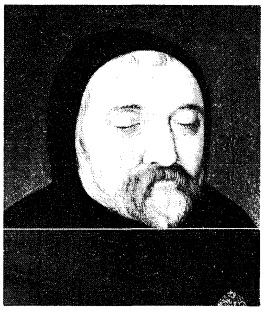
Like many men in the late Middle Ages, he occupied his time with astrology, magic, and the attempted manufacture of gold from base metals; but he also travelled as far as the Holy Land (1437), associated with Humanists, and collected books and precious stones.

NORWAY

• Frederick I–VI: *see* Frederick I–VI (Denmark).

PALATINATE

• Frederick III, byname FREDERICK THE PIOUS, German FRIEDRICH DER FROMME (b. Feb. 14, 1515, Simmern, Ger.—d. Oct. 26, 1576, Heidelberg, Rhenish Palatinate), elector Palatine of the Rhine (1559–76) and a leader of the German Protestant princes who worked for a Protestant victory in Germany, France, and the Netherlands.



Frederick III the Pious, detail of a portrait by an unknown artist, *c.* 1576; in the Historisches Museum der Pfalz, Speyer, Ger.

By courtesy of the Historisches Museum der Pfalz, Speyer, Ger.

Frederick adopted Lutheranism in 1546 and Calvinism somewhat later. His Calvinism and his opposition to the Habsburg emperors made his electoral position insecure, because the Peace of Augsburg (1555) covered relations only between Catholics and Lutherans, and the German Protestant princes were unwilling to venture an attack on the emperor. Frustrated in Germany, Frederick sent his sons to aid foreign Protestants, John Casimir to the French Huguenots and Christopher to Holland. By the time Frederick died, the Palatinate had become the centre of German Calvinism.

• Frederick IV, byname FREDERICK THE RIGHTEOUS, German FRIEDRICH DER AUFRICHTIGE (b. March 5, 1574, Amberg, Palatinate—d. Sept. 19, 1610, Heidelberg), elector Palatine of the Rhine, only surviving son of the elector Louis VI.

Frederick's father died in October 1583, when the young elector came under the guardianship of his uncle John Casimir, an ardent Calvinist. In January 1592, on the death of John Casimir, Frederick undertook the government of the Palatinate and continued his uncle's policies of hostility to the Catholic Church and the Habsburgs and cooperation with foreign Protestants. He was often in communication with Henry of Navarre, afterward Henry IV of France, and like him was unremitting in his efforts to conclude a league

among the German Protestants. After many delays the Union of Evangelical Estates was actually formed in May 1608, under the leadership of the elector, and he took a prominent part in directing the operations of the union until his death. Frederick was very extravagant, and liked to surround himself with pomp and luxury.

• **Frederick V** (b. Aug. 26, 1596, Amberg, Upper Palatinate—d. Nov. 29, 1632, Mainz, Ger.), elector Palatine of the Rhine, king of Bohemia (as Frederick I, 1619–20), and head of the Protestant union against Catholic Austria at the beginning of the Thirty Years' War.

After receiving a French education, Frederick succeeded his father, the elector Frederick IV, in 1610. When the Protestant Bohemian estates revolted against the Catholic emperor Ferdinand II and offered the crown to the young elector, he accepted and was crowned

Frederick V, detail of a portrait by an unknown artist, c. 1620; in the Historisches Museum der Pfalz, Speyer, Ger.

By courtesy of the Historisches Museum der Pfalz, Speyer, Ger.

in Prague in November 1619. Abandoned by his allies, however, Frederick was routed in the Battle of the White Mountain, near Prague (Nov. 8, 1620), by the armies of the Catholic League under Johann Tserclaes, Graf von Tilly.

Two armies, raised by Ernst von Mansfeld and Christian of Brunswick in 1621, fought for Frederick's cause in western Germany, but they were defeated within two years. Spanish and Bavarian troops occupied the Palatinate, Frederick's electoral dignities were transferred to Maximilian I of Bavaria (1623), and in 1628 Bavaria annexed the Upper Palatinate. As more Protestant princes entered the widening conflict, one of their aims was the restoration of Frederick, but this was never accomplished. He fled to The Hague in 1622 and for the rest of his life lived on money supplied by the Dutch and English. When Sweden joined the anti-Habsburg coalition, Frederick followed Gustavus II Adolphus in his march across Germany (1630–32), but he died before he was able to reclaim his throne.

Prussia

• **Frederick I** (b. July 11, 1657, Königsberg, Prussia—d. Feb. 25, 1713, Berlin), elector of Brandenburg (as Frederick III), who became the first king in Prussia (1701–13), freed his domains from imperial suzerainty, and continued the policy of territorial aggrandizement begun by his father, Frederick William, the Great Elector.

In 1688 Frederick succeeded to the electorate and at once set out, assisted by the capable Eberhard von Danckelmann, his boyhood tutor, now prime minister, on the course that was to yield him a monarch's crown 13 years later. Frederick maintained a large, splendid court and an army out of proportion to his territories and position to further his pretensions.

In European politics, he allied himself with Austria and the sea powers (England and Holland) against France. Prussian troops were

Frederick I, engraving, 1701

Archiv fur Kunst und Geschichte, Berlin

sent to the Netherlands (1688) to protect William of Orange's continental lands against expected French attacks when William crossed the Channel to accept the English crown. By this act Frederick hoped to gain the Dutch stadholdership for himself or his descendants, but he was eventually frustrated. Although, in the wars of the Grand Alliance against Louis XIV (1689–97), Prussia's contingents in the imperial army distinguished themselves everywhere, Prussia emerged practically unrewarded at the Treaty of Rijswijk (1697). On Nov. 16, 1700, however, Austria and Prussia signed a secret treaty that permitted Frederick to crown himself king in Prussia, thus finally realizing his long-cherished ambition. Austria agreed to this elevation primarily to gain Prussian aid in the threatening war against France over the succession to the Spanish throne. In return, Frederick promised to send 8,000 troops beyond the normal Prussian contingent to the imperial army, to give preference to Habsburg candidates in imperial elections, and to vote with Austria on all important matters in the German Diet as far as Prussian interests permitted. Thus, when Frederick crowned himself in Königsberg on Jan. 18, 1701, Prussia was saddled with weighty obligations. Only his son, Frederick William I, and his grandson, Frederick II the Great, were able to exploit Prussia's enhanced position to the full and transform the new kingdom into a great European power.

During the War of the Spanish Succession (1701–14), Frederick remained a loyal ally to Austria, and Prussia's military contribution proved outstanding; but again, at the Treaty of Utrecht (1713), Frederick's territorial rewards were small, consisting of the Swiss canton of Neuchâtel and a few enclaves on the lower Rhine.

Prussia's elevation to a monarchy gave greater cohesion to the diverse and dispersed Hohenzollern lands, which now were turned into provinces. Frederick also freed the new kingdom from imperial judicial suzerainty and increased its revenues. An influx of Dutch and French Protestants was instrumental in the creation of new industries, the reclamation of land, and the stimulation of intellectual life. The founding of the University of Halle (1694), the Academy of the Arts (1696), and the Academy of the Sciences (1700), of which the eminent philosopher Gottfried Wilhelm Leibniz became the first president, further contributed to Prussia's growing cultural importance.

• **Frederick II,** byname FREDERICK THE GREAT, German FRIEDRICH DER GROSSE (b. Jan. 24, 1712, Berlin—d. Aug. 17, 1786, Potsdam, near Berlin), king of Prussia (1740–86), a brilliant military campaigner who, in a series of diplomatic strategems and wars against Austria and other powers, greatly enlarged Prussia's territories and made Prussia the foremost military power in Europe. An enlightened absolute monarch, he favoured French language and art and built a French Rococo palace, Sans Souci, near Berlin.

A brief account of the life and works of Frederick II follows; for a full biography, *see* MACROPAEDIA: Frederick the Great.

Subjected to a Spartan regimen from infancy, Frederick tried to escape to England in 1730; when the attempt failed he submitted in terror to his father, who placed him on probation in the civil administration. Frederick acceded to the throne on his father's death (1740). As king he liberalized laws regarding censorship, religion, and torture and reinvigorated Prussian society and its institutions. Although he governed as an absolute ruler, Frederick's domestic policies reflected his view that the state exists for the welfare of the individual. He conquered Silesia (1740–45), undermining the Habsburg hold on the imperial throne in Vienna. The Seven Years' War (1756–63) confirmed his hold on Silesia and marked the beginning of Prussia's leadership of the German states. In 1785 he founded the League of Princes to defend these states against imperial incursions.

• **Frederick III:** *see* Frederick (German Empire).

Saxony

• **Frederick I,** byname FREDERICK THE WARLIKE, German FRIEDRICH DER STREITBARE (b. April 11, 1370—d. Jan. 4, 1428, Altenburg, Thuringia), elector of Saxony who secured the electorship for the House of Wettin, thus ensuring that dynasty's future importance in German politics.

An implacable enemy of the Bohemian followers of Jan Hus, church reformer and accused heretic, Frederick aided the Holy Roman emperor Sigismund against them from 1420 on. When the last Saxon elector of the Ascanian dynasty, Albert III, died in 1422, the emperor Sigismund, ignoring the claims of the elector Frederick I of Brandenburg, in whose hands he did not wish to see another electorate, awarded that dignity to Frederick the Warlike.

Recurrent territorial conflicts between Frederick and his relatives were resolved by the Naumburg treaty, which made Wettin lands inalienable.

• **Frederick II,** byname FREDERICK THE GENTLE, or MILD, German FRIEDRICH DER SANFTMÜTIGE (b. Aug. 22, 1411, Leipzig—d. Sept. 7, 1464, Leipzig), Saxon elector (1428–64) and eldest son of Frederick the Warlike; he successfully defended his electorship against the Ascanian Saxe-Lauenburg line and instituted regular diets in his territories.

Frederick settled his disputes with the Bohemian followers of Jan Hus, church reformer and condemned heretic, in 1432, and relations were cemented in 1464, when his son Albert married the daughter of the Bohemian leader George of Poděbrady. The burgravate of Meissen, acquired in 1439, added considerable land and income. From 1446 to 1451 Frederick fought the Bruderkrieg (Brothers' War) against his brother William over territorial claims.

• **Frederick III,** byname FREDERICK THE WISE, German FRIEDRICH DER WEISE (b. Jan. 17, 1463, Torgau, Saxony—d. May 5, 1525, Lochau, near Torgau), elector of Saxony who worked for constitutional reform of the Holy Roman Empire and protected Martin Luther after Luther was placed under the imperial ban in 1521.

Succeeding his father, the elector Ernest, in 1486, Frederick allied himself with Berthold, archbishop of Henneberg, to promote imperial reforms that would increase the power of

the nobles at the expense of the Holy Roman emperor. In 1500 he became president of the Reichsregiment (Imperial Governing Council), which, however, because of lack of funds was soon disbanded. He was instrumental in securing the election of the emperor Charles V in 1519 after refusing the crown himself.

Frederick appointed Luther and his colleague Philipp Melanchthon to the University of Wittenberg and refused to carry out a papal bull against Luther in 1520. After the ban was imposed on Luther the next year, Frederick welcomed him to the Wartburg, where Luther translated the Bible into German.

A patron of the artists Albrecht Dürer and Lucas Cranach the Elder and a friend of the Humanist Georg Spalatin, Frederick also collected a large number of religious relics and founded the University of Wittenberg in 1502. Never having married, he died without legitimate heirs.

Sicily

- **Frederick I:** *see* Frederick I (Germany/Holy Roman Empire).
- **Frederick II (or I):** *see* Frederick II (Germany/Holy Roman Empire).
- **Frederick III (or II)** (b. 1272—d. June 25, 1337, Paterno, Sicily), king of Sicily from 1296, who strengthened the Aragonese interest there against the Angevins of Naples.

Appointed regent of Sicily by his brother, James II of Aragon, in 1291, Frederick was elected king by the Sicilian parliament (Dec. 11, 1295), to prevent the island's return to the rule of the Angevin Charles II of Naples; he was crowned on March 25, 1296. To revive the Ghibelline tradition of the Holy Roman emperors Frederick I and II, he called himself Frederick III, though he was in fact only the second Frederick to reign in Sicily. A war with Naples and the papacy followed. By the Peace of Caltabellotta (Aug. 31, 1302), it was agreed that Frederick should retain Sicily with the title of "king of Trinacria" until his death, when the island would revert to the Angevins.

When hostilities broke out again in 1310, Frederick reassumed the title "king of Sicily" and had his son Peter designated as his successor, thus ensuring the continuance of Aragonese rule in Sicily.

Swabia

- **Frederick III:** *see* Frederick I (Germany/Holy Roman Empire).
- **Frederick VI:** *see* Frederick II (Germany/Holy Roman Empire).

Sweden

- **Frederick (I)** (b. April 17, 1676, Kassel, Hesse-Kassel—d. March 25, 1751, Stockholm), first Swedish king to reign (1720–51) during the 18th-century Age of Freedom, a period of parliamentary government.

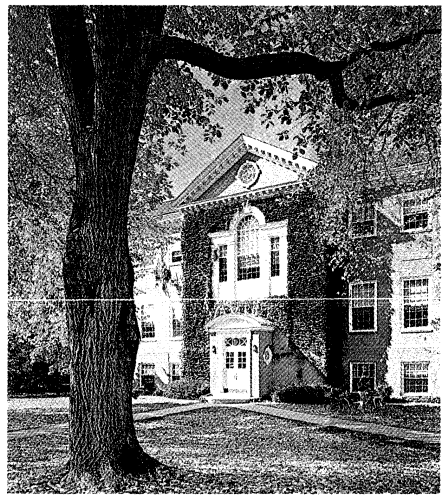
Frederick (I), detail from an oil painting by M. von Mijtens the Younger, *c.* 1730; in Gripsholm Castle, Sweden

By courtesy of the Svenska Portrattarkivet, Stockholm

Frederick was the eldest surviving son of the landgrave of Hesse-Kassel. He fought bravely for England during the War of the Spanish Succession (1701–14). His marriage in 1700 to Louise of Prussia ended with her death in 1705, and in 1715 he married Ulrika Eleonora, sister of Charles XII of Sweden, after first proposing in 1708. She succeeded to the Swedish throne at the death of Charles XII in 1718, but, devoted to Frederick, she abdicated in his favour in 1720, and he was elected king as Frederick I with the aid of anti-absolutist parliamentary forces that had earlier been instrumental in the election of Ulrika, who then inaugurated the Age of Freedom.

During his 31-year reign, Frederick I was virtually powerless, devoting his time to hunting and love affairs. He had several children by his mistress Hedvig Taube, his marriage with Ulrika being childless.

Frederick, city, seat (1748) of Frederick County, north central Maryland, U.S., on a tributary of the Monocacy River, 45 mi (72 km) west of Baltimore. Settled in 1733 and laid out in 1745 as Frederick Town, it was supposedly named for Lord Baltimore's son, Frederick Calvert. The British Stamp Act received its first repudiation from jurists in the



The Joseph Henry Apple Library, Hood College, Frederick, Md.

Syd Greenberg—Photo Researchers

County Court House (Nov. 23, 1765). During the Revolution, Frederick sent two companies of minutemen to Boston and supplied 1,700 men to support George Washington at Valley Forge.

Although victorious at the Battle of Monocacy (July 9, 1864), fought to the south at Frederick Junction, Confederate forces were delayed long enough for Union reinforcements to reach the city of Washington. Following the battle, Confederate Gen. Jubal Early levied a $200,000 ransom on the city to avoid its destruction; the last bond on this debt was not redeemed until Oct. 1, 1951.

The city is an agricultural trading and small manufacturing centre nationally known for its lime-cement products and brushes. Fort Detrick U.S. Army Research Laboratory (1943) is also an important economic factor. Institutions include Hood College (1893), Frederick Community College (1957), and the Maryland School for the Deaf (1867).

Francis Scott Key, author of "The Star Spangled Banner," was born nearby and was buried in Mt. Olivet Cemetery. Chief Justice Roger Brooke Taney, who delivered the Dred Scott Case decision (1857) that made slavery legal in the territories, lived in Frederick, and his house (1799) contains Taney and Scott Key mementos. Barbara Fritchie's reputed taunting of "Stonewall" Jackson's "rebel hordes" marching through Frederick has been eternalized in John Greenleaf Whittier's poem "Barbara Frietchie"; her house has been reconstructed as a museum. Inc. 1833. Pop. (1980) 27,557.

Frederick, PRINCE OF WALES: *see* Frederick Louis, prince of Wales.

Frederick BARBAROSSA: *see* Frederick I *under* Frederick (Germany/Holy Roman Empire).

Frederick OF LORRAINE: *see* Stephen IX *under* Stephen (papacy).

Frederick THE FAIR: *see* Frederick *under* Frederick (Holy Roman Empire).

Frederick THE GENTLE: *see* Frederick II *under* Frederick (Saxony).

Frederick THE GREAT: *see* Frederick II *under* Frederick (Prussia).

Frederick THE MILD: *see* Frederick II *under* Frederick (Saxony).

Frederick THE PIOUS: *see* Frederick III *under* Frederick (Palatinate).

Frederick THE RIGHTEOUS: *see* Frederick IV *under* Frederick (Palatinate).

Frederick THE WARLIKE: *see* Frederick I *under* Frederick (Saxony).

Frederick THE WISE: *see* Frederick III *under* Frederick (Saxony).

Frederick, Empress: *see* Victoria, German Empress.

Frederick Augustus, German FRIEDRICH AUGUST, name of electors and kings of Saxony, grouped below chronologically and indicated by the symbol •.

- **Frederick Augustus I** (elector): *see* Augustus II *under* Augustus (Poland).
- **Frederick Augustus II** (elector): *see* Augustus III *under* Augustus (Poland).
- **Frederick Augustus I** (b. Dec. 23, 1750, Dresden, Saxony—d. May 5, 1827, Dresden), first king of Saxony and duke of Warsaw, who became one of Napoleon's most loyal allies and lost much of his kingdom to Prussia at the Congress of Vienna.

Succeeding his father in 1763 as the elector Frederick Augustus III, he brought order and efficiency to his country's finances and administration. In foreign policy, he was neutralist but drifted toward Prussia, whose side he took in the Bavarian succession dispute (1778–79), when it prevented Bavaria's cession to Austria. For his cooperation he received substantial financial compensation from Prussia. In 1785, Frederick Augustus joined the Prussian-sponsored Fürstenbund (League of Princes), but remained neutral during the Austro-Prussian dispute in 1790. Offered the Polish crown in 1791, he declined. The next year Saxony reluctantly joined the coalition against Revolutionary France but was defeated by 1796. Again entering the struggle on Prussia's side in 1806, after the decisive defeat at Jena in the same year, Frederick Augustus made peace with Napoleon, which secured the title of king of Saxony for him. A year later, Napoleon secured the grand duchy of Warsaw for him. Frederick Augustus remained a loyal ally to France even after the disastrous Russian campaign (1812–13). Although he had started half-hearted negotiations with Austria, he broke them off after the French victory at Lützen (May 1813). In the Battle of Leipzig (October 1813), however, his troops went over to Prussia and he was taken prisoner. At the Congress of Vienna in 1815, Frederick Augustus lost three-fifths of his territory to Prussia. He spent the rest of his life attempting to rehabilitate his truncated state.

• **Frederick Augustus II** (b. May 18, 1797, Dresden, Saxony—d. Aug. 9, 1854, the Tirol, Austria), reform-minded king of Saxony and nephew of Frederick Augustus I, who favoured German unification but was frightened into a reactionary policy by the revolutions of 1848–49.

Frederick Augustus II of Saxony, detail from an engraving, 1854

By courtesy of the Staatsbibliothek, West Berlin

Frederick Augustus shared the regency with his uncle, King Anton, from 1830 to 1836, when he succeeded to the throne. The constitution of 1831, granting a measure of representative government, was partly his work. He continued to advocate reform after his accession but, lacking resolution, accomplished very little. Frederick Augustus sympathized with the plan for German unity espoused by the Frankfurt National Assembly in 1848, though he refused to accept that body's liberal draft constitution. This refusal led to the Dresden revolt in May 1849, which was crushed only with the aid of Prussian troops. Thereafter, F.F. von Beust, a reactionary enemy of Prussia and friend of Austria, brought Saxony wholly into the Austrian camp. After the abortive revolution, Frederick Augustus became less and less active in the government of his state. Always an enthusiastic amateur botanist, who had travelled extensively in Europe pursuing this hobby, he died as the result of an accident on one of his expeditions to the Tirol.

Frederick Charles, PRINCE OF PRUSSIA, byname THE IRON PRINCE, German FRIEDRICH KARL, PRINZ VON PREUSSEN, or DER EISERNE PRINZ (b. March 20, 1828, Berlin—d. June 15, 1885, Klein Glienicke, near Potsdam, Ger.), Prussian field marshal, victor in the Battle of Königgrätz (Sadowa) on July 3, 1866.

Frederick Charles, 1875

By courtesy of the Staatsbibliothek, West Berlin

The eldest son of Prince Charles of Prussia and nephew of the future German emperor William I, Frederick Charles was educated from childhood for a military career. He became a colonel in 1852 and a major general in 1854, in which year he married Princess Marie Anne of Anhalt.

In 1861 he was made a general of cavalry and in 1864 fought capably against Denmark. At Königgrätz on the Bohemian front in the Seven Weeks' War, he commanded the Prussian 1st Army, which had the major responsibility for the decisive victory over Austria.

During the Franco-German War of 1870–71, Frederick Charles commanded the 2nd Army. In the early fighting he drove Marshal A.F. Bazaine's French forces back into Metz, and on Oct. 27, 1870, he received the capitulation of that city. He was promoted to field marshal the following day. Subsequently he captured Orléans, thoroughly disrupted the French Army of the Loire, and broke up Gen. A.E.A. Chanzy's part of that force at Le Mans.

Despite the success of the Metz operations, they were costly in German manpower and were otherwise open to criticism. The Prince's forceful character and tactlessness, moreover, resulted in friction with Gen. K.F. von Steinmetz, commander of the 1st Army. Whatever his personal shortcomings, Frederick Charles is remembered for his genuine military ability.

Frederick Henry, PRINCE OF ORANGE, COUNT OF NASSAU, Dutch FREDERIK HENDRIK, PRINS VAN ORANJE, GRAAF VAN NASSAU (b. Jan. 29, 1584, Delft, Holland—d. March 14, 1647, The Hague), the third hereditary stadholder (1625–47) of the United Provinces

Frederick Henry, detail of a painting by Gerrit van Honthorst; in the Mauritshuis, The Hague

By courtesy of the Mauritshuis, The Hague

of the Netherlands, or Dutch Republic, the youngest son of William I the Silent and successor to his half-brother Maurice, prince of Orange. Continuing the war against Spain, Frederick Henry was the first of the House of Orange to assume semimonarchical powers in foreign as well as domestic policies.

Early life. Frederick Henry was born less than half a year before the murder of his father, William the Silent, the principal leader of the Dutch struggle for independence from Spain.

As a younger son, he was destined by his mother, a daughter of the Huguenot leader Gaspard de Coligny, for a career in her native France; but his half brother, Maurice of Nassau—who had succeeded their father as stadholder—as well as the States General, insisted that Frederick Henry serve his country. He was accordingly educated at the University of Leiden and made a member of the council of state at the age of 17. He began to take part in most of Maurice's military expeditions and was sent on various foreign missions. During the politico-religious crisis of the years 1617–19, precipitated by a doctrinal conflict within the Reformed (or Calvinist) Church, Frederick Henry, like his mother, kept cautiously to the middle of the road.

Until the age of 40, Frederick Henry was reputed to be "too fond of women to tie himself permanently to one of them" but under strong pressure from Maurice, who had no legitimate offspring, and, almost at the latter's deathbed, he married. His wife, a lady-in-waiting to the exiled queen of Bohemia, soon acquired a fair amount of political influence as well as a universal reputation for venality, but she also managed to endow The Hague in the 17th century with some semblance of Baroque court life.

Stadholder. At Maurice's death, in 1625, Frederick Henry became stadholder in five of the seven United Provinces; a sixth, Groningen, was added in 1640. Even in Friesland, the eventual succession to the office of stadholder was assigned to Frederick Henry's son, William (born 1626). Although in theory no more than the appointed "servants" of the different assemblies of the estates, provincial and general, the princes of Orange, by establishing hereditary succession to the various stadholderships, were clearly on their way to acquiring the status of sovereigns. In view of Frederick Henry's anomalous, somewhat awkward position as a minor princeling at the helm of the government of a federation of oligarchic republics, anachronistically flourishing in a world drifting toward absolutism, his ambition was normal.

As a strategist, Frederick Henry proved himself to be the foremost disciple of his brother, Maurice, and the Dutch wars against the Spanish continued to be considered a kind of military academy for young European noblemen. The Prince's universally recognized strength lay in capturing fortified "places"; once he was even heard to exclaim: "God deliver us from pitched battles," and every one of his yearly campaigns had the conquest of some important town or fortress as its aim. Hence, the borderline between the modern kingdoms of Belgium and The Netherlands came to be drawn largely according to Frederick Henry's successes and failures.

By far the most spectacular of these sieges was that of Hertogenbosch, but if the capitulation of this city marked Frederick Henry's proudest moment, it also demonstrated the inherent weakness of his position. Although his contemporaries present the prince as little short of omnipotent in the Dutch Republic, his power was based on the delicate balancing of various elements. To counterbalance the oligarchy in Holland, which contributed more than 58 percent to the federal budget, the prince needed the support of the six minor members of the United Provinces and that of the Puritan masses of the country, including those in Holland.

Although not irreligious, Frederick Henry was, like his father, a champion of as far-reaching a religious tolerance as circumstances allowed. In this respect he displayed, paradoxically, a much closer affinity with his political opponents, the Holland oligarchy, than he did with his traditional supporters. Yet as far as policymaking was concerned, this affinity was of little avail; for the Hollanders remained stubbornly opposed to a costly war, which, moreover, if waged too successfully, threatened to reintegrate the port of Antwerp as a formidable rival for Amsterdam into the political body of the free Netherlands. To make his yearly campaigns politically acceptable absorbed almost more of Frederick Henry's energies than the campaigns themselves. Clever tactician that he was, he managed, however, unlike his brother, Maurice, before and his son, William II, after him, to avoid an open conflict with the assembly of Holland.

Until about 1640, Frederick Henry alone was responsible for the United Provinces' foreign policy. From the dynastic point of view, his activities were crowned by the marriage in 1641 between his heir, William II, and Mary, the eldest daughter of Charles I of Great Britain. Consequently, during the English Civil War, the stadholder sided unconditionally with the

King, whereas the Holland oligarchy favoured Parliament.

French alliance. More important was Frederick Henry's French policy, culminating (1635) in the so-called treaty of partition between the two countries and stipulating a partitioning of the southern Netherlands, if conquered by arms from the Spanish. The treaty further provided for the yearly payment of a considerable French subsidy, thus enabling the prince to continue the war in spite of the reluctance of the war-tired assembly of Holland to finance it. But the very first campaign of the French and Dutch armies combined under Frederick Henry's command nearly ended in disaster, and, in spite of his conquests of the cities of Breda and Hulst, the alliance never regained its momentum. The trend toward peace with Spain became more and more irresistible, and, largely through the influence of his wife, even Frederick Henry was eventually won over to the peace party. Prematurely aged after long years of suffering from gout, he did not live to see the peace officially concluded in January 1648. He died in March 1647 and was interred with great pomp in the family vault at Delft.

(J.J.P.)

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Frederick Louis, PRINCE OF WALES, German FRIEDRICH LUDWIG (b. Jan. 6, 1707, Hannover, Hanover—d. March 20, 1751, London), eldest son of King George II of Great Britain (reigned 1727–60) and father of King George III (reigned 1760–1820); his bitter quarrel with his father helped bring about the downfall of the King's prime minister, Sir Robert Walpole, in 1742.

After his grandfather became king of Great Britain as George I in 1714, Frederick was betrothed to Wilhelmina Sophia Dorothea, daughter of Frederick William I, king of Prussia, but the match was prevented by the ill will between the parents. On the accession of George II (1727) Frederick returned to England, was created duke of Cornwall, and in 1729 became prince of Wales.

The relations between father and son deteriorated rapidly, the chief bone of contention being the King's refusal to make Frederick an adequate allowance. In 1735 the Prince wrote or inspired the *Histoire du Prince Titi,* which contained offensive caricatures of both the King and Queen. After Frederick married Augusta, daughter of Frederick II, duke of Saxe-Gotha, in April 1736, George II proposed to give his son an allowance of £50,000 a year, but this Frederick considered inadequate. The breach became irreparable when Frederick allowed his opposition friends to raise the matter, unsuccessfully, in Parliament (1737). He went to the length of refusing to allow his first child to be born under the parental roof, carrying off his wife, almost in labour, from Hampton Court.

Frederick Louis, detail of a portrait by Philip Mercier, *c.* 1736–38; in the National Portrait Gallery, London

By courtesy of the National Portrait Gallery, London

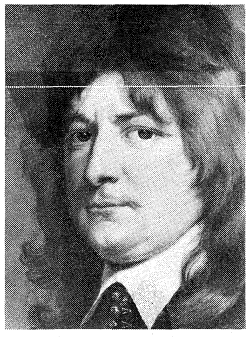
After this insult, Frederick was banned from the court, and foreign ambassadors were told not to visit him. His new home, Leicester House, became a centre for political opposition. Frederick hated Sir Robert Walpole in particular; after Walpole's downfall he was formally reconciled with his father but continued until his death to intrigue against all George's ministers. In 1745 George refused to allow him to command the army against the Jacobites.

Frederick having died in 1751, his eldest son, George, succeeded to the throne as George III in 1760.

Frederick William, German FRIEDRICH WILHELM, name of rulers grouped below by country and indicated by the symbol •.

BRANDENBURG

• **Frederick William,** byname THE GREAT ELECTOR, German DER GROSSE KURFÜRST (b. Feb. 16, 1620, Cölln, near Berlin—d. May 9, 1688, Potsdam, near Berlin), elector of Brandenburg (1640–88), who restored the Hohenzollern dominions after the devastations of the Thirty Years' War—centralizing the political administration, reorganizing the state finances, rebuilding towns and cities, developing a strong army, and acquiring clear sovereignty over ducal Prussia. All these measures contributed to the foundation of the future Prussian monarchy.



Frederick William, the Great Elector, portrait by Adriaan Hanneman; in the castle at Dessau, Ger.

Foto Marburg—Art Resource/EB Inc.

Frederick William was the eldest son of the elector George William and Elizabeth Charlotte of the Palatinate, a granddaughter of William the Silent, prince of Orange.

He grew up amid the chaos of the Thirty Years' War, in which Brandenburg suffered particularly heavily, and was forced to spend his childhood years far from the Berlin court in the fortress of Küstrin, where he was educated in the Calvinist faith. His stay in Holland between his 14th and 18th years, the time divided between the University of Leiden and the court of his future father-in-law, Frederick Henry of Orange, at The Hague, left him with lasting impressions. The future elector was, above all, impressed by Holland's imposing maritime and commercial power, as well as by its pioneering achievements in military technology and organization. He retained a marked preference for Dutch architecture and agriculture and a strong desire to open Brandenburg to international commerce and maritime trade.

Early years of reconstruction. When Frederick William, completely inexperienced in politics, succeeded his father as elector in December 1640, he took over a ravaged land occupied by foreign troops. Under his father's powerful favourite, Graf Adam von Schwarzenberg, Brandenburg had changed sides from the Swedes to the Habsburgs and had thus been drawn into the struggle on both sides. Residing until 1643 not in Brandenburg, the heartland of his domain, but rather in Königsberg (since 1945 Kaliningrad, U.S.S.R.), the capital of the remote Duchy of Prussia, the Elector at first pursued a policy of cautious neutrality in order to escape the pressure of the rival powers. He discharged the Brandenburg troops in the service of the Habsburg emperor and concluded an armistice with Sweden.

He soon recognized, however, that without an army he could never become master in his own house. In 1644, at the beginning of negotiations to conclude the Thirty Years' War, he had already started to organize his own military force. Though his army was small, Brandenburg could not support it without requisitioning funds from the Duchy of Cleves, in the west, and from the Duchy of Prussia. For the first time Brandenburg's territories, united only by their allegiance to the person of the Elector, were drawn together for a political purpose. The standing army was the first institution used by the increasingly absolutist rulers of Brandenburg to combat the privileges of the estates of the individual territories. It was never entirely disbanded and became the core of the 18th-century Prussian army.

This army was not big enough to allow Frederick William to conduct an independent foreign policy. Moreover, his marriage in 1646 to Louise Henriette of Orange failed to bring the anticipated Dutch support. Lacking the support of friendly great powers at the peace congress of Westphalia in 1648, he did not attain his aim of acquiring all of Pomerania, with the Oder estuary and the important harbour of Stettin (since 1945 Szczecin). He had to be content with eastern Pomerania, the secularized dioceses of Minden and Halberstadt, and the promise of the archbishopric of Magdeburg, all of which were, however, important as links to his western German possessions.

After seven years of peaceful reconstruction, Frederick William saw his political and military ability put to a difficult test with the outbreak of the First Northern War (1655–60). By invading Poland, King Charles X Gustav of Sweden sought to expand the power in the Baltic that Sweden gained by the Peace of Westphalia. Frederick William, as duke of Prussia, owed fealty to the Polish king, but, when offered an alliance by Sweden in return for control over the East Prussian ports, the Elector chose armed neutrality. When Charles Gustav rapidly overran Poland and advanced against East Prussia, Frederick William had to exchange Polish for Swedish suzerainty and provide armed support to Charles Gustav. In the three-day Battle of Warsaw in July 1656, the untried army of Brandenburg, under the Elector's command, passed its test of fire. To keep the Elector on his side, the Swedish king granted him full sovereignty over the Duchy of Prussia. This did not prevent Frederick William, when Sweden's military position deteriorated, from entering into negotiations with Poland, which now renounced suzerainty over East Prussia. With his new allies, Poland and the Habsburg emperor, the Elector drove the Swedes from western Pomerania. French intervention, however, forced Frederick William once again to give up his Pomeranian conquests. Ratified in the Treaty of Oliva in 1660, this renunciation was balanced by confirmation of the Elector's full sovereignty over the Duchy of Prussia.

The Elector's ability to gain his ends arose not only from the ease with which he changed sides but also from his success in forcing the provincial estates to support the standing army independently of tax appropriations by the diets. In the second half of his reign, he removed control of taxation and finances from the estates altogether, thereby laying the groundwork for the powerful bureaucracy of later Prussian absolutism, with its standing army, fixed taxes, and an officialdom dependent on the sovereign alone.

Attempts to establish balance of power. The year 1661, in which Louis XIV assumed the reins of government in France, ushered in an era of vast power struggles in Europe. In the conflict erupting between Austria and Spain, on the one side, and France and Sweden, on the other, the Elector hoped to maintain the balance of power by preventing either side from achieving predominance. He sought not a simple policy of neutrality but rather, as he recommended to his successor in his political testament of 1667, to advance the interests of his house by always joining the weaker power against the stronger. Here lies the basis for the continual shifts in his policy of alliances: "Brandenburg's intermittent fever," which became proverbial in the 17th century.

In 1672, when Louis XIV prepared for the invasion of Holland, Frederick William, still true to his policy of supporting the weaker power, allied himself with the Dutch states-general. Their sole European ally, he concluded an aid agreement with them, fully aware of the danger from France to his territories of Cleves on the lower Rhine. But after the unexpectedly rapid collapse of the Netherlands forced him to make a separate peace with France in 1673, the Elector adopted a policy of neutrality, which he abandoned only when the Holy Roman Empire declared war against France. In July 1674 he joined the alliance of the Habsburg emperor, Spain, and the Netherlands. Frederick William's military expectations were disappointed by the slow progress of the allies on the upper Rhine. He also suffered a more serious personal loss with the death of the gifted young heir to the throne, Karl Emil.

When the Swedes invaded Brandenburg, the Elector turned northward, and under his command his army, in June 1675, scored its first independent victory. In a contemporary folk song Frederick William was for the first time called the "Great Elector." In the same year, allied with the Emperor and with Denmark, he once more began to retrieve the spoils of the Thirty Years' War from the Swedes. For the second time he gained western Pomerania by the sword, only to lose it again under French pressure. Abandoned by his allies, he had to yield the fruits of his victory in the Peace of Saint-Germain-en-Laye in 1679.

Later policies. Frederick now decided to gain in alliance with France what he could not obtain by opposing it. In 1679 he concluded a secret pact with France, committing himself, in return for large subsidies, to support French candidates in the next elections for king of Poland and for emperor. The alliance endured as long as the Elector believed that Louis XIV would help him gain possession of western Pomerania. When he realized that this hope was vain, Frederick William changed political partners, for the last time, in 1685. The Elector's disillusionment with Louis XIV coincided with the assumption by William of Orange (later King William III of Great Britain) of his historical role as founder of the Grand Alliance. against Louis XIV. The Elector, impressed that William was a prince of Orange and his own nephew, concluded a defense pact with the Netherlands in 1685. He drew still closer to William's side with the issuance of the Edict of Potsdam on Nov. 8, 1685, in which he granted asylum to all Huguenots expelled from France by Louis XIV after the revocation of the Edict of Nantes. Thus, at the end of his life, the Great Elector returned to the political ties of his early years. He did not live to witness the great shift in the European balance of power that his nephew was to effect through his landing in England and his succeeding the Catholic Stuart King James II. But he was aware of William's plans when he died in 1688, the year of England's Glorious Revolution.

Legacy. The Great Elector bequeathed to his son Frederick (after 1701, Frederick I, king of Prussia) a well-organized state, widely respected for its sound finances and efficient army. Frederick William had gone far toward integrating his inherited and acquired territories by establishing national institutions and central administrative bodies. He did, however, endanger the further integration by endowing the children of his second marriage, contracted in 1668 with Dorothea of Holstein-Glücksburg, with semi-autonomous principalities. Many of his ambitious plans were not realized. Just as he was unable to provide a pathway to the Baltic for his country, his attempt to establish a colony on the Guinea coast of Africa remained only an episode in Brandenburg–Prussian history. He was far more successful in the economic field. The systematic colonization of the sparsely populated country, the improvement of trade routes through canal construction, and the establishment and operation of factories after the mercantilist model were begun under Frederick William. In this area, too, the Elector established a tradition that was broadened by his 18th-century successors.

Frederick William adopted the so-called government in council form of monarchical rule, whereby the ruler exercised his power with the aid of his principal council and functioned almost as a president. He always listened to his advisers' opinions but made all important decisions himself.

The political views of all rulers of that period were rooted in religion. For the Great Elector royal power was a God-given duty, a common Christian viewpoint that was given a special character by the Elector's Calvinist beliefs, which bind the ruler, just as the least of his subjects, to prove himself visibly in his daily duties. Here lies the religious basis of Frederick William's ambition for political power and of his immense, yet restrained, energy, which is still evident today in Andreas Schlüter's famous equestrian statue of the Great Elector in Berlin. (S.Sk.)

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HESSE-KASSEL

• **Frederick William** (b. Aug. 20, 1802—d. Jan. 6, 1875, Prague), elector of Hesse-Kassel from 1847 after 16 years' co-regency with his father; he was noted for his reactionary stand against liberalizing trends manifested during the revolutionary events of 1848. In 1850 he re-instated an unpopular adviser, Hans Daniel Hassenpflug, who called on the German Confederation to restore by force the authority of the elector. At the end of the Seven Weeks' War (1866), in which he sided with Austria, he was deposed, and his lands were seized by the victorious Prussians.

PRUSSIA

• **Frederick William I** (b. Aug. 15, 1688, Berlin—d. May 31, 1740, Potsdam, Prussia), second Prussian king who transformed his country from a second-rate power into the efficient and prosperous state that his son and successor, Frederick II the Great, made the dominant military power on the Continent.

The son of the elector Frederick III, later Frederick I, king of Prussia, Frederick William grew up at a glamorous court, but his own temperament was ascetic, and he disapproved of the court's dissolute atmosphere. In 1706 he was married to Sophia Dorothea, the daughter of George Louis, elector of Hanover (later George I of England). His experiences in the War of the Spanish Succession (1701–14) decisively shaped his future; he realized that the army was his vocation, and he met Prince Leopold I of Anhalt-Dessau, who became his lifelong friend and principal adviser in military matters.

Frederick William I, detail from a portrait by Antoine Pesne, *c.* 1733; in Sanssouci Palace, Potsdam, Ger.
Foto Marburg—Art Resource/EB Inc.

Frederick William was to spend the rest of his life building the Prussian Army into Europe's best fighting instrument. Realizing that Prussia's military and financial weakness made it dependent on the relations between the great powers, Frederick William resolved to make his state financially independent.

In 1713 Prussia's armed forces numbered 38,000 men, supported in large part by foreign subsidies. When Frederick William died in 1740, he left his son an army of about 83,000 out of a population of 2,200,000, a war chest of more than 8,000,000 taler, and a Prussia that had become the third military power on the Continent, after Russia and France.

The canton system of recruitment and replacement, a mild form of draft introduced in 1733, provided one-half the manpower of Frederick William's army. The rest of the soldiers were recruited from all over Europe. Frederick William also created from his fractious nobility the loyal Prussian officer corps. Prince Leopold of Anhalt-Dessau, a brutal, if efficient, drillmaster, provided the instrument wielded by these officers—the Prussian infantry, which could outmarch and outshoot all others.

The need for funds, coupled with Frederick William's genuine concern for his subjects, led to a number of sweeping reforms and innovations. A thrifty, practical Protestant, the King on his accession all but dissolved his extravagant court. Prussia's eastern territories, depopulated by the plague of 1709, were resettled and made prosperous once again. The lot of the peasantry improved. In his own domains, which eventually comprised one-third of all the land, Frederick William freed the serfs completely (1719) and abolished hereditary leases. In 1717 a yearly tax replaced the aristocracy's feudal war service. Against considerable opposition, he levied additional taxes in Prussia and Lithuania. Prussia's commercial policies were strictly mercantilist, encouraging industry and manufacture, especially the wool industry, which clothed the King's army. Con-

vinced that an efficient state could not afford illiterate subjects, Frederick William instituted compulsory primary education in 1717. In 1723 he centralized his administration under a general directory through which his ministers executed his orders. Near the end of his reign, he initiated a program of extensive legal codification. Thus, Frederick William left his heir an efficient, centralized state with sound finances and an excellent army.

Frederick William's foreign policy proved to be much less effective than his domestic programs. He acquired Swedish Pomerania by the Treaties of Stockholm (1719–20), but his lifelong ambition, the incorporation of the duchies of Jülich and Berg on the lower Rhine, remained unfulfilled. Relations with Austria and England cooled considerably and by 1739 Prussia's only ally was France.

• **Frederick William II** (b. Sept. 25, 1744, Berlin—d. Nov. 16, 1797, Berlin), king of Prussia from Aug. 17, 1786, under whom, despite his lack of exceptional military and political gifts, Prussia achieved considerable expansion.

Frederick William II, pastel by Johann Heinrich Schröder
Foto Marburg—Art Resource/EB Inc.

The son of Frederick the Great's brother Augustus William, he became heir presumptive on his father's death in 1758. He was intellectually receptive and devoted to the arts, but when he succeeded Frederick the Great as king, he was unable to perpetuate his uncle's system of personal government; the direction of the Prussian state fell to a few favourites. Nevertheless Prussia grew: it acquired Ansbach and Bayreuth when the margrave Charles Alexander renounced his territories (1791), and it gained Danzig (Gdańsk), Thorn (Toruń), and a large part of central Poland (including Warsaw) in the Second (1793) and Third (1795) Partitions of that country.

In foreign affairs Frederick William cooperated with the Holy Roman emperor Leopold II and entered into an Austro-Prussian alliance (Feb. 7, 1792), chiefly because of a common opposition to the French Revolution. In the War of the First Coalition, Frederick William's preoccupation with getting his share of Poland led him to conduct the war halfheartedly, and in 1795 he withdrew from the coalition by concluding the separate Treaty of Basel. In domestic affairs the King gained easy popularity by abolishing the state monopoly on coffee and tobacco, although the loss of revenue had to be made good by increasing the excise duty on beer, flour, and sugar. Frederick William's most notorious domestic measure was the *Religionsedikt* ("Religious Edict") of 1788, largely the work of his favourite, Johann Christoph von Wöliner. It gave legal recognition to the principle of toleration while restricting the freedom of religious instruction and binding the clergy to a narrow Protestantism. Although it was zealously enforced (Immanuel Kant was reprimanded and several important journals moved abroad to avoid censorship), the act proved ineffective. A notable law code (*Allgemeines Preussisches Landrecht*) including various liberal statutes, however, was promulgated (1794).

Under Frederick William cultural activities flourished, mostly in Berlin. Painting, architecture, and the theatre were encouraged, and especially music: Mozart and Beethoven visited the King and dedicated chamber music to him, and Frederick William himself played the cello.

He contracted two dynastic marriages, the first of which was dissolved. During the lifetime of both his royal consorts he also contracted two morganatic marriages. His son by the second of these wives, Sophia Juliana, Gräfin Dönhoff, was the future statesman Friedrich Wilhelm, Graf von Brandenburg.

• **Frederick William III** (b. Aug. 3, 1770, Potsdam, Prussia—d. June 7, 1840, Berlin), king of Prussia from 1797, the son of Frederick William II. Neglected by his father, he never mastered his resultant inferiority complex, but the influence of his wife, Louisa of Mecklenburg-Strelitz, whom he married in 1793, occasionally moved him outside his essentially pedestrian character.

His policy of neutrality in the Wars of the Second and Third Coalitions accelerated the decline of Prussia's prestige. Domestic reforms before the Battle of Jena foreshadowed later reforms without, however, altering the absolutist structure of the state. Until 1807 he clung to the traditional cabinet government, influenced by mediocre personages. After the military collapse of 1806–07 and the loss of all provinces west of the Elbe River, he finally realized that Prussia would have to make decisive changes. He therefore sanctioned the reforms proposed by Prussian statesmen such as Karl Stein and Karl von Hardenberg, but these amounted only to a reform of the higher bureaucracy, not of the royal prerogative. The King never lost his fear that reform might lead to "Jacobinism," and he could not tolerate outstanding men as advisers. Through the War of Liberation (1813–15) he remained remote from his people's ardour, being always subservient to the Russian emperor Alexander I and in harmony with the Austrian statesman

Frederick William III, detail from a portrait by Sir Thomas Lawrence, 1818; in Windsor Castle, Berkshire
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Klemens von Metternich. In the crisis of the Vienna Congress over the partition of Saxony, he sided with Alexander I, thus bringing Prussia to the brink of war against England, France, and Austria (January 1815). The final compromise allowed Prussia to acquire the Rhine province, Westphalia, and much of Saxony. In contrast to these territorial gains, the last 25 years of Frederick William's reign show a downward trend of Prussia's fortunes, to which his personal limitations largely contributed.

• **Frederick William IV** (b. Oct. 15, 1795, Cölln, near Berlin—d. Jan. 2, 1861, Potsdam, Prussia), king of Prussia from 1840 until 1861, whose conservative policies helped spark the Revolution of 1848. In the aftermath of the failed revolution, Frederick William followed a reactionary course. In 1857 he was incapacitated by a stroke, and his brother, the future William I, became regent (1858–61).

Frederick William IV, detail from a portrait by Franz Krüger; in Monbijou Palace, Berlin
Foto Marburg—Art Resource/EB Inc.

Early life. Frederick William was the son of the future king Frederick William III and Louisa of Mecklenburg-Strelitz. He was educated by tutors, mainly experienced civil servants. Though he was completely unsoldierlike by nature, his experiences in the German War of Liberation (1813–15) against Napoleon left lasting traces on his political and intellectual development. He became and remained a disciple of the German Romantic movement, with its nostalgia for the Middle Ages. Romanticism appealed to his extremely sensitive dilettante artistic nature. A draftsman interested in architecture and landscape gardening, he was a patron of Christian Daniel Rauch, a noted sculptor, and Karl Friedrich Schinkel, an architect and city planner. His marriage in 1823 to Elizabeth of Bavaria, a convert to Lutheranism, proved happy, although they had no children.

As crown prince, Frederick William developed romantic-conservative convictions that led him to approach even politics as a question of ideas and problems rather than as a matter of hard reality. Conservative philosophers, men of letters, and politicians were among his friends and the men he admired. Even though barely 20, he used his influence to restrict the promised constitution of 1815 to the creation of district and provincial estates, in which the landed aristocracy had an overwhelming majority. For him liberalism meant revolution: a modern constitution was "a scrap of paper" interposed as an intolerable barrier between the patriarchal, divinely justified king and his people. Though he was no absolutist and had no genuine will to domination, yet, by his romanticizing mystique and his unlimited respect for the alleged "organic growth" of the medieval estates, he stood irreconcilably opposed to the political ideas of the 19th century and to the heritage of the French Revolution. Tensions were not lessened by his genuine personal piety. As for him, cultural homogeneity outweighed political unity, but he was fundamentally opposed to the movement toward a German national state; after Prussia's occupation by Napoleon, he regarded his country's close alignment with Austria as essential. He never contested the Habsburg empire's primacy, which he saw as consecrated by history; for the king of Prussia he claimed only the military dignity of an "arch-general" of the empire.

Accession. Frederick William quickly disappointed the great hopes aroused by his accession in 1840, for he was by no means willing to fulfill the constitutional aspirations of the Liberals. In 1842 he permitted only "united committees" of the provincial estates; and in 1847, after long delay, he summoned not a popular representative assembly but the United Diet, comprising all the provincial estates, with the right to grant taxes and loans but without the right to meet at regular intervals. This unwieldy body remained his ideal, even though the narrow limits of his concessions immediately produced a conflict (the Diet's refusal of the proposed loan for the Berlin–Königsberg railway) and even though this first assembly of all Prussia powerfully increased the people's self-confidence on the eve of the Revolution of 1848.

Revolution of 1848. Despite belated attempts to organize a common resistance by the German governments, Frederick William was eventually completely overwhelmed by the revolution in March 1848, which was inspired by the revolution of the preceding month in France. He could neither prevent the street fighting in Berlin by last-minute concessions nor ride the wave; after the withdrawal of the troops to barracks, he masked his submission to the revolution by a processional ride through Berlin under the black and red and golden flag, the symbol of the united Germany, by paying homage to the bodies of the victims of the soldiery, and by his promise that "Prussia is henceforth merged in Germany." Finally he had to convene a Prussian national assembly. Under the influence of his entourage, however, he roused himself to a stubborn resistance: he appointed his uncle, the Count of Brandenburg (a son of Frederick William II's last morganatic marriage), prime minister; removed the assembly from Berlin and then dissolved it; and imposed a constitution the first moderately liberal draft of which was modelled on that of Belgium. These measures restored the leading role to the crown and its instruments, the army and the bureaucracy, firmly supported by the recently formed Conservative party.

When, on April 3, 1849, Frederick William refused the imperial crown offered by the national assembly in Frankfurt am Main—because as a true conservative he would accept it only from the German princes—he destroyed the constitution drafted by that assembly. Under Russian and English pressure, moreover, he had withdrawn Prussian support of the rising in the duchies of Schleswig and Holstein, aimed at overthrowing Danish rule there. Next, however, largely contravening his previous policy, he attempted to establish a German union under Prussian leadership (1849–50)—though this, as a "Little German" federation, should remain allied with a "wider" federation embracing Austria. When Austria challenged this union, the King shrank from war, preferring capitulation at the Punctation of Olmütz convention. Though Prussia had to return to the federal Diet at Frankfurt am Main, Prussian leadership of the German customs union, which excluded Austria, remained unchallenged.

In religious affairs Frederick William, in 1841, settled the "Cologne church conflict" on terms very favourable to the Roman Catholics, with whom, largely influenced by his love for the old and picturesque, he had great sympathy; he also furthered the reconstruction of Cologne cathedral. On the other hand, he actively promoted the joint Anglican-Lutheran bishopric of Jerusalem.

Final years. The final years of his reign were a period of reaction. Frederick William, rejecting the bureaucratic absolutism of his prime minister Otto von Manteuffel, worked above all for recasting the constitution of 1848 in a conservative mold. This included the disastrous introduction of three-class suffrage according to income in 1850 instead of universal suffrage, the retention of the monarchical character of army and bureaucracy, the reestablishment of the conservative district assemblies and the provincial diets, and the conversion (1854) of the first chamber into a house of lords entirely dominated by the predominantly aristocratic landowners. He believed this house of lords to be modelled on the English upper house, but in a political testament he implored his successors to refuse to take the oath on the Prussian constitution.

In 1857 a stroke resulted in paralysis. From this time on, with the exception of brief intervals, the King's mind was clouded, and his brother William (afterward emperor) took on the duties of government, becoming regent in 1858. Frederick William died at Sanssouci Palace in 1861. (Ha.He.)

BIBLIOGRAPHY. Although there is no definitive biography, E. Lewalter, *Friedrich Wilhelm IV* (1938), in German, is still indispensable for the study of Frederick.

Frederick William, CROWN PRINCE OF PRUSSIA: *see* Frederick III *under* Frederick (German Empire).

Fredericksburg, city, in, but administratively independent of, Spotsylvania County, northeastern Virginia, U.S., at the head of navigation of the Rappahannock River. The site, settled in 1671, was laid out in 1727 and named for Prince Frederick Louis, father of King George III. It developed as a port with a busy English trade. William Paul, brother of John Paul Jones, set up the first tailor shop there. In 1732 George Washington's father, who owned Ferry Farm (where according to tradition George cut down the cherry tree) across the Rappahannock, bought three lots in the town and became one of its trustees.

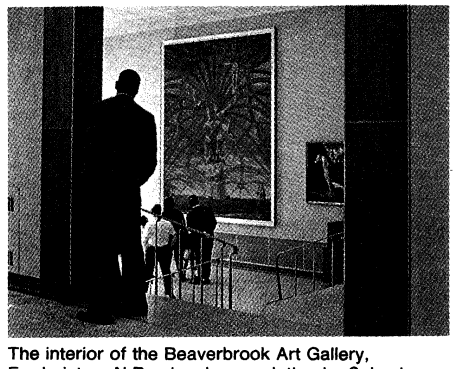
Strategically situated midway between Washington and Richmond, it was a major objective of both sides during the American Civil War and changed hands seven times. A bloody engagement was fought there on Dec. 13, 1862. Before the war ended, three subsequent major battles were fought in the area—those of Chancellorsville (May 1–4, 1863); the Wilderness (May 5–7, 1864); and Spotsylvania Courthouse (May 8–21, 1864). Parts of the four battlefields, a national cemetery with graves of 15,000 Federal soldiers, and a museum are included in the Fredericksburg and Spotsylvania National Military Park (5,000 ac [2,023 ha]).

The city serves an agricultural region (dairy and beef cattle) and has light manufacturing. It is the seat of Mary Washington College (1908) and Germanna Community College (1970). Historic sites include the home and grave of Washington's mother (Mary Ball Washington), the law office of James P. Monroe (later president), the Rising Sun Tavern (*c.* 1760), built by Washington's brother Charles, and the apothecary shop of Hugh Mercer, Washington's friend. George Washington Birthplace National Monument is 38 mi (61 km) east, with James Monroe's birthplace close by. Inc. town, 1781; city, 1879. Pop. (1980) 15,322.

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

Fredericksburg, Battle of (Dec. 13, 1862), bloody engagement of the U.S. Civil War fought at Fredericksburg, Va.; its outcome—a crushing Union defeat—immeasurably strengthened the Confederate cause. Gen. A.E. Burnside, newly appointed commander of the Northern forces, planned to cross the Rappahannock River with an army of more than 120,000 troops and advance on the Southern capital at Richmond. Confederate Gen. Robert E. Lee countered by taking a strong position on high ground behind Fredericksburg with a force of about 78,000. The attack on December 13 proved a complete failure, and Burnside's casualties totalled more than 12,500, compared to only about 5,000 for the carefully entrenched Confederates. General Burnside was relieved of his command the following month and has been severely criticized by historians for his conduct of this battle. Once again the Union had failed in what should have been its main objective—destruction of the army of northern Virginia. Richmond seemed as far away as ever. For the South, the victory restored morale lost after Lee's retreat from Maryland following his unsuccessful Antietam campaign in September.

Fredericton, city, capital (since 1785) of New Brunswick, Canada, and seat of York County, on the Saint John River, 84 mi (135 km) from its mouth in the south central part of the province. Occupying the site of the French Ft. Nashwaak (1692) and the Acadian settlement of St. Anne's Point (1731), it was laid out by United Empire Loyalists (Tories) in 1785 and named after Frederick, son of King George III. After 1825 it became a British garrison town, and its reconstructed military compound has been designated a federal historic site. Now primarily an administrative and educational centre, the city is the seat of the University of New Brunswick (1785; Canada's first university) and St. Thomas University (1910). The city's Anglican Christ Church Cathedral (1845–53) is a replica of the Gothic St. Mary's in Snettisham, Norfolk, Eng. A set of Audubon's bird paintings and a 1783 copy of England's Domesday Book are in the Georgian-style Provincial Legislative Building (1880), and the nearby Beaverbrook Art Gallery has notable 18th–20th century collections, including paintings by Winston Churchill. At King's Landing, 18 mi west, is a full-scale reconstruction of a Loyalist settlement. Also in or near Fredericton are the Royal Canadian Mounted Police regional headquarters, the Canadian Army's Camp Gagetown, and an agricultural research station. The city is the shopping and distributive centre for central New Brunswick; its manufactures include shoes, canoes, lumber products, and bricks.



The interior of the Beaverbrook Art Gallery, Fredericton, N.B., showing a painting by Salvador Dalí

By courtesy of the Canadian Government Travel Bureau, Ottawa; photograph, M. Milne

Fredericton has a noted literary tradition: the Rev. Jonathan Odell (satirist of the American Revolutionary War) lived there, and the novelist Julia Catherine Hart (1796–1867) and the poets Sir Charles Roberts (1860–1945), Bliss Carman (1861–1929), and Francis Sherman (1871–1926) were born in or near there. The Playhouse (home of Theatre New Brunswick) presents drama and musicals year-round. Inc. 1848. Pop. (1981) 43,723.

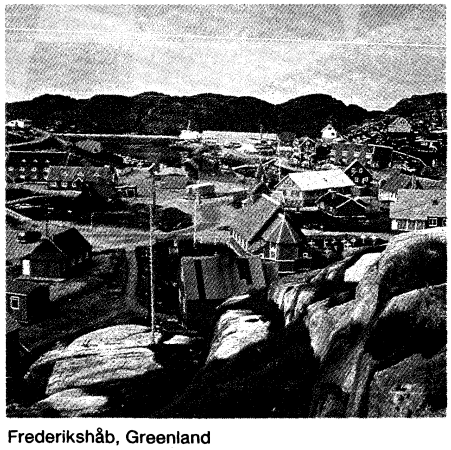
Frederik (Danish, Dutch, Norwegian, etc., personal name): *see under* Frederick.

'rederik Hendrik (Dutch stadholder): *see* 'rederick Henry.

'rederiksberg, independent municipality in 3reater Copenhagen, northeastern Sjælland Zealand), Denmark. It was founded in 1651 ›y Frederick III as a settlement for Dutch ›easants brought to nearby Amager Island. Chartered in 1857, it became encircled by Copenhagen early in the 20th century. It is the site of the Copenhagen Zoo, the Royal Veterinary and Agricultural University (1856), the state broadcasting service, a commercial college, and the Military Academy in the early 18th-century Frederiksberg Slot (castle). The main industries include the Royal Porcelain Factory, the Carlsberg breweries, and cable and wireworks. Pop. (1982 est.) 88,047.

Frederiksborg, *amtskommune* (county), northeastern Sjælland (Zealand), Denmark, between the Isefjord and The Sound (Øresund). Its undulating surface of glacial sands and clays is lake strewn and well wooded, and the fertile loams support prosperous mixed farming. The *amtskommune* (area 520 sq mi [1,346 sq km]) was named after Frederiksborg Slot (castle; 1560) in Hillerød; the castle is now a national history museum. Its administrative centre is Hillerød, and its largest city is the port of Helsingør (*q.v.*). Kronborg Slot (castle) near Helsingør once controlled the northern entry into The Sound. Fredensborg Castle (built 1719–26), northeast of Hillerød, is the royal residence during the autumn. Pop. (1982 est.) 329,815.

Frederikshåb, Greenlandic PÂMIUT, or PAAMIUT, town, southwestern Greenland, on the Atlantic coast at the mouth of 30-mi- (48-km-) long Kvanefjord and south-southeast



Frederikshåb, Greenland

By courtesy of the Royal Danish Ministry of the Foreign Affairs, Copenhagen; photograph, Peter Juul

of Frederikshåbs Isblink (ice field), a navigation landmark. It was founded in 1742. Seal hunting, fishing, and sheep raising are the main occupations, and there is a weather and radio station. Pop. (1982) 2,318.

Frederikshavn, city and port, Nordjyllands *amtskommune* (county), northern Jutland, Denmark, on the Kattegat (strait), east of Hjørring. A fishing village in the 16th and 17th centuries, it was fortified (Fladstrand Citadel) in the late 17th century to secure the route to Norway. The name was changed to Frederikshavn when it was chartered (1818). Shipping connections with Norway and Sweden make it an important centre for overseas trade, shipbuilding, fishing and related industries, and a transit point for tourists. The powder magazine of the 17th-century citadel remains and houses a military museum. The nearby 18th-century manor house of Bangsbo, former home of statesman Johan Knudsen (1865–1942), also houses a museum. Pop. (1981) city, 24,938; (1982 est.) mun., 35,398.

Frederiksted, also called WESTEND, town on the west coast of St. Croix, U.S. Virgin Islands, 17 mi (27 km) southwest of Christiansted. Historically, the town was a mercantile centre for the sugar-based economy of St. Croix because of its deep-sea port and warehouse facilities. Innovations in cargo handling, the termination of the sugar industry, and the improvement of facilities at Christiansted in the 1960s and 1970s led to the town's economic decline. The deepwater roadstead harbour is the only natural resource capable of reversing the trend; in the late 1970s the government initiated major improvements to the pier and developed tourist facilities, in order to encourage private investment. The town's Victorian architecture dates from its reconstruction after a fire in 1878. Two miles away is one of the island's great showplaces, Whim Greathouse, restored to depict the life of the sugar planters at their peak. Pop. (1980) 1,046.

Frédérix, Jacques: *see* Feyder, Jacques.

Fredholm, (Erik) Ivar (b. April 7, 1866, Stockholm—d. Aug. 17, 1927, Stockholm), Swedish mathematician who founded modern integral equation theory.

Fredholm entered the University of Uppsala in 1886. There, and later at the University of Stockholm (1888–93), he was mainly interested in mathematical physics. After receiving his Ph.D. from Uppsala in 1898 his interest turned to integral equations. He also worked as an actuary until 1906, when he was appointed professor of theoretical physics at the University of Stockholm.

In a paper that appeared in 1900 entitled "Sur une nouvelle méthode pour la résolution du problème de Dirichlet" ("On a New Method for the Resolution of Dirichlet's Problem"), Fredholm developed the essential parts of the theory of what is now known as Fredholm integral equations and solved the Fredholm equation of the second type, namely a definite integral.

Although he published only a few papers, Fredholm quickly gained a reputation throughout Europe for his comprehensive work. His efforts in large part inspired the later investigations of the German mathematician David Hilbert.

Fredonia, village in the town (township) of Pomfret, Chautauqua County, western New York, U.S., on the Canadaway Creek, near Lake Erie, immediately south of Dunkirk. Settled in 1804, its pseudo-Latin name, coined *c.* 1800 by Dr. Samuel Latham Mitchill and meaning "place of freedom," was originally proposed as the name of the nation. It was the site of the first natural gas well in the U.S. to be harnessed (1821) for illumination. The first local unit of the Grange (a fraternal organization of farmers) was established there in 1868, as was one of the first branches of the Woman's Christian Temperance Union (1873). There is some light manufacturing, but Fredonia's economy depends primarily on grapes from the surrounding vineyards. The New York State University College at Fredonia originated in 1826 as Fredonia Academy. Inc. 1829. Pop. (1980) 11,126.

Fredrik (Swedish personal name): *see under* Frederick.

Fredrikshald (Norway): *see* Halden.

Fredrikstad, town, Østfold *fylke* (county), south of Oslo, southeastern Norway. Located on the eastern shore of Oslofjorden at the mouth of the river Glåma, it was founded in 1567 by Frederick II as a fortress town and has remains of the original fortifications. Fredrikstad's excellent harbour, protected by the island of Kråkerøy, is open year-round. Sawmilling, shipping, and fishing are the main industries; lumber, chemicals, granite, and feldspar are exported. Fredrikstad is known for its workshops that create models for the distinctive Norwegian products, notably glass, silverware, and textiles. The surrounding area is rich in rock carvings, monumental stones, and graves from the early Christian era. Pop. (1983 est.) mun., 27,618.

Fredro, Aleksander (b. June 20, 1793, Suchorów, Galicia—d. July 15, 1876, Lwów, Pol.), Polish comic dramatist whose work, influenced by Molière and by Goldoni, is remarkable for its brilliant characterization, ingenious construction, and skillful handling of verse metres.

Born to a wealthy and powerful landed family, Fredro was educated by private tutors. At the age of 16 he joined the cavalry division of the Polish Army and subsequently fought for the French in the Napoleonic Wars, including the Moscow campaign. In 1814 he spent a few months in Paris, where he attended plays and studied French drama. After leaving the army in 1815 to care for his estate at home, he began to write seriously. Among the more notable plays written during that period are *Mąż i żona* (produced 1822; "Husband and Wife"), a comedy of marital infidelity; *Śluby panieńskie* (1833; "Maidens' Vows"), concerned with psychological development; and *Zemsta* (1834; "Vengeance"), a brilliantly constructed comedy, considered to be his masterpiece. He abruptly stopped writing in 1835 after the extremist Romantic poet Seweryn Goszczyński said in a magazine article that Fredro's work was nonnational and full of absurdities. He returned to writing about 19 years later with several interesting plays; these did not, however, compare to his earlier productions. His memoirs, *Trzy po trzy* ("Topsy Turvy Talk"), written late in his life in the picaresque manner of Laurence Sterne, are considered to be among the most brilliant pieces of Polish prose.

Free Birth, Law of (Brazilian history): *see* Rio Branco Law.

free church, generally, any Protestant religious body that exists in or originates in a land having a state church but that is itself free of governmental or external ecclesiastical control. Examples of such free churches are the Baptists in Scotland, where the established church is Presbyterian; the Presbyterians in England, where the Anglican Church is established; the Waldensian Church in Italy, where the Roman Catholic Church is established; and the Mission Convenant Church in Sweden, where the established church is Lutheran.

In the narrower sense, the term free churches was first applied collectively to several nonepiscopal Protestant evangelical communions in England that convened the first Free Church Congress in 1892 and combined in 1896 to form the National Council of the Evangelical Free Churches. In 1940 this group merged with the Federal Council of the Evangelical Churches to form the Free Church Federal Council.

Free Church Federal Council, organization of free churches (not part of the Church of England) of England and Wales, including Methodist, Baptist, the United Reformed Church in England and Wales (a Presbyterian–Congregational merger), and some other churches. It was formed in 1940 by the union of the National Council of the Evangelical Free Churches (founded 1896) and the Federal Council of the Evangelical Free Churches (founded 1919) for the purpose of cooperating in matters of mutual concern.

The council is presided over by a moderator who holds office for one year. It works through local councils, which elect representatives to the national council and send delegates to an annual congress. The member denominations

send direct representatives to congress and council.

Free Church of Scotland, church organized in 1843 by dissenting members of the Church of Scotland. The disruption was the result of tensions that had existed within the Church of Scotland, primarily because of the development early in the 18th century of two groups within the church—the Moderates, who were primarily interested in social activities, in culture, and in their position within the established church, and the Evangelicals, who were stricter Calvinists who believed in adherence to the Westminster Confession. Patronage, approved by the British Parliament in 1712, allowed wealthy landowners to appoint ministers to local churches, and the church came to be controlled by the Moderates. In the 19th century the Evangelicals became stronger and insisted on more freedom from the state and the right of congregations to elect their own ministers. When the courts and Parliament upheld the patrons' rights to appoint ministers, many Evangelicals decided that they must leave the established church.

At the opening session of the General Assembly of the Church of Scotland on May 18, 1843, the Evangelicals read a statement that it was impossible to hold a free assembly of the church. They then went to another hall and organized the first General Assembly of the Free Church of Scotland. Thomas Chalmers (*q.v.*) was elected the first moderator. Considered more than a secession from the established church, the event came to be known as the Disruption.

The new church was made up of about one-third of the ministers and laity of the Church of Scotland. Giving up all claims to income, churches, professorships, and ministers' homes provided by the established church, the new church set up voluntary funds that supported ministers, built new churches, homes, and schools, and provided for missionary work.

The accomplishments of the Free Church within a few years were remarkable, and under strong leadership it was a powerful force in Scotland. It adjusted to cultural change, provided new churches for the population, and gradually accepted new approaches to biblical interpretation that caused some dissension.

In 1900 the Free Church united with the United Presbyterian Church (formed in 1847 by earlier dissenting groups) to form the United Free Church. By 1929 patronage had been abolished in the Church of Scotland, and that church had been disestablished and the United Free Church consequently reunited with it.

A minority of the Free Church members protested the union with the United Presbyterian Church and continued as the Free Church of Scotland. The congregations were mainly in the Gaelic-speaking districts in the Highlands and islands.

Free Corps (German paramilitary group): *see* Freikorps.

Free Democratic Party, German FREIE DEMOKRATISCHE PARTEI (FDP), German centrist political party that advocates individualism and free economic competition. Although it has a relatively small following, it has made and broken governments by forming coalitions with larger parties.

Delegates from liberal parties in the American, British, and French zones of occupation formed the FDP in December 1948. In the West Germany of the early 1950s the FDP took part in the coalition government of the Christian Democratic Union (CDU). It left the coalition in 1956 to join with the Social Democratic Party (SPD) as an opposition party. After the national elections in 1961, when the CDU and its coalition partner, the Christian Social Union (CSU), lost their absolute majority, the FDP exacted the promise of Chancellor Konrad Adenauer's resignation as the price of its cooperation in a new coalition. The FDP's disillusionment with the policies of the new chancellor, Ludwig Erhard, appears to have been the main motive for the party's second withdrawal from its coalition with the Christian Democrats in November 1966. After national elections in 1969, the FDP joined forces with the SPD to overcome the CDU–CSU plurality in the national assembly and elect the SPD leader Willy Brandt chancellor. The FDP remained in coalition with the SPD until 1982, when it formed a coalition government with the Christian Democrats and Christian Social Union. After the 1983 and 1987 parliamentary elections, the FDP remained part of a governing coalition with the CDU and the CSU.

free-electron model of metals, in solid-state physics, representation of a metallic solid as a container filled with a gas composed of free electrons (*i.e.,* those responsible for high electrical and thermal conductivity) that move in a virtually uniform potential arising largely from metal ions in the crystal lattice. The free electrons, considered identical to the valence electrons of free metal atoms, are presumed to be moving independently of one another throughout the entire crystal.

The free-electron model was first proposed by the Dutch physicist Hendrik A. Lorentz shortly after 1900 and was refined in 1928 by Arnold Sommerfeld of Germany. Sommerfeld introduced quantum-mechanical concepts, most notably the Pauli exclusion principle (*q.v.*). Although the model provided a satisfactory explanation for certain properties (*e.g.,* conductivity and electronic specific heat) of simple monovalent metals, it had some serious shortcomings. It did not, for example, take into account the interaction of free electrons with the metal ions. Researchers soon recognized that a broader system was needed to explain the behaviour of complex metals and semiconductors. By the mid-1930s the free-electron model was largely superseded by the band theory (*q.v.*) of solids.

free energy, in thermodynamics, energylike property or state function of a system in thermodynamic equilibrium—it has the dimensions of energy and its value is determined by the state of the system and not by its history—expressed in two forms: the Helmholtz free energy, A, sometimes called work function, and the Gibbs free energy, G, sometimes F. If E is the internal energy of the system, PV the pressure–volume product, and TS the temperature–entropy product, then $A = E - TS$ and $G = E + PV - TS$. Free energy is an extensive property; *i.e.,* the magnitude depends on the amount of the substance present in a given thermodynamic state.

The changes in free energy, ΔA or ΔG, are useful in evaluating certain thermodynamic processes. In a reversible process, the work under constant temperature and constant volume is equal to the change in the Helmholtz free energy, ΔA, and the work under constant temperature and constant pressure is equal to the change in the Gibbs free energy, ΔG.

Changes in free energy can be used to judge whether certain transformations of state can occur spontaneously. Under certain conditions of constant temperature and volume, the transformation of state will occur spontaneously, slowly or rapidly, if the Helmholtz free energy of the final state is smaller than that of the initial state; that is, if the difference ΔA between the final and the initial state is negative. Under conditions of constant temperature and pressure, the transformation of state will occur if the change in the Gibbs free energy, ΔG, is negative.

free enterprise economy: *see* capitalism.

free-fall, in mechanics, state of a body that moves freely in any manner in the presence of gravity. The planets, for example, are in free-fall in the gravitational field of the Sun. Newton's laws show that a body in free-fall follows an orbit such that the sum of the gravitational and inertial forces equals zero. This explains why an astronaut in a spacecraft orbiting the Earth experiences a condition of weightlessness: the Earth's gravitational pull is equal and opposite to the inertial—in this case, centrifugal—force because of the motion of the vehicle. Gravitational forces are never uniform, and therefore only the centre of mass is in free-fall. All other points of a body are subject to tidal forces because they move in a slightly different gravitational field. The Earth is in free-fall, but the pull of the Moon is not the same at the Earth's surface as at its centre; the rise and fall of ocean tides occur because the oceans are not in perfect free-fall.

Free French, French FRANÇAISES LIBRES, in World War II (1939–45), members of a movement for the continuation of warfare against Germany after the military collapse of Metropolitan France in the summer of 1940. Led by General Charles de Gaulle, the Free French were eventually able to unify most French resistance forces in their struggle against Germany.

On June 16, 1940, the government of France was constitutionally transmitted to Marshal Philippe Pétain, who had already decided that France must conclude an armistice with Germany. Two days later, a French army officer, General Charles de Gaulle, appealed by radio from London (whence he had fled on June 17) for a French continuation of the war against Germany. On June 28 de Gaulle was recognized by the British as the leader of Free France (as the nascent resistance movement was named), and from his base in London de Gaulle began to build up the Forces Françaises Libres, or Free French Forces. At first these consisted merely of French troops in England, volunteers from the French community resident in England since prewar times, and a few units of the French navy.

In the autumn of 1940 the French colonial territories of Chad, Cameroun, Moyen-Congo, French Equatorial Africa, and Oubangi-Chari (all in sub-Saharan Africa) rallied to de Gaulle's Free France, and the smaller French colonies in India and in the Pacific soon followed suit. A Free French military expedition in September 1940 to capture the important naval base of Dakar in French West Africa failed, however, and the base remained in the hands of French forces loyal to the national government that Pétain had set up in Vichy.

In 1941 Free French forces participated in British-controlled operations against Italian forces in Libya and Egypt, and that same year they joined the British in defeating the Vichy forces in Syria and Lebanon. In September de Gaulle created the Comité National Français (French National Committee), a Free French government-in-exile that was recognized by the Allied governments.

Despite these gains, the Free French remained a small force until 1942, by which time an underground anti-Nazi Résistance movement had sprung up in France. In his efforts to obtain the support of the Résistance, de Gaulle changed the name of his movement to Forces Françaises Combattantes (Fighting French Forces) and sent his emissary Jean Moulin to France to try to unify all the various Résistance groups in France under de Gaulle's leadership. Moulin came close to accomplishing this in May 1943 with his establishment of the Conseil Nationale de la Résistance (National Council of the Resistance).

The successful Anglo-American invasion of northwestern Africa in November 1942 resulted in the defection of most of the Vichy

troops stationed there to the side of the Free French. De Gaulle then entered a power struggle with the Allied-backed commander-in-chief of the French forces in North Africa, General Henri Giraud. In June 1943 a Comité Français de Libération Nationale (French Committee of National Liberation) was constituted in Algiers, with Giraud and de Gaulle as its joint presidents. But de Gaulle soon outmaneuvered Giraud, whose resignation in the spring of 1944 left de Gaulle in supreme control of the entire French war effort outside of Metropolitan France. More and more Résistance groups were meanwhile acknowledging de Gaulle's leadership.

More than 100,000 Free French troops fought in the Anglo-American campaign in Italy in 1943, and, by the time of the Allied invasion of Normandy in June 1944, the Free French forces had swelled to more than 300,000 regular troops. They were almost wholly American-equipped and supplied. In August 1944 the Free French 1st Army, under General Jean de Lattre de Tassigny, took part in the Allies' invasion of southern France, driving thence northeastward into Alsace before joining in the Western Allies' final thrust into Germany. In August 1944 the Résistance groups, now organized as Forces Françaises de l'Intérieur (French Forces of the Interior), mounted an anti-German insurrection in Paris, and the Free French 2nd Armoured Division under General Jacques-Philippe Leclerc drove into Paris to consummate the liberation. On Aug. 26, 1944, de Gaulle entered Paris in triumph.

free imperial city: *see* imperial city.

free jazz, approach to jazz improvisation that emerged during the late 1950s and was a major stream of jazz thereafter, especially with groups led by pianist Cecil Taylor, by saxophonists Ornette Coleman, John Coltrane, Eric Dolphy, Pharoah Sanders, Archie Shepp, Albert Ayler, and Sun Ra, and by the Chicago-based Association for the Advancement of Creative Musicians. In free jazz, musicians improvise freely without adherence to time-keeping patterns, conventional solo versus accompaniment roles, or the preset arrangement of harmonies (a chord progression) that commonly guided improvisation in earlier styles. Despite such freedom, music called free jazz usually indicates an improviser's freedom only from having to create music compatible with preset harmonies. Only in very rare moments is any free jazz genuinely atonal or arrhythmic. Free jazz is also an identifying label for high-energy, collective improvisation in which dense sound textures are created from furiously generated note sequences and in which the goals of lyricism and easily discernible melodic development that typified earlier styles are not relevant.

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Free Laos: *see* Lao Issara.

free market economy: *see* capitalism.

Free Methodist Church of North America, Holiness church in the Wesleyan-Arminian tradition that emphasizes the doctrine of sanctification, a postconversion process of spiritual and moral growth through prayer, Bible study, interaction with fellow believers, and simplicity of worship and lifestyle. The church was organized in 1860 by the Reverend B.T. Roberts and several associates after Roberts and some other ministers and laymen had been expelled from the Methodist Episcopal Church, which they had criticized for not maintaining the original standards of Methodism. In addition to sanctification, the Free Methodist Church stresses evangelical beliefs, such as the virgin birth of Jesus. In 1960 the Holiness Movement Church of Canada merged with the Free Methodist Church of North America. The church's name derives from its rejection of the practice in some churches of renting pews to provide income.

free port, area within which goods may be landed, handled, manufactured, and reshipped without the intervention of the customs authorities. Only when the goods are moved to consumers within the country in which the free-port zone is located do they become subject to the prevailing customs duties. Examples of free ports are Copenhagen, Gdańsk (Poland), Stockholm, Singapore, New York City, and Salina Cruz (Mexico).

The primary purpose of a free port or a free-port zone is to remove from a port, with many geographic advantages for trade, those hindrances to trade caused by high tariffs and complex customs regulations. Among the advantages of the system are the quicker turnaround of ships through the reduction in the formalities of customs examinations and the ability to display and often fabricate goods freely.

In several cases, the free-port function has declined. Alternative devices such as the bonded warehouse and associated systems are used in some large seaports (*e.g.,* London and Amsterdam). It is probable that the free-port system is most defensible and most successful for large zones within busy major ports.

free radical (chemistry): *see* radical.

free school: *see* informal school.

Free Silver Movement, in late 19th-century U.S. history, advocacy of unlimited coinage of silver. The movement was precipitated by an act of Congress in 1873 that omitted the silver dollar from the list of authorized coins (the "Crime of '73"). Supporters of free silver included owners of silver mines in the West, farmers who believed that an expanded currency would increase the price of their crops, and debtors who hoped it would enable them to pay their debts more easily. For true believers, silver became the symbol of economic justice for the mass of the American people.

The Free Silver Movement gained added political strength at the outset because of the sharp economic depression of the mid-1870s. Its first significant success was the enactment of the Bland–Allison Act in 1878, which restored the silver dollar as legal tender and required the U.S. Treasury to purchase each month between $2,000,000 and $4,000,000 worth of silver and coin it into dollars. When farm prices improved in the early 1880s, pressure for new monetary legislation declined, but the collapse of land and farm prices beginning in 1887 revived the demand by farmers for the unlimited coinage of silver. Congress responded in 1890 by enactment of the Sherman Silver Purchase Act, which increased the government's monthly silver purchases by 50 percent.

In the years immediately after 1890, a combination of pressures sharply reduced the amount of gold in the U.S. Treasury, precipitating a panic in the spring of 1893. Conservatives charged that the Sherman Act was the cause of the panic, and in the summer of 1893 Congress repealed that act. Farmers in the South and West condemned this action, blamed the greed of eastern bankers for the depressed state of the economy, and resumed their demand for the unlimited coinage of silver. This had been an important objective of the Populist Party in the election of 1892, and in 1896 the Democrats, despite strong opposition from President Grover Cleveland, made unlimited coinage of silver the principal plank in their platform. They then nominated William Jennings Bryan, the most effective champion of free silver (*see* Cross of Gold speech), as their candidate for president. The Republicans won the election, and in 1900 a Republican majority in Congress enacted the Gold Standard Act, which made gold the sole standard for all currency.

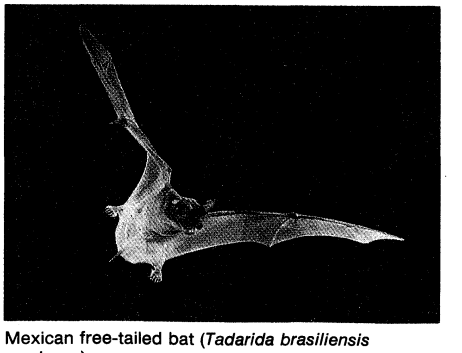
Free-Soil Party (1848–54), minor but influential political party in the pre-Civil War period of U.S. history that opposed the extension of slavery into the western territories. Fearful of expanding slave power within the national government, Rep. David Wilmot of Pennsylvania in 1846 introduced into Congress his famous Wilmot Proviso, calling for the prohibition of slavery in the vast southwestern lands that had been newly acquired from Mexico. The Wilmot concept, which failed in Congress, was a direct ideological antecedent to the Free-Soil Party. Disappointed by the ambivalent position of the Whig Party toward slavery, "Conscience" Whigs held a convention in August 1848 at Buffalo. There they were joined by delegates from 17 states drawn from the Liberty Party (*q.v.*) and the anti-slavery faction of the New York Democrats, known as "Barnburners" (*see* Hunkers and Barnburners). The Free-Soilers' historic slogan calling for "free soil, free speech, free labor, and free men" attracted small farmers, debtors, village merchants, and household and mill workers, who resented the prospect of black-labour competition—whether slave or free—in the territories.

In 1848 the Free-Soil Party nominated the former U.S. president Martin Van Buren to head its ticket. Though the party polled only 10 percent of the popular vote in the presidential election that year, it weakened the regular Democratic candidate in New York and contributed to the election of the Whig candidate General Zachary Taylor as president. The Free-Soil vote was reduced to 5 percent in 1852, when John P. Hale was the presidential nominee. Nevertheless, a dozen Free-Soil congressmen later held the balance of power in the House of Representatives, thus wielding considerable influence. In addition, the party was well represented in several state legislatures. In 1854 the disorganized remnants of the party were absorbed into the newly formed Republican Party, which carried the Free-Soil idea of opposing the expansion of slavery one step farther by condemning slavery as a moral evil as well.

free-space room (acoustics): *see* anechoic chamber.

free-tailed bat, also called MASTIFF BAT, any of about 90 species of bats of the family Molossidae, suborder Microchiroptera. Free-tailed bats are found worldwide in warm regions. Their common name is descriptive of the way in which part of the tail extends beyond the membrane attached between the hind legs. Free-tailed bats are also known as mastiff, or bulldog, bats because of their supposed facial resemblance to these dogs.

Swift fliers with stout bodies and long, slender wings, free-tailed bats are small-eyed, often



Mexican free-tailed bat (*Tadarida brasiliensis mexicana*)
Merlin D. Tuttle/Bat Conservation International

heavy-snouted bats about 4–13 centimetres (1⅗–5 inches) long excluding the 1.5–8-cm tail. Their ears are large and are joined across the forehead in some species. Except for the naked free-tailed bat (*Cheiromeles*), which is almost hairless, they have short, usually dark fur.

Free-tailed bats eat insects and roost in tree hollows, caves, and buildings. Most species live in groups, and some, such as the guano-producing Mexican free-tailed bat (*Tadarida brasiliensis mexicana*), form colonies of several million individuals. Free-tailed bats do not hibernate, but some species become inactive in winter; other species migrate seasonally.

free trade, policy by which a government does not discriminate against imports or interfere with exports. It does not necessarily imply that a country abandons all control and taxation of imports and exports.

The theoretical case for free trade is based on the argument of Adam Smith that the division of labour among countries leads to specialization, greater efficiency, and higher aggregate production. From the point of view of a single country there may be practical advantages in restriction, particularly if the country is the main buyer or seller of a commodity. In practice, however, the protection of local industries may prove advantageous only to a small minority of the population, and disadvantageous to the rest.

Since World War II considerable efforts have been made to reduce tariff barriers and currency restrictions among nations. Other barriers, however, that may be equally effective in hindering trade include import quotas, taxes, and subsidies to domestic industries.

free verse, poetry organized to the cadences of speech and image patterns rather than according to a regular metrical scheme. It is "free" only in a relative sense. It does not have the steady, abstract rhythm of traditional poetry; its rhythms are based on patterned elements such as sounds, words, phrases, sentences, and paragraphs, rather than on the traditional prosodic units of metrical feet per line. Free verse, therefore, eliminates much of the artificiality and some of the aesthetic distance of poetic expression and substitutes a flexible formal organization suited to the modern idiom and more casual tonality of the language.

Although the term is loosely applied to the poetry of Walt Whitman and even earlier experiments with irregular metres, it was originally a literal translation of vers libre (*q.v.*), the name of a movement that originated in France in the 1880s. Free verse became current in English poetics in the early 20th century. The first English poets to be influenced by vers libre, notably T.E. Hulme, F.S. Flint, Richard Aldington, Ezra Pound, and T.S. Eliot, were students of French poetry. The Imagist movement, started in England in 1912 by Aldington, Pound, Flint, and Hilda Doolittle ("H.D."), was concerned with more than versification, but one of its principles was "to compose in sequence of the musical phrase, not in sequence of the metronome." Almost from the beginning, the free-verse movement split into two groups, one led by Amy Lowell and a more formal one led by Pound. Eliot's early experimentations with free verse influenced the loosening of formal metrical structures in English poetry. Carl Sandburg, William Carlos Williams, Marianne Moore, and Wallace Stevens all wrote some variety of free verse; the versification of Williams and Moore most closely resembles that of the vers libre poets of France.

free will, in man, the power or capacity to choose among alternatives or to act in certain situations independently of natural, social, or divine restraints. Free will is denied by those who espouse any of various forms of determinism. Arguments for free will are based on the subjective experience of freedom, on sentiments of guilt, on revealed religion, and on the universal supposition of responsibility for personal actions that underlies the concepts of law, rewards, punishments, and incentives. In theology, the existence of free will must be reconciled with God's omniscience and goodness (in allowing man to choose badly), and with divine grace, which allegedly is necessary for any meritorious act. A prominent feature of modern Existentialism is the concept of a radical, perpetual, and frequently agonizing freedom of choice. Jean-Paul Sartre, for example, speaks of the individual "condemned to be free" even though his situation may be wholly determined.

freeboard, distance from the waterline to the freeboard deck of a fully loaded ship; it is measured amidships at the side of the hull. The freeboard deck is the deck below which all bulkheads are made watertight; above it that precaution is not necessary. Freeboard represents the safety margin showing to what depths a ship may be loaded under various service conditions—*e.g.*, the type of cargo, the waters to be navigated, and the season of the year. Freeboard is determined by the design of the vessel, particularly the shape and dimensions of its watertight hull; by its structural strength; and, in the case of a passenger ship, by the subdivision of its watertight compartments. Definite freeboard rules, based on the provision of adequate reserve buoyancy, were first established in the second half of the 19th century, largely through the efforts of Samuel Plimsoll, a British politician and social reformer. *See also* Plimsoll line.

freedman, former slave set free. In ancient Athens, former slaves bore no stigma, and some rose to positions of political or economic power. During the later Hellenistic period, however, some Greek communities passed laws providing separate regulations and restrictions for former slaves. To the Greeks citizenship was a hereditary privilege and thus barred to freedmen, but under Roman law a manumitted slave might become a citizen if the proper legal form was followed, although he did not enjoy full civic rights.

During the Middle Ages in Spain, the slaves of the government and the church, with little hope of emancipation, enjoyed certain privileges denied to ordinary bondsmen; freedmen, subject to many disabilities, were hardly in a better condition than slaves. In Carolingian times the descendants of a freedman could claim the rights of the freeborn only after three generations had passed.

Later, notably in the conditions of North American blacks from colonial times forward, racial differences between slaves and owners have reinforced the tendency to attach the stigma of slavery to freedmen and the free offspring of slaves. *See* Reconstruction; Freedmen's Bureau; Black Codes, U.S.; Union Leagues; lynching.

Freedman, Maurice (b. Dec. 11, 1920, London—d. July 14, 1975, London), British professor of social anthropology at Oxford University and, during his lifetime, one of the world's leading experts on Chinese anthropology. He was also renowned for contributions to Jewish studies, the sociology of religion, legal anthropology, and political anthropology.

After studying English at King's College, London, and serving in the Royal Artillery in World War II, Freedman enrolled as a graduate student of anthropology at the London School of Economics and Political Science, where, after doing fieldwork in Singapore, he was offered a lectureship in anthropology in 1951. He became a professor in 1965. During this tenure, he also held visiting appointments at Yale University, the University of Malaya, and Cornell University. In 1970 he accepted a chair at Oxford, where he remained until his death.

Freedman's Chinese studies can be classified into four phases. The first began with his Singapore research, from which emerged works on the Chinese family and marriage, Chinese law, Chinese religion, and Chinese community organization. The second phase occurred in the early 1950s, when, using literary sources, he began to reconstruct traditional Chinese society with special reference to the institutions of kinship and marriage. In the third phase he studied what he called residual China, notably Hong Kong and Taiwan. The final phase was the study of the intellectual history of Sinological anthropology. In this stage, he chronicled the stories of the early attempts at understanding Chinese society.

Freedman's literary output was large and varied. Some of Freedman's works are *Chinese Family and Marriage in Singapore* (1957), *Chinese Lineage and Society* (1966), *Main Trends of Research in the Social and Human Sciences* (1972), and *Social and Cultural Anthropology* (1973).

Freedmen's Bureau (1865–72), during the Reconstruction period after the U.S. Civil War, popular name for the U.S. Bureau of Refugees, Freedmen, and Abandoned Lands, established by Congress to provide practical aid to 4,000,000 newly freed black Americans in their transition from slavery to freedom. Headed by Maj. Gen. Oliver O. Howard (*q.v.*), the Freedmen's Bureau might be termed the first federal welfare agency. Despite handicaps of inadequate funds and poorly trained personnel, the bureau built hospitals for, and gave direct medical assistance to, more than 1,000,000 freedmen. More than 21,000,000 rations were distributed to impoverished blacks as well as whites.

Its greatest accomplishments were in the field of education: more than 1,000 Negro schools were built and more than $400,000 spent to establish teacher-training institutions. All major Negro colleges were either founded by, or received financial help from, the bureau. Less success was achieved in civil rights, for the bureau's own courts were poorly organized and short-lived, and only the barest forms of due process of law for freedmen could be sustained in the civil courts. Its most notable failure concerned the land itself. Thwarted by Pres. Andrew Johnson's restoration of abandoned lands to pardoned Southerners and the adamant refusal of Congress to consider any form of land redistribution, the bureau was forced to oversee sharecropping arrangements that inevitably became oppressive. Congress, preoccupied with other national interests and responding to the continued hostility of white Southerners, brought the bureau to an end in July 1872.

freedom, degree of, in mathematics, any of the number of independent quantities necessary to express the values of all the variable properties of a system. A system composed of a point moving in space, for example, has three degrees of freedom because three coordinates are needed to determine the position of the point.

The number of degrees of freedom is reduced by constraints such as the requirement that a point move along a particular path. Thus, a simple pendulum has only one degree of freedom because its angle of inclination is specified by a single number. In a chemical system, the condition of equilibrium imposes constraints: properties such as temperature and composition of coexisting phases cannot all vary independently (*see* phase rule, Gibbs).

If, in a statistical sample distribution, there are n variables and m constraints on the distribution, there are $n - m$ degrees of freedom.

freehold, in English law, ownership of a substantial interest in land held for an indefinite period of time. The term originally designated the owner of an estate held in free tenure, who possessed, under Magna Carta, the rights of a free man. A freehold estate was distinguished from nonfreehold estates such as copyhold, tenancy at will, and tenancy for a fixed period, the customary landlord–tenant relationship. Knight service and frankalmoign, which required military and ceremonial services respectively, and free socage, which involved certain services of husbandry or manual labour, were types of free tenure. *See also* copyhold; socage.

Freeman, Douglas Southall (b. May 16, 1886, Lynchburg, Va., U.S.—d. June 13, 1953, Westbourne, Hampton Gardens, near Richmond, Va.), American journalist and author noted for writings on the Confederacy.

After receiving degrees from Johns Hopkins University and Washington and Lee University, Freeman began a long and distinguished teaching career. Among numerous other posts, he served for a year (1934–35) as a visiting professor of journalism at Columbia University, remaining on the faculty as a nonresident from 1936 to 1941. From 1936 on he was also a lecturer at the Army War College. And from 1915 to 1949 Freeman edited the Richmond (Va.) *News Leader.*

Among his honorary appointments and affiliations, Freeman was a member of the advisory council of the War Department's History Division and of the Presidential Committee on Higher Education. In 1935 Freeman won the Pulitzer Prize for his four-volume biography, *R. E. Lee.*

His other works include *Virginia—A Gentle Dominion* (1924); *The Last Parade* (1932); *The South to Posterity: An Introduction to the Writings of Confederate History* (1939); *Lee's Lieutenants, A Study in Command,* 3 vol. (1942–44); *John Steward Bryan* (1947); and *George Washington,* 7 vol. (1948–57), the final volume of which was prepared by his assistants after his death—the whole work earning him a second, posthumous Pulitzer Prize in 1958.

Freeman, Mary Eleanor Wilkins, *née* WILKINS (b. Oct. 31, 1852, Randolph, Mass., U.S.—d. March 13, 1930, Metuchen, N.J.), American writer known for her stories and novels of frustrated lives in New England villages.

In 1867 the Wilkins family moved to Brattleboro, Vt., where Mary graduated from high school. After one year at Mount Holyoke Female Seminary, South Hadley, Mass., she began writing stories and verse for children to help support her family, and she quickly became successful. Returning to Randolph, she did her best writing there in the 1880s and '90s. In 1902 she married Charles M. Freeman of Metuchen, N.J., where she lived until her death.

Although she produced a dozen volumes of short stories and as many novels, Freeman is remembered chiefly for the first two collections of stories, *A Humble Romance and Other Stories* (1887) and *A New England Nun and Other Stories* (1891), and the novel *Pembroke* (1894). Edward Foster's *Mary E. Wilkins Freeman* (1956) is a critical study.

Freeman, Sir Ralph (b. Nov. 27, 1880, London—d. March 11, 1950, London), English civil engineer whose Sydney Harbour Bridge (1932), New South Wales, with a main arch span of 1,650 feet (500 m), is one of the longest steel-arch bridges in the world.

In 1901 Freeman joined a London firm of consulting engineers, later known as Freeman, Fox & Partners. His works include the Victoria Falls Bridge over the Zambezi River, on the border of present-day Zimbabwe and Zambia; the Royal Naval Propellant factory built during World War II; the Furness shipbuilding yard in Lancashire; and five major bridges in southern Africa. He also prepared designs for the bridge over Auckland Harbour, New Zealand.

From 1928 to 1936 he was a member of the Steel Structures Research Committee, a British organization, and chairman of the panel responsible for effecting the committee's designs. He was knighted in 1947.

Freeman, Richard Austin (b. 1862, London—d. Sept. 30, 1943, Gravesend, Kent, Eng.), popular English author of novels and short stories featuring the fictional character John Thorndyke, a pathologist-detective.

Richard Austin Freeman, *c.* 1935
C.V. Briant

Educated as a physician and surgeon, Freeman practiced in the Gold Coast (now Ghana), where he caught a fever. Eventually forced by ill health to retire from practice (1904), he began to write fiction. *The Red Thumb Mark* (1907) was the first of many works featuring Thorndyke.

Freemasonry, the teachings and practices of the secret fraternal order of Free and Accepted Masons, the largest worldwide secret society. Spread by the advance of the British Empire, Freemasonry remains most popular in the British Isles and in other countries originally within the empire.

Freemasonry evolved from the guilds of stonemasons and cathedral builders of the Middle Ages. With the decline of cathedral building, some lodges of operative (working) masons began to accept honorary members to bolster their declining membership. From a few of these lodges developed modern symbolic or speculative Freemasonry, which particularly in the 17th and 18th centuries, adopted the rites and trappings of ancient religious orders and of chivalric brotherhoods. In 1717 the first Grand Lodge, an association of lodges, was founded in England.

Freemasonry has, almost from its inception, encountered considerable opposition from organized religion, especially from the Roman Catholic Church, and from various states.

Though often mistaken for such, Freemasonry is not a Christian institution. Freemasonry contains many of the elements of a religion; its teachings enjoin morality, charity, and obedience to the law of the land. For admission the applicant is required to be an adult male believing in the existence of a Supreme Being and in the immortality of the soul. In practice, some lodges have been charged with prejudice against Jews, Catholics, and nonwhites. Generally, Freemasonry in Latin countries has attracted freethinkers and anticlericals, whereas in the Anglo-Saxon countries, the membership is drawn largely from among white Protestants.

In most lodges in most countries, Freemasons are divided into three major degrees—entered apprentice, fellow of the craft, and master mason. In many lodges there are numerous degrees—sometimes as many as a thousand—superimposed on the three major divisions; these organizational features are not uniform from country to country.

In addition to the main body of Freemasonry derived from the British tradition, there are now a number of appendant groups that are primarily social or fun organizations, which have no official standing in Freemasonry but which draw their membership from the higher degrees of Freemasonry. They are especially prevalent in the United States. Among those known for their charitable work are the Ancient Arabic Order of the Nobles of the Mystic Shrine (the "Shriners"). Female relatives of Master Masons may join the Order of the Eastern Star; boys, the Order of DeMolay and the Order of Builders; and girls, the Order of Job's Daughters and the Order of Rainbow. English Masons are forbidden to affiliate with any of the fun organizations or quasi-Masonic societies, on pain of suspension.

Freeport, town, southwestern shore of Grand Bahama island, The Bahamas. In 1955 the colonial Bahamian government entered into the so-called Hawksbill Creek Agreement with the newly created Grand Bahama Port Authority Limited (headed by an American lumber financier, Wallace Groves), which was pledged to plan, construct, and administer a "Port Area" (Freeport) and to license businesses and industries therein in exchange for various tax exemptions and privileges for 99 years. (Subsequent amendments revised the prerogatives of the Port Authority, but it still remains.) So successful was the venture that the population of Freeport, 150 persons in 1956, multiplied more than a hundredfold in the coming decades, and the town and neighbouring resorts drew about 500,000 tourists a year in the late 20th century. Freeport is the site of hotels, golf courses, developed beaches, one of the world's largest casinos, and the International Bazaar, which houses a variety of exotic duty-free shops. Freeport is also the location of a giant petrochemical transshipment complex and of banks catering to foreign financial interests. Pop. (1980 prelim.) 25,423.

Freeport, city, seat (1837) of Stephenson County, northwestern Illinois, U.S., on the Pecatonica River. Founded in 1835, it was settled by Pennsylvania Germans disappointed with the conditions in the Galena lead-mining district, 40 miles (64 km) west. The settlement (called Winneshiek) supposedly became known as "Free Port" because of a protest by the wife of William Baker, a trader, who freely entertained travelers. With the coming of the Galena and Chicago Union Railroad (1853), followed by the Illinois Central and Racine and Mississippi railroads, Freeport developed as a trading and shipping point for agricultural produce. Its economic base has diversified to include light manufacturing and a sizeable insurance industry.

On Aug. 27, 1858, Freeport was the scene of the second Lincoln–Douglas debate, during which Stephen Douglas formulated the "Freeport Doctrine" that a territory had the right to exclude slavery in spite of contrary Supreme Court decisions. "Lincoln the Debater," a statue by Leonard Crunelle in Taylor Park, commemorates the debate. Highland Community College was established in 1962 in Freeport. A farm museum is maintained by the Stephenson County Historical Society. Inc. 1855. Pop. (1984 est.) 25,901.

Freeport, city, Brazoria County, southeastern Texas, U.S., at the mouth of the Brazos River, on the Gulf Intracoastal Waterway, 60 miles (97 km) south of Houston. Founded in 1912 by exploiters of local sulfur deposits, it was developed as a deepwater port and now forms part of the industrial complex of Brazosport. It processes and exports chemicals and gasoline. Commercial fishing

(shrimp) is also significant. A large-scale salt-water conversion plant is immediately east. Velasco, which served as temporary capital of the Texas Republic and where the treaty concluding the Texas Revolution was signed (1836), was annexed by Freeport in 1957. A lighthouse (1896) is at the river's mouth. Inc. 1949. Pop. (1980) 13,444.

Freer Gallery of Art, museum in Washington, D.C., endowed and built by the Detroit industrialist Charles Lang Freer to house the distinguished collection of Oriental art that he gave to the United States government in 1906. The Freer Gallery was administratively made a part of the Smithsonian Institution, and in 1923 it was opened to the public.

The Freer collection includes 19th-century American paintings, and has the world's largest collection of Whistler's works, including the famed Peacock Room, decorated by Whistler as a prank. It was originally the dining room of an English shipbuilder, who after purchasing Whistler's painting "Rose and Silver: The Princess from the Land of Porcelain," permitted the artist to redecorate the room to harmonize with the picture. Using the peacock as his theme, Whistler trimmed borders off Oriental rugs and painted over leather wallcovering to create an exotic gold and turquoise atmosphere for his painting. Two gold peacocks with crystal eyes adorn the wall opposite the picture. The entire room was purchased by Freer for $63,000.

Freesia, genus of about 20 species of South African plants of the iris family (Iridaceae), with bulblike structures (corms), grassy foliage, and wiry spikes of bell-like, lemon-scented

Freesia
W.H. Hodge

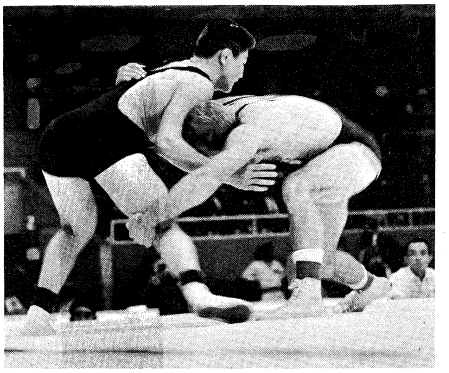
flowers in white, yellow, orange, and blue. The approximately 60-centimetre- (2-foot-) tall flower spikes usually turn at right angles from the stem, displaying the flowers in a horizontal line.

Two species much used in hybridization are *F. refracta,* greenish yellow to yellow or white, and *F. armstrongii,* tinged rose-purple. The plants are grown indoors in pots or in gardens in mild climates.

freestyle wrestling, one of three styles of wrestling used in international amateur and Olympic competition (the others are Greco-Roman wrestling and sambo) under supervision of the Fédération Internationale de Lutte Amateur (International Amateur Wrestling Federation). It was derived from the English Lancashire, or catch-as-catch-can, style, in which nearly all holds were permitted.

Under international rules any fair hold, trip, or throw is permitted. Any hold that endangers life or limb is illegal—strangleholds, for example, are forbidden, as well as kicking, punching, butting with the head, and holding the costume. Wrestlers are cautioned for irregularities, and three cautions mean disqualification. For a serious offense, a wrestler may be disqualified immediately.

Bouts are held on a mat at least 6 metres (about 20 feet) square (8 metres for world championship or Olympic matches). The duration of a bout is nine minutes (since 1967), divided into three periods of three minutes each, separated by intervals of one minute. Each period begins with both wrestlers in a standing position, regardless of their positions at the end of the previous period.



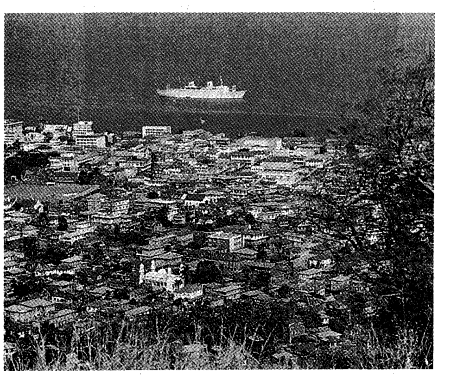
Olympic freestyle lightweight match, Tokyo, 1964
Rapho/Photo Researchers

The bout is supervised by a referee in the ring, three outside judges, and a timekeeper. A fall is awarded when one contestant holds both of his opponent's shoulders to the mat for one second. The referee signals a fall by striking the mat with his hand. If no fall takes place, the bout is decided on points awarded by the judges for manoeuvres leading toward a fall.

Weight classes (upper limits) in Olympic and international events are: light flyweight, 48 kg (105 lb); flyweight, 52 kg (114.6 lb); bantamweight, 57 kg (125.7 lb); featherweight, 63 kg (138.9 lb); lightweight, 70 kg (154.3 lb); welterweight, 78 kg (171.9 lb); middleweight, 87 kg (191.8 lb); light heavyweight, 97 kg (213.8 lb); heavyweight, 100 kg (220.4 lb); and super heavyweight, over 100 kg (220.4 lb). Wrestlers may compete in only one class in any one contest.

A similar style of wrestling is practiced in United States schools and colleges. Weight classes are different, and scoring includes an award to a wrestler who controls his opponent for the greater part of a match. U.S. professional wrestling is also similar but involves more showmanship than genuine competition. For world champions, *see* Sporting Record: *Wrestling. See also* Olympic Games.

Freetown, capital, chief port, and largest city of Sierra Leone, West Africa, on the rocky Sierra Leone Peninsula, at the seaward tip of a range of wooded hills, which were named Serra Leôa ("Lion Mountains") by the Portuguese navigator Pedro da Sintra when he explored the West African coast in 1462. By the 1650s the increased activity of British, French, Dutch, and Danish trading companies ended the limited degree of Portuguese control over the coastal trade. An English abolitionist, Granville Sharp, selected the site (south of the mouth of the Sierra Leone River) in 1787 as a haven for African slaves, freed and destitute in England. (They were known as the Black Poor.) In 1792 the Sierra Leone Company assumed responsibility and helped settle slaves from Nova Scotia who had fought for the British in the American Revolutionary War, the "Maroons," runaway slaves of Jamaica, and others from captured slave ships. They were landed at King Jimmy's Watering Place (now a bustling marketplace). Their descendants, known as Creoles, are now outnumbered by Mende and Temne immigrants from the interior. In 1821 Freetown became the seat of government for all of Great Britain's West African possessions, a position it retained (with slight changes) until 1874. Freetown, incorporated as a municipality in 1893, became the nation's capital in 1961.



Freetown, Sierra Leone, and its harbour
Shostal—EB Inc.

Freetown's excellent natural harbour (an important World War II naval base) has deep-water docking facilities at the Queen Elizabeth II Quay. Its exports include palm oil and kernels, cocoa, coffee, ginger, and kola nuts. The city is the nation's commercial and transportation centre; industrial enterprises are limited and include diamond cutting, confectionary, paint and shoe enterprises, rice milling, and fish packing. Construction of the Guma Dam has solved Freeport's longtime water problem and provided more electrical power. Hastings Airfield (10 mi [16 km] southeast) handles domestic flights; the international airport at Lungi is across the Sierra Leone River.

Freetown is the site of Fourah Bay College on Mt. Aureol (founded 1827, part of the University of Sierra Leone, 1967), Njala University College (1965), the Milton Margai Training College at Goderich, the Freetown Teachers College, a technical institute, and several government and Christian and Muslim secondary schools. Ft. Thornton (1796), now the State House and residence of the president, and the House of Representatives stand on Tower Hill.

There are several mosques and churches, notably the Anglican St. George's Cathedral (1852). The National Museum, housed in the former Cotton Tree Railroad Station, contains historical documents and traditional wood and stone sculptures. Pop. (1974) 276,247.

freeway: *see* expressway.

freezing, in food processing, method of preserving food by lowering the temperature to inhibit microorganism growth. The method has been used for centuries in cold regions, and a patent was issued in Britain as early as 1842 for freezing food by immersion in an ice and salt brine. It was not, however, until the advent of mechanical refrigeration that the process became widely applicable commercially. In 1880 a cargo of meat shipped from Australia to Britain under refrigeration accidentally froze, with such good results that the process was at once adopted for long-distance shipments and other storage. In the 20th century quick, or flash, freezing was found to be especially effective with certain types of food.

Except for beef and venison, which benefit from an aging process, meat is frozen as promptly as possible after slaughter, with best results at temperatures of 0° F (−18° C) or lower. Fruits are frozen in a syrup or dry-sugar pack to exclude air and prevent both oxidation and dessication.

Most commercial freezing is done either in cold air kept in motion by fans (blast freezing) or by placing the foodstuffs in packages or metal trays on refrigerated surfaces (contact freezing).

For freeze-drying, *see* dehydration.

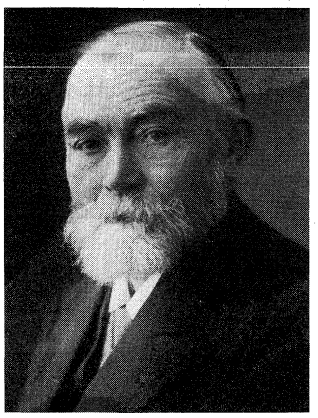
freezing nucleus, any particle that, when present in a mass of supercooled water, will

induce growth of an ice crystal about itself; most ice crystals in the atmosphere are thought to form on freezing nuclei. *See* condensation nucleus.

freezing point, temperature at which a liquid becomes a solid. As with the melting point, increased pressure usually raises the freezing point. The freezing point is lower than the melting point in the case of mixtures and for certain organic compounds such as fats. As a mixture freezes, the solid that forms first usually has a composition different from that of the liquid, and formation of the solid changes the composition of the remaining liquid, usually in a way that steadily lowers the freezing point. This principle is used in purifying mixtures, successive melting and freezing gradually separating the components. The heat of fusion (*see* thermal fusion), the heat that must be applied to melt a solid, must be removed from the liquid to freeze it. Some liquids can be supercooled—*i.e.,* cooled below the freezing point—without solid crystals forming. Putting a seed crystal into a supercooled liquid triggers freezing, whereupon the release of the heat of fusion raises the temperature rapidly to the freezing point.

The addition of one mole (molecular weight in grams) of any non-ionic (does not form ions) solute to 1,000 grams of water lowers the freezing point of the water by 1.885° C, and this has been used as an accurate method for determining molecular weights.

Frege, (Friedrich Ludwig) Gottlob (b. Nov. 8, 1848, Wismar, Mecklenburg-Schwerin—d. July 26, 1925, Bad Kleinen, Ger.), German mathematician and logician, who



Frege

By courtesy of the Universitatsbibliothek, Jena, E. Ger.

founded modern mathematical logic. Working on the borderline between philosophy and mathematics—viz., in the philosophy of mathematics and mathematical logic (in which no intellectual precedents existed)—Frege discovered, on his own, the fundamental ideas that have made possible the whole modern development of logic and thereby invented an entire discipline.

Frege was the son of Alexander Frege, a principal of a girls' high school in Wismar. His mother, Auguste Frege, *née* Bialloblotzky, who was perhaps of Polish origin, outlived her husband, who died in 1866. Frege entered the University of Jena in 1869, where he studied for two years, and then went to the University of Göttingen for a further two—in mathematics, physics, chemistry, and philosophy. Frege spent the whole of his working life as a teacher of mathematics at Jena: he became a *Privatdozent* in May 1871, was made an *ausserordentlicher Professor* (associate professor) in July 1879, and became statutory professor of mathematics in May 1896. He lectured in all branches of mathematics (though his mathematical publications outside the field of logic are extremely few) and also on his own logical system. A great many of his publications, however, were expressly philosophical in character: he himself once said, "Every good mathematician is at least half a philosopher, and every good philosopher at least half a mathematician." He kept aloof from his students and even more aloof from his colleagues.

Though Frege was married, his wife died during World War I, leaving him no children of his own. There was an adopted son, Alfred, however, who became an engineer.

Frege was, in religion, a liberal Lutheran and, in politics, a reactionary. He had a great love for the monarchy and for the royal house of Mecklenburg, and during World War I he developed an intense hatred of socialism and of democracy, to which he came to ascribe the loss of the war and the shame of the Treaty of Versailles. A diary kept at the end of his life reveals, as well, a loathing of the French and of Catholics and an anti-Semitism extending to a belief that the Jews must be expelled from Germany.

Frege had a vivid awareness of his own genius and a belief that it would one day be recognized; but he became increasingly embittered at the failure of scholars to recognize it during his lifetime. He delighted in controversy and polemic; but the originality of his own work, the almost total independence of his own ideas from other influences, past or present, was quite exceptional and, indeed, astonishing.

System of mathematical logic. In 1879 Frege published his *Begriffsschrift* ("Concept-script"), in which, for the first time, a system of mathematical logic in the modern sense was presented. No one at the time, however—philosopher or mathematician—comprehended clearly what Frege had done, and when, some decades later, the subject began to get under way, his ideas reached others mostly as filtered through the minds of other men, such as Peano; in his lifetime there were very few—one was Bertrand Russell—to give Frege the credit due to him. He was not yet too downcast by the failure of the learned world to appreciate the *Begriffsschrift,* which, after all, discourages the reader by the use of a complex and unfamiliar symbolism to express unfamiliar ideas. He resolved, however, to compose his next book without the use of any symbols at all.

There followed a period of intensive work on the philosophy of logic and of mathematics, embodied initially in his first book, *Die Grundlagen der Arithmetik* (1884; *The Foundations of Arithmetic*). The *Grundlagen* was a work that must on any count stand as a masterpiece of philosophical writing. The only review that the book received, however, was a devastatingly hostile one by Georg Cantor, the mathematician whose ideas were the closest to Frege's, who had not bothered to understand Frege's book before subjecting it to totally unmerited scorn.

Wounded by the reception of his second book, Frege nevertheless devoted the next decade to producing a series of brilliant philosophical articles in which he elaborated his philosophy of logic. These articles contain many deep insights, although, as Frege systematized his theories, there appeared a certain hardening into a kind of scholasticism. There followed a return to the philosophy of mathematics with the first volume of *Grundgesetze der Arithmetik* (1893; partial Eng. trans., *Basic Laws of Arithmetic*), in which Frege presented, in a modified version of the symbolic system of the *Begriffsschrift,* a rigorous development of the theory of *Grundlagen.* This, too, received only a single review (by Peano). The neglect of what was to have been his chef d'oeuvre finally embittered Frege, who had complained, in the preface, of the apparent ignorance of his work on the part of writers working in allied fields. The resulting bitterness shows in the style of Frege's controversial writing. Seldom has criticism of previous writers been more deadly than in his *Grundlagen;* but it is expressed with a lightness of touch and is never unfair. In volume 2 of the *Grundgesetze* (1903), however, the attacks became heavyhanded and abusive—a means of getting back at the world that had ignored him.

Contradictions in Frege's system. A worse disaster than neglect, however, was in store for him. While volume 2 of the *Grundgesetze* was at the printer's, he received on June 16, 1902, a letter from one of the few contemporaries who had read and admired his works—Bertrand Russell. The latter pointed out, modestly but correctly, the possibility of deriving a contradiction in Frege's logical system—the celebrated Russell paradox. The two exchanged many letters; and, before the book was published, Frege had devised a modification of one of his axioms intended to restore consistency to the system. This he explained in an appendix to the book. After Frege's death, it would be shown by a Polish logician, Stanisław Leśniewski, that Frege's modified axiom still leads to contradiction. Probably Frege never discovered this. Even a brief inspection, however, of the proofs of the theorems in volume 1 would have revealed that several crucial proofs would no longer go through, and this Frege must have found out.

In any case, 1903 effectively marks the end of Frege's productive life. He never published the projected third volume of the *Grundgesetze,* and he took no part in the development of the subject, mathematical logic, that he had founded, though it had progressed considerably by the time of his death. He published a few polemical pieces; but, with the exception of three essays in the philosophy of logic produced after the end of the war, he did no further creative work. In 1912 he declined, in terms expressing deep depression, an invitation by Russell to address a mathematical congress in Cambridge.

At the very end of Frege's life, he again started to work on the philosophy of mathematics, having arrived at the conclusion that one of the fundamental bases of his earlier work—the attempt to found arithmetic on logic—had been mistaken; but the work did not progress very far and was not published.

Up to an advanced age, Frege hiked every summer in Mecklenburg, his native region. He finally retired during World War I and went to live in Bad Kleinen, in Mecklenburg.

Influence of Frege's work. Frege's work represents the beginning of modern logic because of his invention of the notation of quantifiers and variables. (In natural language, generality is represented by inserting an expression like "everything" or "something" in the argument-place of the predicate; in the notation used in logic since Frege, the argument-place is filled by a variable letter, say x, and the resulting expression prefixed by a quantifier, "For every x" or "For some x," said to "bind" that variable.) By means of this notation he solved the problem that had baffled the logicians of the Middle Ages and prevented the further advance of logic ever since, viz., the analysis of sentences involving multiple generality. In him there also appeared the first clear separation between the formal characterization of logical laws and their semantic justification. His philosophical work is of an importance far more general than the area to which he principally applied it, the philosophy of mathematics: he initiated a revolution, in fact, as profound as that of René Descartes in the 17th century. Whereas Descartes had made epistemology the starting point for all

philosophy, Frege gave this place to the theory of meaning or the philosophy of language. His work has been influential because he made the restricted part of philosophy in which he worked basic to all the rest. The effect was imparted in the first place, however, through the work of others, particularly that of Wittgenstein, who visited him in 1914 and who revered him. But, since John Austin's translation of the *Grundlagen* into English in 1950, the direct influence of Frege's writing among English-speaking philosophers has been very great. No one supposes that Frege said the last word on any topic; but there is scarcely a live question in contemporary philosophy of language for whose examination Frege's views do not form at least the best starting point.

(Mi.D.)

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Frei (Montalva), Eduardo (b. Jan. 16, 1911, Santiago, Chile—d. Jan. 22, 1982, Santiago), Chilean politician and the first Christian Democratic president of Chile (1964–70).

Frei graduated in law in 1933 from the Catholic University of Chile, where he had been president of the National Association of Catholic Students in 1932–33. He served as a delegate to the Congress of Catholic Young People held in Rome in 1934 and helped organize a youth department within the Chilean Conservative Party in 1935. Until 1937 he was the editor of the daily *El Tarapaca* of the seaport town of Iquique, in which he opposed Marxism. In 1938, disillusioned with the Conservative Party, he joined other youth department leaders to form the National Falange, an anti-fascist social Christian party. While a professor of labour law at the Catholic University in 1940–45, he was elected president of the Falange in 1941, 1943, and 1945. He served as an innovative and highly competent minister of public works in the coalition cabinets of presidents José Antonio Ríos in 1945–46 and Gabriel González Videla in 1946–49. In 1949 he was elected to the Senate.

In 1957 the Falange joined with the Social Christian Conservatives to form the Christian Democratic Party, which drew its inspiration from the French Catholic philosopher Jacques Maritain and European Christian Democratic movements. Frei placed third as the party's presidential candidate in 1958, as the party showed increasing strength at the expense of the Conservatives, and by 1964 his presidential candidacy appeared to be the only effective alternative to Marxism. While Salvador Allende, the candidate of the leftist coalition, called for nationalization, Frei offered a moderate program of "Chileanization" of U.S.-owned copper interests as well as economic stabilization and a more equitable distribution of wealth. He won a decisive victory and in 1965 also won control of the lower house of Congress. Although he raised expectations of major change, he achieved only mixed success as president. His plan for 51 percent Chilean control of copper mining was thought to be still too favourable to U.S. corporate interests. His administration was harassed by labour unrest and persistent inflation. His agrarian-reform policies did not achieve expected objectives, nor did the Christian Democratic notion of public participation through "Communitarianism" succeed. Marked progress was made, however, in expanding educational opportunities for the impoverished. Unable to succeed himself, he retired in 1970. Frei wrote many articles and several books on economics and political subjects.

Frei test, procedure used in the diagnosis of lymphogranuloma venereum, a venereal disease caused by a virus. The yolk of a chick embryo is infected with the virus, which is then inactivated by heat. A small amount of this commercial preparation is injected into the skin of the forearm. In a positive reaction, which indicates that the person tested has, or has had, the disease, an inflammatory nodule at least 6 millimetres (about ¼ inch) in diameter with reddened skin around is usually present at the end of 48 hours.

Freiberg, city, Saxony *Land* (state), eastern Germany, on the Freiberger Mulde River, at the northeastern foot of the Erzgebirge (Ore Mountains), southwest of Dresden. An early influential silver-mining community (founded *c.* 1190 and chartered early in the 13th century) and the source (1296–1307) of a mining code (*Freiberger Stadtrecht*), its name is derived from the extensive mining rights that then belonged to the "free miner." Until the 16th century it was the largest city, economic centre, and mint of Saxony. The Reformation was introduced there in 1536 by Henry the Pious, then a resident. The town suffered severely in the 17th century during the Thirty Years' War and again during the French occupation from 1806 to 1814. The Altstadt (Old City) has three separate parts: the oldest, the Civitas Saxonum, a maze of alleys around the Nikolai (St. Nicholas) church; the Untermarkt (Lower Market), a merchant district with the modern cathedral at its centre; the Oberstadt (Upper City), with the town hall and St. Peter's Church as its notable landmarks. Medieval buildings include the town hall (1410–16); Freudenstein Castle (rebuilt 1566–79); the cathedral (1484–1501) with the noted Goldene Pforte (1230; Golden Portal) from an earlier church; and parts of the old town wall, notably, Donats Turm (Donat Tower). The geologists Clemens A. Winkler and Abraham G. Werner taught at the town's renowned Freiberg School of Mining (opened 1765, the oldest of its kind in the world). There are also institutes for radium, nonferrous metals, fuel, and leather.

The silver mines were abandoned as unproductive in 1913, and the other mines (lead, pyrites, zinc) became public property in 1936. In addition to mining there are manufactures of machinery, electrical and precision instruments, leather, textiles, and porcelain. Pop. (1989 est.) 51,341.

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Freiburg, *Regierungsbezirk* (administrative district), southwestern Baden-Württemberg *Land* (state), southwestern Germany. Freiburg is bordered by Switzerland to the south, France to the west, and the *Regierungsbezirke* of Karlsruhe to the north and Tübingen to the east. The district occupies an area of 3,613 sq mi (9,357 sq km) and is coextensive with the southern portion of the larger historic region of Baden (*q.v.*).

The title margrave of Baden originated in 1112. Baden was made a grand duchy in Napoleon's reorganization of Germany in 1806 and a *Land* of the German Reich under the constitution of 1919. Three post-World War II states of West Germany—Baden, Württemberg-Baden, and Württemberg-Hohenzollern—were merged in 1952 to form the present state of Baden-Württemberg. Southern Baden, roughly encompassing the current district of Freiburg, became the new *Land's* southwestern *Regierungsbezirk* of Südbaden. In 1973 an administrative reform altered the boundaries of Südbaden and changed its name to Freiburg, after the largest city and administrative seat of the district.

The southern Schwarzwald (Black Forest), the heart of Germany's largest continuous forest area and source of the Danube and Neckar rivers, occupies nearly all of Freiburg. Dense fir forests that give the region its name lie on an undulating plateau of granite and gneiss topped with higher rounded hills. The plateau is broken by many river valleys including the deep Kinzig valley, the boundary between the northern and southern Black Forest. In western Freiburg the plateau rises some 2,600 ft (800 m) in a steep scarp from the fertile Upper Rhine Plain. The forest extends approximately 40 mi (60 km) in width before its more gentle eastern slopes meet the valleys of the upper Danube and Neckar rivers on the Baar plateau. The Schwabische Alb (Swabian Jura) borders the Baar to the east. The highest peak in the Black Forest, the Feldberg, reaches 4,897 ft (1,493 m) in elevation in southwestern Freiburg and is surrounded by the beautiful Titisee and Schluchsee glacial lakes. Farmers specialize in livestock production in the higher districts of the Black Forest, where mountain pastures above the tree line are used for summer grazing and permanent pastureland is found in valley basins. Harsh climatic conditions limit arable cultivation to hardy cereals. Fruit is grown in valleys cutting into the western escarpment, most commonly grapes, plums, and cherries used in *kirschwasser,* a famous Black Forest cherry brandy.

Specialized industries comprise an important sector of the Black Forest economy. Lumbering is widely dispersed at valley sites where natural water power is available. Large woodworking industries such as furniture factories and paper mills, however, are generally located on the western fringes of the plateau, reducing transportation costs to market areas. The manufacture of modern clocks and precision and optical instruments has grown from the traditional wood-carving and cuckoo clock industries. Well-known clock factories are located in Schramberg, Villingen, and Schwenningen. Trossingen is famous for its organs and accordions. The textile industry has spread into southern villages from Switzerland, and tourism continues to grow. Numerous health spas and year-round holiday resorts have made the Black Forest one of Europe's most visited tourist areas. Freiburg im Breisgau, situated on the western slopes, is the economic and cultural centre of the Black Forest and has a flourishing tourist trade. The city produces electrical equipment and chemicals and is an important timber and wine trade centre.

West of the Black Forest the mild climate and fertile loess soils of the Upper Rhine Plain's Ortenau and Breisgau regions favour intensive cultivation. Many farmers specialize in vegetable gardening and in crops such as tobacco, sugar beets, hops, and malting barley, in addition to vineyards and orchards. Offenburg is the principal city of the Ortenau wine and fruit-growing district and a publishing centre. Vineyards around the volcanic Kaiserstuhl mountain and in the Markgräfler Land at the Black Forest's southwestern termination produce some of Germany's finest wines. The Dinkelberg and Hotzenwald

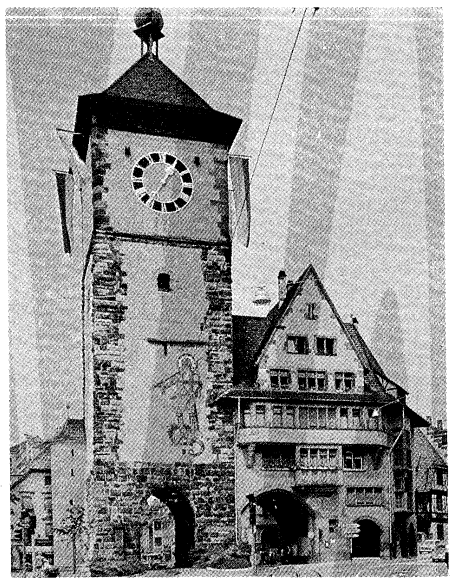
border the Rhine River in southern Freiburg, and in the southeast the Hegau region with its volcanic cones extends to the Bodensee (Lake Constance), Germany's largest lake. The economy of Konstanz, the chief town on the lake, is based on tourism, commerce, and electrical, textile, and metal-processing industries.

The majority of the population of Freiburg are descendants of the Alemanni, a Suebic people who occupied the territory from the 3rd century AD. The predominant language of the district is the Alemannic dialect, merging into Swabian in the east. In the Black Forest isolated farmsteads and small hamlets are the dominant forms of rural settlement. The population is predominantly Roman Catholic. Pop. (1989 est.) 1,896,377.

Freiburg (Switzerland): *see* Fribourg.

Freiburg, Albert Ludwig University of, German in full ALBERT-LUDWIGS-UNIVERSITÄT FREIBURG IM BREISGAU, academically autonomous coeducational institution of higher learning at Freiburg im Breisgau, Ger., financially supported by the state of Baden-Württemberg. Founded in 1457 by Archduke Albrecht of Austria and confirmed by the Holy Roman emperor and the pope, the university was at first named after its founder, but at the beginning of the 19th century added "Ludwig" to the name in honour of its patron, Archduke Ludwig of Baden. Beginning in 1620 Jesuits took over its teaching in philosophy and the chief theological chairs. When Freiburg was ceded to Louis XIV of France in 1677, the university fled to Constance, Switz. Reestablished in Freiburg early in the following century, it developed into a centre for the Catholic Enlightenment in south Germany. Becoming a state institution, it gained fame for its instruction in law. The modern university includes faculties of theology, law, medicine, economics, philosophy, mathematics, the sciences, and forestry.

Freiburg im Breisgau, city, Baden-Württemberg *Land* (state), southwestern Germany. It is picturesquely situated on the western slopes of the Black Forest, where the Dreisam River flows into the Rhine valley. It was founded and chartered in 1120 by the dukes of Zähringen as a free market town (hence its name). In 1218 it passed to the counts of Urach, who assumed the title of counts of Freiburg. Under the Habsburgs after 1368, it was the administrative centre for the outlying Austrian possessions from 1648 to 1805. It was captured in 1525 by the Bauernbund (Peasants' and Farmers' League); in 1632 and 1638 by the Swedes; during the Thirty Years' War (1644) by the Bavarians; and in 1677, 1713, and later by the French, who fortified it. In 1806 it was returned, together with the Breisgau and Ortenau areas, to the ruling house of Baden. Almost all of the old part (the medieval Innenstadt) of the city was completely destroyed by Allied bombing during World War II.



Schwabentor (tower), Freiburg im Breisgau, Ger.
K. Praedel—ZEFA/EB Inc.

The administrative area of the city covers about 31 square miles (80 square km), only about a quarter of which is residential, the remainder comprising oak and pine forests, farmland, and parkland. The Basler Hof, the former residence of the chapter of Basel Cathedral, now houses the city's administrative offices. The Münster, begun in the 13th century and the seat (since 1827) of a Roman Catholic archbishopric, was the only German cathedral to be completed in the Gothic style between the 12th and 16th centuries; its 370-foot (113-metre) tower, its richly decorated main entrance, and the triptych by Hans Baldung Grien on the high altar are particularly noteworthy. Other interesting buildings include the Franciscan Church of St. Martin (dating from the 13th century), the 16th-century town hall, the Jesuit church (1685–1701), and the 18th-century Wenzingerhaus, now the state college of music. The Albert Ludwig University of Freiburg was founded in 1457 by Albrecht VI. The Augustiner Museum contains valuable works of medieval and Baroque art from the upper Rhine district. There are also museums of natural science, folklore, and prehistory.

The cultural and economic centre of the Black Forest, Freiburg is a tourist and conference centre with an important trade in timber and wine. Pop. (1989 est.) 183,979.

Freidank (fl. early 13th century), German didactic poet whose work became regarded as a standard repository of moral precepts.

The poet was a wandering minstrel of burgher origin, born probably in Alemannic or Swabian territory. He took part in the crusade of Frederick II in 1228–29. Several of the impressions left by these experiences are recorded in the one work by which he is known, *Bescheidenheit* ("Moderation"), a collection of gnomic verse, which seems to have been written about 1230. The fables, proverbs, and other sources on which Freidank drew were common property. His achievement lay in the formulation of aphorisms that have the authority of proverbs.

Freie Bühne (German: "Free Stage"), independent theatre founded by the critic and director Otto Brahm in 1889 in Berlin for the purpose of staging new, naturalistic plays. Like André Antoine's Théâtre-Libre in Paris, Brahm gave private performances to theatre subscribers only. The Freie Bühne's first production was of Henrik Ibsen's *Gengangere* (1881; *Ghosts*) in September 1889. A month later, Brahm staged Gerhart Hauptmann's first play, *Vor Sonnenaufgang* (1889; *Before Dawn*), a tragedy of working-class people. During the following seasons, Brahm's presentations included the important naturalist drama dealing with a degenerate family, *Die Familie selicke* (1890; "The Happy Family") by Arno Holz, as well as plays by Leo Tolstoy, Émile Zola, and August Strindberg. Although the Freie Bühne was a success, it lasted for only three seasons, largely because Berlin's commercial theatre had by then embraced the new theatrical movement of naturalism. But it inspired the creation of other private theatres and amateur groups throughout Berlin, Munich, and Vienna.

freight car, also called GOODS WAGGON, railroad car designed to carry cargo. Early freight cars were made largely of wood. All-steel cars were introduced by about 1896 and within 30 years had almost completely replaced the wooden variety. Modern freight cars vary widely in shape and size, but virtually all of them evolved from three basic types that had been in use since the early 1800s: the open-top car, the boxcar, and the flatcar.

Open-top cars may be either gondola or hopper cars. Hoppers are used to haul bulk freight such as coal, gravel, and grain; they have either several discharge hatches or a collapsible bottom for rapid unloading. Gondola cars have fixed bottoms and must be unloaded from above with the help of a crane; they are used to transport manufactured goods. Boxcars are enclosed cars with sliding doors on the sides; they serve to transport manufactured goods requiring protection from the weather and pilferage. Certain types of boxcars, known as refrigerator cars, are heavily insulated and specially cooled to convey fresh or frozen foods over long distances. Another variation of the common boxcar is the stock car with slatted sides, which is used to transport cattle, sheep, and other livestock. The flatcar has long been utilized for hauling heavy construction machinery and military equipment. During the 1950s British Railways and various other European railroad companies developed high-capacity flatcars suitable for carrying huge demountable containers filled with a variety of cargoes and standardized for use on container ships and flatbed trailers as well. About the same time, American railroads introduced the piggyback car, a flatcar modified to hold as many as two truck trailers in place. Later piggyback-car designs utilized double-stacked trailers on interconnected flatcars. The two-level and three-level rack cars widely used in the United States and Canada for conveying new automobiles are also examples of redesigned flatcars. A similar innovation is the transporter wagon, or car van, employed by some continental European and American passenger trains to haul the automobiles of touring motorists who wish to travel part way by rail. One other specialized freight car is the cylindrically shaped tank car constructed to carry a variety of liquids, including industrial chemicals.

Freikorps, English FREE CORPS, any of several private paramilitary groups that first appeared in December 1918 in the wake of Germany's defeat in World War I. Composed of ex-soldiers, unemployed youth, and other discontents and led by ex-officers and other former military personnel, they proliferated all over Germany in the spring and summer of 1919 and eventually numbered more than 65 corps of various names, sizes, and descriptions. Most were nationalistic and radically conservative and were employed unofficially but effectively to put down left-wing revolts and uprisings in Berlin, Bremen, Brunswick, Hamburg, Halle, Leipzig, Silesia, Thuringia, and the Ruhr; they fought miniature wars and sometimes resorted to plunder and roughhousing. At first sanctioned, or even supported, by such figures as Defense Minister Gustav Noske and General Paul von Hindenburg, the Freikorps finally came to be viewed as a nuisance and a threat, and their activities were eventually supplanted by regular army and police work or assumed by the new units of the Nazis and other political parties. Ernst Röhm, a Freikorps commander, later became head of the Nazi SA, or Brownshirts.

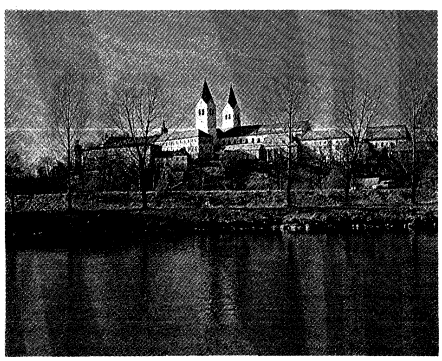
Freiligrath, (Hermann) Ferdinand (b. June 17, 1810, Detmold, Westphalia [Germany]—d. March 18, 1876, Cannstatt, near Stuttgart, Ger.), one of the outstanding German political poets of the 19th century, whose verse gave poetic expression to radical sentiments.

After working as an accountant in a bank in Amsterdam (1831–39), Freiligrath abandoned commerce for literature with the success of his first poems, the Romantic *Gedichte* (1838;

"Poems"). Influenced by Victor Hugo, these early poems are characterized by vividly imaginative and evocative exotic scenes and technical virtuosity; they won him a pension from the Prussian king Frederick William IV. His views became increasingly radical, however, and in 1844 he renounced the pension upon the publication of his collection of political poems *Glaubensbekenntnis* (1844; "Statement of Conscience"). His poetry was banned, and he was forced to leave Germany for Belgium and Switzerland and then England. His poems in *Ça ira* (1846) and the *Neuere politische und soziale Gedichte* (1849 and 1851; "Newer Political and Social Poetry"), celebrating the Revolution of 1848, which brought him back to Germany, were even more strongly socialistic and anti-monarchical. In them his passionate convictions were given both pictorial and rhetorical expression; they are considered to be among the best examples of German revolutionary poetry of the time. The poem *Die Toten an die Lebenden* (1848; "From the Dead to the Living") resulted in his arrest for subversion, but he was acquitted. He moved to Cologne, where he formed a long-standing friendship with Karl Marx, with whom he edited the *Neue rheinische Zeitung* ("New Rhenish Newspaper"). In 1851 he returned to England to escape further political persecution. He was the London manager of the General Bank of Switzerland from 1856 to 1865. In 1868 a public subscription of 60,000 talers raised in Germany enabled him to return.

Among Freiligrath's other important works are his translations of the social poetry of William Wordsworth, Henry Wadsworth Longfellow, Walt Whitman, Robert Burns, Victor Hugo, and Molière; these translations successfully reproduce the atmosphere of the originals and did much to familiarize the German public with those authors.

Freising, city, Bavaria *Land* (state), southern Germany. It lies along the Isar River, north-northeast of Munich. It was the site of a castle in the 8th century, and, after the missionary bishop Korbinian came there in 724 and St. Boniface established the bishopric in 739, it became the ecclesiastical and cultural centre of old Bavaria. The bishopric was secularized in 1803, later reconstituted, and transferred

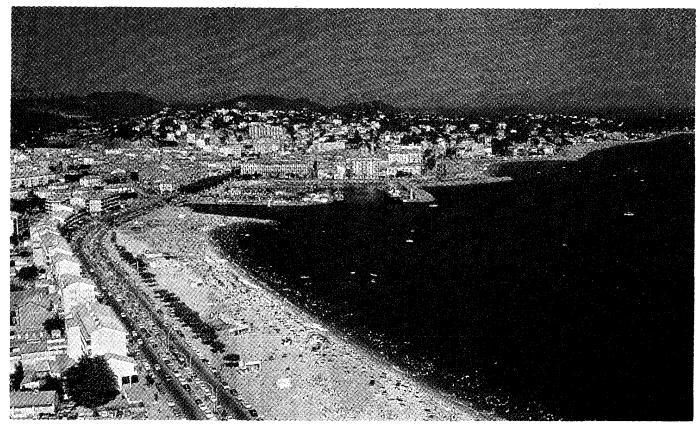


Domberg (cathedral hill) with the cathedral along the Isar River, Freising, Ger.
D.H. Teuffen—ZEFA/EB Inc.

to Munich in 1821. The city is dominated by the Domberg (cathedral hill) with its cathedral (1160–1205), St. John's Church (1319–21), and the Benedict Church (*c.* 1160, altered 1716). Freising's other notable buildings include St. George's Church (*c.* 1440), the former Benedictine abbey of Weihenstephan (now a college of agriculture and brewing), the abbey brewery (licensed since 1146, one of the oldest in the world), and the former bishops' palace. Besides brewing, Freising's industries include the manufacture of electrical machinery, textiles, and chemicals. Pop. (1989 est.) 35,201.

Freistadt, town, *Bundesland* ("federal state") Oberösterreich, northeast-central Austria, near the Czechoslovakian frontier. First mentioned in 1241, it is an old fortified town on the ancient iron- and salt-trade route connecting the Danube and Bohemia. The town is ringed with fortifications, double walls, moats, towers, and gates that are still largely intact. The town centre is an unspoiled ensemble of old town houses and public buildings in Gothic style, notably the Church of Our Dear Lady (the parish church), with Gothic murals and windows. Pop. (1981) 6,251.

Fréjus, town, Var *département,* Provence-Alpes-Côte-d'Azur *région,* southeastern France. It lies south of the Estérel hills, southwest of Cannes. The town is on the site of an ancient naval base founded by Julius Caesar



Fréjus, Fr., and its beach on the Côte d'Azur (French Riviera)
Club Iris

in approximately 50 BC and known originally as Forum Julii. Its Roman ruins include a 3rd-century amphitheatre, an aqueduct, and ancient fortifications. The cathedral of Notre-Dame et Saint-Étienne (13th century) has a 5th-century baptistery. Fréjus was the birthplace of the Roman poet Gaius Cornelius Gallus and of the French revolutionary statesman E.-J. Sieyès (1748). The town was devastated by flood when nearby Malpasset Dam collapsed in 1959.

The town's economic activities focus on tourism, the production of wines and fruits (especially peaches), the quarrying of fluorspar and barite (barium sulfate), and the manufacture of building materials and metals. Pop. (1982) 28,489.

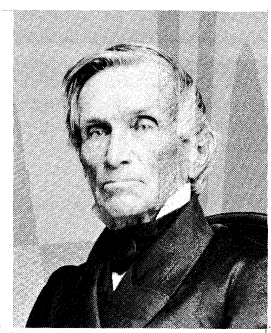
Frelimo, in full FRENTE DE LIBERTAÇÃO DE MOÇAMBIQUE, English MOZAMBIQUE LIBERATION FRONT, political and military movement that sought to wrest Mozambican independence from Portugal and then formed the governing party of newly independent Mozambique in 1975.

Frelimo was formed in neighbouring Tanzania in 1962 by exiled Africans from Mozambique who were seeking to overthrow Portuguese colonial rule in their country. The movement's original leader was Eduardo Mondlane; he held the nascent organization together, obtained support from both communist and western European countries, and built a force of several thousand guerrillas who became active in northern Mozambique. Mondlane was assassinated in 1969 and was succeeded by Samora Machel, a pragmatic military commander who extended Frelimo's activities to central Mozambique. By the mid-1960s the Portuguese colonial authorities had 70,000 troops in Mozambique to put down the insurgency, but to no avail. Following the left-wing military coup in Portugal in 1974, Mozambique attained independence in 1975 under a Frelimo government headed by Machel. Frelimo subsequently restructured itself as a Marxist-Leninist party and tried to revive the country's shattered economy, but the movement was hampered from the late 1970s on by the dissident Mozambican group known as Renamo (*q.v.*).

Frelinghuysen, Frederick Theodore (b. Aug. 4, 1817, Millstone, N.J., U.S.—d. May 20, 1885, Newark, N.J.), lawyer and U.S. senator who as secretary of state obtained Pearl Harbor as a U.S. naval base.

He was born into a family that had long been prominent in politics. Left an orphan at the age of three, he was adopted by his uncle, Theodore Frelinghuysen. He graduated from Rutgers College in 1836, studied law in his uncle's law office, and succeeded to the latter's large practice in 1839. Frelinghuysen was one of the founders of the Republican Party in New Jersey and served as the state's attorney general from 1861 to 1866.

In 1866 he was appointed to the U.S. Senate to fill a vacancy and was elected the following year to fill the unexpired term. Defeated for the Senate in 1869, he was elected for a full six-year term beginning in 1871. He was one of the Senate's ablest debaters and did important work as chairman of the committee on foreign affairs during the negotiations over the *Alabama* claims. President Chester A. Arthur appointed Frelinghuysen secretary of state in 1881 to succeed James G. Blaine. Patient and firm in his handling of diplomatic affairs, he favoured closer commercial relations with



Frelinghuysen
By courtesy of the Library of Congress, Washington, D.C.

Latin America and negotiated a change in the treaty with Hawaii to give the United States a naval base at Pearl Harbor. He also opened treaty relations with Korea (1882) and mediated several international disputes.

Fremantle, city and principal port of Western Australia, on the Indian Ocean at the mouth of the Swan River (which forms an inner harbour). Now part of the Perth metropolitan

area, Fremantle is one of Australia's largest ports and an initial landfall for ships from Europe. It was laid out in 1829 and named after Captain Sir Charles Fremantle, a British naval officer who took possession of the area around the river mouth in order to prevent French or U.S. incursions there. Not subject to fog, storms, or strong tides, the port became a major whaling centre. It grew during the late 19th century by serving the Coolgardie–Kalgoorlie goldfield (320 miles [515 km] inland), and, in 1901, with harbour improvements, it surpassed the port of Albany, 230 miles (370 km) southeast, in importance. During World War II it served as the principal Allied submarine base in the Southern Hemisphere.

Fremantle, a city since 1929, is now a major industrial centre manufacturing superphosphate fertilizer, furniture, refined sugar, scoured wool, leather, ships, steel, automobiles, cement, petroleum products, and aluminum. A terminus of the Trans-Australian Railway, Fremantle is also linked by rail to the state's chief agricultural areas. Exports include petroleum, grains, flour, wool, mineral concentrates, and refrigerated meats. The large industrial complex of Kwinana is nearby. The outer harbour is 73 square miles (190 square km) in extent, while the inner harbour (in the mouth of the Swan River), opened in 1897, was expanded in 1969 with a container terminal employing one of the world's largest container-lifting cranes. Fremantle is the base for the state's largest commercial fishing fleet. Pop. (1986) 23,540.

Fremont, city, Alameda county, California, U.S., on the southeast shore of San Francisco Bay (there spanned by the Dumbarton Bridge), on the Hetch Hetchy Aqueduct. Site of Mission San José de Guadalupe (founded in 1797), the city, named for John C. Frémont, the Western explorer, was formed in 1956 through the amalgamation of five communities—Centerville, Irvington, Niles, Mission San José, and Warm Springs. Freeway connections stimulated residential and industrial growth as part of the San Francisco Bay development. Ohlone (junior) College (1965) is in Fremont. Pop. (1988 est.) 158,236.

Frémont, John C(harles) (b. Jan. 21, 1813, Savannah, Ga., U.S.—d. July 13, 1890, New York, N.Y.), American mapmaker and explorer of the Far West, an important figure in the U.S. conquest and development of California. He ran unsuccessfully as the first Republican presidential candidate in 1856.

In 1838 Frémont assisted the French scientist Jean-Nicolas Nicollet in surveying and mapping the upper Mississippi and Missouri rivers. He also headed an expedition (1841) to survey the Des Moines River for Nicollet, who had given him expert instruction in geology, topography, and astronomy. His growing taste for wilderness exploration was whetted by the expansionist enthusiasm of Missouri senator Thomas Hart Benton, who became his adviser, sponsor, and, in 1841, father-in-law. Benton's influence in government enabled Frémont to accomplish within the next few years the mapping of much of the territory between the Mississippi valley and the Pacific Ocean. In 1842 the War Department sent him to survey the route west to Wyoming, and in 1843, accompanied by the colourful guide Kit Carson and mountain man Thomas Fitzpatrick, he completed a survey to the mouth of the Columbia River. After thoroughly exploring much of the Northwest, he made a winter crossing of the Sierra Nevada to California, further adding to his fame.

War with Mexico over the annexation of Texas seemed imminent, and in the spring of 1845 Frémont headed a third expedition west with possible secret instructions for action in case of war. Upon his arrival in California he defied Mexican authorities, throwing his support behind a small group of dissident Americans near Sonoma who started an unofficial uprising and created the Bear Flag Republic. When news of the declaration of war with Mexico (May 1846) reached California, Frémont was appointed by Commodore Robert F. Stockton as major of a battalion and, with Stockton, completed the conquest of the future 31st state. Meanwhile, General Stephen Watts Kearny entered California from the southeast with orders to establish a government, leading to an obvious conflict of authority. Frémont accepted California's capitulation from Mexican officials at Cahuenga Pass, near Los Angeles, and Stockton appointed him military governor of California. Kearny, however, had Frémont arrested and court-martialed in Washington, D.C., in 1847–48 for disobedience. He was sentenced to dismissal from the army, and although his penalty was set aside by President James K. Polk, Frémont resigned. Through it all, he retained the high regard of the general public.

Frémont became a multimillionaire in the 1848 California gold bonanza, and in 1850 he was elected one of the state's first two senators. A firm opponent of slavery, he was nominated for the presidency in 1856 by the new Republican Party. In the election he was defeated by the Democratic candidate, James Buchanan, but he came closer to uniting the electorate of the North and West against the South than had any previous candidate.

Frémont served unsuccessfully as a Union officer in the American Civil War, and he resigned from the army (1862) a second time. Still popular, he was considered for the presidential nomination again in 1864 but withdrew to avoid dividing the party. Thereafter he retired from public life to devote himself to railroad projects in the West. In 1878, after losing his fortune, he was appointed governor of the Arizona Territory, where he served until 1883.

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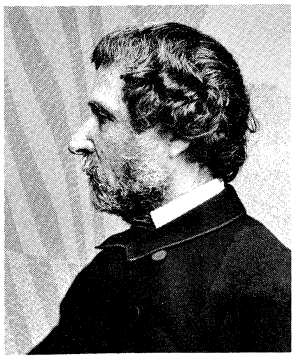


Frémont

By courtesy of the Library of Congress, Washington, D.C.

Frémy, Edmond (b. Feb. 28, 1814, Versailles, Fr.—d. Feb. 3, 1894, Paris), French chemist best known for his investigations of fluorine compounds. In 1831 he entered the laboratory of Joseph-Louis Gay-Lussac and, after holding several teaching posts, succeeded Gay-Lussac in the chemistry chair at the Museum of Natural History, Paris (1850), of which he became director (1879–91).

Frémy investigated osmic acid, ozone, and compounds of iron, tin, and lead, among others. He sought to isolate free fluorine and discovered hydrogen fluoride and a series of its salts. He studied the colouring matters of leaves and flowers and the composition of animal substances. He contributed to the technology of iron, steel, sulfuric acid, glass, paper, and, in particular, the saponification of fats. He sought to obtain crystals of aluminum oxide and succeeded in making rubies.

French, Daniel Chester (b. April 20, 1850, Exeter, N.H., U.S.—d. Oct. 7, 1931, Stockbridge, Mass.), sculptor whose work is probably more familiar to a wider American audience than that of any other native sculptor.

Daniel Chester French, *c.* 1915

Peter A. Juley & Son

French's first important commission, which came from the town of Concord, Mass., was the statue "The Minute Man" (1875), commemorating the Concord fight 100 years earlier. It became the symbol for defense bonds, stamps, and posters of World War II. French's great marble, the seated Lincoln in the Lincoln Memorial, Washington, D.C., was dedicated in 1922. In the intervening 50 years he created a vast number of works on American subjects. Among these are the equestrian statues of General Ulysses S. Grant in Philadelphia and General George Washington in Paris; three pairs of bronze doors for the Boston Public Library; the "Standing Lincoln," Lincoln, Neb.; the statue of Ralph Waldo Emerson in the public library, Concord, Mass.; the "Alma Mater" at Columbia University; and the "Four Continents" at the New York City customhouse.

French, Free: *see* Free French.

French, Sir George Arthur (b. June 19, 1841, Roscommon, Ire.—d. July 28, 1921, London, Eng.), British soldier in Canada who organized the North West Mounted Rifles (later the North West Mounted Police, then Royal North West Mounted Police, now Royal Canadian Mounted Police).

French attended the Royal Military academies at Sandhurst and Woolwich and in 1860 obtained a commission in the Royal Artillery. In 1871 he went to Canada as an inspector of artillery. In 1873 he organized the North West Mounted Rifles and was its first commissioner; he commanded the march from Dufferin, Man., to the foothills of the Rockies in 1874, to establish law and order in the region. He was also head of the School of Gunnery at Kingston, Ont.

French resigned his post in Canada in 1876 and returned to serve in the British army, going first to Australia and then to India. He attained the rank of major general in 1900 and was knighted in 1902.

French, John (Denton Pinkstone), 1ST EARL OF YPRES, VISCOUNT FRENCH OF YPRES AND OF HIGH LAKE (b. Sept. 28, 1852, Ripple, Kent, Eng.—d. May 22, 1925, Deal, Kent), field marshal who commanded the British army on the Western Front between August 1914, when World War I began,

and Dec. 17, 1915, when he resigned under pressure and was succeeded by General (afterward Field Marshal) Douglas Haig.

The battles fought under his direction at Ypres, Belg., and elsewhere are remembered chiefly for inordinate numbers of British casualties—*e.g.,* 110,000 dead in the first two battles of Ypres. He was considered unable to adapt himself to unfamiliar conditions of war or to work harmoniously with the British government, his own subordinates, or the French and Belgian generals with whom he was supposed to cooperate.

A soldier from 1874, French became a public figure with his successful leadership of British cavalry against the Boers in the South African War (1899–1902). He was appointed inspector general in 1907 and chief of the Imperial General Staff in 1913.

On Aug. 23, 1914, near Mons, Belg., French directed the first major engagement of British troops in the war. Although superior German strength forced him to retreat, he had intended merely to cover the withdrawal of the French 5th Army, and as a delaying action the battle was a success. He was criticized, however, for his failure to coordinate the movement of his two corps or even to remain in touch with their commanders. After a costly battle at Le Cateau, Fr., on August 26, he seemed to lose his nerve and planned to withdraw south of the Seine River and perhaps from France altogether. Lord Kitchener, the British secretary of state for war, induced him to remain in action and to work more closely with the French and Belgian armies.

On Oct. 19, 1914, French ordered his force, increased by that time to three corps, to start a two-branched offensive eastward from Ypres. The British collided with German armies that began an offensive of their own the next day. By November 22 the First Battle of Ypres ended in stalemate. The bitter resistance of French's army appeared heroic to the British public but accomplished little except holding the Allied line. In 1915 the battles of Neuve-Chapelle (from March 10), Ypres again (from April 22), and Loos (from September 25) likewise achieved no positive result. French's indecisive use of his reserves at Loos led to his removal.

French was created a viscount in 1916 and an earl in 1922. He was commander in chief in the United Kingdom and then (1918–21) lord lieutenant of Ireland. In 1919 he published *1914,* his own account of the war.

French Academy, French ACADÉMIE FRANÇAISE, French literary academy, established by the French first minister Cardinal de Richelieu in 1634 and incorporated in 1635, and existing, except for an interruption during the era of the French Revolution, to the present day. Its original purpose was to maintain standards of literary taste and to establish the literary language. Its membership is limited to 40. Though it has often acted as a conservative body, opposed to innovations in literary content and form, its membership has included most of the great names of French literature—*e.g.,* Pierre Corneille, Jean Racine, Voltaire, the Viscount de Chateaubriand, Victor Hugo, Joseph-Ernest Renan, and Henri Bergson. Among numerous European literary academies, it has consistently retained the highest prestige over the longest period of time.

French and Indian War, the American phase of a worldwide, nine-years' war (1754–63) fought between France and Great Britain. (The more complex European phase was the Seven Years' War [1756–63].) It determined the control of the vast colonial territory of North America. Three earlier phases of this extended contest for overseas mastery are treated separately: King William's War (1689–97), Queen Anne's War (1702–13), and King George's War (1744–48).

The French and Indian War began over the specific issue of whether the upper Ohio River valley was a part of the British Empire, and therefore open for trade and settlement by Virginians and Pennsylvanians, or part of the French Empire. Behind this issue loomed an infinitely larger one, however: which national culture was to dominate the heart of North America. Settlers of English extraction were in a preponderance in the coveted area, but French exploration, trade, and Indian alliances predominated. As early as 1749, the governor-general of New France specifically ordered the area cleared of all British, with the aim of restricting their settlements to the territory east of the Appalachian Mountains. In the spring of 1754, the French ousted a Virginia force from the forks of the Ohio River, and a skirmish was precipitated by Colonel George Washington. Shortly, Washington's force was surrounded at Fort Necessity, Pa., and forced to surrender. Ultimately the war spread to every part of the world where either of the two nations had territorial interests.

The first four years saw nothing but severe reverses for the British regulars and American colonials, primarily because of superior French land forces in the New World. Lack of colonial assistance to the war effort compounded British problems. By the end of 1757, however, the course of the war began to be altered by three major influences. One was the dynamic leadership of the British prime minister, William Pitt the Elder, who saw that victory in North America was the supreme task in the worldwide struggle and who has been truly called the organizer of victory in the Great War for the Empire. The second was the increasing superiority of British financial and industrial resources, food supplies, and naval equipment, as opposed to growing national bankruptcy and economic paralysis faced by France. Finally, both the British and Americans were becoming seasoned wilderness fighters.

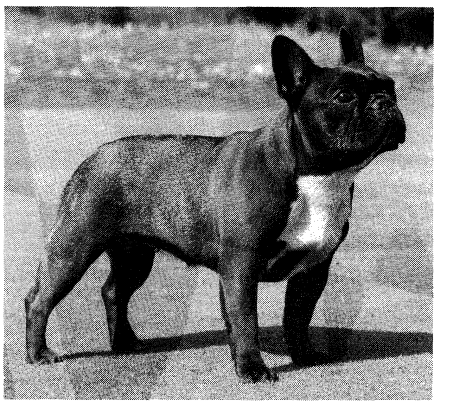
In 1758 and 1759, aided by effective blockades off the coast of France as well as in the Gulf of St. Lawrence, the British won important victories at Louisbourg, Fort Frontenac, Fort Carillon (later Ticonderoga), and Crown Point, and at Fort Duquesne (now Pittsburgh) and Fort Niagara. The climax came with the British victory on the Plains of Abraham (Sept. 13, 1759), where Quebec was forced to surrender and where both commanders, James Wolfe and the Marquis de Montcalm, were fatally wounded (*see* Quebec, Battle of). A year later, Montreal and the whole of New France had fallen. By the Treaty of Paris (Feb. 10, 1763), France ceded its territory on mainland North America east of the Mississippi River (including Canada) to Great Britain; Spain ceded Florida to Britain but in return received the Louisiana Territory (*i.e.,* the western half of the Mississippi River basin) and New Orleans from the French. Though unpopular with the British public, which would have preferred France's rich sugar-producing islands of the West Indies rather than Canada, the 1763 treaty is often thought to mark the beginning of Britain's imperial greatness. Ironically, Britain's problems arising from victory, such as war debts and the administration and settlement of an expanded colonial empire, contained the very seeds of the conflict that would lead to the U.S. War of Independence during the following decade.

French billiards, also called CAROM BILLIARDS, game played with three balls (two white and one red) on a table without pockets, in which the object is to score caroms (British cannons) by driving one of the white balls into both of the other balls, counting one point for each carom.

The standard table is 5 by 10 feet (152 by 305 cm), although smaller tables of similar proportions are used. The table is marked with three spots, one near its head, one at its centre, and one near its foot. The red ball is spotted on the foot spot, the white on the head spot, and the first player's cue ball within six inches directly to either side of the white object ball. The cue ball must contact the red ball first on the break (first) shot; on subsequent shots either red or white may be the first ball hit. When a player fails to score, he yields to his opponent, who plays the balls as they have been left. A game is usually continued until one player scores an agreed number of points, often 50.

French Broad River, river rising in the Blue Ridge, Transylvania county, western North Carolina, U.S., and flowing 210 miles (340 km) northeast past Brevard, then northwest past Asheville, N.C., and through the Great Smoky Mountains into Tennessee, where it turns west to join the Holston River near Knoxville, forming the Tennessee River. Douglas Dam and Reservoir, part of the Tennessee Valley Authority (TVA), is on the French Broad east of Knoxville. The river was named French Broad to distinguish it from North Carolina's Broad River. The French Broad flows west and was associated with French settlers to the west. Main tributaries are the Pigeon and Nolichucky rivers.

French bulldog, byname FRENCHIE, a small dog of the nonsporting group, which was developed in France in the later 1800s from crosses between small native dogs and small bulldogs of a toy variety. The French bulldog is a small counterpart of the bulldog (*q.v.*), but



French bulldog

© Sally Anne Thompson—Animal Photography Partnership

it has large, erect ears, rounded at the tips. Its skull is flat between the ears and domed above the eyes, and the expression is typically one of alertness, rather than moroseness as in the bulldog. A valued companion and watchdog, the French bulldog stands 28 to 30 cm (11 to 12 inches) and weighs about 10 kg (22 pounds). Its short, fine coat may be any of a number of colours, such as brindle, grayish brown (fawn), or white.

French Championships, byname FRENCH OPEN, French in full CHAMPIONNATS INTERNATIONAUX DE FRANCE DE TENNIS ("France's International Championships of Tennis"), international tennis championship tournament established as a men's interclub competition in 1891.

The first French national championships were held in the Stade Français. In 1897 women's singles matches were added to tournament play. Women's doubles matches were added in 1925, the same year that the French Championships were opened to non-French players. In 1968 the tournament was opened to professional as well as amateur players, as were a number of the most established cham-

pionships. Play moved in 1928 to the Stade Roland-Garros, which contains clay courts. The French Championships are generally held in late May–early June. The All-England (Wimbledon) Championships, the U.S. Open, the Australian Open, and the French Open constitute the "Big Four," or "Grand Slam," of tennis.

For winners of the French Championships, *see* Sporting Record: *Tennis.*

French Communist Party, French PARTI COMMUNISTE FRANÇAIS (PCF), French branch of the international communist movement. Its large electorate once gave it considerable influence.

Founded in 1920 by the left wing of the French Socialist Party, the PCF did not gain significant votes until 1936, when it affiliated with Léon Blum's leftist Popular Front coalition government.

In 1945 the PCF won some 25 percent of the vote in France's first post-World War II election, and in 1946 it took part in the Fourth Republic's first government. After May 1947, when the Communists were dismissed from the Cabinet as a result of hardening political attitudes, the PCF did not participate in any Fourth Republic administration, though it won an average of more than 22 percent of the vote in the six general elections from June 1951 to June 1968 and commanded a large representation in the National Assembly.

When General Charles de Gaulle became president of the Fifth Republic in 1958, the PCF lost a good deal of ground in a surge of right-wing and nationalist feeling. In September 1965, the party lent its support to other left-wing parties to form the Fédération de la Gauche Démocrate et Socialiste (Federation of the Democratic and Socialist Left). The alliance succeeded in keeping de Gaulle from an absolute majority in the first round of the 1965 election. In the first round of the June 1969 presidential election, the PCF candidate came in third, with 21 percent of the vote. By the mid-1970s, however, serious strains developed in the alliance of the left; and in 1978 the PCF temporarily abandoned the alliance. The PCF was again allied with the Socialist Party in the 1981 elections. Though its own representation fell dramatically in the National Assembly, it received four cabinet posts in the new socialist government. In 1984, in a change of ministries, it lost these posts.

The PCF was a highly disciplined and centralized party with a largely working-class base. It controlled the largest trade-union organization in France, the General Confederation of Labour (Confédération Générale du Travail; CGT), and published the daily newspaper *L'Humanité.* The PCF is generally pro-Soviet, and it reestablished party relations with the Chinese Communist Party in 1982. The party by the late 20th century had lost many of its traditional working-class supporters.

French Community, French LA COMMUNAUTÉ, association of states created in 1958 by the constitution of the Fifth French Republic to replace the French Union (itself the successor of the former French colonial empire) in dealing with matters of foreign policy, defense, currency and economic policy, and higher education. By the late 1970s the association was defunct. Although the relevant articles of the constitution were not abrogated, they were no longer applied; and the Community fell into oblivion.

French Congo, French CONGO FRANÇAIS, French possessions in Equatorial Africa from 1897 until 1910, when the colonies of Gabon, Middle Congo (Moyen-Congo), and Ubangi-Shari-Chad were federated under the name Afrique Équatoriale Française (AEF). Thereafter, the term French Congo was used to designate the Middle Congo, until it became the Congo Republic (1959; later the People's Republic of the Congo).

French East India Company, byname of (1664–1719) COMPAGNIE FRANÇAISE DES INDES ORIENTALES (French: "French Company of the East Indies"), or (1719–20) COMPAGNIE DES INDES ("Company of the Indies"), or (1720–89) COMPAGNIE FRANÇAISE DES INDES ("French Company of the Indies"), any of the French trading companies established in the 17th and 18th centuries to oversee French commerce with India, eastern Africa, and other territories of the Indian Ocean and the East Indies.

The first company, the Compagnie Française des Indes Orientales, was established by Jean-Baptiste Colbert, finance minister to King Louis XIV. It had difficulty gaining the financial support of French merchants, and Colbert is thought to have pressured many of them to join. He persuaded François Charpentier of the French Academy to write a glowing advertisement about the benefits of joining the company, asking why the French should purchase gold, pepper, cinnamon, and cotton from foreign merchants. Louis XIV wrote to 119 towns, ordering merchants to gather and discuss subscribing to the company, but many felt that this was a thinly veiled tax and refused. By 1668, the king himself was the biggest investor, and the company was to remain under his control.

In constant competition with the already-established Dutch East Indies Company, the French company mounted expensive expeditions that were often harassed and even confiscated by the Dutch. The French East India Company flourished briefly from 1670 to 1675; but by 1680 little money had been made, and many ships were in need of repair.

In 1719 the Compagnie Française des Indes Orientales was absorbed by the short-lived Compagnie des Indes. This company became entangled in the disastrous financial schemes of the fiscal administrator John Law, and so it suffered severely in the ensuing French economic crash of 1720. The company was then reorganized under the name Compagnie Française des Indes.

The revived company obtained the colonies of Mauritius (Île de France) in 1721 and Mahé in Malabar (India) in 1724. By 1740 the value of its trade with India was half that of the British East India Company.

The ablest leader of the company, Joseph-François Dupleix, was appointed the governor-general of French India in 1742. In 1746 he captured Madras but failed to take the neighbouring British fort of St. David. Dupleix set out to ruin the British company by means of alliances with local Indian powers, but the British supported rival Indian groups, and a private war between the two companies broke out in 1751. After being recalled to Paris in 1754, Dupleix unsuccessfully sued the company for money that he had spent on its behalf in India.

During the Seven Years' War (1756–63) between France and England, the French were defeated, and Pondicherry, the capital of French India, was captured in 1761. Because the French economy saw more profit from trade in the West Indies, the French East India Company lacked government support. Its monopoly over French trade with India was ended in 1769, and thereafter the company languished until its disappearance during the French Revolution in 1789.

French Equatorial Africa, French AFRIQUE ÉQUATORIALE FRANÇAISE (AEF), collectively, four French territories in central Africa from 1910 to 1959. In 1960 the former territory of Ubangi-Shari (Oubangui-Chari), to which Chad (Tchad) had been attached in 1920, became the Central African Republic and the Republic of Chad; the Middle Congo (Moyen-Congo) became the Congo Republic, now the People's Republic of the Congo; and Gabon became the Republic of Gabon.

French Guiana, officially DEPARTMENT OF FRENCH GUIANA, French GUYANE FRANÇAISE, or DÉPARTEMENT DE LA GUYANE FRANÇAISE, overseas *département* of France, northeastern coast of South America. French Guiana has an area of 33,399 square miles (86,504 square km) and is bounded by Brazil to the south and east, Suriname to the west, and the Atlantic Ocean to the northeast. The capital is Cayenne. French Guiana's population was estimated at 98,600 in 1990.

French Guiana

The land. Geologically, the rock underlying French Guiana forms part of the crystalline massif of the Guiana Highlands. Rivers, which flow generally northeastward to the sea, have greatly eroded the massif, and most of French Guiana is low-lying. The Maroni River forms the French Guiana–Suriname border in the west, and the Oyapock forms the border with Brazil in the east. The Tumac-Humac Mountains in the south reach an elevation of 2,300 feet (700 m). Recent alluvial deposits have formed a swampy coastal plain southeast of Cayenne and support mangroves and grasses. Older alluvial deposits form a savanna west of Cayenne. Dense tropical forests (mostly hardwood) predominate outside the coastal plain and cover more than four-fifths of the land area. French Guiana is subject to heavy rainfall between December and July; annual rainfall reaches 150 inches (3,800 mm) around Cayenne and tapers off toward the northeast. High temperatures predominate, and monthly averages vary between 77° and 80° F (25° and 27° C) at Cayenne. Wildlife includes tapir, caiman, ocelot, sloth, great anteater, and armadillo. Mineral reserves are limited to kaolin, gold, and bauxite.

The people. French Guiana's population is principally Creole (mulatto) with minorities of ethnic blacks, American Indians, metropolitan French, Lebanese, Chinese, East Indians, Laotians, Haitians, Brazilians, and Vietnamese. The principal languages spoken are French (official); Creole; Taki-Taki (Sranan), spoken by the ethnic blacks; American Indian dialects; and the various languages of the immigrant communities. The principal religion is Roman Catholicism, adhered to by about 90 percent of the population. Buddhism and Islām are practiced among the East Indians and Southeast Asians. The populace is concentrated principally in and around Cayenne, the largest city, and the coastal regions; the interior is largely uninhabited. Demographic rates are those generally typical of a developing country. There was immigration from Southeast Asia, Haiti, and the French Caribbean territories during the late 20th century.

The economy. French Guiana has a developing market economy, patterned on metropolitan France and sustained by aid from France. Services and the production, processing, and export of agricultural, forestry, and fishing products are the largest sectors of the economy. The gross national product (GNP) per capita is one of the highest in South America.

Agriculture produces a large share of the GNP and employs about one-eighth of the registered work force as well as many small subsistence and part-time farmers. Subsistence farming predominates and centres on the growing of cassava, dasheen (taro), sweet potatoes, rice, corn (maize), and bananas and plantains. Most small farms are worked and owned by families, but there are some large estates engaged in growing cash crops, including sugarcane, limes, bananas, and tropical fruits, largely for export to France.

Forests contain valuable commercial species. Some of all forestland is reserved by the state, but most is open to exploitation. Most of the timber cut is used for industrial purposes, and of this about two-fifths is exported. Pastures cover less than 1 percent of the land and support mainly cattle, pigs, and poultry. Meat and milk production is limited, and large quantities of both must be imported. Shrimps account for most of the annual fish catch.

Mineral industries are of negligible importance, and French Guiana must import mineral fuels and metallic minerals. Gold, gravel, and sand are the only minerals extracted.

The limited manufacturing industries are concentrated on fish, meat, and crop processing and rum and sawn wood production. Most capital and consumer goods must be imported. Electricity is generated entirely from imported mineral fuels.

Most of the labour force is employed in administration and public services and agriculture. Wages and benefits are legislated at the same rates as those that prevail in France. Unemployment and inflation are high.

Although about two-thirds of the country's roads are paved, the road system is seriously underdeveloped in the interior. Dégrad des Cannes, Le Larivot, Saint-Laurent-du-Moroni, and Kourou are the principal ports. Some of the country's waterways are navigable by small ocean-going craft, but most are navigable only by shallow-draft vessels. An international airport is located at Cayenne. There is a rocket-launching base at Kourou, used by the European Space Agency.

The balance of trade is unfavourable, with exports covering only about one-eighth of imports. Food products, machinery, consumer goods, and refined petroleum dominate imports; shrimp, forest products, and gold are the leading exports. Major trading partners are France and the United States. French Guiana receives substantial aid and technical assistance from France.

Government and social conditions. French Guiana is governed by the provisions of the French Constitution as an overseas *département* of France and, as such, forms an integral part of the French Republic. It sends two elected representatives to the National Assembly and one to the Senate. Local government is headed by a prefect and by a 19-member General Council and a 31-member Regional Council; members of both are elected by universal adult suffrage. There is a local court of appeal. The principal political party is the Parti Socialiste Guyanais. Other political parties operate freely and include the Rassemblement pour la République (Gaullist), the Union pour la Démocratie Française, and the Unité Guyanaise (Marxist, pro-independence). The violence-oriented Front National Libéré de la Guyane, however, is outlawed.

The social-security system of France is used in French Guiana. It provides payments for work injury, unemployment, and maternity, as well as family allowances and also old-age, disability, and survivor pensions. Health conditions are generally good. The principal causes of death are diseases of the arteries, accidents, and cancer. The Pasteur Institute, located in Cayenne, conducts research on tropical and endemic local diseases and is renowned throughout Latin America. Life expectancy averages 63 years for men and 70 years for women.

Education is free and compulsory between the ages of 6 and 16. Nearly all eligible children attend. There are private colleges and several teacher-training colleges, and university education is available in France or the French Antilles. The news media are free from direct government control, but subsidies and licensing induce considerable self-control. The principal newspaper is *La Presse de la Guyane,* published in Cayenne.

French Guiana's cultural life reflects the diverse background of the resident ethnic communities. Indigenous and African crafts, customs, and arts predominate among American Indians and ethnic blacks. In the metropolitan areas a distinctive mixed-creole culture is dominant, highlighted by brilliantly coloured and distinctively patterned costumes; dances reflecting African, East Indian, and French 18th-century influence; and festivals, especially the pre-Lenten Carnival, when much of the population devotes itself to costume design, musical composition, and dance competitions. Léon Damas, a French Guianese poet, was a leader of the Caribbean *modernismo* literary movement of the 1920s.

History. Spaniards explored the Guiana coast in 1500 and settled the area around Cayenne in 1503. French merchants from Rouen opened a trading centre in Sinnamary in 1624, followed by others from Rouen or Paris who founded Cayenne in 1643. The Treaty of Breda awarded the territory to France in 1667, and the Dutch, who had occupied Cayenne in 1664, were expelled in 1676. Inhabitants of the territory were made French citizens, with representation in the French Parliament after 1877. However, by 1852 the French began using the territory as a penal colony where deported convicts were imprisoned in dreadful conditions exemplified by the notorious Devil's Island. More than 70,000 French convicts were deported to French Guiana between 1852 and 1939; the penal colony on Devil's Island was abolished only after the startling exposé by Albert Londres (1884–1932). Another aspect of French Guiana, however, was the pioneering community at Mana (1827–46) founded by Anne-Marie Javouhey, mother-superior of the community of St. Joseph of Cluny, who with Father Libermann established one of the earliest educational systems for the freed black slaves and women, in the spirit of French liberal Catholic humanism.

French Guiana became a *département* of France in 1946. The general postwar economic stagnation was partially relieved by the construction of the European Space Agency's rocket-launching base and a new town at Kourou in 1968 and by the adoption in the late 1970s of the *Plan Vert* (Green Plan), which encouraged increased agricultural and forestry production.

French horn, also called HORN, French COR D'HARMONIE, German WALDHORN, the orchestral and military horn derived from the *trompe* (or *cor*) *de chasse,* a large, circular hunting horn that appeared in France in about 1650 and soon began to be used orchestrally. Use of the term French horn dates at least from the 17th century. Valves were added to the instrument in the early 19th century. Modern French horns exist in two principal types, French and German.

The French type, though once dominant in France and England, now is reduced to only sporadic use. It has about 7 feet (2 m) of integral tubing to which is added a separate coiled crook (a detachable piece of tubing) inserted at the narrow end, lowering the horn's fundamental pitch. The crook, by lengthening the tubing and lowering the series of notes producible, puts the horn in the key of F, the basic tonality of the modern horn. The mouthpiece is slightly cup-shaped, the original straight funnel shape now being obsolete. The right hand of the player is placed inside the bell mouth, and the left actuates the three rotary valves (piston valves in English-made horns); when depressed they deflect air through additional tubing and lower the pitch by certain intervals. In France the third valve is normally an ascending one—*i.e.,* when depressed, it cuts off air from a section of tubing, raising the pitch by a whole tone.

The German type, now universally accepted, has a relatively larger bore, dispenses with the separate crook, and uses rotary valves. It is built in F or a fourth higher in B♭, or, more commonly, as a double horn, introduced about 1900 by Fritz Kruspe, providing for instantaneous choice, by means of a thumb valve, of two tonalities, usually F and B♭ or B♭ and A. This choice allows technical benefits such as greater certainty on the higher notes. The German bore and the choked mouthpiece also facilitate complex passage work and can deliver a more massive tone. The range of the valved horn extends from the third B below middle C to the second F above (actual pitch). Muting is effected either by inserting a separate mute of closed conical form or by stopping the bell throat with the right hand, raising the pitch approximately a semitone, for which the player compensates.

A symphony orchestra normally includes four horns. Orchestral use of the horn, aside from its appearance in operatic hunting scenes, began in about 1700, when the *trompe de chasse* was introduced from France into Bohemia. Players in the 18th century inserted a hand into the bell to alter the pitch to obtain additional notes, the notes of the *trompe* being limited to the instrument's natural harmonic series (as for the fundamental note C: c–g–c′–e′–g′–b♭′ [approximate pitch]–c″–d″–e″, etc.), hence the name hand horn. Together with the use of crooks for various tonalities as required, this technique was used for works by Mozart and Beethoven but was superseded about 1815 by the two-valved horn and in 1830 by the three-valved horn, which permitted the chromatic scale to be produced even more readily.

French India Company: *see* Indes, Compagnie Française des.

French Indochina (Southeast Asia): *see* Indochina.

French Island, island within the bay of Western Port, southern Victoria, Australia, southeast of Melbourne, 84 square miles (218 square km) in area. Low and marshy in the northwest, it rises to wooded hills. Farming is carried out on the island, and there is some tourism. The island harbours many birds, koalas, and rat kangaroos (potoroos). Pop. (1981) 123.

French language, French FRANÇAIS, Romance language spoken in France, Belgium, and Switzerland; in Canada (principally Quebec) and northern New England; and in many other countries and regions formerly or currently governed by France. It is an official language of more than 25 countries. Written materials in French date from the Strasbourg Oaths of 842.

The standard for French is based on the dialect of Paris, called Francien, which has been the official standard language since the mid-

16th century. Francien has largely replaced other regional dialects of French spoken in northern and central France; these dialects made up the so-called *langue d'oïl* (the term is based on the French use of the word *oïl,* modern *oui,* for "yes"). Standard French has also greatly reduced the use of the Occitan language (*q.v.*) of southern France (the so-called *langue d'oc,* from Provençal *oc* for "yes"). Occitan's major dialect, Provençal, was a widely used medieval literary language. Regional dialects of French survive for the most part only in uneducated rural speech, although the Picard–Walloon dialect of northern France and the Norman dialect of western France gave strong competition to Francien in medieval times, and Walloon is still spoken in Belgium. Other dialects are Orléanais, Bourbonnais, Champenois, Lorrain, Bourguignon, Franc-Comtois, Gallo, Angevin, Maine, Poitevin, Saintongeais, and Angoumois.

French phonology is characterized by great changes in the sounds of words as compared to their Latin parent forms as well as to cognates in the other Romance languages. For example, Latin *secūrum* "sure, secure" became Spanish *seguro* but French *sûr;* Latin *vōcem* "voice" became Spanish *voz* but French *voix,* pronounced *vwa.*

French grammar, like that of the other Romance languages, has been greatly simplified from that of Latin. Nouns are not declined for case. Formerly, they were marked for plural by the addition of *-s* or *-es,* but the ending, though retained in spelling, has generally been lost in speech. Masculine and feminine gender are distinguished but are usually marked not in the noun but rather in the accompanying article or adjective. Plural marking in spoken French is often similarly distinguished. The verb in French is conjugated for three persons, singular and plural, but again, although distinguished in spelling, several of these forms are pronounced identically. French has verb forms for indicative, imperative, and subjunctive moods; preterite, imperfect, present, future, and conditional, and a variety of perfect and progressive tenses; and passive and reflexive constructions.

French Lick, resort town, Orange county, southern Indiana, U.S. It lies 50 miles (80 km) northwest of Louisville, Ky., and is encircled by Hoosier National Forest. Founded in 1811, the settlement was named after an 18th-century French trading post in the area and an animal (salt) lick within the town boundaries. The first hotel on the site was built in the early 1840s by William A. Bowles, who laid out the town in 1857. Thomas Taggart (1856–1929), later chairman of the Democratic National Committee, purchased the hotel in about 1900 and was instrumental in French Lick's development as a year-round health resort and convention centre. The hotel has spa facilities based on water with high mineral content from nearby artesian springs. At West Baden Springs (1 mile north) is a former grand resort hotel that now houses Northwood Institute (1966), a business college. Inc. 1857. Pop. (1986 est.) 2,230.

French literature, the body of written works produced in the French language, in France and in French-speaking lands beyond its borders. French was one of the five major Romance languages to develop from Vulgar Latin as a result of the Roman occupation of western Europe. For the French-language literatures of countries other than France, *see* African arts; Belgian literature; Canadian literature.

A brief treatment of the French literature of France follows. For full treatment, *see* MACROPAEDIA: French Literature.

The earliest evidence of literature in recognizable Old French is the Romance version of the Oath of Strasbourg (842). A few other texts, all religious in content, survive from before about 1100. The origins of French literature are thus obscure. After the 12th century there is more written evidence, particularly in the form of historical chronicles. More than 80 chansons de geste (songs of deeds) have survived. The earliest is the *Chanson de Roland,* known only from a manuscript copied in England in about 1100.

Until the 13th century it seems that the major French literary activities following the Norman Conquest had been in England, but during the 13th and 14th centuries French literature developed again in its homeland. A progression from local epics before the 13th century to the adaptation of the major epics of antiquity and of the themes of the Arthurian cycle is clear. The vehicle for the expression of these epics, oral poetry, continued through the Middle Ages, as did allegory, a popular form exemplified in the *Roman de la rose.* The earliest French dramas are the liturgical plays, the *mystères,* which are based on biblical stories, and the *miracles,* which involve the miraculous intervention of a saint. By the 14th century the *mystères* and *miracles* gave way to *moralités,* didactic in intention, which were satirical farces without political or moral intent.

The 14th century brought an extension in scope and popularity of the existing literary genres in France. One example is the wide range of fabliaux (comic verse tales) written in this period. Fables, especially animal tales, also grew in popularity. The copying of manuscripts reached a peak with illuminated manuscripts, and a new start was made in historical chronicles with the *Grandes Chroniques de Saint-Denis.* Jean Froissart was the great chronicler of European history during the 14th century, Eustache Deschamps published the first work on French versification, and Guillaume de Machaut was the greatest poet and musician of the age. It was François Villon, however, who was the precursor of French Classicism.

The 16th century is one of the richest and most varied French literary periods: it saw the passing of the Middle Ages and the growth and maturity of the Renaissance, producing such unique figures as the humorist François Rabelais, the poet Pierre de Ronsard, and the essayist Michel de Montaigne. Until the middle of the 16th century plays like those of the medieval period were still being produced, but with the Renaissance came an entirely new class of subjects and modes of treatment that swept away all except the farce. The change came from Italy, inspired by new translations of ancient Greek and Roman classics. In poetry there was an enormous wealth and variety at this time. Ronsard formed La Pléiade with six other French Renaissance poets and set out to create a literature to rival Italy's. Prose writers on political, theological, and scientific subjects were numerous.

François de Malherbe, the first important poet of the next period, called for refinement of the language. In the first half of the 17th century the polish and elegance of French prose reflected a desire for stability in a world of change. The philosophers René Descartes and Blaise Pascal were known for their prose styles as well as for their philosophies. In the theatre Pierre Corneille and Jean Racine, the masters of French classical tragedy, were enormously successful, and Molière wrote a brilliant succession of comedies that writers of the next period found difficult to match. Nicolas Boileau and Jean de la Fontaine made important strides in 17th-century poetry, and Marie de La Fayette wrote the first novel proper, *La Princesse de Clèves*—but these works were written within strict Classical conventions, against which the 18th century was to see a vigorous reaction.

The revocation of the Edict of Nantes of 1685, which granted increased religious liberty to French Protestants, marked a new era in French literature. Classicism was not yet extinct, but there was an abundance of ecclesiastical literature, some of which prefigured the Enlightenment. Important changes were about to happen: 18th-century tragedy became identified with Voltaire, and comedy with the socially aware farces of Pierre Beaumarchais. The poetic output of the 18th century was enormous, and the novel grew in stature; but the century is most famous for the development, in literature, of its rational thought, exemplified in Voltaire's *Lettres philosophiques* and in the work of the encylopaedist Denis Diderot.

The philosophic basis of the French Revolution was laid by writers who did not live to witness it—Voltaire, Diderot, and Jean-Jacques Rousseau—and the demands of the struggle were such that there was little scope for literature. Nor did the Consulate and Empire provide better conditions, and writers worked in secret, among them François-René de Chateaubriand. The way was thus open for the literary revolution that arose from the change in political climate. More freedom came with the restoration of the monarchy, resulting in the literary achievements of the French Romantics: in poetry the great names were Alphonse de Lamartine, Alfred de Vigny, Victor Hugo, and Alfred de Musset. The Romantic movement revived the theatre and gave new prestige to the novel. Honoré de Balzac portrayed contemporary life in his great collection of novels, *La Comédie humaine;* like those of Stendhal (pseudonym of Marie-Henri Beyle), his novels are social and political documents. Historical and critical studies, exemplified by the criticism of Charles-Augustin Sainte-Beuve, also became accepted genres in French literature.

The social upheavals of 1848 checked Romanticism, and the Parnassian movement took over. The two movements were bridged by Hugo and by the poet Charles Baudelaire, whose melancholia and idealism attached him to Romanticism but whose rigour of technique purged it of its faults. The Parnassian poets—heralded by Théophile de Gautier, who expounded the doctrine of "art for art's sake"—aimed to rescue French verse from the verbal and emotional imprecision of the Romantics.

Apparently unaffected by the Franco-Prussian War of 1870, Emile Zola took realism a step farther by creating the Naturalist school, in which the novel was to serve the same ends as a scientific thesis. The short-story writer Guy de Maupassant belonged to this school, whereas his rival Anatole France reacted against it. In poetry, Baudelaire opened the way to Symbolism, and Arthur Rimbaud became the explorer who blazed the trail for modern poetry. Symbolism treated the senses as a reflection of the spiritual universe, and Stéphane Mallarmé became a central figure in the movement.

Only a few important 20th-century novels appeared before 1919, none touching the beauty and complexity of Marcel Proust's *À la recherche du temps perdu* (1914–27). Proust and then André Gide dominated French fiction until 1940. In his *Les Faux-Monnayeurs* Gide expounded the theme of the amoral adolescent. Little survived of World War I literature, and there followed a realist-revolutionary crisis. Observation and fantasy combine in the regional novelists, the greatest of whom is Jean Giono. Such writers as François Mauriac, Julien Green, and Georges Bernanos preferred to use the novel as a vehicle for the exploration of the psyche. In the novel of adventure Joseph Kessel is outstanding, while André Malraux gave his novels philosophical significance.

The real explosion in the novel did not happen until after 1940, with the work of Simone

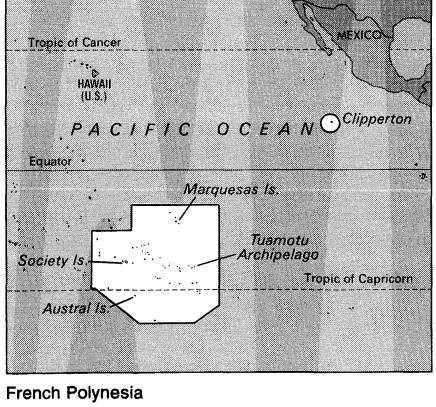
de Beauvoir, Albert Camus, and Jean-Paul Sartre, who were primarily concerned with the novel as a vehicle for political or philosophical ideas. Samuel Beckett attacked story, plot, character, form, style, meaning, chronology, and analysis of thought, bringing certain modernist tendencies to their logical conclusion.

At the turn of the century the theatre had been torn between neosymbolism and social realism and only broke free after 30 years: between 1920 and 1940 the stage play was less experimental than circumstances allowed, with no successful innovations. The most original post-1940 dramatist was Jean Genet, with his complex antinaturalistic and antisocial theatre, but the turning point came in 1950 with Eugene Ionesco and his "pure" theatre, stripped of convention, abstract, crudely poetic, and imaginative.

Until Guillaume Apollinaire the only real poetic achievement of the century was the stabilizing of free verse. Apollinaire synthesized contemporary forms and pointed them in new directions—he reconciled classical intellectuality and form with Romantic enthusiasm, intuition, and experimentation. After him, French poets seem to have shown little of the adventurousness displayed in the theatre and the novel.

French National Railways: *see* Société Nationale des Chemins de Fer Français.

French Polynesia, officially TERRITORY OF FRENCH POLYNESIA, French TERRITOIRE DE LA POLYNÉSIE FRANÇAISE, collection of island groups and overseas territory of France situated in the south-central Pacific Ocean about 9,700 miles (15,700 km) from Paris. The territory covers an area (including inland water) of some 1,550 square miles (4,000 square km). The capital is Papeete on the island of Tahiti. The islands are scattered across the Pacific between latitudes 7° and 27° S and longitudes 134° and 155° W; there are 130 islands in all, and they are divided into five archipelagoes: the Society Islands, the Tuamotu Archipelago, the Gambier Islands, the Marquesas Islands, and the Tubuai Islands. Tahiti (402 square miles [1,042 square km]) in the Society group



French Polynesia

is the largest island. The population in 1988 was estimated at 188,000.

A brief treatment of French Polynesia follows. For full treatment, *see* MACROPAEDIA: Pacific Islands.

For current history and for statistics on society and economy, *see* BRITANNICA WORLD DATA ANNUAL.

The land. The islands can be divided into two distinct physiographic groups: the less numerous but larger high volcanic islands (Society, Tubuai, Marquesas, and Gambier) and the more numerous low coral islands (*e.g.,* Tuamotu). The volcanic islands are mountainous with rugged peaks, deep and narrow valleys, fast-flowing rivers, narrow coasts, fertile soil, and dense vegetation. Mount Orohena (7,352 feet [2,241 m] above sea level) on Tahiti is the highest point of the territory. The coral islands lack soil cover and permanent streams, raising serious supply problems for agriculture and drinking water. Coconut plantations are virtually the only vegetation on the coral islands.

The climate of French Polynesia is tropical. At Papeete the annual average temperature is 79° F (26° C), ranging from 70° F (21° C) in the cool and dry season (May–October) to 91° F (33° C) in the warm rainy season (November–April). Precipitation is abundant, varying from 120 inches (3,050 mm) near the coasts to 160 inches (4,060 mm) in the mountains. The relative humidity is always high (80 to 90 percent). Annually between December and February, French Polynesia is subject to typhoons.

Most of the plant species on the islands were introduced by the first Polynesians, with others added later by Europeans. Coconuts, cassava, pineapples, watermelons, potatoes, tomatoes, lettuce, cucumbers, taros, and bananas are the chief crops. The only important minerals are phosphate and cobalt found in the Tuamotu Archipelago.

The people. More than two-thirds of the population are Polynesians. Part-Polynesians known as Demis account for about one-tenth of the total. The Demis represent a strong economic and political force, being a combination of French Polynesia's two most influential cultures, European and Polynesian. Minority groups consist of Chinese and part-Chinese, Europeans (mostly French), and Americans. The official languages are French and Tahitian, which has a number of dialects and is used by many of the indigenous islanders. More than half of the population is Protestant (mostly members of the Evangelical Church of French Polynesia), and two-fifths is Roman Catholic, with smaller communities of Mormons and other Christians.

French Polynesia's relatively high average annual growth rate is the result of a high birth rate and a moderate death rate. In the 1960s and 1970s a nuclear-testing program and growing tourism prompted many outer islanders to relocate on the main islands, and during the 1970s significant emigration to New Caledonia also affected the growth rate. Nearly two-fifths of the population is younger than 15 years of age.

More than two-thirds of the population lives on Tahiti. Immigration to Tahiti from the other islands during the 1970s and 1980s pressured Tahiti's economic and social facilities. About three-fourths of French Polynesia's population is urban.

The economy. The economy of French Polynesia is based for the most part on administrative and commercial services and on light industries, and it is heavily dependent on expenditures by French military personnel, who are in French Polynesia essentially to support the nuclear-testing facilities located in the Tuamotus.

Agriculture accounts for less than 5 percent of the gross national product (GNP) and is dominated by the production of copra and vanilla for export and vegetables and tropical fruits for local consumption. All copra is sold to a corporation in which the territorial government has a controlling interest. Animal husbandry includes the raising of pigs, cattle, and goats and has been improved by the import of dairy and beef cattle breeds from New Zealand and Australia. Large quantities of foodstuffs are imported. Freshwater and marine fishing, as well as oyster and shrimp farming, provide livelihood to many islanders. Cultured pearls are exported from the Tuamotu and Gambier islands.

Mineral industries are of negligible economic importance, and fuels, mineral raw materials, and metals must be imported. Manufacturing industries account for more than 5 percent of the GNP, and they consist mostly of small-scale enterprises that produce coconut oil, processed foods, beer, construction materials, printed cloth, sandals, copper wares, and publications.

Electricity is primarily generated from imported fuels. A hydroelectric power station was opened in Tahiti in 1981.

With the introduction of international air service in 1960 and subsequently of interisland service, tourism has grown. Visitors come largely from the United States, France, and Australia. The country's international airport is at Faaa, near Papeete, and interisland shipping is a major means of local transport; the main seaport is Papeete.

The islands' external trade is dominated by France, which supplies almost half of the total imports and receives more than half of the total exports. The United States is French Polynesia's second most important trading partner.

Government and social conditions. French Polynesia is an overseas territory of France, represented in the French Parliament by two deputies and one senator. Pressure for increased self-government produced new statutes in 1977 and 1984 that provided for greater local autonomy, with the French maintaining control of foreign affairs, defense, monetary policy, and justice. Legislative power resides with the Territorial Assembly, whose 41 members are directly elected to five-year terms. The chief executive is the high commissioner, appointed by the French government; he holds considerable power. The Council of Ministers, headed by a president elected by the Assembly from among its members, holds significant administrative power, especially in the areas of commerce and development. Justice is administered by the Supreme Court of Appeal and the Court of First Instance.

French Polynesia has adequate health services and a relatively high standard of living, both maintained primarily through French financial aid. Well-dispersed health facilities include the main hospital in Papeete, regional hospitals in each outer island group, and a service that provides regular periodic doctor visits to all outer islands and atolls. Life expectancy at birth is 65 years for males and 70 years for females.

Free education (compulsory through the end of primary school) is provided in government-run primary, secondary, and technical schools, supplemented by church-run schools. The University of the Pacific (established in 1987) has its administrative centre in Papeete. Almost all of the population is literate. French-language newspapers are free of censorship. Radio and colour-television broadcasting is operated by the government. There is automatic telephone service on Tahiti and manual service interisland, as well as cable and telex service.

Cultural life. French Polynesian culture is based on folk arts and traditions. The absence of newspapers in Tahitian, the small amount of broadcasting in the Tahitian language, and the nonrecognition of vernacular languages as official handicap efforts to protect the indigenous culture. Traditional outrigger canoes (*pirogues*) are still widely used, but traditional culture has waned with the increasing impact of western-European-style culture and technology. The Gauguin Museum in Tahiti contains numerous Polynesian artifacts, including Easter Island-like statues from Raivavae. Traditional Polynesian dances and ceremonies on Tahiti are performed for tourists in hotels and on days when tour ships are in port. On the outer islands, cultural traditions have survived to a greater extent. Foreign settlement on Maiao is banned; on Raiatea in Apooiti village, fire walking is practiced; and nearby the Tapu-tapuatea marae, built of coral slabs

and formerly the most sacred spot in French Polynesia, has been restored as a historical monument. The introduction of Tahiti-based radio has hastened the loss of local dialects and customs.

History. The Marquesas Islands of French Polynesia were probably settled by AD 300 by Polynesians from Tonga and Samoa, who dispersed from the Marquesas to the rest of what is now French Polynesia and beyond. Ferdinand Magellan sighted Pukapuka in the Tuamotu Archipelago in 1521. During Captain James Cook's first voyage (1769), the Society Islands were named after the expedition's sponsor, Britain's Royal Society. In the late 18th century the adventures of the HMS *Bounty* took place in the waters of French Polynesia.

The history of the Society Islands is primarily a history of Tahiti. Missionaries arrived there in 1797, and by 1815 their labours were rewarded when the Tahitian chief Pomare II converted to Christianity. In 1842 Tahiti became a French protectorate and in 1880 a colony. The Gambier group became a protectorate in 1844 and a colony in 1881. Rimatara and Rurutu became protectorates and colonies of France in 1889 and 1900, respectively. The Tuamotu Islands became dependencies of Tahiti in 1847 and part of the colony in 1880. The chiefs of the Marquesas Islands ceded sovereignty to France in 1842.

Administratively, the islands were originally part of the French Colony of Oceania. After World War II French Polynesia became an overseas territory of France. Under the leadership of Pouvanaa a Oopa the pro-autonomy party, Tahitian People's Democratic Assembly (Rassemblement Democratique des Populations Tahitiennes), won majorities in the Territorial Assembly in 1953 and 1957. Pouvanaa was arrested and exiled by French authorities in 1960. The movement toward autonomy continued under John Teariki and Francis Sanford in the 1960s and '70s. Pouvanaa was finally released in 1971 and was promptly elected as the territory's representative to the French Senate. In 1966 the French began nuclear testing on Mururoa atoll. This atoll and neighbouring Fangataufa atoll were ceded to France by the Territorial Assembly in 1964. In 1975 worldwide opposition forced the French to move the testing underground on Fangataufa. In the late 1970s the autonomy movement continued, and the French national assembly granted partial autonomy in 1977.

French republican calendar, dating system that was adopted in 1793 during the French Revolution and which was intended to replace the Gregorian calendar with a more scientific and rational system that would avoid Christian associations. The Revolutionary Convention established the calendar on Oct. 5, 1793, setting its beginning (1 Vendémiaire, year I) on the Gregorian date of Sept. 22, 1792.

The 12 months of the French republican calendar each contained three decades (instead of weeks) of 10 days each; at the end of the year were grouped five (six in leap years) supplementary days. The months in order were Vendémiaire, Brumaire, Frimaire, Nivôse, Pluviôse, Ventôse, Germinal, Floréal, Prairial, Messidor, Thermidor, and Fructidor. For the saints' names that had been attached to the Gregorian days, there were substituted names of seeds, trees, flowers, and fruits. The Gregorian calendar was reestablished in France by the Napoleonic regime on Jan. 1, 1806.

French Revolution, also called REVOLUTION OF 1789, the revolutionary movement that shook France between 1787 and 1799 and reached its first climax there in 1789. Hence the conventional term "Revolution of 1789," denoting the end of the ancien régime in France and serving also to distinguish that event from the later French revolutions of 1830 and 1848.

A brief treatment of the French Revolution follows. For full treatment, *see* MACROPAEDIA: France.

Although historians disagree on the causes of the Revolution, the following reasons are commonly adduced: (1) France had the largest population in Europe and could not feed it adequately, (2) the rich and expanding bourgeoisie was excluded from political power more systematically than in any other country, (3) the peasants were acutely aware of their situation and were less and less inclined to support the anachronistic and burdensome feudal system, (4) the Philosophes, who advocated social and political reform, had been read more widely in France than elsewhere, and (5) French participation in the American Revolutionary War had completed the ruin of the state's finances.

Aristocratic revolt (1787–89). The revolt took shape in France when the controller general of finances, Charles-Alexandre de Calonne, arranged the summoning of an assembly of "notables" (prelates, great noblemen, and a few representatives of the bourgeoisie) in February 1787 to propose reforms designed to get rid of the deficit in the budget by increasing the taxation of the privileged. The assembly rejected the reforms and demanded the calling of the Estates-General, which represented the clergy, the nobility, and the Third Estate (the commoners) and which had not met since 1614. The efforts made by Calonne's successors to enforce reform in spite of resistance led to the so-called revolt of the "aristocratic bodies," notably that of the *parlements* (the most important courts of justice), whose powers were curtailed by the edict of May 1788. During the spring and summer of 1788 there was unrest in Paris, Grenoble, Dijon, Toulouse, Pau, and Rennes. The king, Louis XVI, had to yield; summoning Jacques Necker to the ministry, he promised to convene the Estates-General for May 5, 1789. He also, in practice, granted freedom of the press, and France was flooded with pamphlets on projects for the reconstruction of the state. The elections to the Estates-General, held between January and April 1789, coincided with further disturbances, as the harvest of 1788 had been a bad one. There were practically no exclusions from the voting; and the electors drew up *cahiers de doléances,* which listed their grievances and hopes. They elected 600 deputies for the Third Estate, 300 for the nobility, and 300 for the clergy.

Events of 1789. The Estates-General met at Versailles on May 5, 1789. They were immediately divided over a fundamental issue: should they vote by head, so as to give advantage to the Third Estate, or by estate, in which case the two privileged ones might outvote the third? In the bitter struggle over this legal issue the deputies of the Third Estate soon won the support of the parish priests against the privileged, whom the king favoured. The Third Estate was victorious when, in defiance of the king, it met on June 20 in the *jeu de paume* (tennis) court and swore never to disperse until it had given France a new constitution. The king grudgingly gave in and invited the clergy and nobility to join the Third Estate and so to form the National Constituent Assembly; but at the same time he began gathering troops to dissolve it.

These two months of prevarication at a time when the problem of maintaining food supplies had reached its climax infuriated the towns and the provinces. Rumours of an "aristocratic conspiracy" by the king and the privileged to overthrow the Third Estate led to the Great Fear of July 1789, when the peasants were nearly panic-stricken. The gathering of troops around Paris and the dismissal of Necker provoked insurrection in Paris. The Parisian rabble on July 14, 1789, seized the Bastille, symbol of royal tyranny. It was no longer a revolt but a revolution. The king had again to yield; visiting Paris, he showed his recognition of the sovereignty of the people by wearing the tricolour cockade.

In the provinces the Great Fear of July made the peasants rise against their lords. The nobles and the bourgeois now took fright. The National Assembly could see only one way to check the peasants; on the night of Aug. 4, 1789, it decreed the abolition of the feudal regime and of the tithe. Next it introduced the Declaration of the Rights of Man and of the Citizen (August 26), proclaiming liberty, equality, the inviolability of property, and the right to resist oppression.

The decrees of August 4 and the Declaration were such innovations that the king refused to sanction them. The rabble of Paris rose again and on October 5 marched to Versailles. Next day they brought the royal family back to Paris. The National Constituent Assembly followed the court, and in Paris it went to work on a new constitution.

The new regime. The National Constituent Assembly completed the abolition of feudalism, suppressed the old "orders," established civil equality (at least in metropolitan France, since slavery was retained in the colonies), and assured equality of rights insofar as eligibility to public office was concerned. The decision to nationalize the lands of the Roman Catholic church in France in order to pay off the public debt led to a widespread redistribution of property. The bourgeoisie and the peasant landowners were undoubtedly the chief beneficiaries, but some farm workers also were able to buy land. Having deprived the church of its resources, the Assembly then resolved to reorganize the church, enacting the Civil Constitution of the Clergy, which was rejected by the pope and by the majority of the French clergy. This produced a schism that aggravated the violence of the accompanying controversies.

The complicated administrative system of the ancien régime was swept away by the National Constituent Assembly, which substituted a rational system based on the division of France into *départements,* districts, cantons, and communes administered by elected assemblies. The principles underlying the administration of justice were also radically changed, and the system was adapted to the new administrative divisions. The judges were to be elected.

The National Constituent Assembly tried to create a monarchical regime in which the legislative and executive powers were shared between the king and an assembly. This regime might have worked if the king had really wanted to govern with the new authorities, but Louis XVI was weak and vacillating and was the prisoner of his aristocratic advisers. On June 20–21, 1791, he tried to flee the country, but he was stopped at Varennes and brought back to Paris.

Revolution and counterrevolution in France and in Europe. The events in France gave new hope to the revolutionaries who had been defeated a few years before in the United Provinces, Belgium, and Switzerland. Likewise, all who wanted changes in England, Ireland, the German states, the Austrian lands, or Italy viewed the Revolution with sympathy. In all these countries Revolutionary clubs were formed.

Numbers of the French counterrevolutionaries—nobles, ecclesiastics, and some bourgeois—abandoned the struggle in their own country and emigrated. As "émigrés," many formed armed groups close to the northeastern frontier of France and sought help from the rulers of Europe. The rulers were at first indifferent to the Revolution but began to worry

when the National Constituent Assembly proclaimed a revolutionary principle of international law, namely that a people had the right of self-determination. In accordance with this principle the papal territory of Avignon was reunited with France on Sept. 13, 1791. The gulf widened between France and the rest of Europe. The persecution of supporters of the Revolution, collectively described as Jacobins, increased outside France, and finally France declared war against Austria and Prussia on April 20, 1792.

War, regicide, and the Reign of Terror. In the first phase of the war (April–September 1792) France suffered defeats; the Austro-Prussian army crossed the frontier and advanced rapidly toward Paris. Believing that they had been betrayed by the king and the aristocrats, the French revolutionaries rose on Aug. 10, 1792, occupied the Tuileries, where Louis XVI was living, and imprisoned the royal family in the Temple. At the beginning of September the Parisian crowd broke into the prisons and massacred the nobles and clergy imprisoned there. Meanwhile, volunteers were pouring into the army as the Revolution had awakened French nationalism. In a final effort the French forces checked the Prussians on Sept. 20, 1792, at Valmy. On the same day a new assembly, the National Convention, met. Next day it proclaimed the abolition of the monarchy and the establishment of the republic.

In the second phase of the war (September 1792–April 1793) the revolutionaries got the better of the enemy. Belgium, the Rhineland, Savoy, and the county of Nice were occupied by French armies, which abolished the feudal regime there. In France the National Convention was divided between the Girondins, who would have liked to organize a bourgeois republic in France and to spread the revolution over the whole of Europe, and the Montagnards, or Men of the Mountain, who, with Robespierre, wanted to give the lower classes a greater share in political and economic power but wanted to restrict their revolutionary activity to France. Despite efforts made by the Girondins, Louis XVI was judged by the Convention, condemned to death for treason, and executed on Jan. 21, 1793.

In the spring of 1793 the war entered a third phase, marked by new French defeats. Austria, Prussia, and Great Britain formed a coalition (later called the First Coalition), to which most of the rulers of Europe adhered. France lost Belgium and the Rhineland, and invading forces threatened Paris. These reverses, as those of 1792 had done, strengthened the extremists. The Girondin leaders were driven from the National Convention, and the Montagnards, who had the support of the sansculottes (workers, craftsmen, shopkeepers, smallholders, and agricultural labourers), seized power and kept it until 9 Thermidor, year II (July 27, 1794). The Montagnards were bourgeois liberals like the Girondins, but under pressure from the sansculottes and in order to meet the requirements of defense they adopted a radical economic and social policy. They introduced the Maximum (government limitation of prices), taxed the rich, brought national assistance to the poor and to the disabled, declared that education should be free and compulsory, and ordered the confiscation and sale of the property of émigrés. These exceptional measures provoked violent reactions: the Wars of the Vendée, the "federalist" risings in Normandy and in Provence, the revolts of Lyon and Bordeaux, and the insurrection of the Chouans in Brittany. Opposition, however, was broken by the Reign of Terror, which entailed the arrest of at least 300,000 suspects, 17,000 of whom were sentenced to death and executed while more died in prisons or were killed without any form of trial. At the same time the revolutionary government raised an army of more than 1,000,000 men.

Thanks to this army, the war entered its fourth phase (from the spring of 1794). A brilliant victory over the Austrians at Fleurus (June 26, 1794) enabled the French to reoccupy Belgium. Victory made the Terror and the economic and social restrictions seem pointless. Robespierre, "the Incorruptible," who had sponsored the restrictions, was overthrown in the National Convention on 9 Thermidor, year II (July 27, 1794) and executed the following day. Soon after his fall the Maximum was abolished, the social laws were no longer applied, and efforts toward economic equality were abandoned. Reaction set in; the National Convention began to debate a new constitution; and, meanwhile, in the west and in the southeast, a royalist "White Terror" broke out. Royalists even tried to seize power in Paris but were crushed by the young general Napoleon Bonaparte on 13 Vendémiaire, year IV (Oct. 5, 1795). A few days later the National Convention dispersed.

The Directory and revolutionary expansion. The constitution of the year III, which the National Convention had voted, placed the executive power in a Directory of five members and the legislative power in two chambers, the Council of Ancients and the Council of the Five Hundred (together called the Corps Législatif). This regime, which was that of a bourgeois republic, would have developed smoothly if war had not perpetuated the struggle between revolutionaries and counter-revolutionaries throughout Europe. The war, moreover, embittered existing antagonisms between the Directory and the legislative councils in France and often gave rise to new ones. These disputes were settled by coups d'état, chiefly those of 18 Fructidor, year V (Sept. 4, 1797), which removed the royalists from the Directory and from the councils, and of 18 Brumaire, year VIII (Nov. 9, 1799), in which Bonaparte abolished the Directory and became the leader of France as its "first consul."

After the victory of Fleurus the progress of the French armies in Europe had continued. The Rhineland and Holland were occupied, and in 1795 Holland, Tuscany, Prussia, and Spain negotiated for peace. When the French army under Bonaparte had entered Italy (1796), Sardinia came quickly to terms. Austria was the last to give in (Treaty of Campo Formio, 1797). Most of the countries occupied by the French were organized as "sister republics," with institutions modeled on those of Revolutionary France.

Peace on the continent of Europe did not end revolutionary expansion. The majority of the directors had inherited the Girondin desire to spread the Revolution over Europe and listened to the appeals of Jacobins abroad. Thus French troops in 1798 and 1799 entered Switzerland, the Papal States, and Naples and set up the Helvetic, Roman, and Parthenopean republics. Great Britain, however, remained at war with France. Unable to effect a landing in England, the Directory, on Bonaparte's request, decided to threaten the British in India by occupying Egypt. An expeditionary corps under Bonaparte easily occupied Malta and Egypt, but the squadron that had convoyed it was destroyed by Horatio Nelson's fleet at the Battle of the Nile on Aug. 1, 1798. This disaster encouraged the formation of a Second Coalition of powers alarmed by the progress of the Revolution. This coalition of Austria, Russia, Turkey, and Great Britain won great successes during the spring and summer of 1799 and drove back the French armies to the frontiers. Bonaparte thereupon returned to France, to exploit his own great prestige and the disrepute into which the military reverses had brought the government. His coup d'état of 18 Brumaire overthrew the Directory and substituted the consulate. Though Bonaparte proclaimed the end of the Revolution, he himself was to spread it in new forms throughout Europe.

French revolutionary and Napoleonic wars, a series of wars between 1792 and 1815 that ranged France against shifting alliances of other European powers and that produced a brief French hegemony over most of Europe. The revolutionary wars, which may for convenience be held to have been concluded by 1801, were originally undertaken to defend and then to spread the fruits of French Revolution. With Napoleon's rise to absolute power, France's aims in war reverted to simple aggrandizement of influence and territory.

A brief treatment of the French revolutionary and Napoleonic wars follows. For full treatment, *see* MACROPAEDIA: European History and Culture.

The overthrow of Louis XVI and the establishment of republican government placed France at odds with the primarily monarchical and dynastic governments of the rest of Europe. In the Declaration of Pillnitz (1791) Austria and Prussia issued a provocative general call to European rulers to assist the French king reestablish himself in power. France declared war in April 1792. On Sept. 20, 1792, French forces under Charles-François Dumouriez and François-Christophe Kellermann turned back an invading Prussian-Austrian force at Valmy, and by November the French had occupied all of Belgium. Early in 1793 Austria, Prussia, Spain, the United Provinces, and Great Britain formed the first of seven coalitions that would oppose France in the next 23 years. In response to reverses at the hands of the First Coalition, the Revolutionary government declared a levy en masse, by which all Frenchmen were placed at the disposal of the army. By that means unprecedently large armies were raised and put in the field during this period. Battles on the Continent in the mid-18th century typically had involved armies of about 60,000 to 70,000 troops, but after 1800 Napoleon routinely maneuvered armies of 250,000; and he invaded Russia in 1812 with some 600,000.

By early 1795 France had defeated the allies on every front and had pushed to Amsterdam, the Rhine, and the Pyrenees; more importantly, Prussia had been forced out of the coalition and had signed a separate peace that held until 1806. In May 1795 the United Provinces of the Netherlands became the French-influenced Batavian Republic. In northern Italy, a strongly positioned French army threatened Austrian-Sardinian positions, but its commander proved reluctant to move. In March 1796 he was replaced by a more dynamic general, Napoleon Bonaparte.

Napoleon executed a brilliant campaign of maneuver against Austrian and Sardinian forces in Italy and in the resultant treaty of Campo Formio forced Austria to cede the Austrian Netherlands (now Belgium and Luxembourg), which became the first territorial additions to the French Republic, and to recognize the Cisalpine and Ligurian republics established by French power in northern Italy.

Napoleon's next campaign was a major failure. He sailed an army to Egypt in May 1798 with the idea of conquering the Ottoman Empire. The defeat of a French naval squadron by Admiral Horatio Nelson in the Battle of the Nile (Aug. 1, 1798) left him without sufficient naval support, however, and, after failing to take Acre in 1799, Napoleon withdrew to France. His army continued to occupy Egypt until 1801. Meanwhile, other French forces had occupied new territories and established republican regimes in Rome, Switzerland (the Helvetic Republic), and the Italian Piedmont (the Parthenopean). As a result the Second Coalition formed, comprising Britain, Russia, the Ottoman Empire, Naples, Portugal, and Austria. The allies' initial successes were reversed by their inability to agree on strategy,

however, and by the time Napoleon became the first consul of France by the coup d'état of 18 Brumaire, year VIII (Nov. 9, 1799), the danger of foreign intervention against the Revolution in France was over. A victory over Austria at Marengo in 1800 and the consequent Treaty of Lunéville left France the dominant power on the Continent. For two years thereafter only Great Britain, with its powerful navy, remained to oppose Napoleon. Nelson's smashing victory at Trafalgar (Oct. 21, 1805) ended a French threat to invade England. In 1805 a Third Coalition formed with Britain, Russia, and Austria. Napoleon won major victories at Ulm and Austerlitz in 1805 and Jena, Auerstädt, and Lübeck, over the new coalition member Prussia, in 1806. The resulting Treaty of Tilsit, in which Prussia was halved at the Elbe and also lost part of Poland, and that of Schönbrunn in 1809, following a brief Austrian uprising, left all of Europe from the English Channel to the Russian border, with the exceptions of Portugal, Sweden, Sardinia, and Sicily, either part of the French Empire, under the control of France, or allied to France by treaty.

In 1806, in an attempt to use French control of Continental ports to blockade Britain indirectly, Napoleon issued the Berlin Decree, by which ships passing to French-controlled ports after calling at British ports were liable to seizure. The Continental System, as this policy was called, was not successful. The general inhibition of European trade that ensued (for Britain responded with a like policy of detaining ships bound for French ports) and the perceived favouritism in the French government's granting of licenses to French merchants for trade with Britain cost Napoleon considerable political support. Meanwhile, though pressed at home, the British were able to expand their colonial markets so as to emerge from the trade war more prosperous than before.

Napoleon's military successes resulted from a strategy of moving armies and striking quickly, sometimes by surprise, often so as to prevent the coordination of the forces opposing him, which he was then able to defeat piecemeal. This strategy necessitated a thorough knowledge of the terrain of the theatre of war, especially as quick movement precluded adequate supplying of his armies without a large amount of requisitioning in the area of operations. The answer to this strategy for Napoleon's enemies was to maintain a threat while avoiding engagements until coordination could be achieved; relying on strong lines of supply, allied armies could await opportunity while Napoleon's troops, chasing them, began to suffer from overextension of their supply lines. This strategy was used first in the Peninsular Campaign of 1811 by the Duke of Wellington, who was able to open up Spain using supply lines through Portugal. It was used most dramatically by the Russian generals Barclay de Tolly and Bagration in their response to Napoleon's invasion of Russia in 1812; they simply withdrew along parallel lines. Unable to win a decisive victory at Borodino on September 7, the only full-scale engagement of the campaign, Napoleon was eventually forced to retreat. The Russian armies then turned to pursuit; Napoleon was forced to march his army back along the same route he had come, now depleted of forage, through the Russian winter in which temperatures reached −30° F (−35° C). In this disastrous campaign, Napoleon lost 500,000 men, the faith of his allies, and the awe of enemies.

A new coalition formed in 1813 and mustered armies that at last outnumbered France's. Napoleon's allies fell away one by one, and by late 1813 he had been forced to withdraw west of the Rhine. An invasion of France commenced early in 1814; Paris was reached in March, and on April 6 Napoleon abdicated. His exile to the island of Elba lasted less than a year, however, and in March 1815 he returned to France and rallied a new army. A seventh and final coalition of Great Britain, Russia, Prussia, and Austria opposed him. The campaign was brief. Napoleon's final defeat, at Waterloo on June 16–18, 1815, was again decided upon the issue of his inability to surprise and prevent the joining up of two armies invading France along separate lines, in this case Wellington's Dutch and English, and Blücher's Prussians. Napoleon abdicated on June 22, and the Bourbon monarchy was restored in the person of Louis XVIII shortly thereafter.

French Section of the Worker's International (French political party): *see* Socialist Party.

French Shore, part of the coast of Newfoundland where French fishermen were allowed to fish and to dry their catch after France gave up all other claims to the island in 1713; previously, Newfoundland had been claimed by France although occupied by England. As defined by the Treaty of Paris (1783), the French Shore extended westward around the island from Cape St. John in the north to Cape Ray in the southwest.

In the 1880s Newfoundland began to develop a lobster fishery, and factories were built on the French Shore. France claimed that this activity interfered with its treaty rights and lodged a protest in 1886. In 1887 a French warship destroyed property at Port Saunders and in 1889 at Meagher's Cove. In 1888 Newfoundland protested against the interference of the French and against the construction of French lobster factories.

France and Great Britain worked out a modus vivendi in 1889, giving each lobster packer a specified strip of coast under the control of British and French commodores, but Newfoundland refused to recognize the agreement. Finally, on April 8, 1904, France sold its claims for 1,375,000 francs.

French Somaliland (Africa): *see* Djibouti.

French State: *see* Vichy France.

French Union, French UNION FRANÇAISE, a political entity created by the constitution of 1946 of the Fourth French Republic. It replaced the French colonial empire with a semifederal entity that absorbed the colonies (overseas *départements* and territories) and gave former protectorates a limited local autonomy with some voice in decision making in Paris. By the constitution of 1958 it was replaced by La Communauté (*see* French Community).

Consult the INDEX *first*

French West Africa, French AFRIQUE OCCIDENTALE FRANÇAISE (AOF), administrative grouping under French rule from 1895 until 1958 of the former French territories of West Africa: Senegal, French Guinea, the Ivory Coast, and the French Sudan, to which Dahomey was added in 1899. Certain territories of the Sudan were grouped together under the name Senegambia and Niger (Sénégambie-Niger; 1903), which was transformed into Upper Senegal and Niger (Haut-Sénégal-Niger; 1904). At the same time Mauritania (Mauritanie) was added to French West Africa. The colony of Upper Volta (Haute-Volta), founded in 1909 and attached in 1932 to the Ivory Coast, was reestablished as a territory of the federation in 1947. Upper Senegal and Niger was renamed the French Sudan in 1920. By 1960 the formerly colonial territories had become independent republics, French Sudan changing its name to Mali. Upper Volta was renamed Burkina Faso in 1984.

Freneau, Philip (Morin) (b. Jan. 2, 1752, New York City—d. Dec. 18, 1832, Monmouth County, N.J., U.S.), poet, essayist, and editor, known as the "poet of the American Revolution."

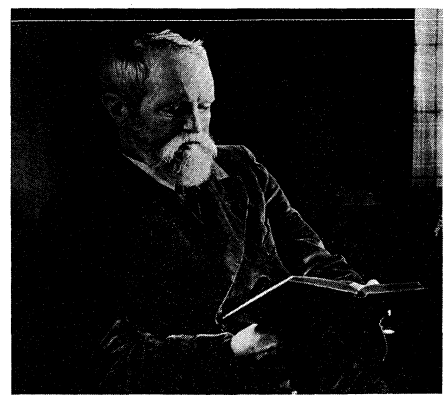
After graduating from Princeton in 1771, Freneau taught school and studied for the ministry until the outbreak of the Revolution, when he began to write vitriolic satire against the British and Tories. Not until his return from two years in the Caribbean islands, where he produced two of his most ambitious poems, "The Beauties of Santa Cruz" and "The House of Night," did he become, however, an active participant in the war, joining the New Jersey militia in 1778 and sailing through the British blockade as a privateer to the West Indies. Captured and imprisoned by the British in 1780, he wrote in verse bitterly, on his release, *The British Prison-Ship* (1781).

During the next several years he contributed to the *Freeman's Journal* in Philadelphia. Freneau became a sea captain until 1790, when he again entered partisan journalism, ultimately as editor from 1791 to 1793 of the strongly Republican *National Gazette,* Philadelphia. Ardently devoted to principles of liberty but recognizing also the necessity of finding solitude for poetry, he alternated quiet periods at sea with periods of active newspaper work, until he retired early in the 19th century to his farm in Monmouth County.

Well schooled in the classics and in the Neoclassical English poetry of the period, Freneau strove for a fresh idiom that would be unmistakably American, but, except in a few poems, he failed to achieve it.

Frenssen, Gustav (b. Oct. 19, 1863, Barlt, Holstein—d. April 11, 1945, Barlt), novelist who was the foremost exponent of *Heimatkunst* (regionalism) in German fiction.

Frenssen studied theology and spent 10 years as a Lutheran pastor. His critical attitude



Frenssen, 1933

By courtesy of the Staatsbibliothek, West Berlin

toward orthodoxy, however, which later developed into a total rejection of Christianity, together with the resounding success of his third novel, *Jörn Uhl* (1901), led him to resign his pastorate and devote all his time to writing. Although Frenssen at times made liberal concessions to the popular taste of the moment, he owed his success, in large part, to the vitality of his characters and the charm and beauty he lent to the locale of his novels—the shores of the North Sea.

About half of Frenssen's novels were translated into English. Among them are: *Die drei Getreuen* (1898; *The Three Comrades,* 1907); *Jörn Uhl* (Eng. trans., 1905); *Hilligenlei* (1905; *Holyland,* 1906); *Der Pastor von Poggsee* (1921; *The Pastor of Poggsee,* 1931); *Klaus Heinrich Baas* (1909; Eng. trans., 1911); *Peter Moors Fahrt nach Südwest* (1907; *Peter Moor's Journey to Southwest Africa,* 1908); and the autobiographical *Otto Babendiek* (1926; abridged, *The Anvil,* 1930).

List of Abbreviations

A.B.	bachelor of arts (Latin *artium baccalaureus*)
ac	acre(s)
Ac	actinium
AC	alternating current
A.C.T.	Australian Capital Territory
AD	in the year of the Lord (Latin *anno Domini*)
Adm.	Admiral
Afg.	Afghanistan
Ag	silver (Latin *argentum*)
AG	Limited-liability Company (German *Aktiengesellschaft*)
AH	in the year of the hijrah (hegira), or Muslim era (Latin *anno Hegirae*)
Al	aluminum, aluminium
Ala.	Alabama
Alb.	Albania
Alg.	Algeria
Alta.	Alberta
Am	americium
AM	before noon (Latin *ante meridiem*)
AM	amplitude modulation
A.M.	master of arts (Latin *artium magister*)
Ar	argon
Arg.	Argentina
Ariz.	Arizona
Ark.	Arkansas
As	arsenic
A.S.S.R.	Autonomous Soviet Socialist Republic
At	astatine
Au	gold (Latin *aurum*)
Aug.	August
b.	born
B	boron
Ba	barium
B.A.	bachelor of arts
BC	before Christ
B.C.	British Columbia
BCE	before the Christian era, or Common Era
Be	beryllium
B.Ed.	bachelor of education
Belg.	Belgium
Bi	bismuth
Bk	berkelium
Bol.	Bolivia
BP	before the present
B.Ph.	bachelor of philosophy
Br	bromine
Braz.	Brazil
Brig.	Brigadier
Brit.	British
B.S.	bachelor of science
B.Sc.	bachelor of science
Bulg.	Bulgaria
c.	about, approximately (Latin *circa*)
C	carbon; Celsius
Ca	calcium
Calif.	California
Can.	Canada
Capt.	Captain
Cb	columbium
C.B.	Companion of the Order of the Bath
C.B.E.	Companion of the Order of the British Empire
Cd	cadmium
Ce	cerium
CE	Christian era, Common Era
cf.	compare (Latin *confer*)
Cf	californium
cg	centigram(s)
ch.	chapter
C.H.	Member of the Order of Companions of Honour
Chron.	Chronicles (Bible)
Cia.	Company (Italian *Compagnia;* Portuguese *Companhia;* Spanish *Compañia*)
Cie.	Company (French *Compagnie*)
cl	centilitre(s)
Cl	chlorine
cm	centimetre(s)
Cm	curium
C.M.G.	Companion of the Order of St. Michael and St. George
CMSA	consolidated metropolitan statistical area
Co	cobalt
Co.	Company
Col.	Colonel; Colossians (Bible)
Colo.	Colorado
Colom.	Colombia
Comdr.	Commander
Comdt.	Commandant
Commo.	Commodore
Conn.	Connecticut
Cor.	Corinthians (Bible)
Corp.	Corporation
cos	cosine
cot	cotangent
Cr	chromium
Cs	cesium
csc	cosecant
cu	cubic
Cu	copper (Latin *cuprum*)
C.V.O.	Commander of the Royal Victorian Order
Czech.	Czechoslovakia
d.	died
Dan.	Daniel (Bible)
D.B.E.	Dame Commander of the Order of the British Empire
DC	direct current
D.C.	District of Columbia
D.C.M.G.	Dame Commander of the Order of St. Michael and St. George
D.C.V.O.	Dame Commander of the Royal Victorian Order
D.D.	doctor of divinity
Dec.	December
Del.	Delaware
Den.	Denmark
Deut.	Deuteronomy (Bible)
D.F.	Federal District (Spanish *Distrito Federal*)
D.Litt.	doctor of letters (Latin *doctor litterarum*)
Dom.Rep.	Dominican Republic
Dr.	Doctor
Dy	dysprosium
E	east
Eccles.	Ecclesiastes (Bible)
ed.	edited; edition; editor
Ed.B.	bachelor of education
eds.	editors
e.g.	for example (Latin *exempli gratia*)
E.Ger.	East Germany
Eng.	England; English
Eph.	Ephesians (Bible)
Er	erbium
Es	einsteinium
est.	estimate; estimated
Esth.	Esther (Bible)
et al.	and others (Latin *et alii,* or *aliae*)
et seq.	and following page(s) (Latin *et sequens, sequentes,* or *sequentia*)
etc.	and so forth (Latin *et cetera*)
Eth.	Ethiopia
Eu	europium
Ex.	Exodus (Bible)
Ezek.	Ezekiel (Bible)
F	Fahrenheit; fluorine
Fe	iron (Latin *ferrum*)
Feb.	February
ff.	and following pages
Fig.	Figure
Fin.	Finland
fl.	flourished (Latin *floruit*)
Fla.	Florida
Fm	fermium
FM	frequency modulation
Fr	francium
Fr.	France
ft	foot, feet
Ft.	Fort
g	gram(s)
Ga	gallium
Ga.	Georgia
gal	gallon(s)
Gal.	Galatians (Bible)
G.B.E.	Knight (or Dame) Grand Cross of the Order of the British Empire
G.C.B.	Knight (or Dame) Grand Cross of the Order of the Bath
G.C.M.G.	Knight (or Dame) Grand Cross of the Order of St. Michael and St. George
G.C.V.O.	Knight (or Dame) Grand Cross of the Royal Victorian Order
Gd	gadolinium
Ge	germanium
Gen.	General; Genesis (Bible)
Ger.	Germany
GmbH	Company with Limited Liability (German *Gesellschaft mit beschränkter Haftung*)
Guat.	Guatemala
h	hour
H	hydrogen
ha	hectare(s)
Ha	hahnium
Hab.	Habakkuk (Bible)
Hag.	Haggai (Bible)
He	helium
Heb.	Hebrews (Bible)
Hf	hafnium
Hg	mercury (Latin *hydrargyrum*)
HMS	His, or Her, Majesty's Ship, or Service
HMSO	His, or Her, Majesty's Stationery Office
Ho	holmium
Hos.	Hosea (Bible)
hr	hour(s)
Hung.	Hungary
I	iodine
ibid.	in the same place (Latin *ibidem*)
Ice.	Iceland
i.e.	that is (Latin *id est*)
Ill.	Illinois
in.	inch(es)
In	indium
Inc.	Incorporated
Ind.	Indiana
Indon.	Indonesia
Ir	iridium
Ire.	Ireland
Isa.	Isaiah (Bible)
Jam.	Jamaica
Jan.	January
Jer.	Jeremiah (Bible)
Josh.	Joshua (Bible)
Jr.	Junior
Judg.	Judges (Bible)
K	Kelvin; potassium (Latin *kalium*); Köchel catalog number
Kan.	Kansas
K.B.E.	Knight Commander of the Order of the British Empire
K.C.B.	Knight Commander of the Order of the Bath
K.C.M.G.	Knight Commander of the Order of St. Michael and St. George
K.C.V.O.	Knight Commander of the Royal Victorian Order
kg	kilogram(s)
KG	Limited Partnership (German *Kommandit Gesellschaft*)
K.G.	Knight of the Order of the Garter
KK	Limited-liability Company (Japanese *Kabushiki Kaisha*)
kl	kilolitre(s)
km	kilometre(s)
kph	kilometre(s) per hour
Kr	krypton
K.T.	Knight of the Order of the Thistle
Ky.	Kentucky
l	litre(s)
La	lanthanum
La.	Louisiana
Lam.	Lamentations (Bible)
lb	pound(s)
Lev.	Leviticus (Bible)
Li	lithium
Liech.	Liechtenstein
Lieut.	Lieutenant
LL.B.	bachelor of laws (Latin *legum baccalaureus*)
LL.D.	doctor of laws (Latin *legum doctor*)
log	logarithm
Lr	lawrencium
Ltd.	Limited
Lu	lutetium
Luxem.	Luxembourg
m	metre(s)
M.A.	master of arts
Maj.	Major
Mal.	Malachi (Bible)
Man.	Manitoba
Mass.	Massachusetts
Matt.	Matthew (Bible)
M.B.E.	Member of the Order of the British Empire
mbH	Limited, with Limited Liability (German *mit beschränkter Haftung*)
Md	mendelevium
Md.	Maryland
M.D.	doctor of medicine (Latin *medicinae doctor*)
Mex.	Mexico
mg	milligram(s)
Mg	magnesium
mi	mile(s)
Mic.	Micah (Bible)
Mich.	Michigan
Mij	Company (Dutch *Maatschappij*)
min	minute(s)
Minn.	Minnesota
Miss.	Mississippi
ml	millilitre(s)
Mlle	Mademoiselle
mm	millimetre(s)
Mme	Madame
Mn	manganese
Mo	molybdenum
Mo.	Missouri
Mong.	Mongolia
Mont.	Montana
Mor.	Morocco
MP	member of Parliament
mph	mile(s) per hour
Mr.	Mister
Mrs.	"Missus"
MS.	manuscript
M.S.	master of science
MSA	metropolitan statistical area
M.Sc.	master of science

Msgr.	Monsignor
MSS.	manuscripts
Mt.	Mount; Mountain(s)
mun.	municipality
MV	Motor Vessel
M.V.O.	Member of the Royal Victorian Order
N	nitrogen; north
Na	sodium (Latin *natrium*)
NA	National Association
Nah.	Nahum (Bible)
Nb	niobium
N.B.	New Brunswick
N.C.	North Carolina
n.d.	no date
Nd	neodymium
N.D.	North Dakota
Ne	neon
NE	northeast
Neb.	Nebraska
Neh.	Nehemiah (Bible)
Neth.	The Netherlands
Nev.	Nevada
Nfd.	Newfoundland
N.H.	New Hampshire
Ni	nickel
Nic.	Nicaragua
N.Ire.	Northern Ireland
N.J.	New Jersey
N.Kor.	North Korea
N.M.	New Mexico
no.	number
No	nobelium
Nor.	Norway
Nov.	November
Np	neptunium
NS	Nuclear Ship
N.S.	New Style (calendar); Nova Scotia
N.S.W.	New South Wales
N.Terr.	Northern Territory
Num.	Numbers (Bible)
NV	Limited-liability Company (Dutch *Naamloze Vennootschap*)
NW	northwest
N.W.Terr.	Northwest Territories
N.Y.	New York
N.Z.	New Zealand
O	oxygen
Obad.	Obadiah (Bible)
O.B.E.	Officer of the Order of the British Empire
Oct.	October
Okla.	Oklahoma
Ont.	Ontario
op.	opus
op. cit.	in the work cited (Latin *opere citato*, or *opus citato*)
Ore.	Oregon
Os	osmium
O.S.	Old Style (calendar)
oz	ounce(s)
p.	page
P	phosphorus
pA	Limited (Italian *per Azioni*)
Pa	protactinium
Pa.	Pennsylvania
Pak.	Pakistan
Pan.	Panama
Pb	lead (Latin *plumbum*)
Pd	palladium
P.E.I.	Prince Edward Island
Pet.	Peter (Bible)
pH	potential of hydrogen (acidity–alkalinity factor)
Ph.B.	bachelor of philosophy (Latin *philosophiae baccalaureus*)
Ph.D.	doctor of philosophy (Latin *philosophiae doctor*)
Phil.	Philippians (Bible); Philippines
Philem.	Philemon (Bible)
PLC	Public Limited Company
Pm	promethium
PM	afternoon (Latin *post meridiem*)
PMSA	primary metropolitan statistical area
Po	polonium
Pol.	Poland
pop.	population
Port.	Portugal
pp.	pages
Pr	praseodymium
P.R.	Puerto Rico
prelim.	preliminary
Pres.	President
Prov.	Proverbs (Bible)
Ps.	Psalms (Bible)
Pt	platinum
Pu	plutonium
qq.v.	which see (plural; Latin *quae vide*)
Que.	Quebec
Queen.	Queensland
q.v.	which see (singular; Latin *quod vide*)
R	Rankine
Ra	radium
Rb	rubidium
Re	rhenium
rev.	revised; revision
Rev.	Revelations (Bible); Reverend
Rf	rutherfordium
Rh	rhodium
R.I.	Rhode Island
Rn	radon
Rom.	Romania; Romans (Bible)
rpm	revolutions per minute
Rt. Rev.	Right Reverend
Ru	ruthenium
s	second
S	south; sulfur
S.	Saint (*san, santo, santa, sant'*)
S. of Sol.	Song of Solomon (Bible)
SA	Limited-liability Company (French *Société Anonyme;* Italian *Società Anònima;* Portuguese *Sociedade Anónima;* Spanish *Sociedad Anónima*)
S.Af.	South Africa
Sam.	Samuel (Bible)
Sask.	Saskatchewan
S.Aus.	South Australia
Sb	antimony (Latin *stibium*)
Sc	scandium
S.C.	South Carolina
Scot.	Scotland
SCSA	standard consolidated statistical area
S.D.	South Dakota
Se	selenium
SE	southeast
sec	secant; second(s)
Sept.	September
S.F.S.R.	Soviet Federated Socialist Republic
Si	silicon
sin	sine
S.Kor.	South Korea
Sm	samarium
SMSA	standard metropolitan statistical area
Sn	tin (Latin *stannum*)
SpA	Limited-liability Company (Italian *Società per Azioni*)
sq	square
Sr	strontium
Sr.	Senior
SS	Steamship
SS.	Saints; Saintliest, or Holiest (Italian *Santissimo, Santissima*)
S.S.R.	Soviet Socialist Republic
St.	Saint (*Sankt, Sint*)
Sta.	Saint (*Santa*)
Ste.	Saint (*Sainte*)
SW	southwest
Swed.	Sweden
Switz.	Switzerland
Ta	tantalum
tan	tangent
Tanz.	Tanzania
Tas.	Tasmania
Tb	terbium
Tc	technetium
Te	tellurium
Tenn.	Tennessee
Th	thorium
Thai.	Thailand
Thess.	Thessalonians (Bible)
Ti	titanium
Tim.	Timothy (Bible)
Tit.	Titus (Bible)
Tl	thallium
Tm	thulium
trans.	translated; translation; translator(s)
Tun.	Tunisia
Tur.	Turkey
U	uranium
U.A.E.	United Arab Emirates
U.A.R.	United Arab Republic
U.K.	United Kingdom
UN	United Nations
U.S.	United States
USGPO	United States Government Printing Office
USS	United States Ship
U.S.S.R.	Union of Soviet Socialist Republics
v.	versus (law)
V	vanadium
Va.	Virginia
Venez.	Venezuela
Vic.	Victoria
Vir.Is.	Virgin Islands
vol.	volume(s)
Vt.	Vermont
W	tungsten (wolfram); west
Wash.	Washington
W.Aus.	Western Australia
W.Ger.	West Germany
Wis.	Wisconsin
W.Va.	West Virginia
Wyo.	Wyoming
Xe	Xenon
Y	yttrium
Yb	ytterbium
yd	yard(s)
Yugos.	Yugoslavia
Zech.	Zechariah (Bible)
Zeph.	Zephaniah (Bible)
Zimb.	Zimbabwe
Zn	zinc
Zr	zirconium

Table of Measurement Conversions

To convert	Into	Multiply by
acres	hectares	0.40468564
Celsius (centigrade)	Fahrenheit	$(C° \times 9/5) + 32$
centimetres	inches	0.3937008
cubic feet	cubic metres	0.028316847
cubic metres	cubic feet	35.31467
Fahrenheit	Celsius (centigrade)	$5/9(F° - 32)$
feet	metres	0.3048
gallons (U.S. liquid)	litres	3.785412
grams	ounces (troy)	0.032150747
hectares	acres	2.471054
inches	centimetres	2.54
inches	millimetres	25.4
kilograms	pounds	2.2046226
kilometres	miles (nautical)	0.5399568
kilometres	miles (statute)	0.6213712
litres	gallons (U.S. liquid)	0.26417205
metres	feet	3.2808399
metres	yards	1.093613298
miles (nautical)	kilometres	1.852
miles (statute)	kilometres	1.609344
millilitres	ounces (U.S. fluid)	0.03381402
millimetres	inches	0.03937008
newtons	pounds (of force)	0.224809
ounces (troy)	grams	31.1034768
ounces (U.S. fluid)	millilitres	29.57353
pounds	kilograms	0.45359237
pounds (of force)	newtons	4.44822
square kilometres	square miles	0.38610216
square miles	square kilometres	2.58998811
yards	metres	0.9144